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SIL 3-EP-16, Rev. A
September, 2017
Page 1 of 31

SUBJECT: Replacing the AC Busbar Assembly and AC Terminal Block 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 (available at Allison.service-solutions.com)
- J-46708 Multimeter (available at Allison.service-solutions.com) or equivalent
- Electrostatic Discharge Wrist Strap (Tool Number 7744 (available at Allison.service-solutions.com) or equivalent) (Refer to Figure 6)
- Pick or Small Flat Blade Screwdriver
- Torx Plus™ T25 Bit
- 6mm Hex Key
- 8mm Hex Socket
- 11mm Hex Socket
- Loctite® 242
- Loctite® 425

Parts Required

- P/N 29540714 – Cover Gasket
- Wire Ties (4 inch and 6 inch – Nylon 6/6 or approved equivalent)

Introduction:

This Service Information Letter (SIL) announces the availability of the AC (Alternating Current) busbar, AC terminal block, and related components and includes the procedure to replace the AC busbar and AC terminal block. The availability of this part eliminates the need for a complete DPIM replacement under certain failure conditions.



NOTE: Replacement of the AC Busbar and Terminal block is not a warrantable repair by Allison Transmission, Inc. if damaged has been caused by arcing. Contact Allison TAC at (800) 252-5283 prior to initiating repairs on a DPIM that is under warranty.

BC / SL7632EN

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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.



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



NOTE: Perform the necessary visual inspection prior to ordering parts. The parts are NOT available as a complete kit. All necessary components must be ordered individually.

Refer to Figure 1 and Figure 2 for locations of the AC busbars, terminal blocks and related components. Refer to Table 1 for list of Service Parts.

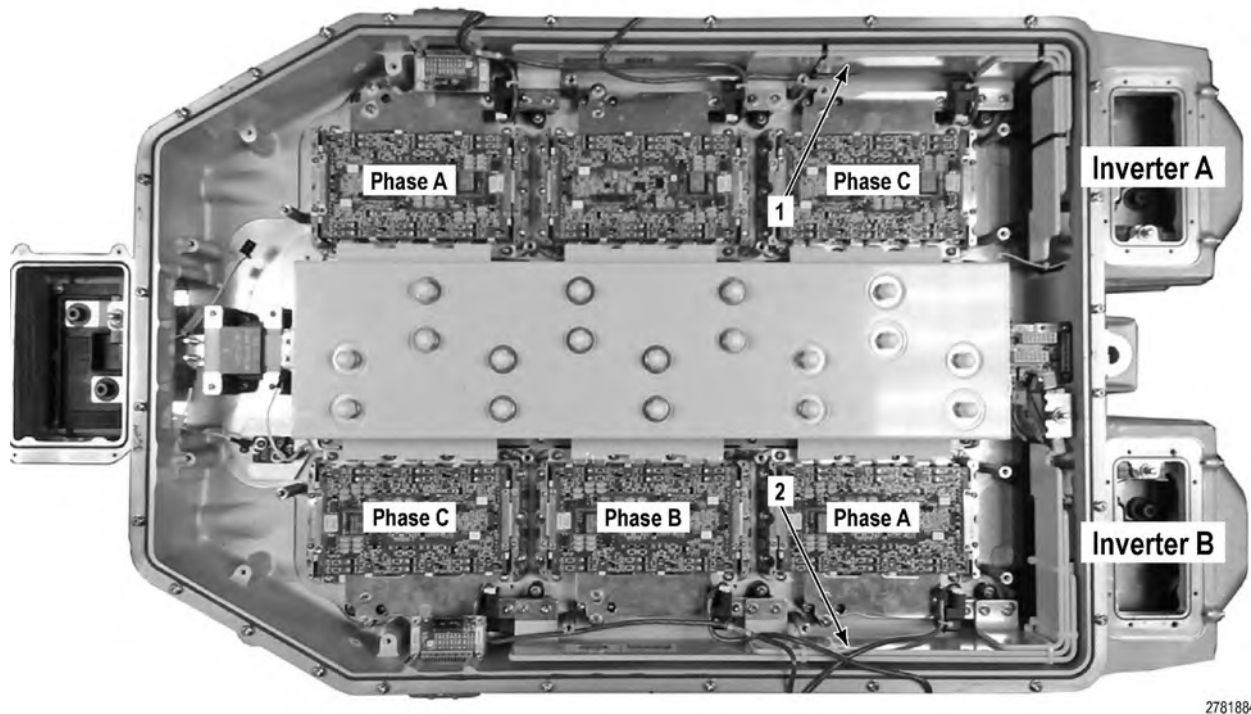
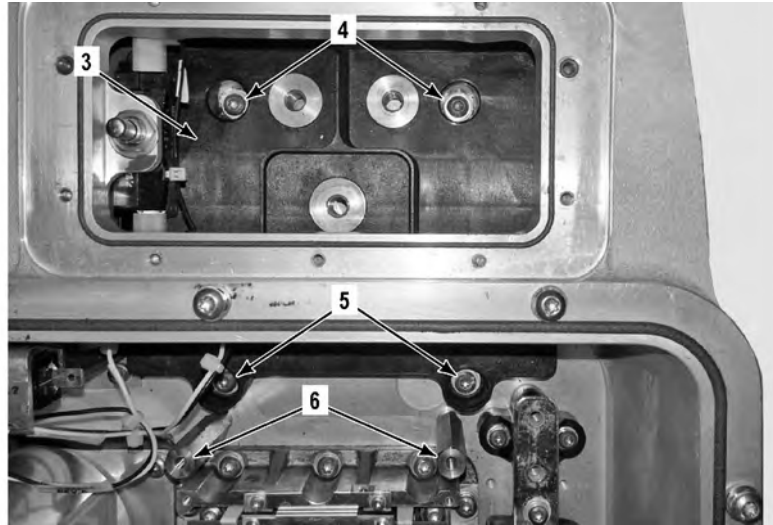


Figure 1. DPIM2 Busbar Locations



2782160

Figure 2. Location of AC Terminal Block, Screws, and BCA Standoff

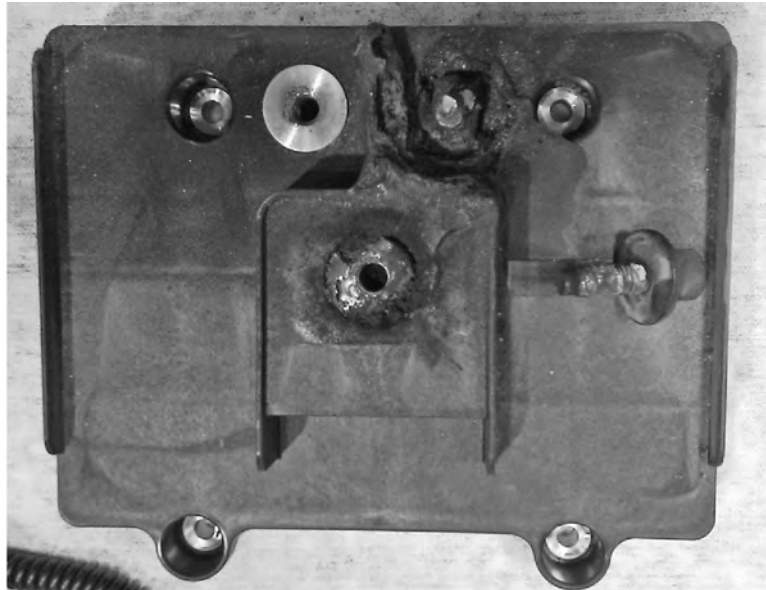
Refer to Table 1 for Service Parts.

Table 1. Service Parts

Item Number	Part Name	Part Number
1	AC Bus Assembly – A	29546765
2	AC Bus Assembly – B	29546764
3	AC Terminal Block – A and B	29546806
4	Screw – M5x22mm	29540587
5	Screw – M5x18mm	29540732
6	BCA Standoff	29548554

Diagnosis:

The AC busbar assembly and AC terminal block may need to be replaced if the HV lug bolt has become loose and components are damaged by electrical arcing. Refer to Figure 3 and Figure 4.



2782330

Figure 3. Damage to AC Terminal Block Caused by Electrical Arcing



2782430

Figure 4. Damage to AC Busbar Caused by Electrical Arcing



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.



WARNING: Smoke inside the DPIM contains harmful Copper Oxide. Use proper protective equipment to protect your skin and eyes from contact. Avoid inhalation of smoke.



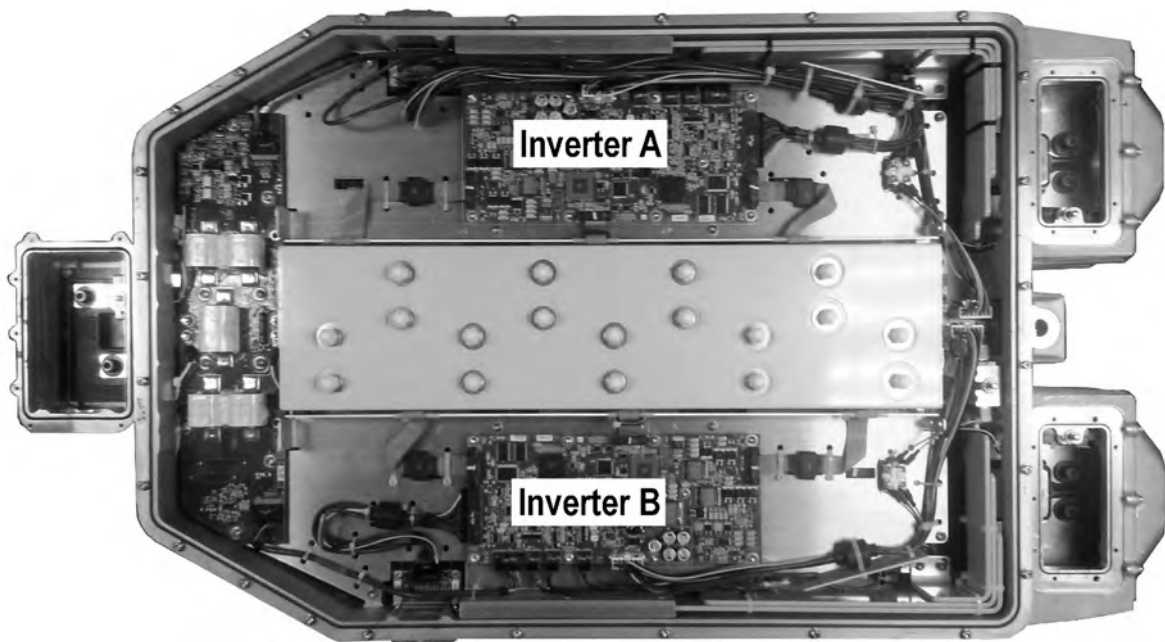
NOTE: Allison Transmission, Inc. requires the removal of the DPIM from the vehicle prior to AC Busbar and AC Terminal Block replacement. Prior to removal of the DPIM, refer to the H 40/50 EP™ System Troubleshooting Manual (TS5812EN) and perform the Electrical Disconnect Verification Procedure.



NOTE: Internal DPIM repairs should NOT be performed if smoke and/or water damage are present. Photograph the smoke and/or water damage and contact Allison TAC at (800) 252-5283.



NOTE: Complete the DPIM Check List prior to replacing the AC busbar assembly and AC terminal block to ensure additional components have not been damaged. 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).



454519

Figure 5. DPIM2 (Main Cover and Lug Box Covers Removed)

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 and AC Terminal Block
- Section 4: Installation of the New AC Terminal Block and AC Busbar Assembly
- Section 5: Installation of BCA Card Mounting Shelf
- Section 6: 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 6.



426411

Figure 6. Electrostatic Discharge Wrist Strap (Tool Number 7744 Shown)

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 7). Set the screws aside for reassembly. Remove the Main Cover. Discard the cover gasket.



421911

Figure 7. DPIM Main Cover

2. Exercising care, cut one (1) wire tie at location shown in Figure 8. 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.



422298

Figure 8. HVIL Circuit Card – Wire Tie Location

3. Cut the two (2) wire ties at locations shown in Figure 9 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.



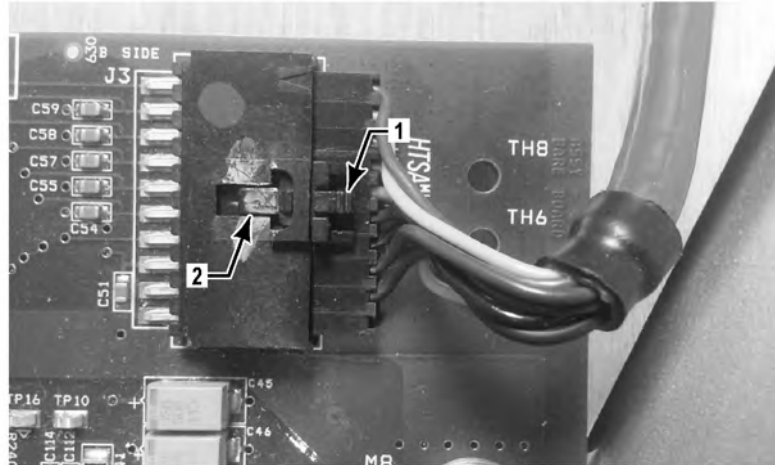
422327

Figure 9. 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 with a Pick or Small Flat Blade Screwdriver (refer to Figure 10).



454544

Figure 10. 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 11.



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



422350

Figure 11. 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.

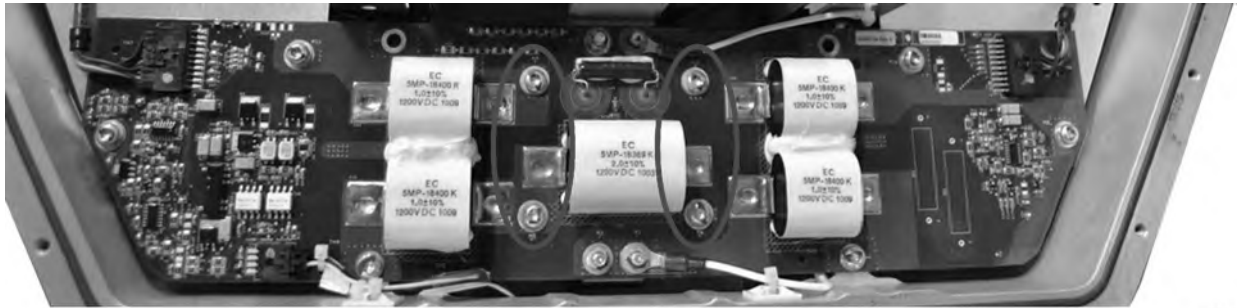
6. Using an 8mm hex socket, remove the four (4) M5 nut/washer assemblies as shown in Figure 12. Disconnect the two (2) wire ring terminals from the studs.



422390

Figure 12. 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 13.



422540

Figure 13. 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 14.



422564

Figure 14. 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 15.



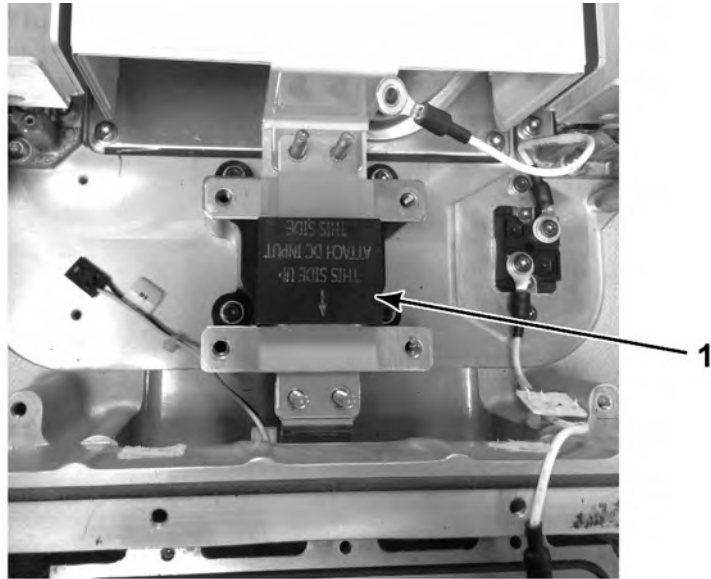
422586

Figure 15. 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 16.



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



437484

(1) – Choke

Figure 16. Verification of Choke Installation

Section 2: Removal of BCA Card Mounting Shelf

1. As required, carefully cut and remove the wire ties retaining the wire harnesses (refer to Figure 17).

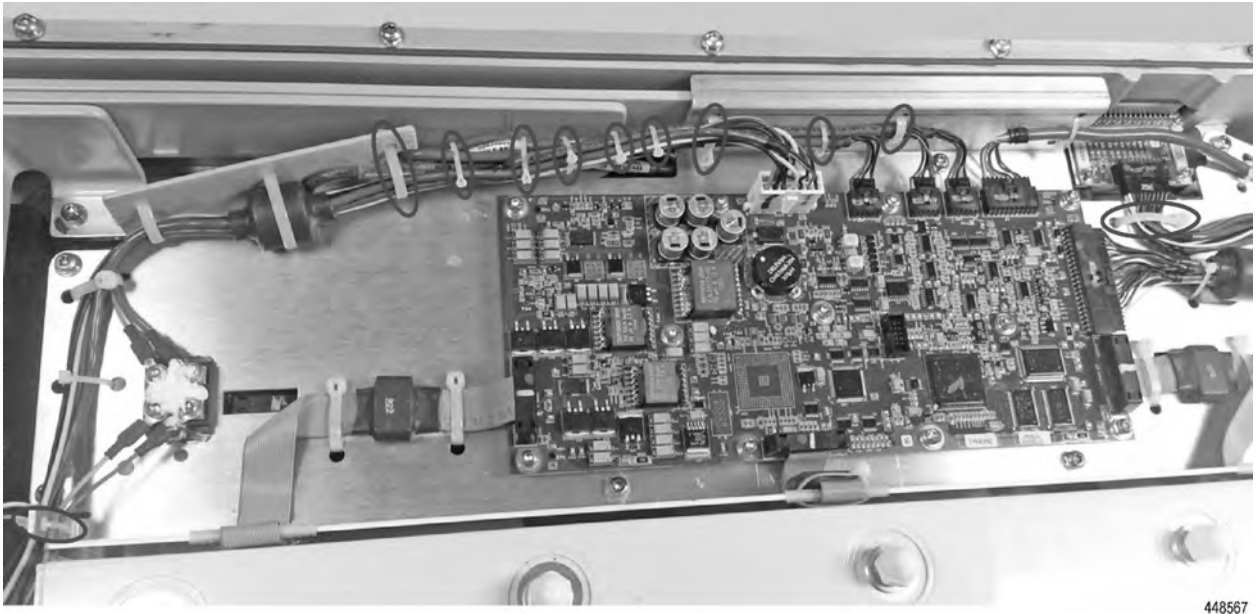


Figure 17. Wire Tie Locations

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 18 and Figure 19).



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

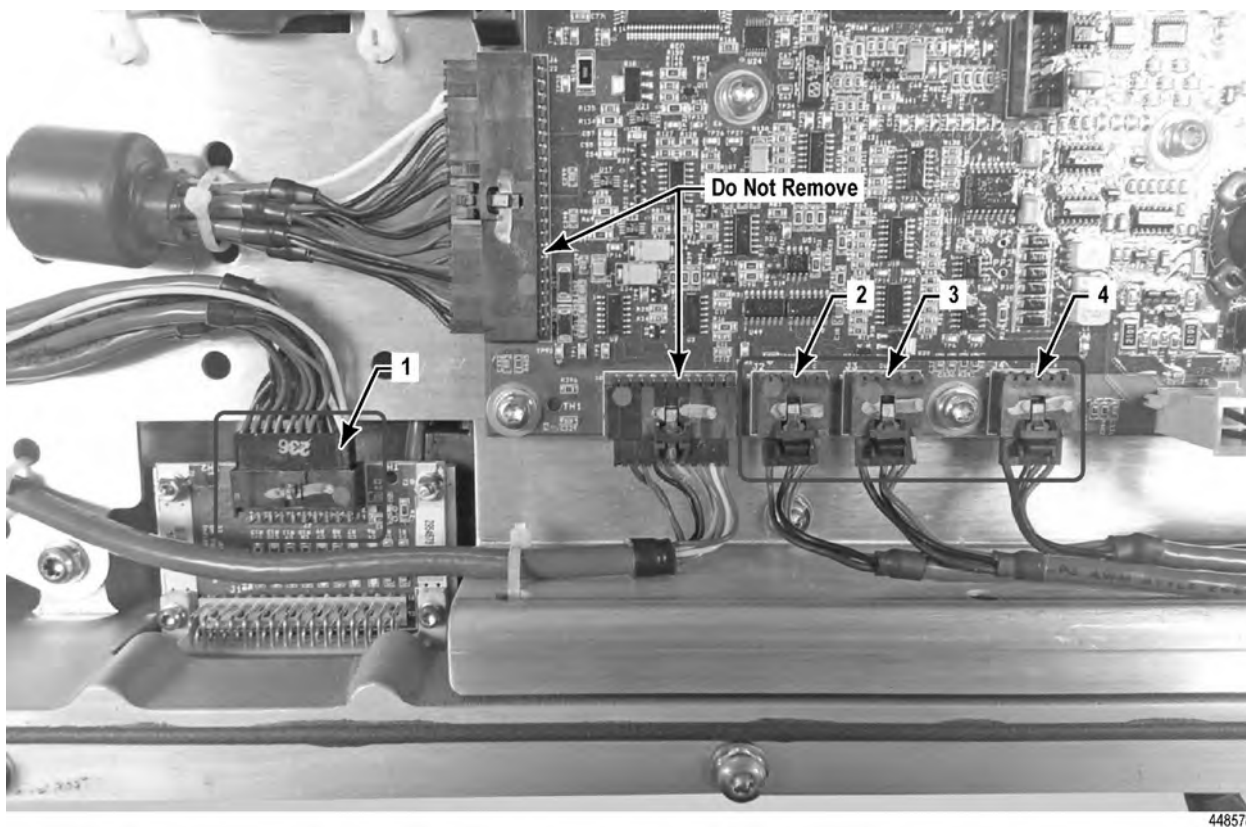


Figure 18. Wire Harness Connector Removal (4 Locations)

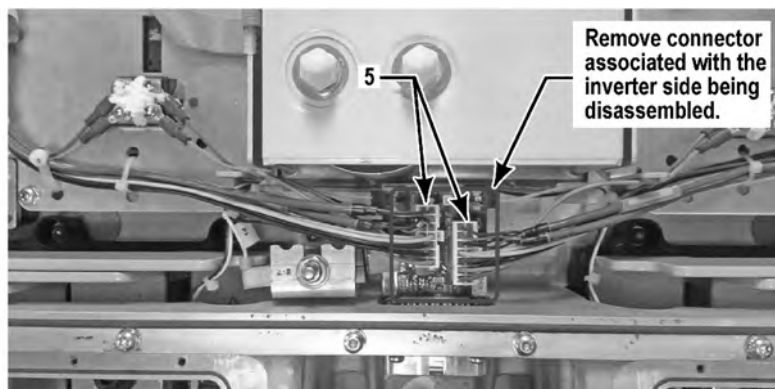
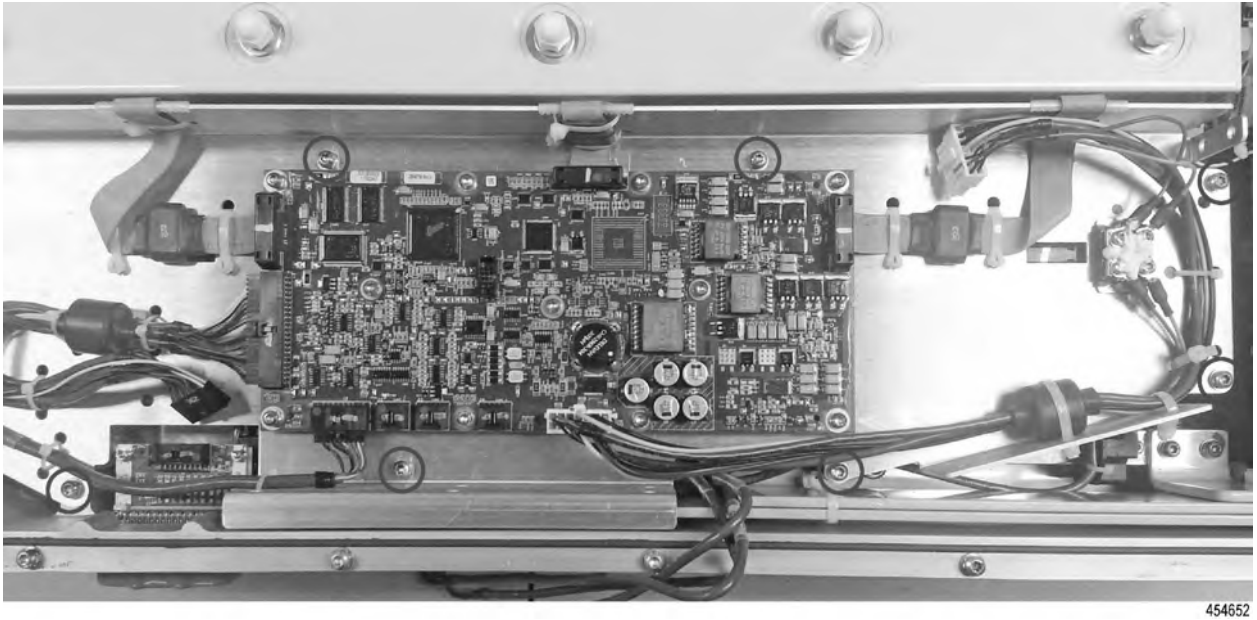


Figure 19. Wire Harness Connector Removal

3. Using a Torx Plus™ T25 bit, remove the seven (7) M5x14mm screws securing the BCA Mounting Shelf (refer to Figure 20).



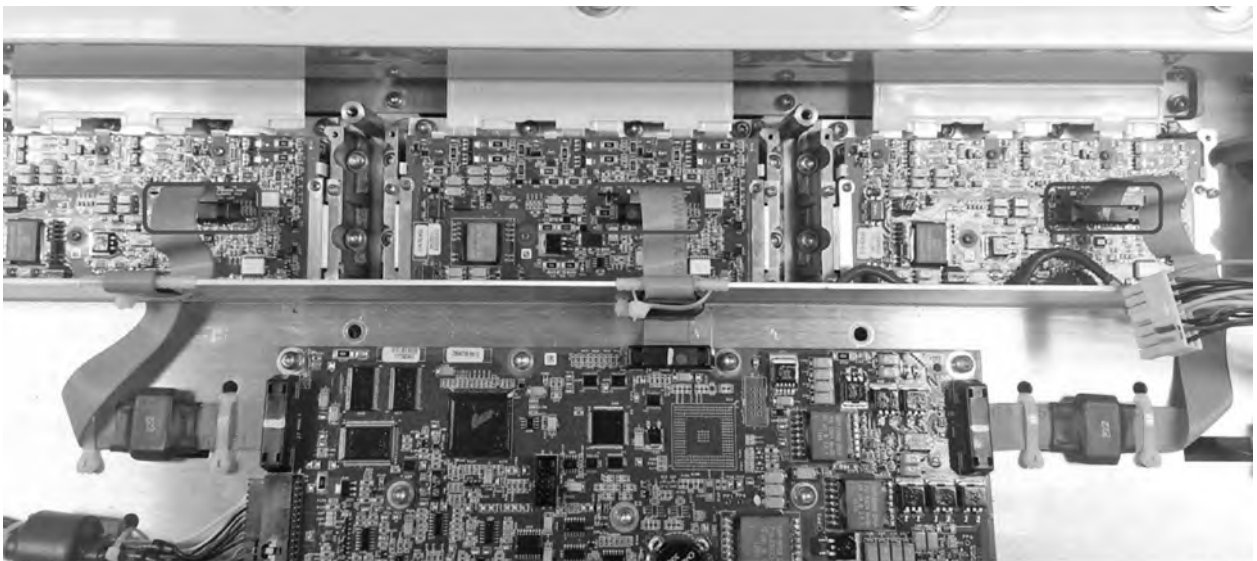
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Figure 20. BCA Mounting Shelf Fastener Locations

4. Carefully lift the BCA Mounting Shelf and set in on the side of the chassis as shown in Figure 21.



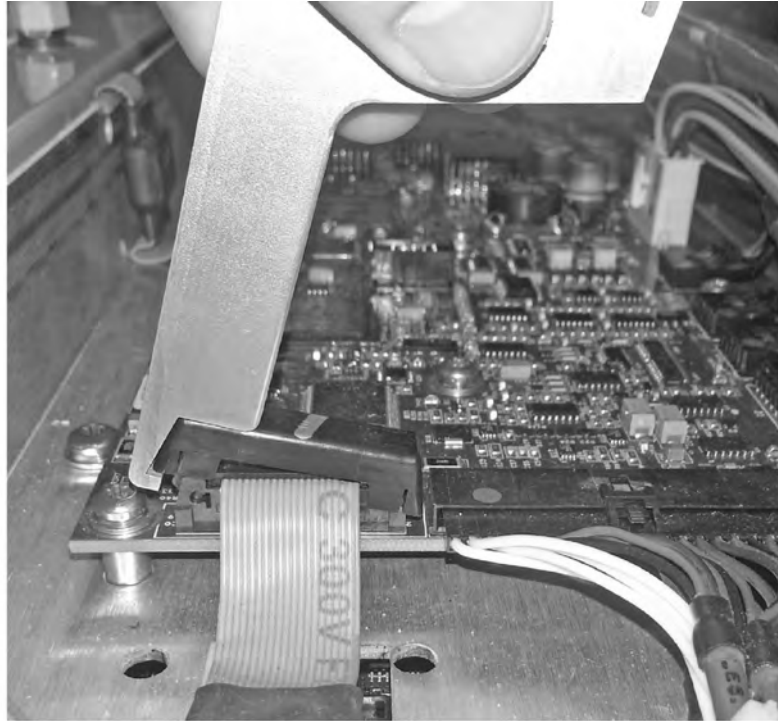
NOTE: Three (3) harnesses are still connecting the BCA Card to the GATE Drive Cards. Do NOT relocate the BCA Mounting Shelf any farther than as shown in Figure 21.



448614

Figure 21. BCA Mounting Shelf (GATE Drive Card Cable Connectors Shown Circled)

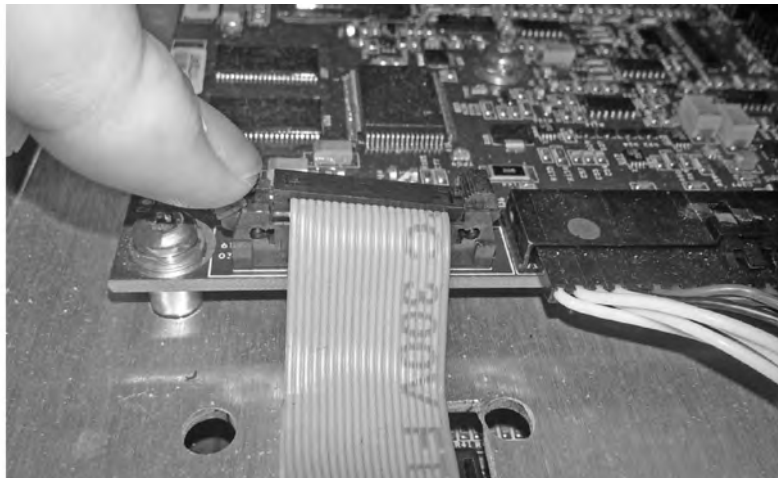
5. Remove three (3) ribbon cable connectors from the GATE Drive Cards (refer to Figure 21) as follows:
 - a. Use the handle of Tab Bending Tool J-51586 to disengage and remove the cable strain relief cap (refer to Figure 22).



448897

Figure 22. 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 23).



448879

Figure 23. Releasing the GATE Drive Card 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) Current Sensors.

Section 3: Removal of the AC Busbar Assembly and AC Terminal Block



NOTE: Refer to Figure 24 for DPIM2 Phase Locations.

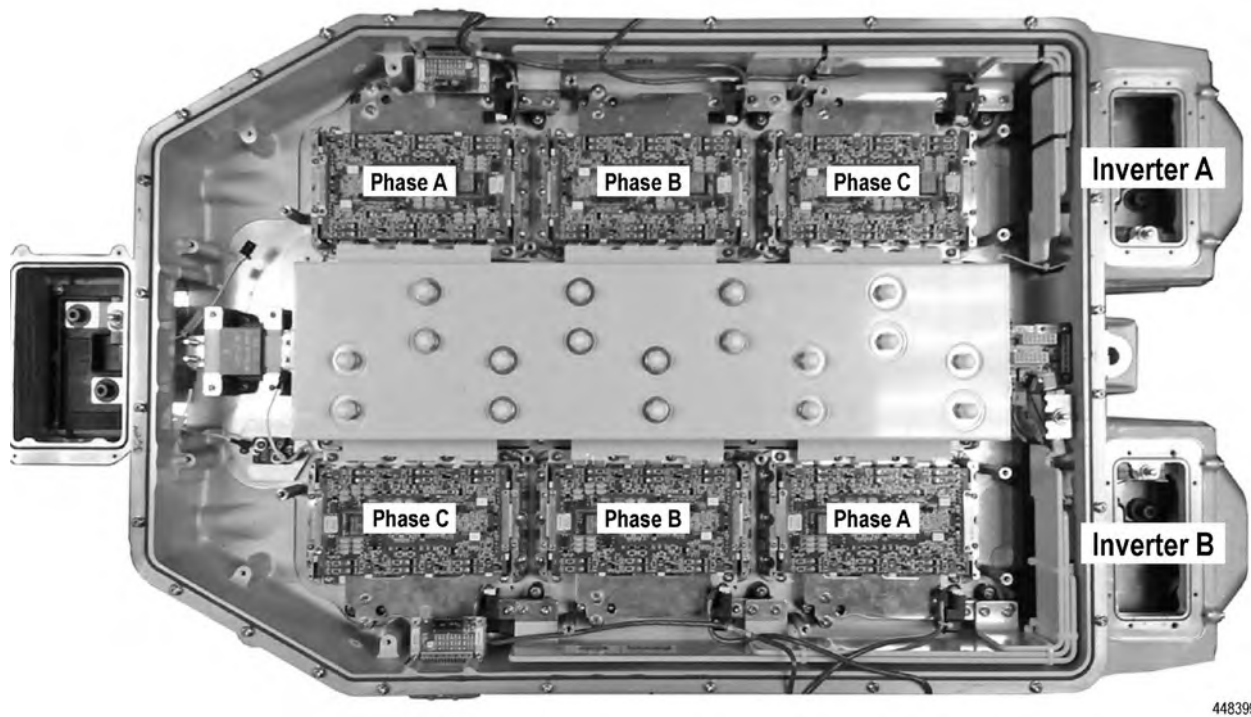


Figure 24. DPIM2 Phase Locations

1. Using a Torx Plus™ T25 bit, remove the six (6) M5x22mm screws (refer to Figure 25).

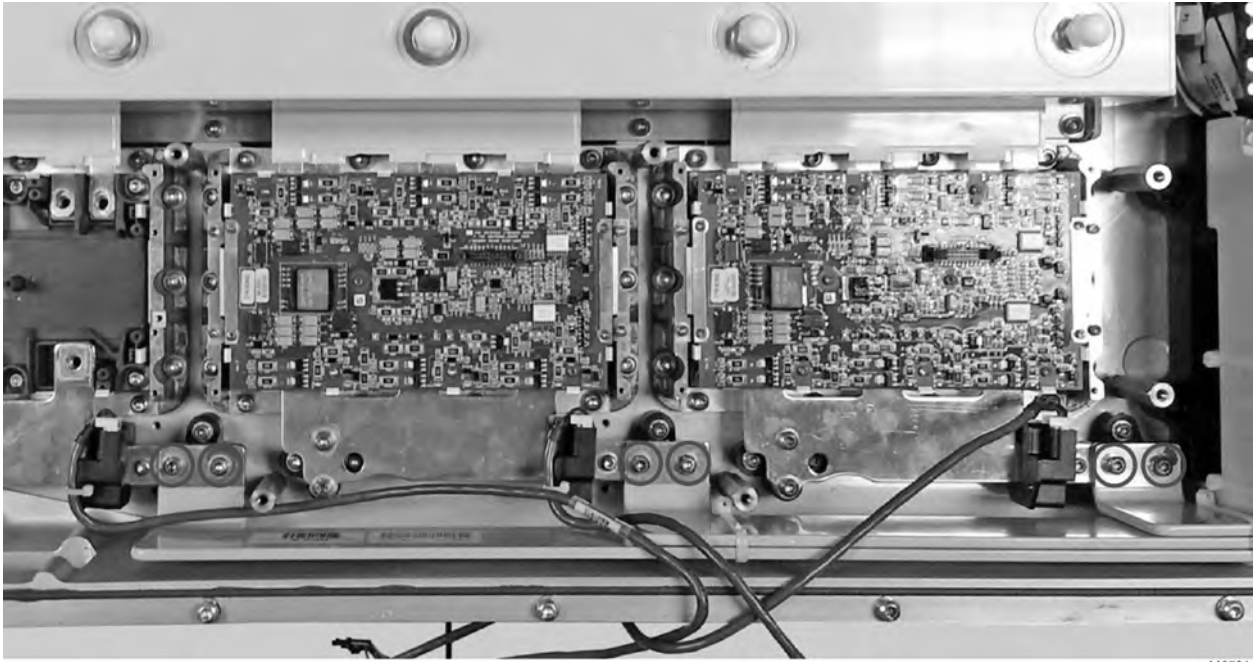


Figure 25. Mounting Screw Locations

2. Using a 6mm hex key, remove the three (3) M8 AC lug bolts (refer to Figure 26).

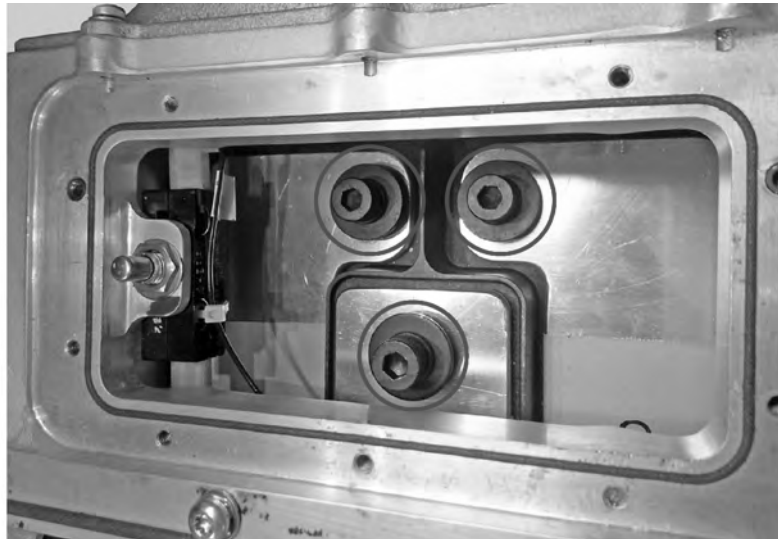
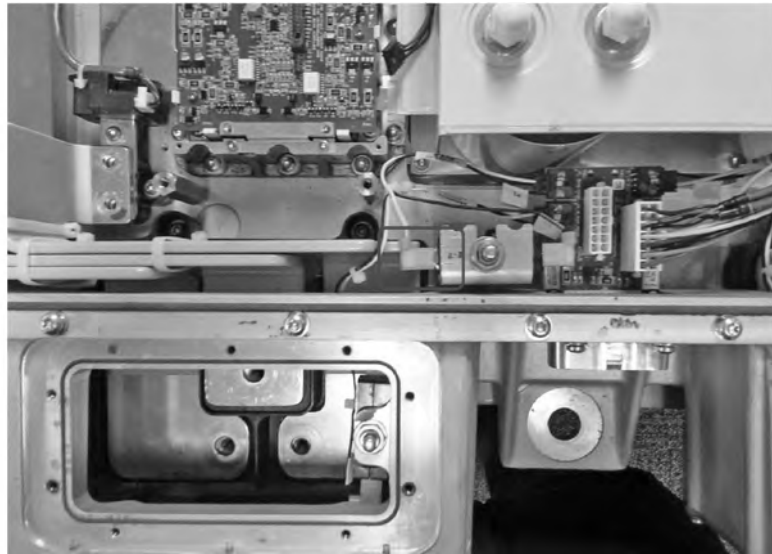


Figure 26. AC Lug Bolts

3. Remove the HVIL switch connector (refer to Figure 27).

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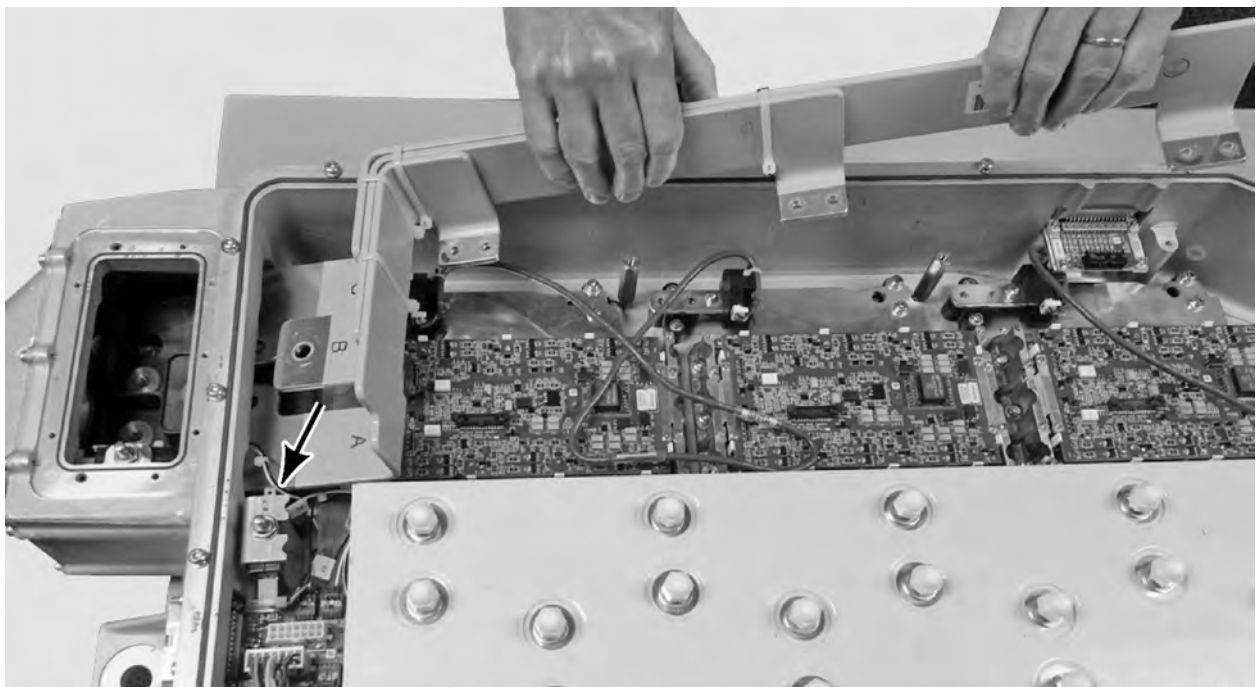
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Figure 27. HVIL Switch Location

4. Carefully remove the AC Busbar Assembly by slightly lifting upward then outward from the AC Lug Box (refer to Figure 28).



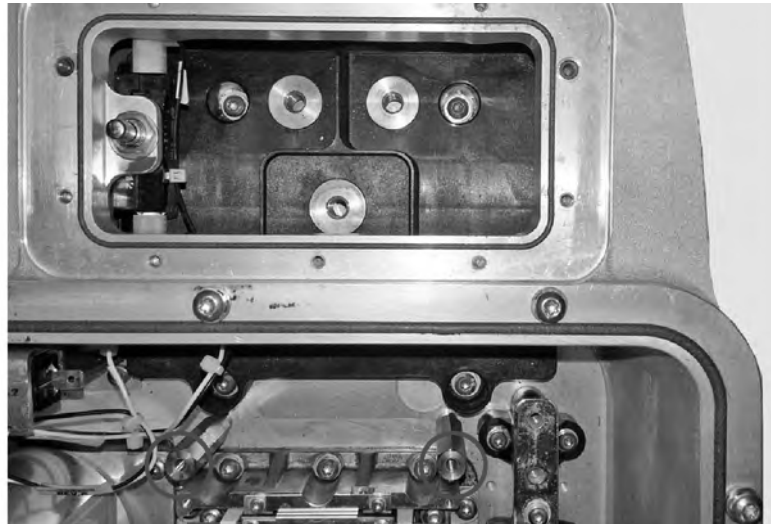
CAUTION: Do not allow the AC Busbar Assembly to strike the HVIL Switch during the removal process.



452074

Figure 28. Removal of AC Busbar Assembly

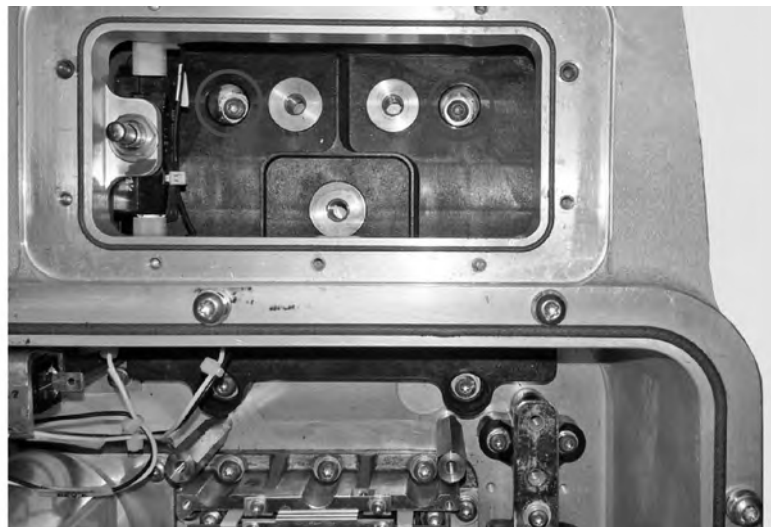
5. Using an 11mm hex socket, remove the two (2) M5 BCA Standoffs (refer to Figure 29).



2782530

Figure 29. BCA Standoff Locations

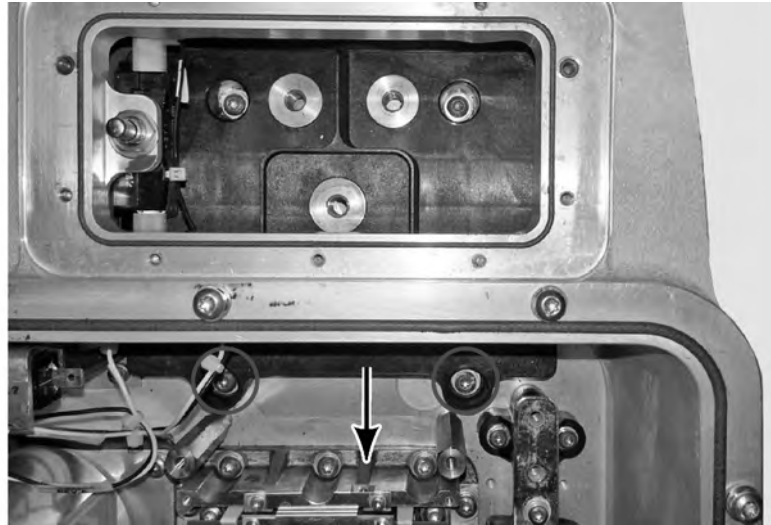
6. Using a Torx Plus™ T25 bit, remove the two (2) M5x22mm screws (refer to Figure 30).



452084

Figure 30. Location of M5x22mm Screws

7. Using a Torx Plus™ T25 bit, remove the two (2) M5x18mm screws and carefully remove the AC Terminal Block through the main cover opening (refer to Figure 31).

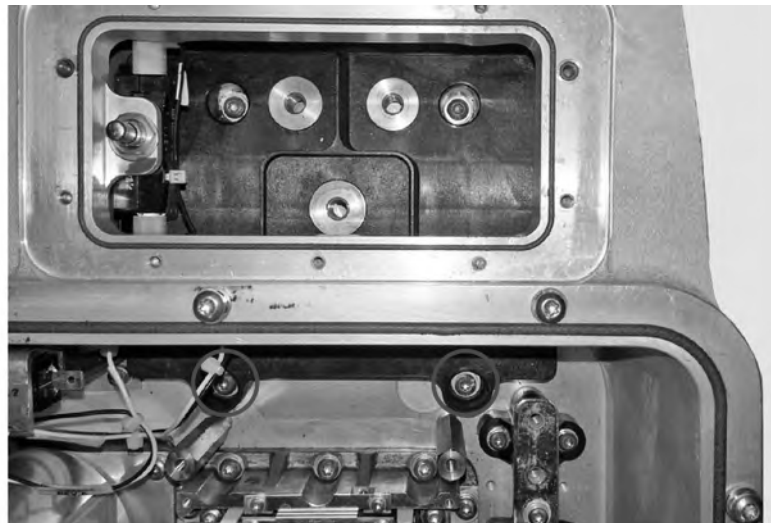


2782760

Figure 31. AC Terminal Block Mounting Screw Locations

Section 4: Installation of the New AC Terminal Block and AC Busbar Assembly

1. Install the new AC Terminal Block into its proper location. Apply one drop of Loctite® 425 or 242 thread locking compound to the ends of the external threads of the two (2) M5x18mm screws. Using a Torx Plus™ T25 bit, install the two (2) M5x18mm screws (refer to Figure 32). Torque the two (2) M5x18mm screws to 3.1-3.5 N·m (27.4-30.9 lb in).

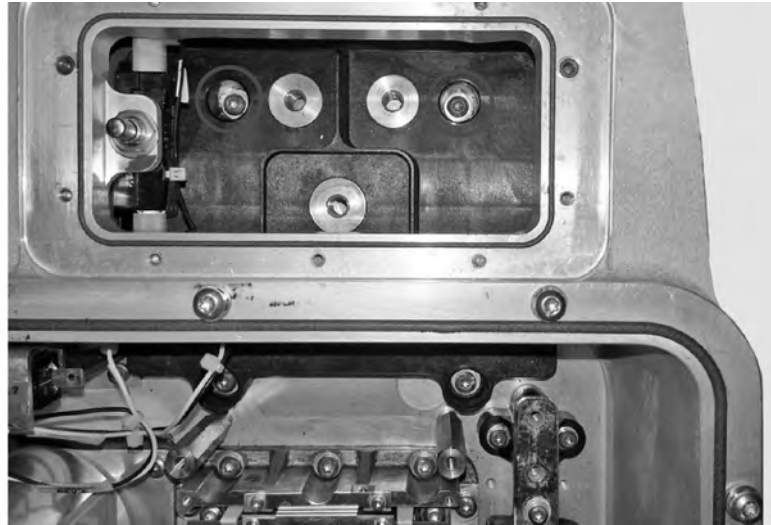


452093

Figure 32. AC Terminal Block Mounting Screw Locations

2. Using a Torx Plus™ T25 bit, install the two (2) M5x22mm screws (refer to Figure 33). Torque the two (2) M5x22mm screws to 3.1-3.5 N·m (27.4-30.9 lb in).

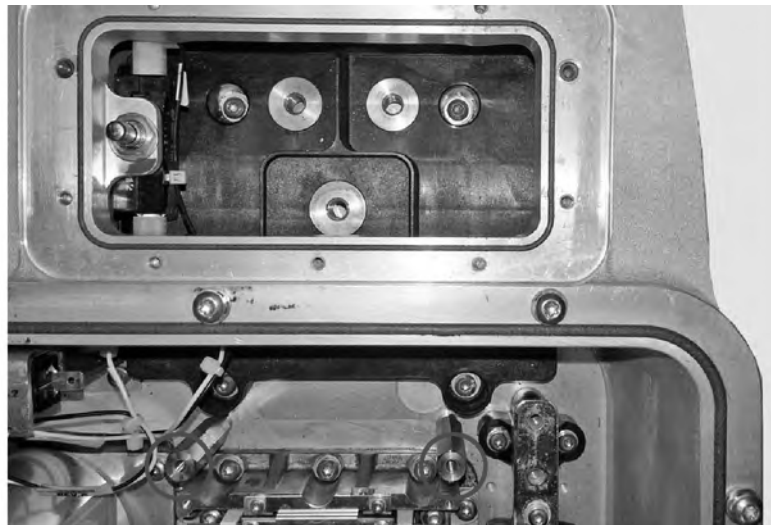
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452084

Figure 33. AC Terminal Block Mounting Screw Locations

3. Apply one drop of Loctite® 242 thread locking compound to the end of the external threads of the M5 BCA Standoff. Using an 11mm hex socket, install the two (2) M5 BCA Standoffs (refer to Figure 34). Torque the two (2) M5 BCA Standoffs to 3.1-3.5 N·m (27.4-30.9 lb in).



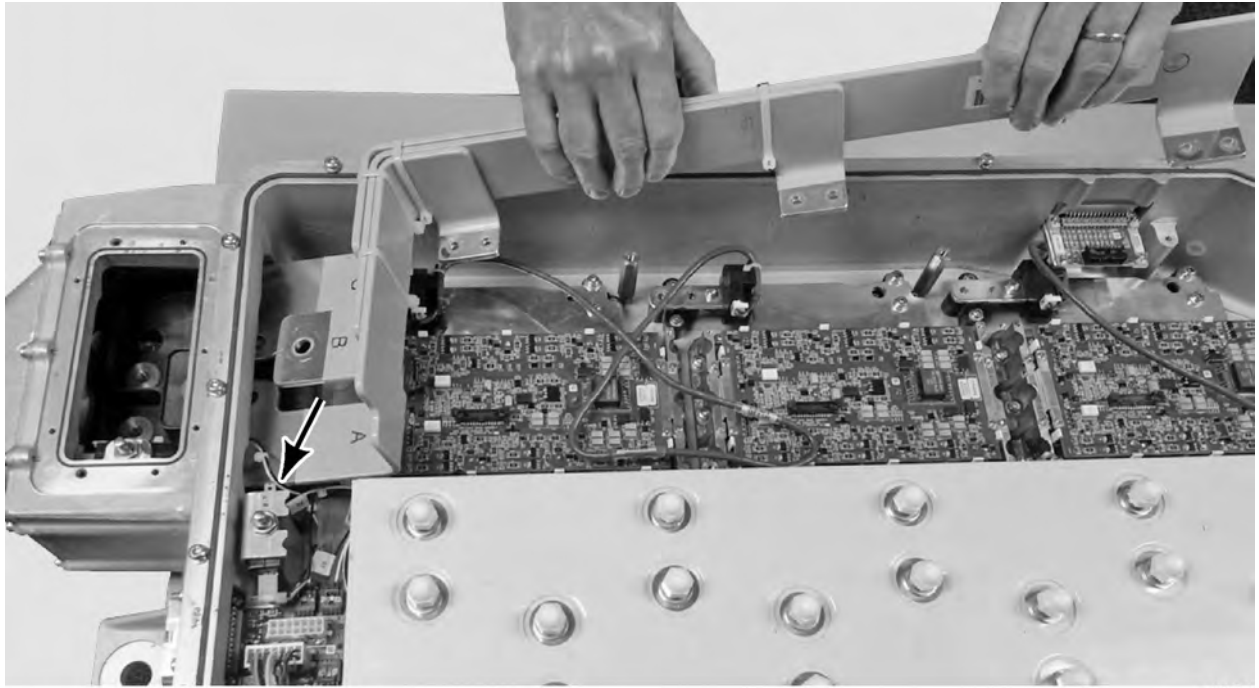
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Figure 34. BCA Standoff Locations

4. Carefully install the AC Busbar Assembly into AC Lug Box (refer to Figure 35).



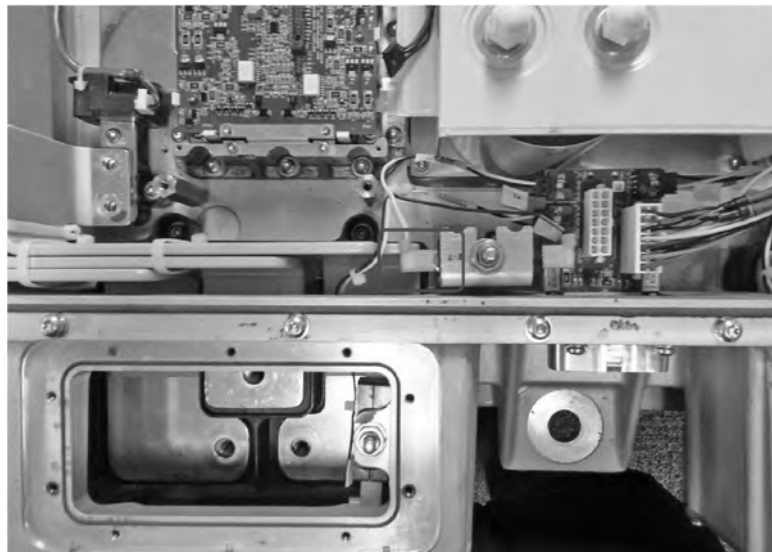
CAUTION: Do not allow the AC Busbar Assembly to strike the HVIL Switch during the installation process.



452074

Figure 35. Installation of AC Busbar Assembly

5. Install the HVIL switch connector (refer to Figure 36).



452064

Figure 36. HVIL Switch Location

6. Install and finger tighten the three (3) M8 AC lug bolts (refer to Figure 37).



448740

Figure 37. AC Lug Bolts

7. 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 38). Torque the six (6) M5x22mm screws to 3.1-3.5 N·m (27.4-30.9 lb in.).



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.

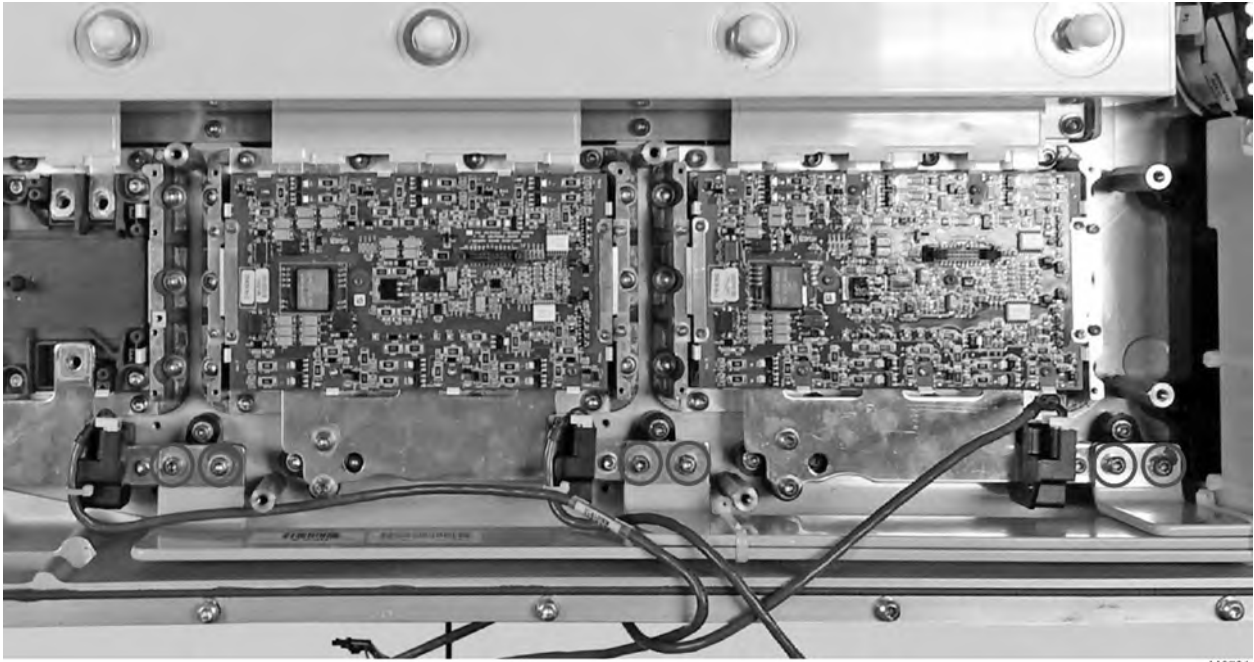


Figure 38. Mounting Screw Locations

Section 5: Installation of BCA Card Mounting Shelf

1. Feed all tie wraps through the BCA Card Mounting Shelf (refer to Figure 39).

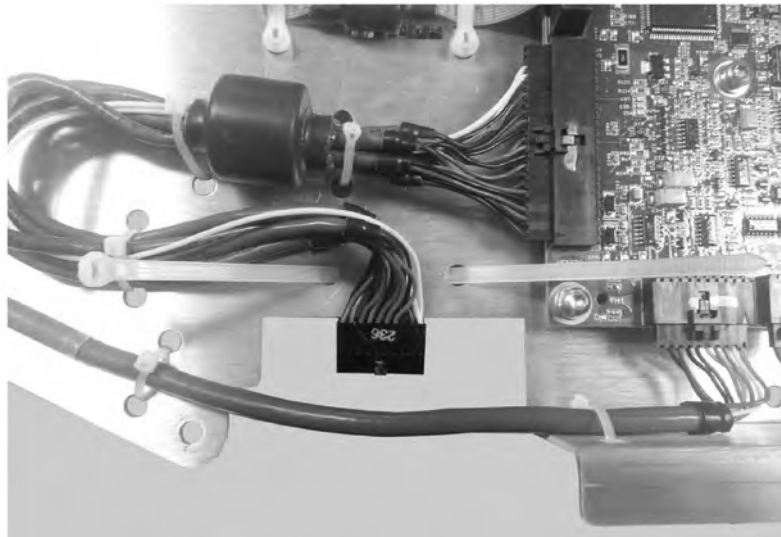


Figure 39. BCA Card Mounting Shelf Tie Wrap Location

2. Place the BCA Mounting Shelf onto the side of DPIM chassis as shown in Figure 40.

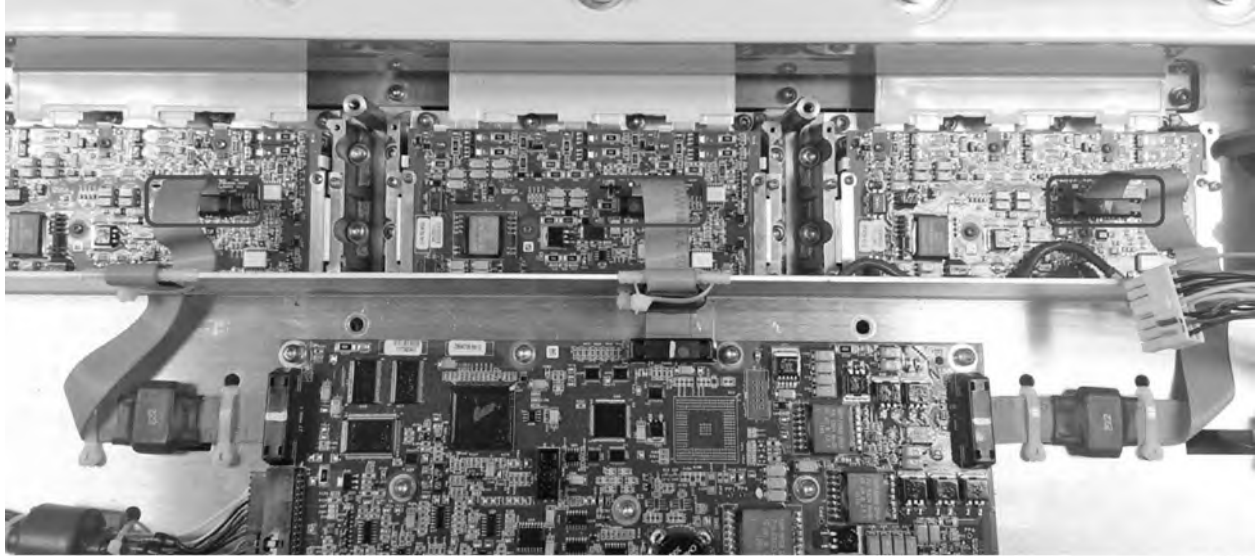


Figure 40. BCA Mounting Shelf (GATE Drive Card Cable Connectors Shown Circled)

3. Connect three (3) GATE Drive Card Connectors to three (3) GATE Drive Cards (refer to Figure 41) and install the cable strain relief caps.

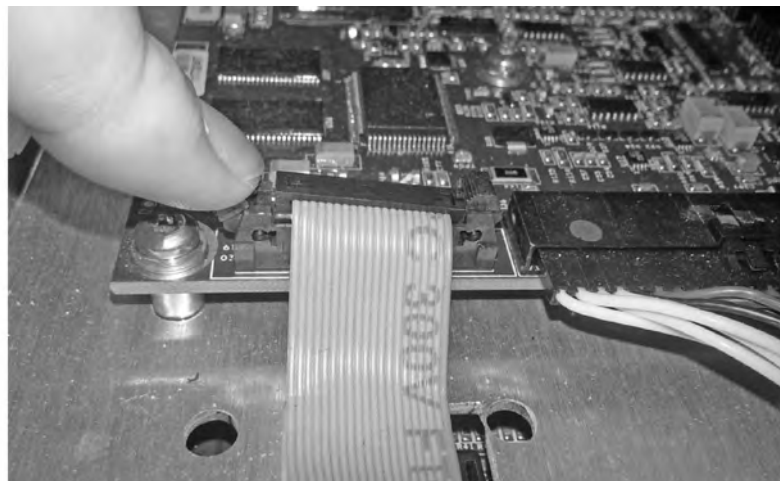


Figure 41. GATE Drive Card Cable Connector Installation (BCA Card Cable Connector Shown for Clarity)

4. 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 42). Torque the seven (7) M5x14mm screws to 3.1-3.5 N·m (27.4-31.0 lb in.).

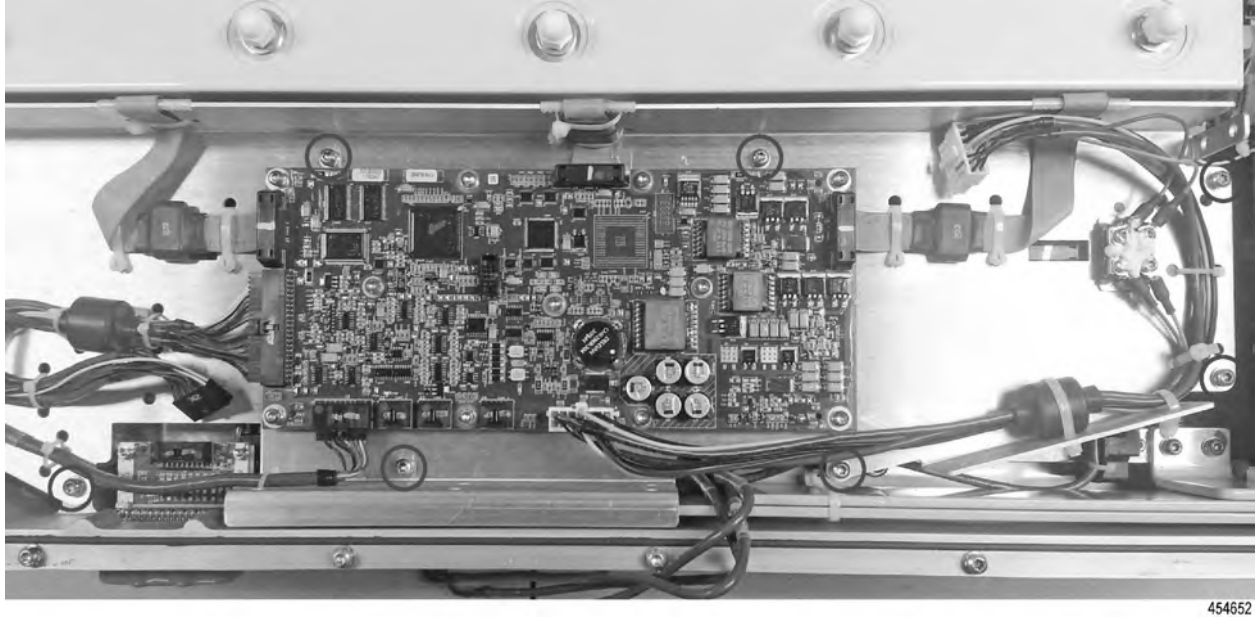
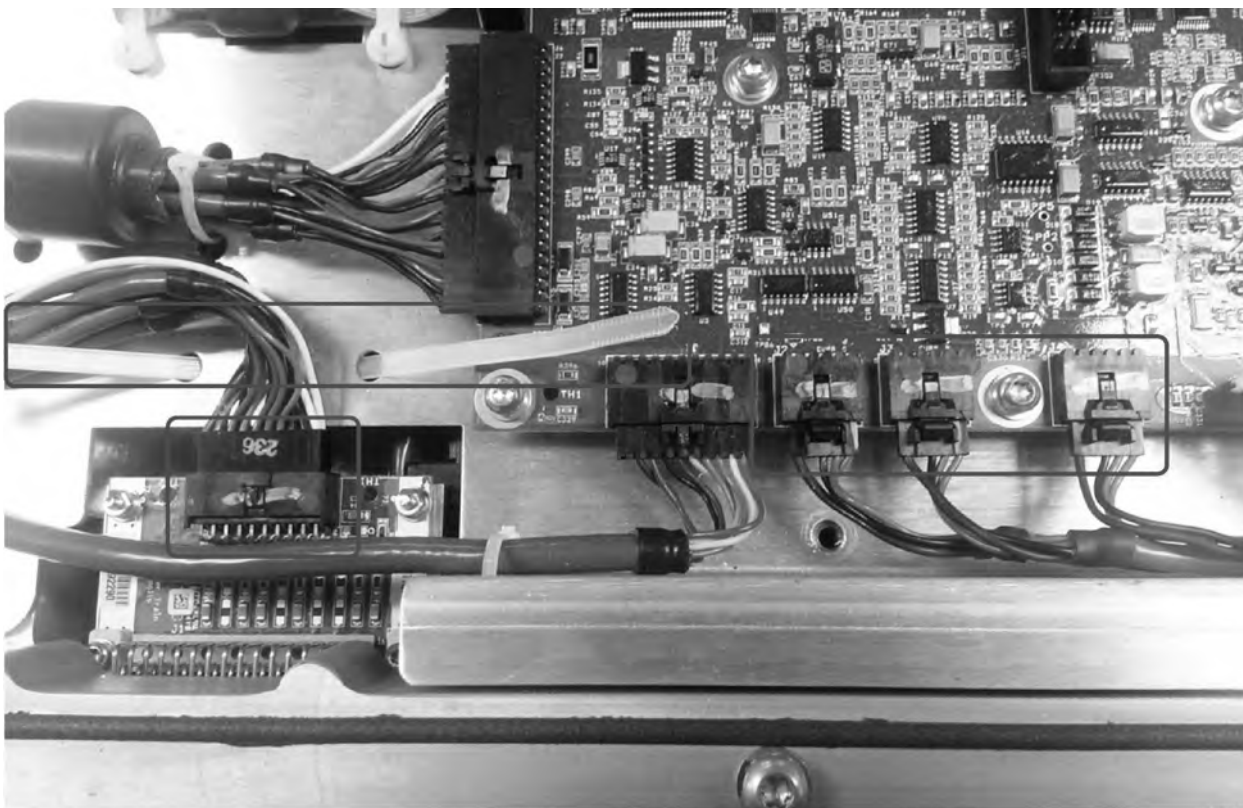


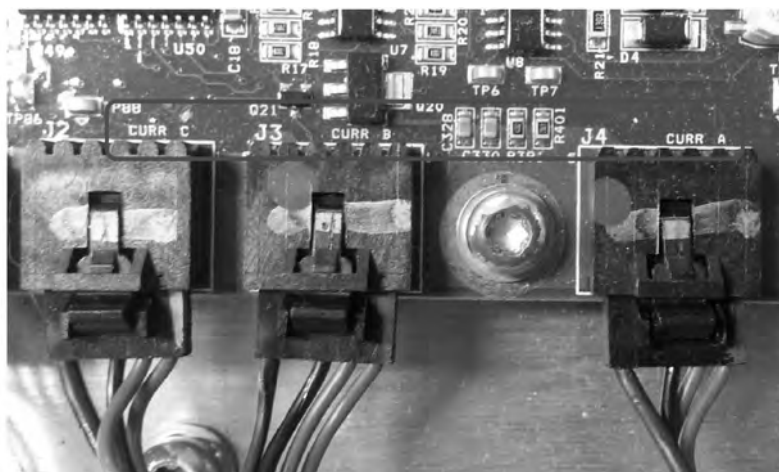
Figure 42. BCA Mounting Shelf Fastener Locations

5. Install five (5) wire harness connectors to circuit card surface mount connectors (refer to Figure 43, Figure 44, and Figure 45).



455457

Figure 43. Wire Harness Connector Installation (4 Locations)



453707

Figure 44. 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).



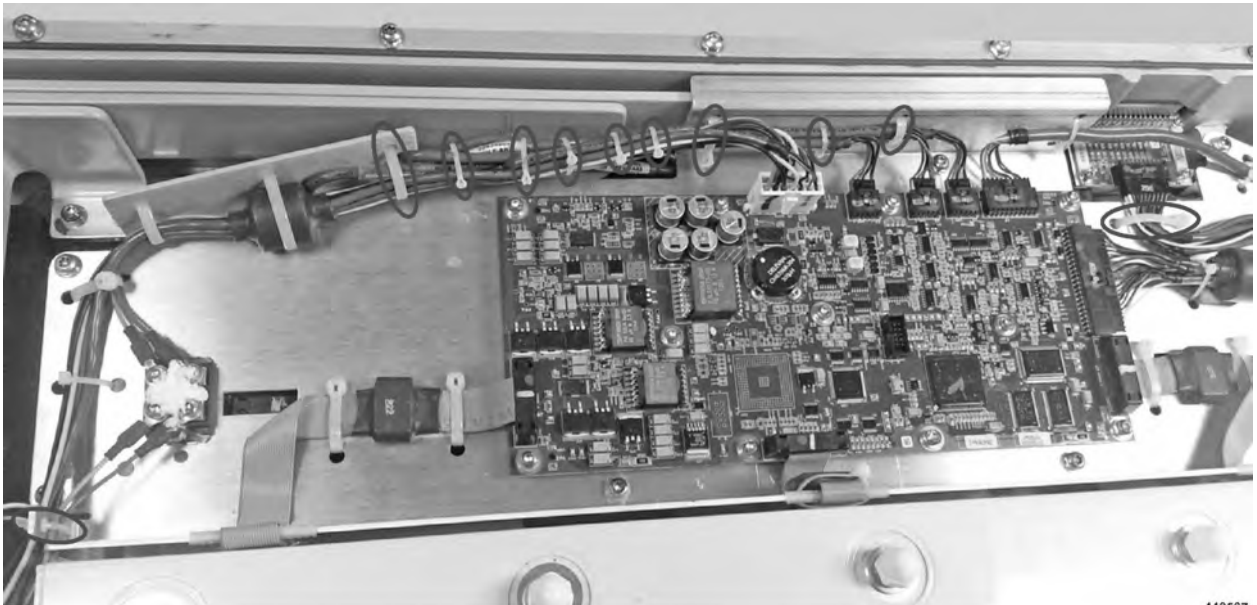
CAUTION: Permanent damage to the H 40/50 EP™ Drive Unit or DPIM can occur if the current sensor harnesses are plugged into the wrong connectors.



448591

Figure 45. Wire Harness Connector Installation

6. Install NEW wire ties as required to retain the wire harnesses (refer to Figure 46).



448567

Figure 46. Wire Tie Locations

Section 6: 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 47.



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.



422298

Figure 47. 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 48.



422350

Figure 48. 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 49 for fastener sizes and locations.

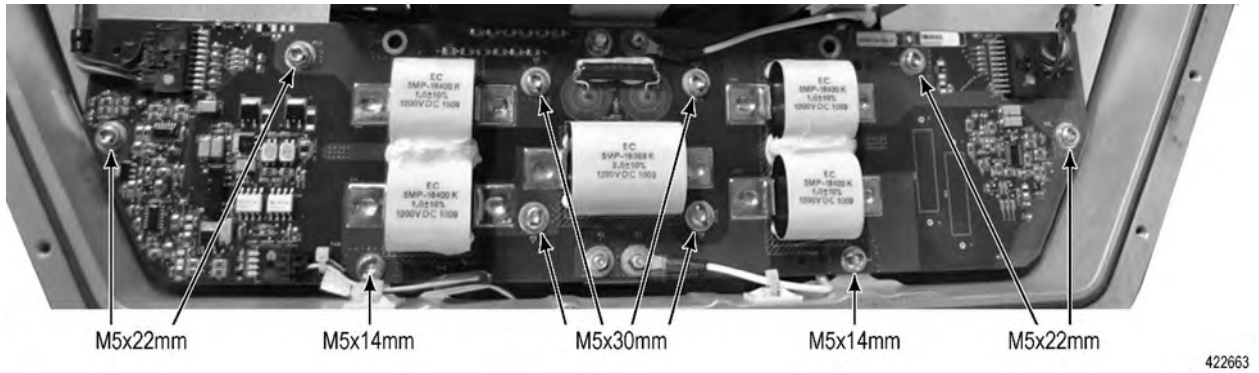


Figure 49. HVIL Circuit Card – Fastener Sizes/Locations

5. Install the two (2) wire ring terminals onto the studs at locations shown in Figure 50. 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 50. 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 47 and Figure 51 for wire tie locations.



Figure 51. 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) M5x18mm machine screws that secure the Main Cover to the DPIM Housing as shown in Figure 52. Torque the screws to 3.1-3.5 N·m (27-31 lb in).



421911

Figure 52. DPIM Main Cover



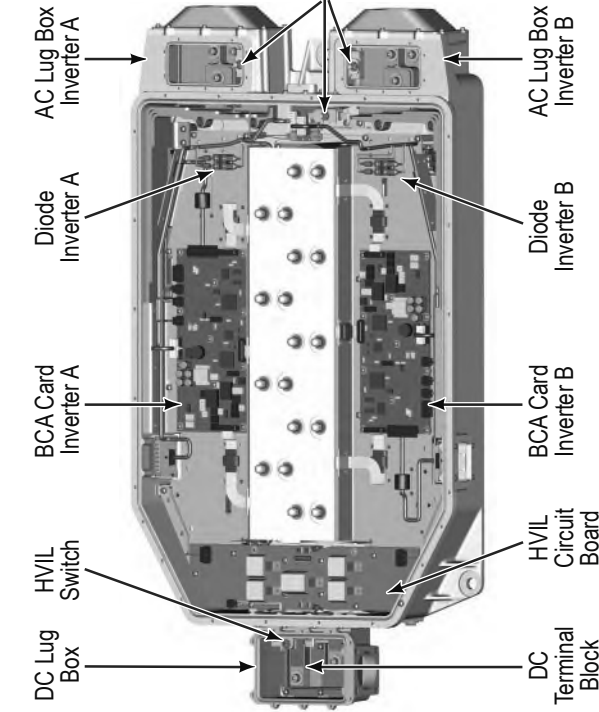
NOTE: For additional information refer to H 40/50 EP™ System Service Manual SM3602EN Appendix E.

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

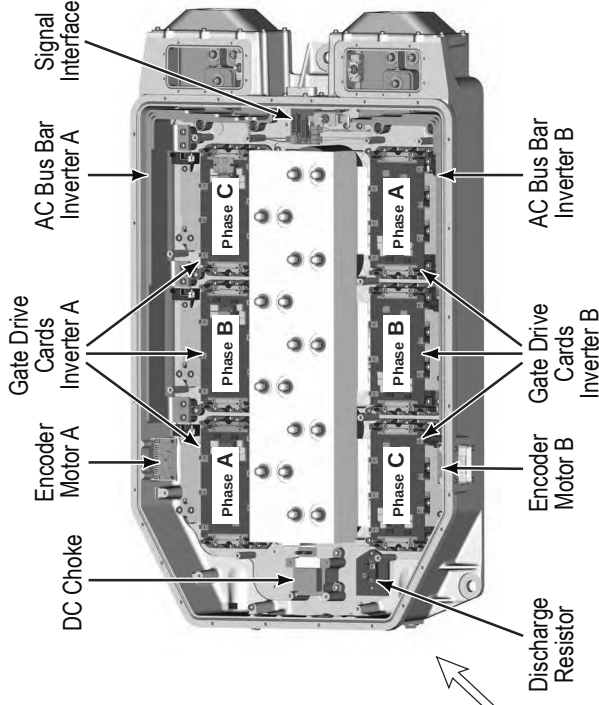
NOTE: This illustration is to be used for identifying the name and location of components within the Dual Power Inverter Module 2 (DPIM2). It is not intended to be used for disassembly and assembly procedures.

DPIM2

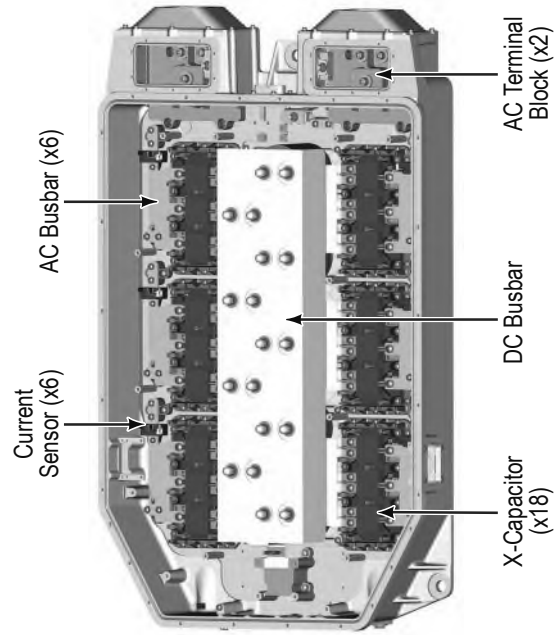
Levels of Assembly



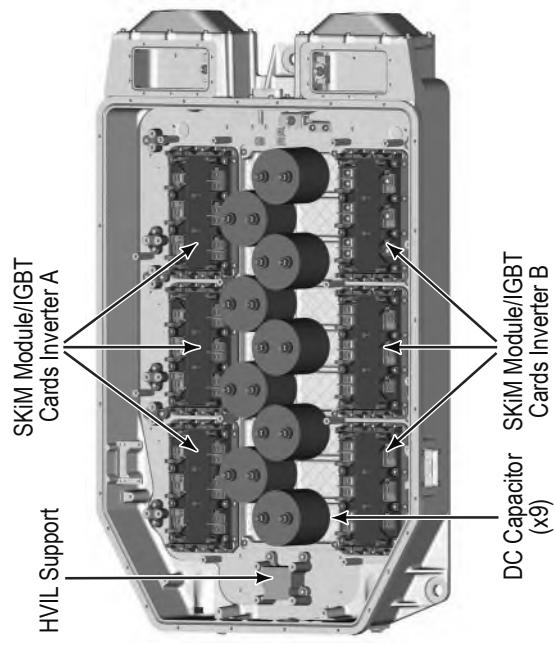
Level 1



Level 2



Level 3



Level 4