

RQ13-003

GM

10/7/2013

Q 09

ACTION

RQ13-003 Request 9 Partial III Response

9. Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and/or evaluations (collectively, “actions”) that relate to, or may relate to, the alleged defect in the subject vehicles that have been conducted, are being conducted, are planned, or are being planned by, or for, GM. Include any and all actions GM conducted on failed or suspect subject components removed from subject vehicles that were sold or were otherwise outside of GM’s control, and include any and all related document for each of these actions. For each such action, provide the following information:

- a. Action title or identifier;
- b. The actual or planned start date;
- c. The actual or expected end date;
- d. Brief summary of the subject and objective of the action;
- e. Engineering group(s)/supplier(s) responsible for designing and for conducting the action; and
- f. A brief summary of the findings and/or conclusions resulting from the action.

For each action identified, provide copies of all documents related to the action, regardless of whether the documents are in interim, draft, or final form. Organize the documents chronologically by action.

Action 9-A: Design, Development, and Validation Plan and Testing Specifications for the Generator Control Module (GCM) in the subject vehicles.

Start Date: September 2006

End Date: September 2011

Objective of Action: Design, Development, and Validation Plan and Testing Specifications and Documentation for the GCM.

Engineering Group(s)/Supplier(s): GM Global Electrification Electronics Engineering, GM Electric Drive Systems, GM Advanced Propulsion Quality, GM Components Holdings LLC (GMCH) Electronics Assembly Engineering, Delphi Corporation (Delphi).

Attachments: ATT_2_GM_CONF disk; folder labeled “Q_09_A”

Summary of findings: The GCM design met all Vehicle Technical Specifications (VTS), Subsystem Technical Specifications (SSTS), development, validation and manufacturing specifications/requirements requirement and validation requirements.

Action 9-B: Investigation and analysis of single vehicle BPIM/APM failure on Shanghai General Motors (SGM) vehicle.

Start Date: July 2011

End Date: August 2012

Objective of action: To investigate, evaluate and analyze information, vehicles and BPIM/APM to identify the root cause for failure.

Engineering Group: GM Global Electrification Electronics Engineering, GM Electric Drive Systems Engineering, GM Global Electrification Quality, GM Advanced Propulsion Quality, GM Components Holdings LLC (GMCH) Electronics Assembly Engineering, Delphi Corporation, Nanya (Kunshan) PCB Corporation (Nanya), United Chemi-Con, INC. (UCC), Exponent, Inc.

Attachments: ATT_1_GM_disk; folder labeled “Q_09_B”,
ATT_2_GM_CONF disk; folder labeled “Q_09_B”,

Summary of findings: GCM Power Board insulation layer change to the BPIM PCBs (Option 1 modification) implemented that addresses failure condition.

Action 9-C: GM Investigation of BPIM (GCM) isolation related issues.

Start Date: July 2012

End Date: May 2013

Objective of action: Investigate, evaluate and analyze isolation related issues alleged in TAC reports and warranty.

Engineering Group: GM Global Electrification Electronics Engineering, GM Electric Drive Systems Engineering, GM Global Electrification Quality, GM Advanced Propulsion Quality, GM Components Holdings LLC (GMCH) Electronics Assembly Engineering, Delphi Corporation, Nanya (Kunshan) PCB Corporation (Nanya), United Chemi-Con, INC. (UCC).

Attachments: ATT_1_GM_disk; folder labeled "Q_09_C",
ATT_2_GM_CONF disk; folder labeled "Q_09_C",

Summary of findings: Modify all 3 GCM PCBs insulation layers (Option 1.5 and Option 3) implemented that addresses failure condition. Service Bulletin 12238, Recalls 13136 and 13142.

Action 9-D: GM Investigation RQ13-003

Start Date: July 2013

End Date: September 2013

Objective of action: GM investigation regarding RQ13-003.

Engineering Group: GM Product Investigations, GM Global Electrification Electronics Engineering, GM Electric Drive Systems Engineering, GM Global Electrification Quality, GM Advanced Propulsion Quality, GM Components Holdings LLC (GMCH) Electronics Assembly Engineering.

Attachments: ATT_2_GM_CONF disk; folder labeled "Q_09_D".

Summary of findings: The inspection procedure described in the GM Recall Bulletin 13136 has proven to be an effective field remedy and has addressed any potential risks to motor vehicle safety.

- The rate of the alleged defect for the vehicles included in 13136 is very low
- The estimated future failure rate for the cap board is extremely low
- There have been no cap board failures in vehicles included in 13136
- If a cap board failure were to occur, it would likely only occur at low mileage and in vehicles subject to 13142 which requires the replacement of the GCM.

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DecodeBCP

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DecodeDTC

'Creation Date: 01/11/12 02:58:12 PM
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DecodeMCP

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DecodeVITM

'Creation Date: 01/11/12 02:58:12 PM

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07EF046240DD33, [11.00 *C] [Temp 4- Present]
07EF046240DF33, [11.00 *C] [Temp 5- Present]
07EF046240E134, [12.00 *C] [Temp 6- Present]
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07EF0462C01603, [State= Normal Operation] [VITM Mode No. 1]
07EF0462C0178B, [13.90 V] [WARRANTY SYSTEM No. 1]
07EF0562C0180473, [113.90 V] [WARRANTY PACK VOLTAGE- No. 1]
07EF0562C0190000, [0.00 A] [WARRANTY PACK CURRENT- No. 1]
07EF0562C01A0000, [0.00 A^2 * sec] [WARRANTY I^2*t- No. 1]
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07EF0462C01C66, [11.0 *C] [WARRANTY BATTERY TEMP #2- No. 1]
07EF0462C01D68, [12.0 *C] [WARRANTY BATTERY TEMP #3- No. 1]
07EF0462C01E66, [11.0 *C] [WARRANTY BATTERY TEMP #4- No. 1]
07EF0462C01F66, [11.0 *C] [WARRANTY BATTERY TEMP #5- No. 1]

07EF0462C02068, [12.0 *C] [WARRANTY BATTERY TEMP #6- No. 1]
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07EF0762C02600000193, [10075 ms] [No. 1]
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07EF0462C0298B, [13.90 V] [WARRANTY SYSTEM No. 2]
07EF0562C02A001C, [2.80 V] [WARRANTY PACK VOLTAGE- No. 2]
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07EF0562C02C0000, [0.00 A^2 * sec] [WARRANTY I^2*t- No. 2]
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07EF0462C03066, [11.0 *C] [WARRANTY BATTERY TEMP #4- No. 2]
07EF0462C03165, [10.5 *C] [WARRANTY BATTERY TEMP #5- No. 2]
07EF0462C03267, [11.5 *C] [WARRANTY BATTERY TEMP #6- No. 2]
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07EF0462C04169, [12.5 *C] [WARRANTY BATTERY TEMP #3- No. 3]
07EF0462C04267, [11.5 *C] [WARRANTY BATTERY TEMP #4- No. 3]
07EF0462C04366, [11.0 *C] [WARRANTY BATTERY TEMP #5- No. 3]
07EF0462C04469, [12.5 *C] [WARRANTY BATTERY TEMP #6- No. 3]
07EF0562C0450DCF, [3535 mV] [WARRANTY MAX CELL VOLTAGE- No. 3]
07EF0462C04609, [9] [WARRANTY MAX CELL NUMBER- No. 3]
07EF0562C0470DB2, [3506 mV] [WARRANTY MIN CELL VOLTAGE- No. 3]
07EF0462C0480D, [13] [WARRANTY MIN CELL NUMBER- No. 3]
07EF0762C04900000016, [22 counts] [No. 3]
07EF0762C04A00000193, [10075 ms] [No. 3]
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07EF0462C04C00, [State= Reset] [VITM MODE No. 4]
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07EF0562C04E0000, [0.00 V] [WARRANTY PACK VOLTAGE- No. 4]
07EF0562C04F0000, [0.00 A] [WARRANTY PACK CURRENT- No. 4]
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07EF0462C05100, [-40.0 *C] [WARRANTY BATTERY TEMP #1- No. 4]
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07EF0562C06B1388, [5000 mV] [WARRANTY MIN CELL VOLTAGE- No. 5]
07EF0462C06C00, [0] [WARRANTY MIN CELL NUMBER- No. 5]
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07EF0762C0700000200F, [8207 mAh] [Accumulated Discharge- History]
07EF0562C07104F7, [127.10 V] [Max Pack Voltage- History]
07EF0762C07200000000, [0 counts] [Accumulated Time At High- History]
07EF0562C073012B, [29.90 V] [Min Pack Voltage- History]
07EF0762C07400000031, [49 counts] [Accumulated Time At Low- History]
07EF0562C07504AD, [119.70 V] [Max OCV Pack- History]
07EF0562C076045F, [111.90 V] [Min OCV Pack- History]
07EF0562C07704BC, [121.20 A] [Max Charge Current- History]
07EF0762C07800000000, [0 counts] [Accumulated Time At High- History]
07EF0562C079066D, [164.50 A] [Max Discharge Current- History]
07EF0762C07A00000012, [18 counts] [Accumulated Time At High- History]
07EF0562C07B2641, [979300.00 A² * sec] [Acc. Time High- History]
07EF0762C07C0000019C, [412 counts] [Accumulated Time At High- History]
07EF0462C07D8F, [31.5 *C] [USAGE MAXIMUM BATTERY TEMP 1- History]
07EF0462C07E90, [32.0 *C] [USAGE MAXIMUM BATTERY TEMP 2- History]
07EF0462C07F8D, [30.5 *C] [USAGE MAXIMUM BATTERY TEMP 3- History]
07EF0462C0808E, [31.0 *C] [USAGE MAXIMUM BATTERY TEMP 4- History]
07EF0462C0818E, [31.0 *C] [USAGE MAXIMUM BATTERY TEMP 5- History]
07EF0462C0828D, [30.5 *C] [USAGE MAXIMUM BATTERY TEMP 6- History]
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RawData

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RQ13-003

GM

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E11 BAS+ salable fuse broken

E11 BAS+ salable vehicle fuse broken

Vehicle History

- Salable in June, 2011
- The vehicle was sent to PATAC to be prepared for media test drive event
- The current mileage is 15 km
- Software/cal: VESCOM 10.3

What occurred before the incident?

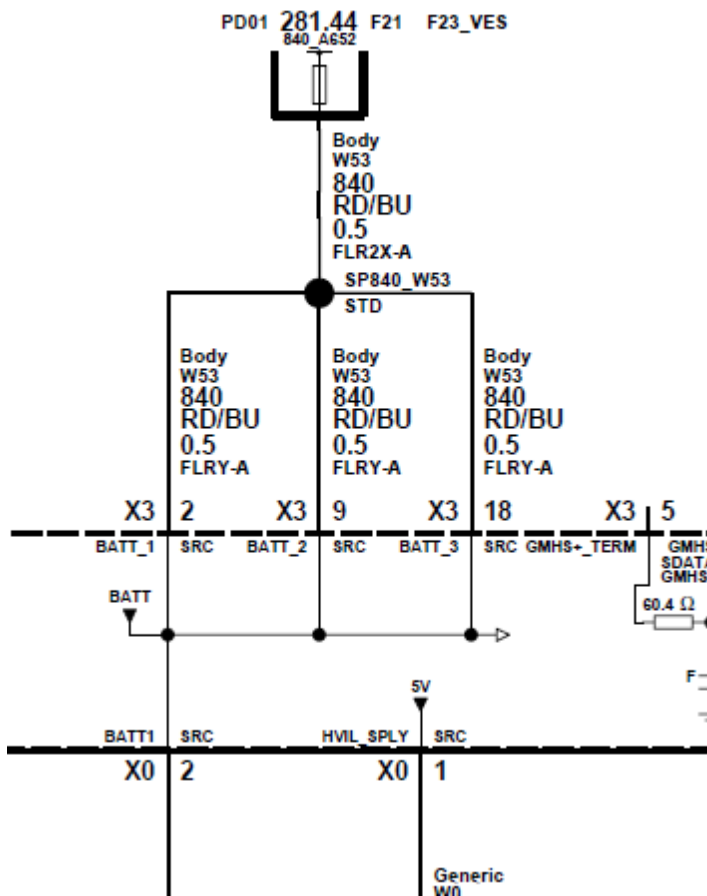
- The vehicle was shipped to PATAC from SGM assembly plant via touring truck

Incident description

- Incident occurred on July 5, 2011.
- When the vehicle was unloaded from the touring truck, it was found that 12V battery voltage low. The vehicle could not be started

What actions right after incident?

- Jump started the vehicle but 12V charging not functional
- Checked the fuse (F23 as shown in the picture). It was broken



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- Checked wire harness of X3-2, X3-9 and X3-18. They were in good conditions
- Every time pull plug X3 and reconnect – causing F23 fuse broken
- Burn mark found in all the three powerpack signal connectors (X1, X2, X3)
- Engineers thought powerpack has short circuit inside so replaced powerpack. Fuse F23 functioned normally but 12V battery charging still not functional.
- Checked 175A fuse (from APM to 12V battery) and found it was broken as well
- Replaced 175A fuse. Now the vehicle is normal

Next Step

- SGM SQE will send the powerpack to supplier for root cause analysis

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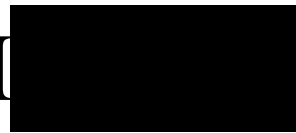
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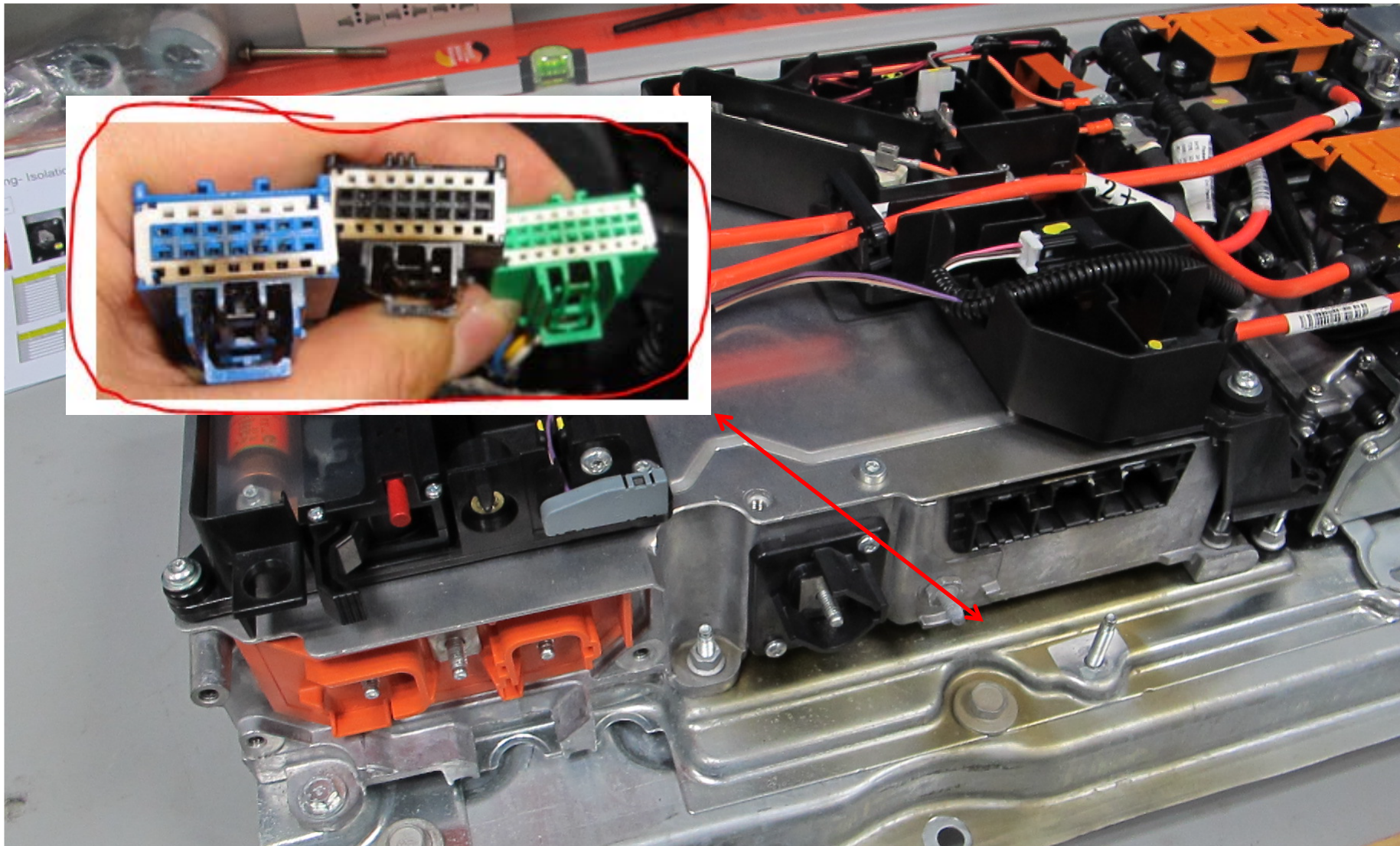
Q 09 B

Electrical Witness Marks

LQ58124111144002 VIN

LSGGF53G4BH





Evidence of arcing on 12V Low Voltage Connectors.

Same Vehicle: VIN LSGGF53G4BH [REDACTED]

Original Powerpack: LQ58124111144002


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High Voltage Isolation Fault

VIN  Pack

LQ5618411109003

SGM E11 BAS+ MVBs

(High Voltage Isolation Fault)

Note: Pictures in this presentation are VIN LSGGF53G4BH[REDACTED]9, replaced suspect powerpack LQ56184111109003 with known good powerpack LQ56184111109004 / original HVIL Cover (20T) LV02984111094007 (1P) 28303974 from July 6th High Voltage Isolation Failure in Dingyuan proving grounds.

Summary:

No visual abnormalities on HVIL cover / new powerpack / or wiring leads (page 2~6)

12V Low Voltage Connectors show no signs of damage (page 7)

HVIL Cover (20T) LV02984111094007 (1P) 28303974 sent to GMCH

Powerpack LQ56184111109003 @ GMIO Engineering Analysis Lab

-Requested electrification testing attached



18 July 2011



19 July 2011

HVIL Cover (20T) LV02984111094007 (1P) 28303974

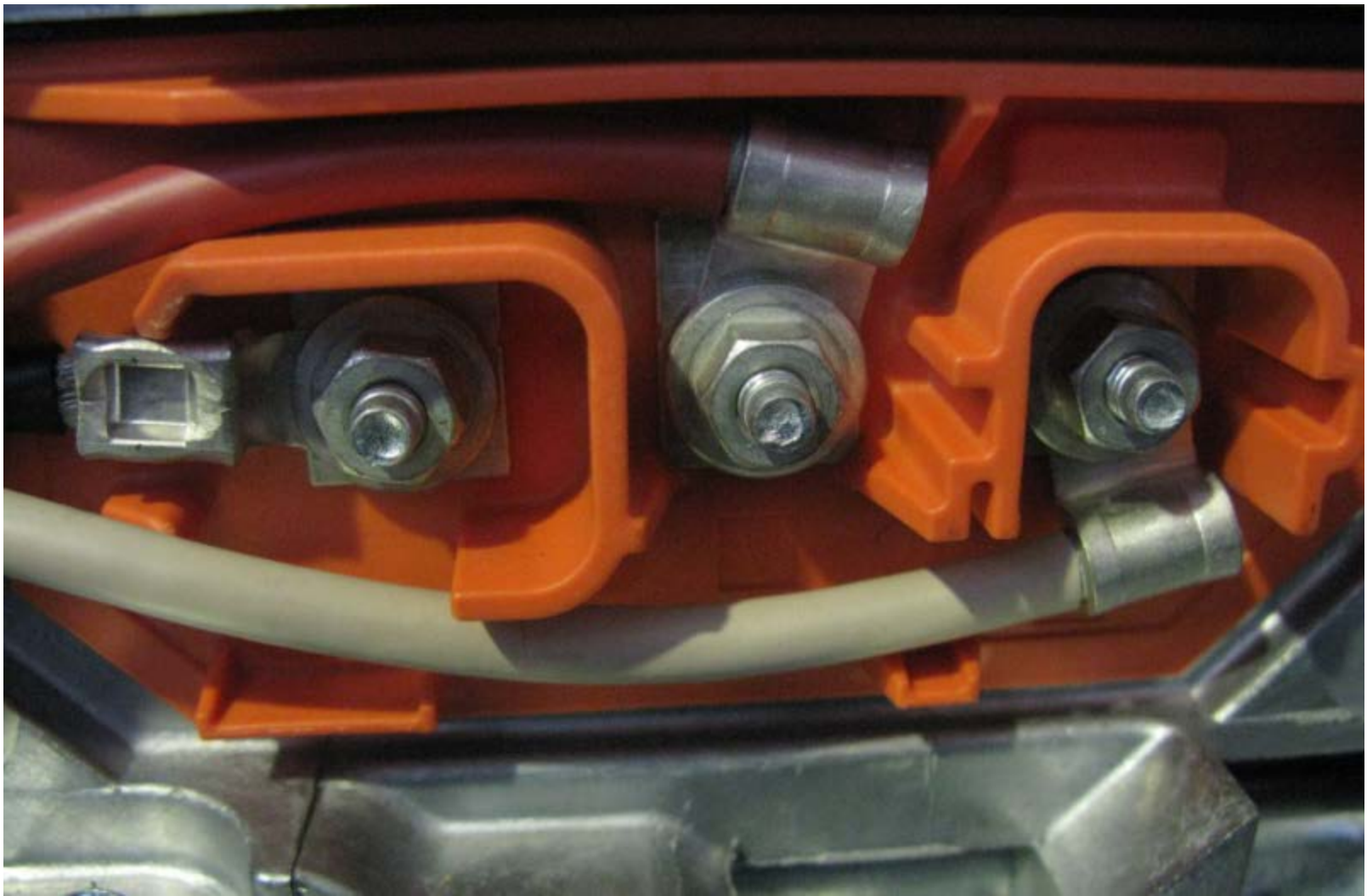


Original HVIL Cover from reported failure: High Voltage Isolation Failure 06July 2011

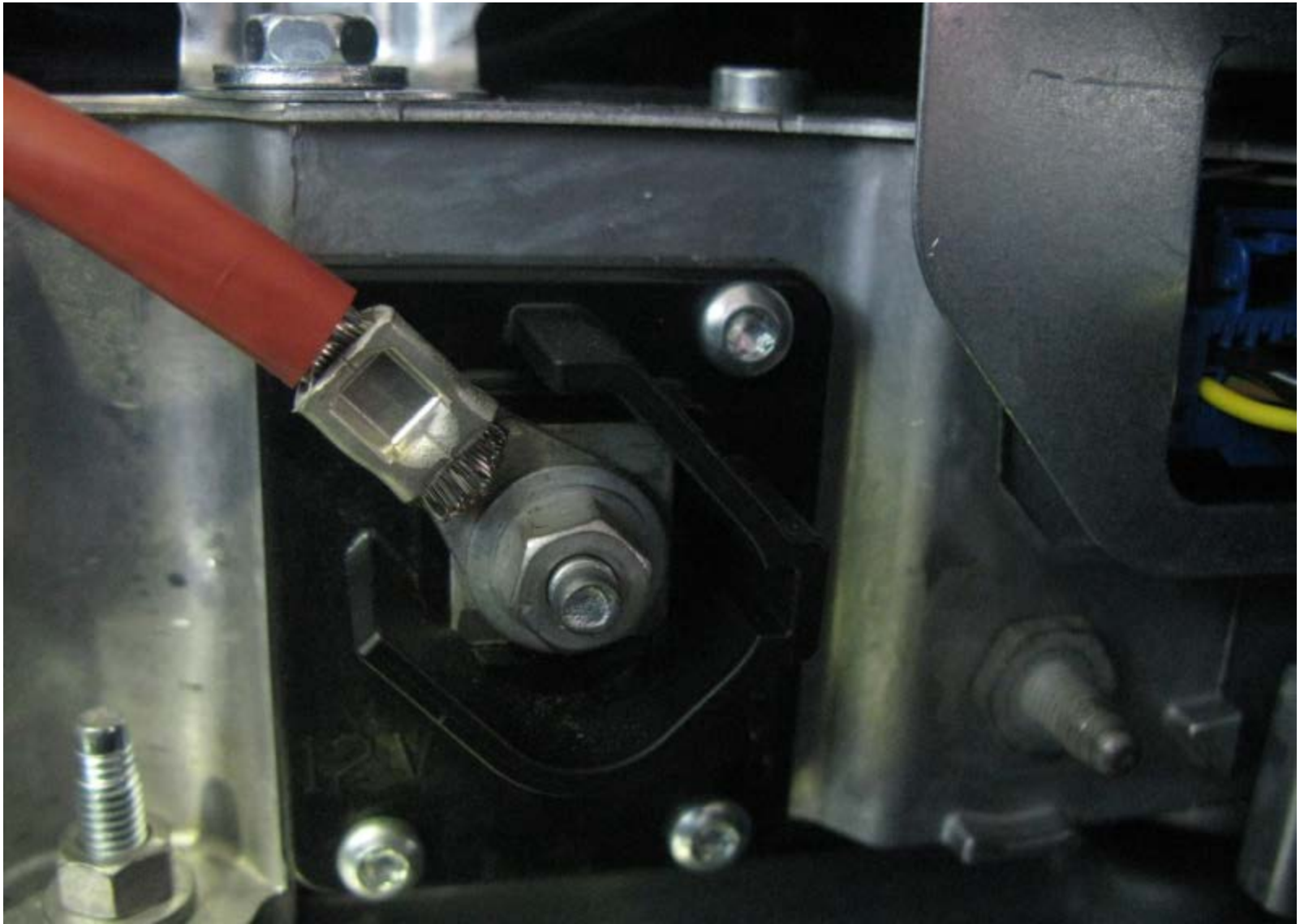
Original Powerpack: LQ56184111109003

Swapped 'known good' Powerpack: LQ 56184111109004

Same Vehicle: VIN LSGGF53G4BH [REDACTED]



3 Phase Terminal Leads: New Powerpack (known good)
LQ56184111109004



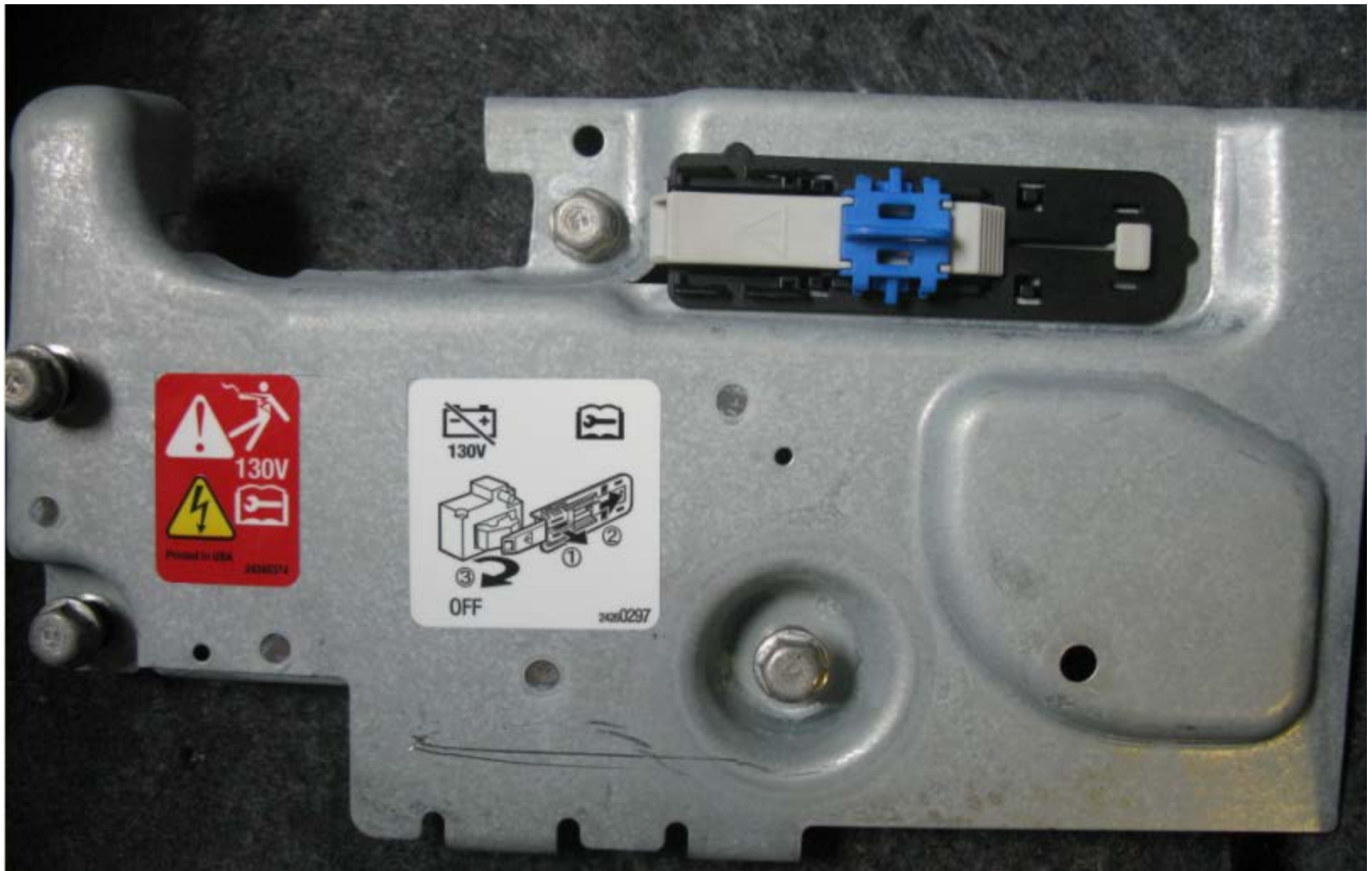
12V Accy terminal: New Powerpack (known good)
LQ56184111109004



Original HVIL Cover (back)

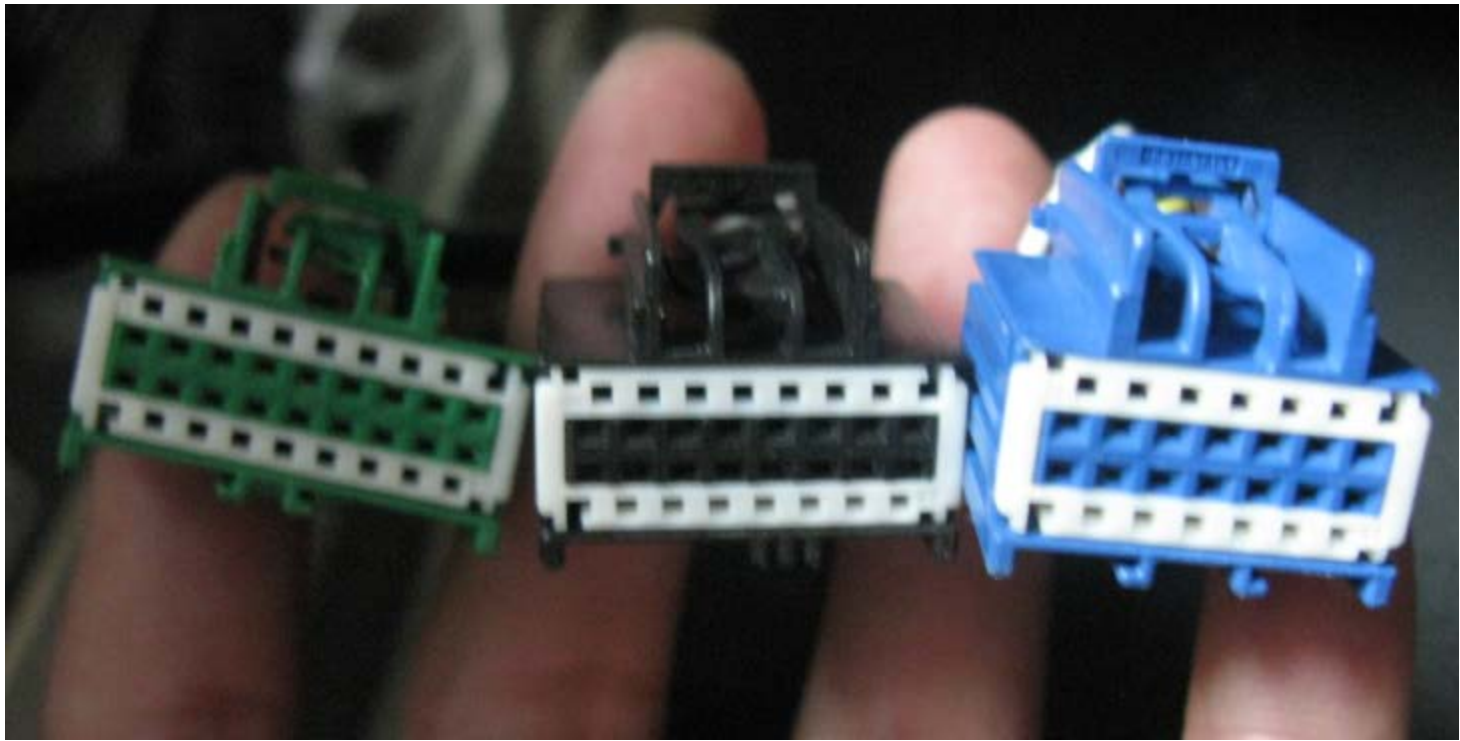
Resistance recheck: 3050ohm

HVIL Cover (20T) LV02984111094007 (1P) 28303974



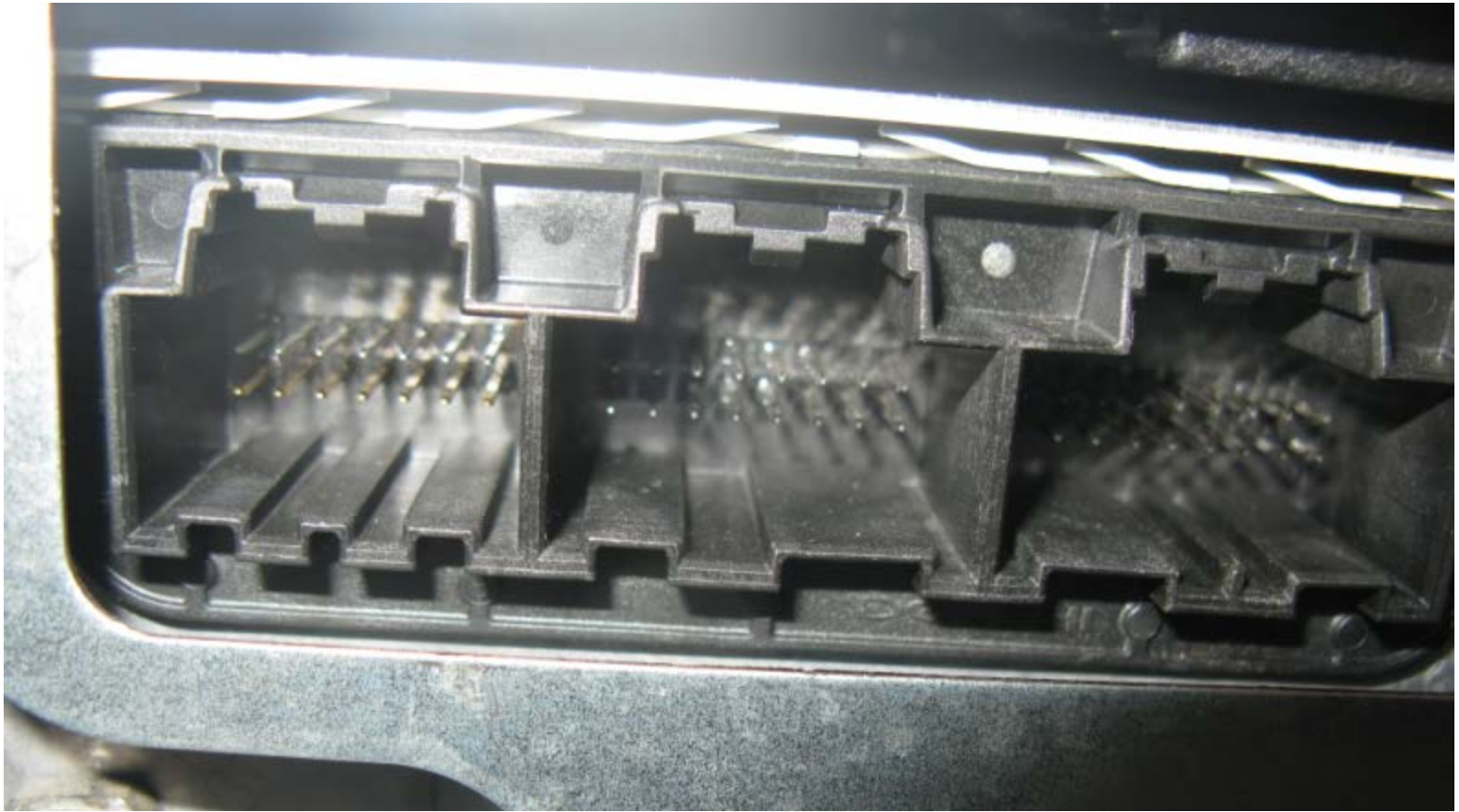
Original HVIL Cover (front)

HVIL Cover (20T) LV02984111094007 (1P) 28303974



BPIM 12 signal connector(body harness side)

VIN# LSGGF53G4BH [REDACTED]



BPIM 12V Low Volatge
System Connectors : New Powerpack (known good)
LQ56184111109004



HVIL terminal (powerpack side)

BPIM 12V Low Volatge

System Connectors : New Powerpack (known good)

LQ56184111109004



New cover installed

RQ13-003

GM

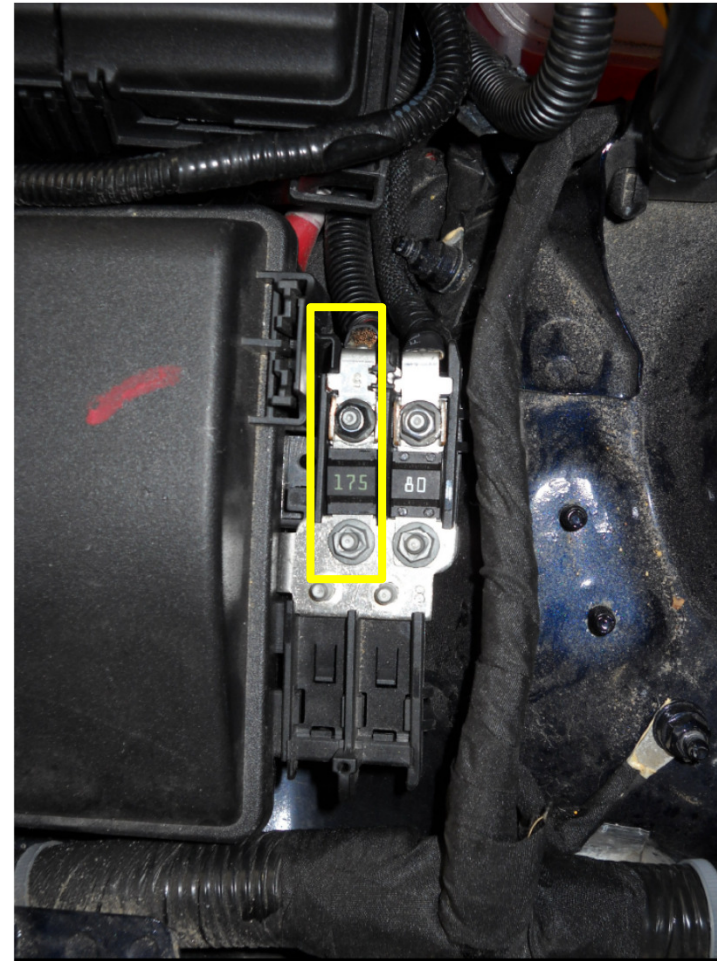
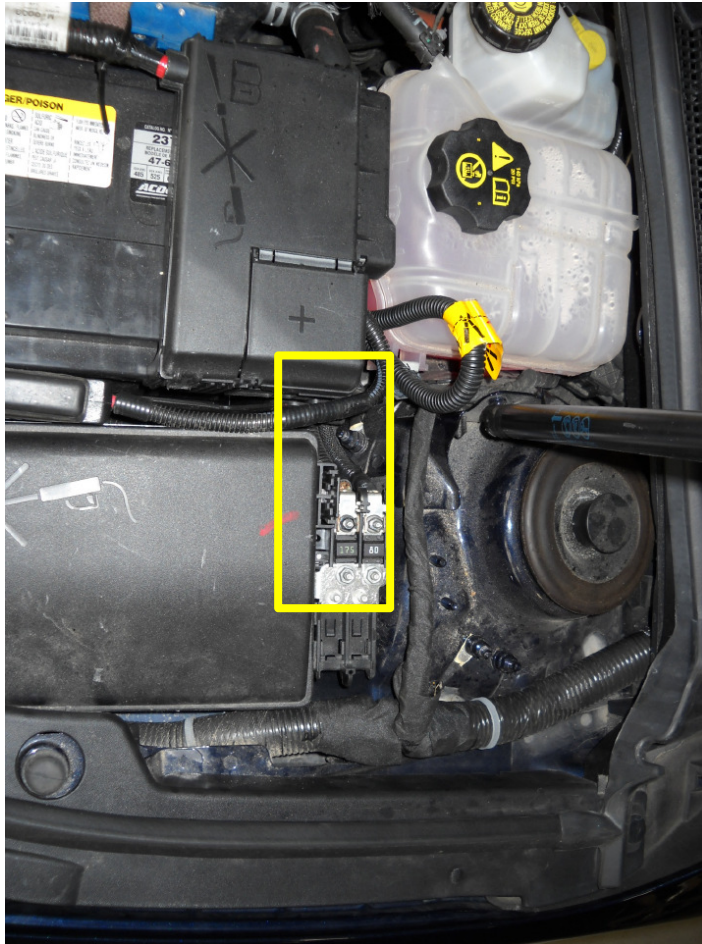
10/7/2013

Q 09 B

Microsoft PowerPoint - BAS+
Power Pack- LeakageCurrent
Measurement

Isolation Measurement in Vehicle

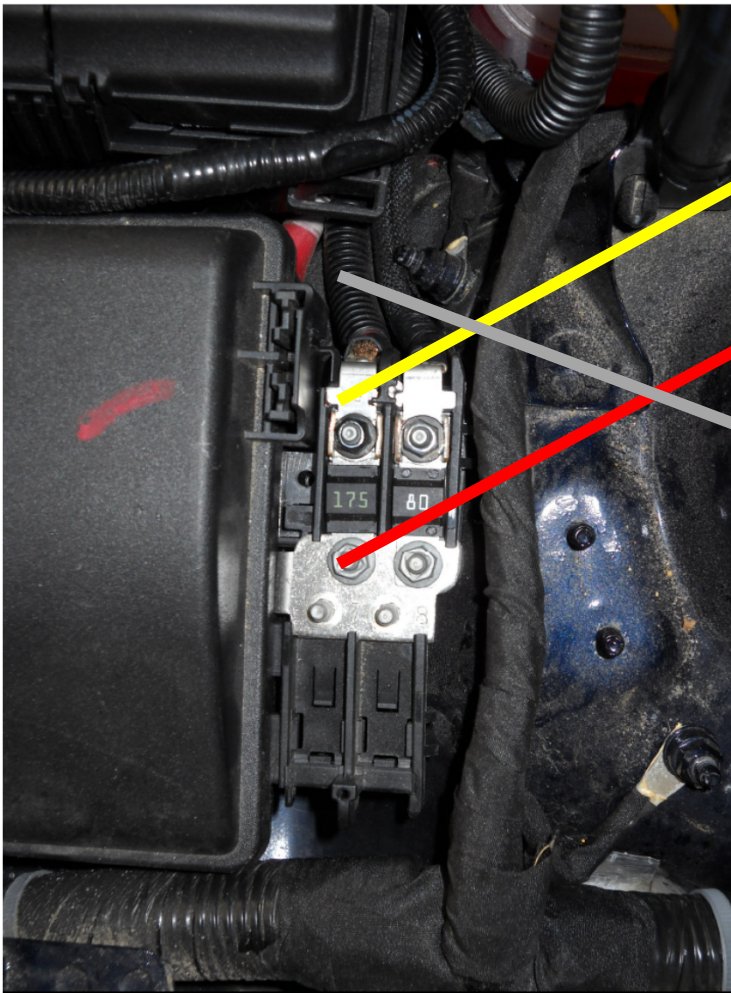
Location of 175 A Fuse





Isolation Measurement in Vehicle

Connecting Ammeter



Remove Cable From Top of 175A Fuse

+ Lead of Ammeter to existing Battery Stud

- Lead of Ammeter to Removed APM Output Cable

Wait One Minute After Connecting. Record Value

Nominal Value= 50 μ A
High Limit= 500 μ A

RQ13-003

GM

10/7/2013

Q 09 B

PowerPack Failure Pics-

LSGGF53G4BH  pack

LQ5812411144002

SGM E11 BAS+ MVBs

(fuse burned – fuse F23 and 175A)

Note: Pictures in this presentation are VIN LSGGF53G4BH [REDACTED], replaced suspect powerpack LQ58124111144002 with known good powerpack LQ58124111143006 / original HVIL Cover from July 5th burned fuse failure.

Summary:

No evidence on the 3phase leads of arching (pages 3 & 4)

No evidence on the 12V accy lead of arching (page 3 & 5)

12V Low Voltage connectors show signs of burn/arching (page 8)

New powerpack shows no evidence of damage (page 9 & 10)

No fault codes set since swapping new Powerpack

Vehicle currently resumed testing.



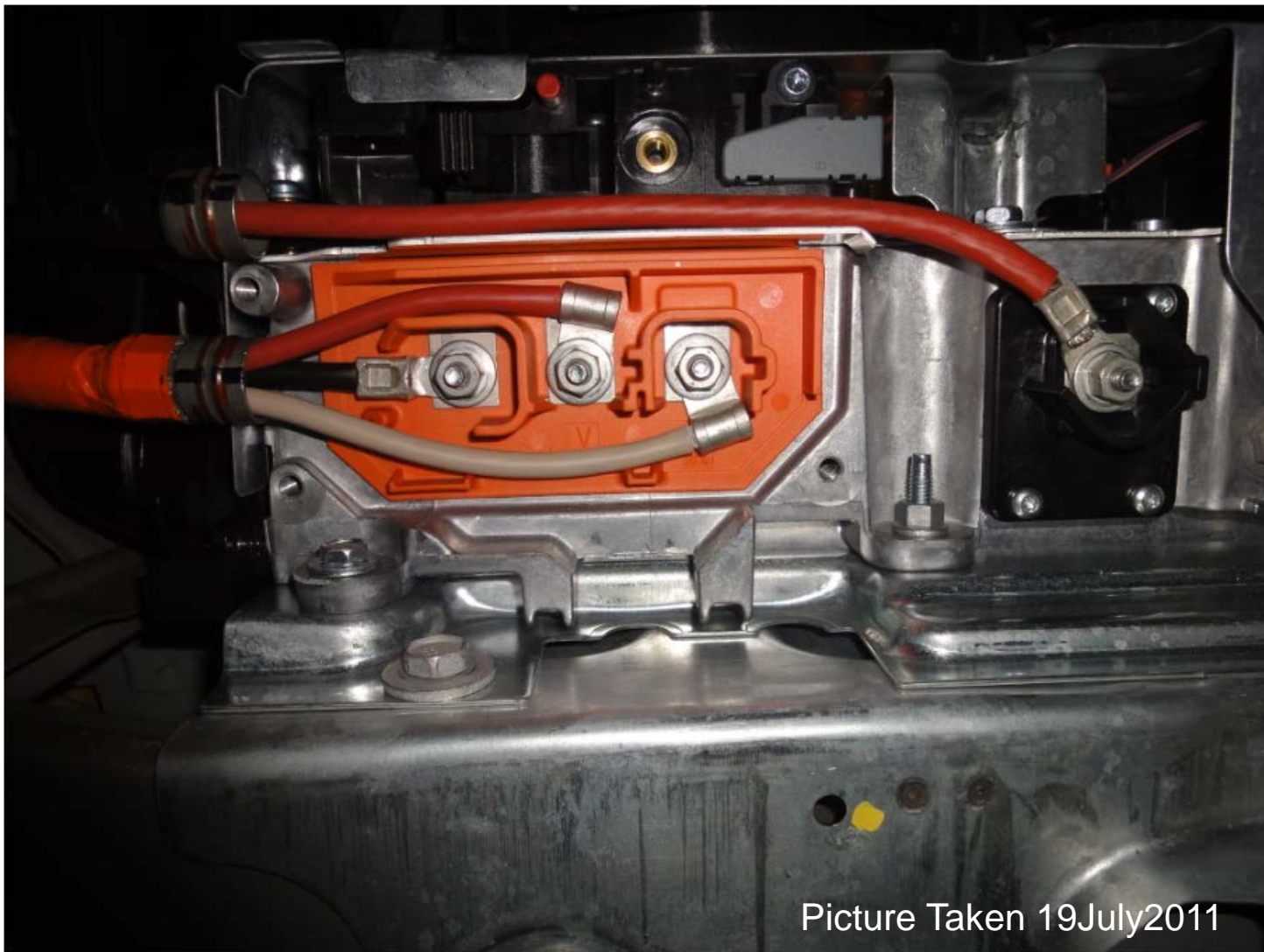
Picture Taken 19July2011

Original HVIL Cover from reported failure: fuse burned – fuse F23 05July 2011

Original Powerpack: LQ58124111144002

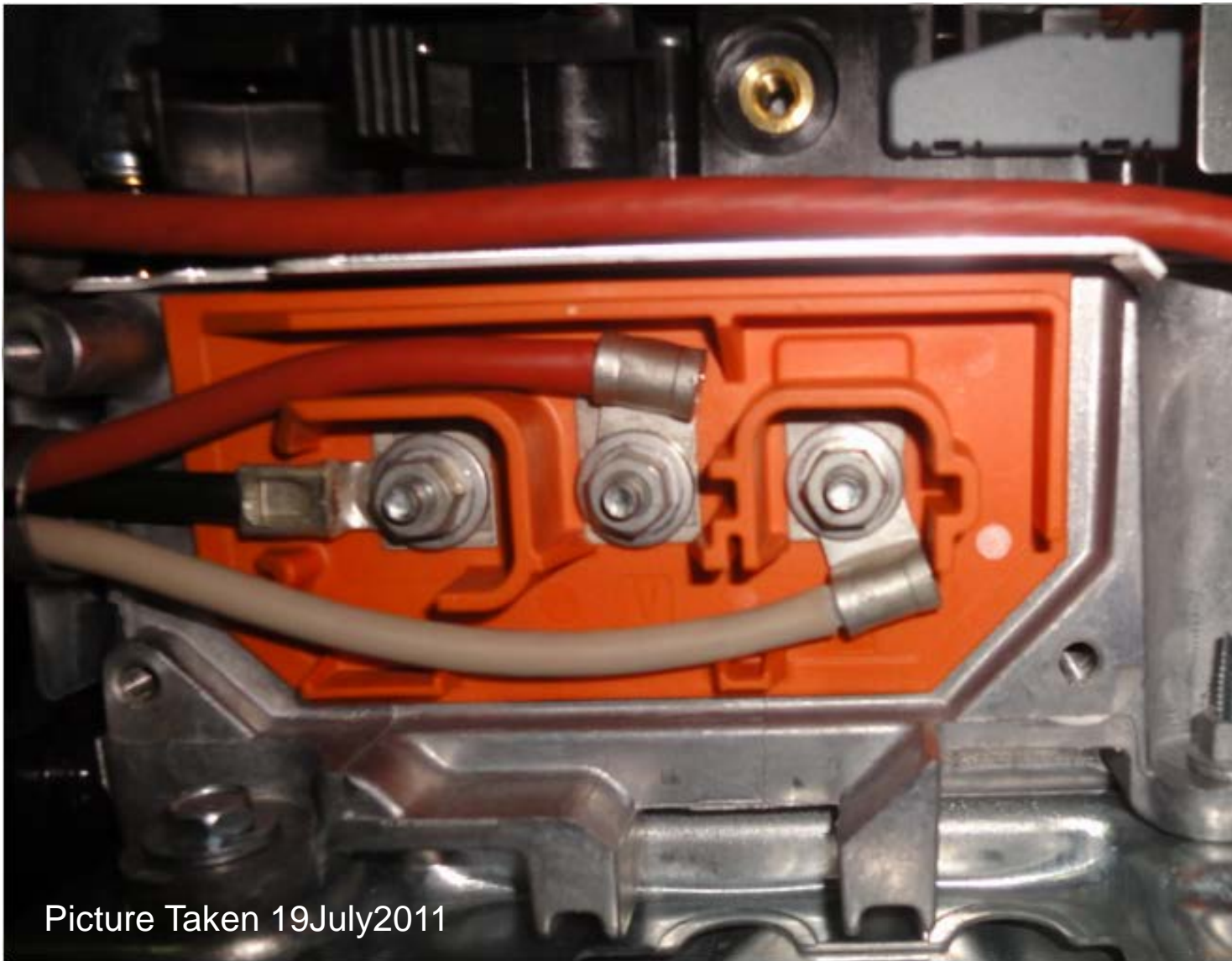
Swapped 'known good' Powerpack: LQ58124111143006

Same Vehicle: VIN LSGGF53G4BH [REDACTED]



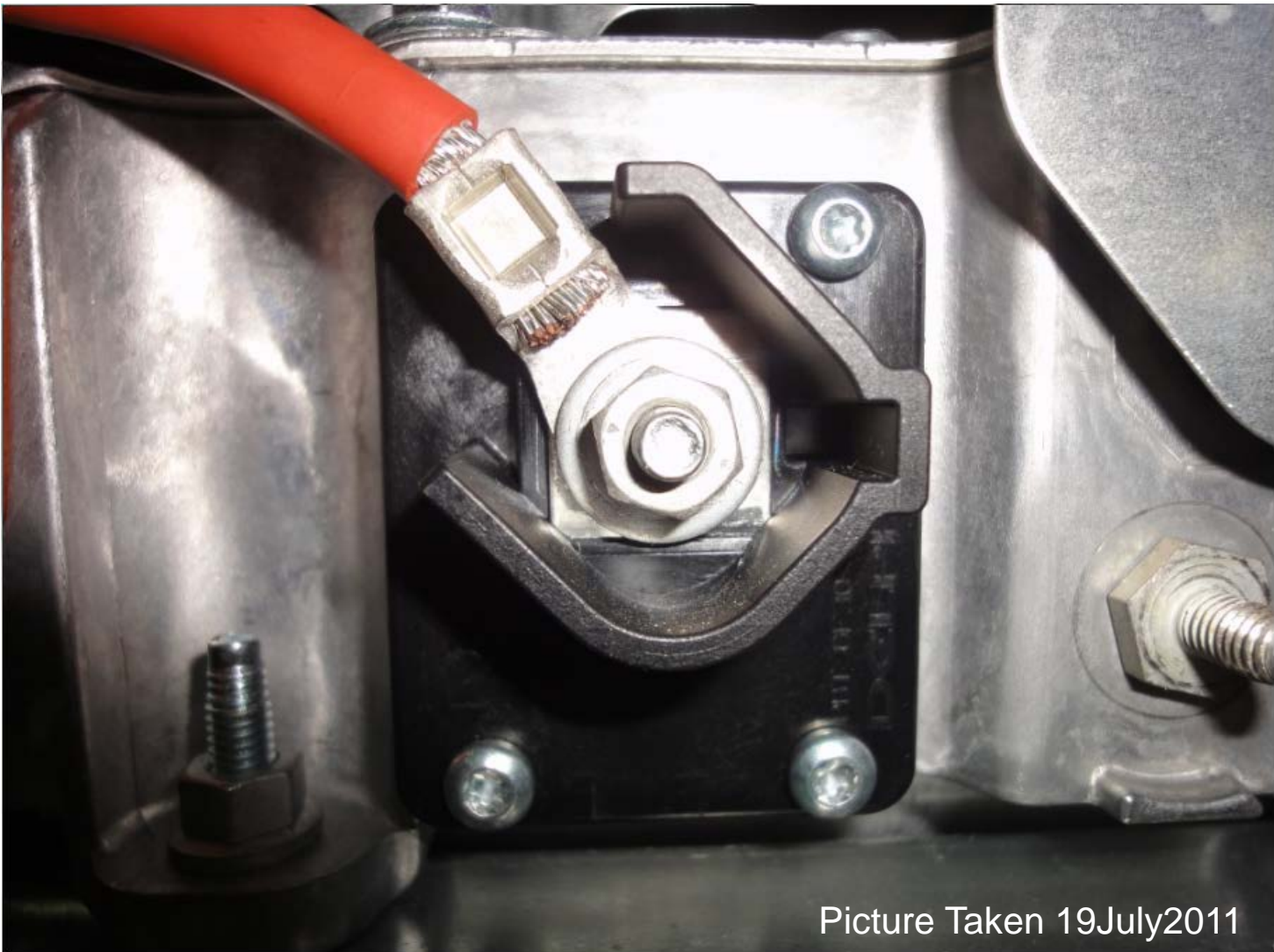
3 Phase Terminal Leads: Powerpack LQ58124111143006

Focus point of picture on wire lead connector – looking for evidence of arcing; source of the discoloration to original Powerpack. No evidence found.



Picture Taken 19July2011

3 Phase Terminal Leads: Powerpack LQ58124111143006
Focus point of picture on wire lead connector – looking for evidence of arcing; source of the discoloration to original Powerpack. No evidence found.



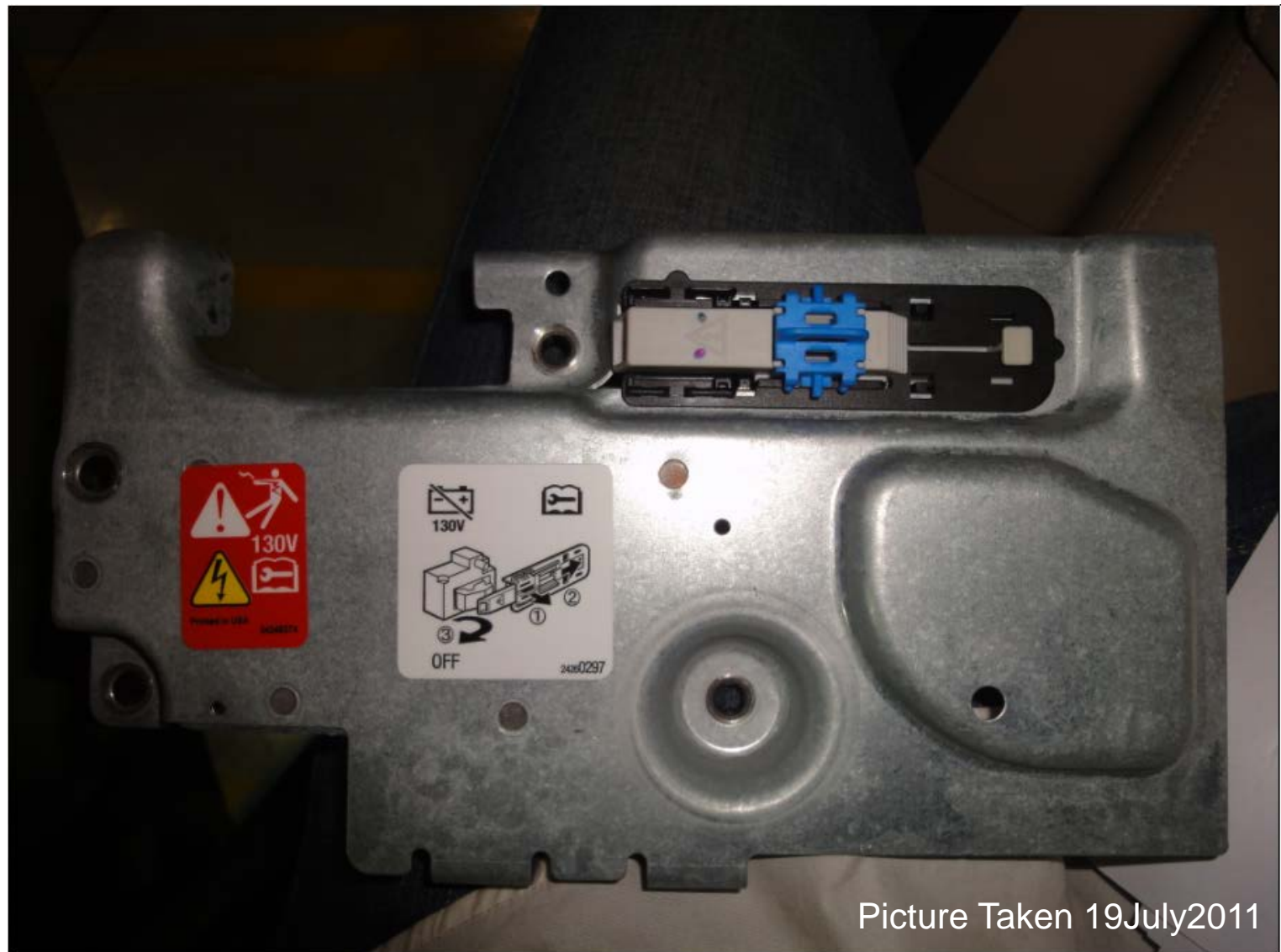
12V Accy Lead: Powerpack LQ58124111143006

Focus point of picture on wire lead connector – looking for evidence of arcing; source of the discoloration to original Powerpack. No evidence found.



Picture Taken 19July2011

HVIL Cover (back)
p/n S92 24260298
(20T) LV02584111143?0
(1P) 28303?74



Picture Taken 19July2011

HVIL Cover (front)
p/n S92 24260298
(20T) LV02584111143?0
(1P) 28303?74



Evidence of arcing on 12V Low Voltage Connectors.

Original Powerpack: LQ5812411144002

Swapped 'known good' Powerpack: LQ5812411143006

Same Vehicle: VIN LSGGF53G4BH

Picture taken 19July2011
In vehicle

BPIM/APM 12V Low Voltage Signal Connectors
Body wiring harness side



Picture Taken 19July2011

BPIM 12 signal connector(powerpack side)

Note: This is NEW powerpack (LQ58124111143006) and do not expect to see damage.



HVIL terminal (powerpack side)

Note: This is new powerpack (LQ58124111143006) and do not expect to see damage on pack.

RQ13-003

GM

10/7/2013

Q 09 B

Powerpack_LQ5812411114400

3_PhotoTaken_20110818

BAS+
Powerpack
LQ58124111144003

Photos taken Aug-18,2011
Thomas Zhu



FLUKE 1587 INSULATION MULTIMETER

55.80 V DC
Auto Range 0.0

LOCK HOLD MINMAX Hz RANGE °C °F

INSULATION TEST

mV Ω mA 50V 1000V INSULATION

V Ω mA CC



FLUKE 1587 INSULATION MULTIMETER

55.78 V DC
Auto Range 60

LOCK HOLD MINMAX Hz RANGE °C °F
INSULATION TEST
mV mV mA 50V 100V INSULATION
OFF V Ω mA CC



 
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MADE IN JAPAN

⚠️
130V
⚡

RQ13-003

GM

10/7/2013

Q 09 C

eAssist No Trouble Found Meeting

Wednesday, June 19, 2013

3:00 PM – 4:00 PM EDT

Invitees (Attendees in Bold):

Brian Ciaverella, Daniel Weaver, David Deal, David J. Martin, Frank Schauerte, Gary Backs, Hossein Lotfalian, Jacob D Bylsma, James Fortune, Joseph Thompson, Kevin Diviney, Kristin L Curran, Len Chalawa, Reena Datta, Rick H Schroeder, Stephen Farris, Tony J. Saliga, William L Aldrich, William Whitlock, Zachary Pieri

Call-in Information:

MML: (866) 226-3606 / (678) 466-7834

Code: 646 2538

Webex Meeting Information:

Meeting Link: <https://gm.webex.com/gm/j.php?ED=194335218&UID=492344932&PW=NmzU1MjM5MDQx&RT=MIMxMQ%3D%3D>

Meeting Number: 268 583 684

Meeting Password: 1234

MEETING AGENDA

Agenda Item	Presenter	Time								
<p>1. Review Post-Option 1 Returns</p> <ul style="list-style-type: none">Review Warranty Spreadsheet (including P1A6F, POCA2) plus TAC and QIS2 history<ul style="list-style-type: none">Brian Ciaverella said he was not able to locate GDS2 data on the following VINs. <table border="1"><tbody><tr><td>1G11D5SR6T [REDACTED] (BPIM606 - set P1A6F twice)</td><td>1G11D5SR6DF [REDACTED] None Found</td></tr><tr><td>1G11D5SR3T [REDACTED] (BPIM591 - set P1A6F twice)</td><td>1G11D5SR3DF [REDACTED] None Found</td></tr><tr><td>1G4GC5ER5T [REDACTED] (BPIM589 - TAC case mentions session logs)</td><td>1G4GC5ER5DF [REDACTED] None Found</td></tr><tr><td>1G11D5SR0T [REDACTED] (BPIM584 - TAC case mentions session logs)</td><td>1G11D5SR0DF [REDACTED] None Found</td></tr></tbody></table>	1G11D5SR6T [REDACTED] (BPIM606 - set P1A6F twice)	1G11D5SR6DF [REDACTED] None Found	1G11D5SR3T [REDACTED] (BPIM591 - set P1A6F twice)	1G11D5SR3DF [REDACTED] None Found	1G4GC5ER5T [REDACTED] (BPIM589 - TAC case mentions session logs)	1G4GC5ER5DF [REDACTED] None Found	1G11D5SR0T [REDACTED] (BPIM584 - TAC case mentions session logs)	1G11D5SR0DF [REDACTED] None Found	All	55 min
1G11D5SR6T [REDACTED] (BPIM606 - set P1A6F twice)	1G11D5SR6DF [REDACTED] None Found									
1G11D5SR3T [REDACTED] (BPIM591 - set P1A6F twice)	1G11D5SR3DF [REDACTED] None Found									
1G4GC5ER5T [REDACTED] (BPIM589 - TAC case mentions session logs)	1G4GC5ER5DF [REDACTED] None Found									
1G11D5SR0T [REDACTED] (BPIM584 - TAC case mentions session logs)	1G11D5SR0DF [REDACTED] None Found									
<p>2. Round Table</p> <ul style="list-style-type: none">Round Table ItemsPrioritize returns for next meetingNext Meeting:<ul style="list-style-type: none">Wednesday, July 18th at 3PM EDT	All	5 min								

eAssist No Trouble Found Meeting

Wednesday, January 23, 2013

3:00 PM – 4:00 PM EST

Invitees (Attendees in Bold):

Daniel Weaver, David Deal, Frederick Billotto, Gary Backs, Hossein Lotfalian, Jacob D Bylsma, James Fortune, Joseph Thompson, Kevin Diviney, Len Chalawa, Reena Datta, Rick H Schroeder, Stephen Farris, Tony J. Saliga

Call-in Information:

MML: (866) 226-3606 / (678) 466-7834

Code: 646 2538

Webex Meeting Information:

Meeting Link: <https://gm.webex.com/gm/j.php?ED=194335218&UID=492344932&PW=NMzU1MiM5MDQx&RT=MIMxMQ%3D%3D>

Meeting Number: 268 583 684

Meeting Password: 1234

MEETING AGENDA

Agenda Item	Presenter	Time
1. Review POCA2 Returns (28 total returns [1 Post-Option 1] as of 15Jan2013) <ul style="list-style-type: none">• Review Warranty Spreadsheet• Review TAC Data of Post-Option 1 Return• Discuss Next Steps	All	10 min
2. Review P1A6F Returns (P1A6F – Starter/Generator System No Crank at Restart) (5 total returns [1 PP/4 BPIM] as of 15Jan2013) <ul style="list-style-type: none">• Summarize status of P1A6F investigation – Saliga• Review Warranty Spreadsheet• Discuss Next Steps	All	20 min
3. Discuss Post-Option 1, No DTCs Returns (22 total returns [3 PP/19 BPIM] as of 15Jan2013) <ul style="list-style-type: none">• Review Warranty Spreadsheet• Discuss Next Steps	All	20 min
4. Round Table <ul style="list-style-type: none">• Prioritize returns for next meeting• Next Meeting:<ul style="list-style-type: none">○ Wednesday, February 6th at 3PM EST	All	10 min

DTC P1AF0

[Diagnostic Instructions](#)

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

[DTC Descriptor](#)

DTC P1AF0

Drive Motor Control Module Hybrid/EV Battery Voltage System Isolation Lost

[Circuit/System Description](#)

The vehicle is equipped with a high voltage isolation monitor feature. The purpose of the isolation monitor is to test the resistance between the high voltage positive and negative direct current (DC) bus and chassis ground. The isolation monitoring system measures the resistance between the high voltage system and chassis ground in the following way: The isolation monitoring system measures voltage potential difference between the positive battery mid pack voltage and chassis ground as well as the voltage difference between negative battery mid pack voltage and chassis ground. These voltage values are used by the Starter/Generator Control Module to calculate a resistance value between the high voltage bus and the chassis ground. If this resistance value is too low, a high voltage isolation fault has occurred.

[Conditions for Running the DTC](#)

- Internal battery voltage sensor value is greater than 100 V
- None of the following DTCs are set: P0AA8, P0AAA, P1AE8, P1AE9, P1AEC, P1E0D, P1E10, P1E11, P1E13, P1E14

[Conditions for Setting the DTC](#)

The calculated resistance between the high voltage DC systems and vehicle chassis ground less than 225.6K Ω

[Action Taken When the DTC Sets](#)

- DTC P1AF0 is a type B DTC.
- If the DTC sets while there is a loss of communication with the sensing and diagnostic module (SDM), the Starter/Generator Control Module will record the fault as a crash event and the DTC will become latched.

[Conditions for Clearing the DTC](#)

- DTC P1AF0 is a type B DTC.
- If the DTC is set as a latched DTC, the crash event must be cleared before the DTC will clear.

[Reference Information](#)

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Schematic Reference

[Hybrid/EV Energy Storage Schematics](#)

Connector End View Reference

[Component Connector End Views](#)

Description and Operation

[Drive Motor Battery System Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

- *EL-48900* HEV Safety Kit
- *EL-50772* Insulation Multimeter

For equivalent regional tools, refer to [Special Tools](#).

[Circuit/System Testing](#)

Danger: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure includes the following steps:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Before working on any high voltage system, be sure to wear the following Personal Protection Equipment:

- Safety glasses with appropriate side shields when within 15 meters (50 feet) of the vehicle, either indoors or outdoors.
- Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors.
 - Visually and functionally inspect the gloves before use.

- Wear the Insulation gloves with leather protectors at all times when working with the high voltage battery assembly, whether the system is energized or not.

Failure to follow the procedures may result in serious injury or death.

Danger: The eAssist battery pack assembly will utilize an exchange program. Please consult the most recent revision of bulletin/PI# PIC5520, available in Service Information (SI), for a list of approved eAssist battery pack assembly service procedures. Components that may be removed and serviced without exchanging the complete battery pack assembly are identified in the bulletin/PI. Please contact the GM Technical Assistance Center (1-877-446-8227) if you have any questions.

Note: In [High Voltage Disabling](#), perform the disabling procedure for servicing components within the A4 Hybrid/EV Battery Pack. The C4A Hybrid/EV Battery Section 1 and C4B Hybrid/EV Battery Section 2 will be disconnected as part of the disabling procedure.

1. Ignition OFF, disable high voltage at the A4 Hybrid/EV Battery Pack. Refer to [High Voltage Disabling](#).
2. Disconnect the U, V, and W three phase lugs at the K59 Starter/Generator Control Module.

Note: The following continuity tests must be performed using the *EL-50772* insulation multimeter. Select the Isolation test setting, then select the 500 V range.

3. Test for greater than 400K Ω between the terminals listed below and chassis ground with the *EL-50772* insulation multimeter set on the Isolation test setting:
 - 3 phase cable terminal U – cable side lug
 - 3 phase cable terminal V – cable side lug
 - 3 phase cable terminal W – cable side lug

⇒ If 400K Ω or less

- 3.1. Disconnect the U, V, and W three phase lugs at the A15 Starter/Generator.
- 3.2. Test for greater than 400K Ω between the U, V, and W three phase studs at the A15 Starter/Generator and chassis ground with the *EL-50772* insulation multimeter set on the Isolation test setting.

⇒ If 400K Ω or less, replace the A15 Starter/Generator.

↓ If greater than 400K Ω

- 3.3. Replace the high voltage 3 phase cables.

↓ If greater than 400K Ω

Note: The following continuity tests must be performed using the *EL-50772* insulation multimeter. Select the Isolation test setting, then select the 500 V range.

4. Test for greater than 400K Ω between the terminals listed below and chassis ground with the *EL-50772* insulation multimeter set on the Isolation test setting:
 - 3 phase terminal U – K59 Starter/Generator Control Module stud
 - 3 phase terminal V – K59 Starter/Generator Control Module stud
 - 3 phase terminal W – K59 Starter/Generator Control Module stud

⇒ If 400K Ω or less

- 4.1. Disconnect and remove the two wiring junction blocks from the A4 Hybrid/EV Battery Pack.

4.2. Test for greater than 400K Ω between the U, V, and W three phase studs at the K59 Starter/Generator Control Module and chassis ground with the *EL-50772* insulation multimeter set on the Isolation test setting.

⇒ If 400K Ω or less, replace the K59 Starter/Generator Control Module.

↓ If greater than 400K Ω

4.3. Replace the two wiring junction blocks.

↓ If greater than 400K Ω

5. Replace the C4A Hybrid/EV Battery Section 1 and C4B Hybrid/EV Battery Section 2.

[Repair Instructions](#)

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Drive Motor Generator Battery Cable Replacement](#)
- [Starter Generator Replacement](#)
- [Generator Battery Replacement](#)
- [Control Module References](#) for Starter/Generator Control Module replacement, programming, and setup

DTC P1B3F or P1B40

[Diagnostic Instructions](#)

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

[DTC Descriptor](#)

DTC P1B3F

High Voltage System Interlock Circuit 2 Low Voltage

DTC P1B40

High Voltage System Interlock Circuit 2 High Voltage

[Diagnostic Fault Information](#)

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0641, P057C, P1B3F	P1B3F	P0641, P1B40	—
Signal	P1B3F	P1B3F	P1B40	—

[Circuit/System Description](#)

The high voltage interlock circuits are utilized to verify high voltage component integrity. The high voltage interlock circuits are two circuit loops that passes through certain high voltage components. The high voltage interlock circuits are used to determine if access to high voltage components is being attempted. The opening of these high voltage components causes high voltage interlock circuit to open. The Starter/Generator Control Module monitors both the high voltage interlock 5 V reference circuit voltage and the high voltage interlock signal circuit voltage in order to detect circuit faults. When the Starter/Generator Control Module detects a loss of high voltage interlock circuit voltage, the high voltage contactors are commanded open.

The service cover for the Starter/Generator and the service cover for the Hybrid/EV Battery Pack each contain a high voltage interlock switch. When either cover is removed, the stater/generator control module will respond by opening the high voltage contacts. The 5 V reference circuits and signal circuits for each of the two high voltage interlock loops are completely separate from one another and are monitored as two separate loops, with each setting a specific DTC to indicate a circuit fault. The 5 V reference circuit that feeds the high voltage interlock switch on the Starter/Generator also supplies the 5 V reference to the brake pedal position sensor.

[Conditions for Running the DTC](#)

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The Starter/Generator Control Module is awake and communicating

[Conditions for Setting the DTC](#)

DTC P1B3F

Voltage on the high voltage interlock signal circuit is less than 0.5 V

DTC P1B40

Voltage on the high voltage interlock signal circuit is greater than 4.5 V

[Action Taken When the DTC Sets](#)

DTCs P1B3F and P1B40 are type B DTCs

[Conditions for Clearing the DTC](#)

DTCs P1B3F and P1B40 are type B DTCs

[Diagnostic Aids](#)

- When a circuit fault is detected on the high voltage interlock loop that feeds the Starter/Generator and the vehicle hood is opened, the Starter/Generator Control Module will respond by turning off inverter switching. This will prevent the Starter/Generator from charging the Hybrid/EV Battery Pack and supplying voltage to the Starter/Generator Control Module 12 V output. Operating in this manner will cause an eventual discharge of both the high voltage battery pack and the 12 V battery.
- Because the 5 V reference circuit also supplies voltage to the brake pedal position sensor, a circuit fault on the high voltage interlock loop that feeds the Starter/Generator will also cause hybrid functions that rely on the brake pedal position, such as auto-stop and regenerative braking, to be disabled.

[Reference Information](#)

Schematic Reference

[Hybrid/EV Energy Storage Schematics](#)

Connector End View Reference

[Component Connector End Views](#)

Description and Operation

[Drive Motor Battery System Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

EL-48900 HEV Safety Kit

For equivalent regional tools, refer to [Special Tools](#).

[Circuit/System Verification](#)

1. Ignition ON.
2. Verify DTC P0641 is not set.
⇒ If the DTC is set
Refer to [DTC P0641](#).
↓ If the DTC is not set
3. Refer to Circuit/System Testing.

[Circuit/System Testing](#)

Danger: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure includes the following steps:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Before working on any high voltage system, be sure to wear the following Personal Protection Equipment:

- Safety glasses with appropriate side shields when within 15 meters (50 feet) of the vehicle, either indoors or outdoors.
- Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors.
 - Visually and functionally inspect the gloves before use.
 - Wear the Insulation gloves with leather protectors at all times when working with the high voltage battery assembly, whether the system is energized or not.

Failure to follow the procedures may result in serious injury or death.

Danger: The eAssist battery pack assembly will utilize an exchange program. Please consult the most recent revision of bulletin/PI# PIC5520, available in Service Information (SI), for a list of approved eAssist battery pack assembly service procedures. Components that may be removed and serviced without exchanging the complete battery pack assembly are identified in the bulletin/PI. Please contact the GM Technical Assistance Center (1-877-446-8227) if you have any questions.

1. Ignition OFF, disconnect the X2 harness connector at the K59 Starter/Generator Control Module, ignition ON.
2. Test for less than 1 V between the following circuit terminals and ground:
 - 5 V Reference circuit terminal 2
 - Signal circuit terminal 1⇒ If 1 V or greater
 - 2.1. Disconnect the harness connector at the A15 Starter/Generator.
 - 2.2. Test for less than 1 V between the following circuit terminals and ground:
 - K59 Starter/Generator Control Module 5 V reference circuit terminal 2 X2
 - K59 Starter/Generator Control Module signal circuit terminal 1 X2⇒ If 1 V or greater, repair the short to voltage on the circuit.
 - ↓ If less than 1 V
 - 2.3. Replace the A15 Start/Generator.
 - ↓ If less than 1 V
3. Ignition OFF.
4. Test for infinite resistance between the following circuit terminals and ground:
 - 5 V Reference circuit terminal 2
 - Signal circuit terminal 1⇒ If less than infinite resistance
 - 4.1. Disconnect the harness connector at the A15 Starter/Generator.
 - 4.2. Test for infinite resistance between the following circuit terminals and ground:
 - K59 Starter/Generator Control Module 5 V reference circuit terminal 2 X2
 - K59 Starter/Generator Control Module signal circuit terminal 1 X2⇒ If less than infinite resistance, repair the short to ground on the circuit.
 - ↓ If infinite resistance
 - 4.3. Disable high voltage at the A4 Hybrid/EV Battery Pack. Refer to [High Voltage Disabling](#).
 - 4.4. Remove the A15 Starter/Generator battery cable access cover.

Note: The 5 V reference and signal circuits pass through the A15 Starter/Generator and the A15 Starter/Generator battery cable block before connecting to a resistor located in the A15 Start/Generator battery cable access cover.
 - 4.5. Verify the terminal integrity of the 5 V reference and signal circuits as they pass through the A15 Starter/Generator and the A15 Starter/Generator battery cable block. Verify none of these terminals are not damaged in a manner that would cause them to be shorted to ground.
 - ⇒ If any of the terminals are damaged, repair or replace the appropriate component as necessary.
 - ↓ If none of the terminals are damaged.
 - 4.6. Replace the A15 Start/Generator.
 - ↓ If infinite resistance
5. Test for 2.5k – 3.5k Ω between the 5 V reference circuit terminal 2 and the signal circuit terminal 1.

⇒ If less than 2.5k Ω

5.1. Disconnect the harness connector at the A15 Starter/Generator.

5.2. Test for infinite resistance between the K59 Starter/Generator Control Module 5 V reference circuit terminal 2 and the K59 Starter/Generator Control Module signal circuit terminal 1.

⇒ If less than infinite resistance, repair the shorted together circuits.

↓ If infinite resistance

5.3. Connect the harness connector at the A15 Starter/Generator.

5.4. Disable high voltage at the A4 Hybrid/EV Battery Pack. Refer to [High Voltage Disabling](#).

5.5. Remove the A15 Starter/Generator battery cable access cover,

5.6. Test for infinite resistance between the K59 Starter/Generator Control Module 5 V reference circuit terminal 2 and the K59 Starter/Generator Control Module signal circuit terminal 1.

⇒ If less than infinite resistance, verify the terminal integrity of the 5 V reference and signal circuits as they pass through the A15 Starter/Generator and the A15 Starter/Generator battery cable block. Verify these terminals are not damaged in a manner that would cause them to be shorted to together.

↓ If infinite resistance

5.7. Test the A15 Starter/Generator battery cable access cover. Refer to Component Testing.

⇒ If the A15 Starter/Generator battery cable access cover does not pass the Component Test, replace the A15 Starter/Generator battery cable access cover.

↓ If the A15 Starter/Generator battery cable access cover passes the Component Test

5.8. Replace the A15 Starter/Generator.

⇒ If greater than 3.5k Ω

5.1. Disconnect the harness connector at the A15 Starter/Generator.

5.2. Test for infinite resistance between the K59 Starter/Generator Control Module 5 V reference circuit terminal 2 and the K59 Starter/Generator Control Module signal circuit terminal 1.

⇒ If less than infinite resistance, repair the shorted together circuits.

↓ If infinite resistance

5.3. Test for less than 2 Ω between the following circuit terminals:

- K59 Starter/Generator Control Module 5 V reference circuit terminal 2 X2 and the A15 Start/Generator 5 V reference circuit terminal 12

- K59 Starter/Generator Control Module signal circuit terminal 1 X2 and the A15 Start/Generator signal circuit terminal 11

⇒ If 2 Ω or greater, repair the open circuit.

↓ If less than 2 Ω

5.4. Connect the harness connector at the A15 Starter/Generator.

5.5. Disable high voltage at the A4 Hybrid/EV Battery Pack. Refer to [High Voltage Disabling](#).

5.6. Remove the A15 Starter/Generator battery cable access cover.

5.7. Test the A15 Starter/Generator battery cable access cover. Refer to Component Testing.

⇒ If the A15 Starter/Generator battery cable access cover does not pass the Component Test, replace the A15 Starter/Generator battery cable access cover.

↓ If the A15 Starter/Generator battery cable access cover passes the Component Test

Note: The 5 V reference and signal circuits pass through the A15 Starter/Generator and the A15 Starter/Generator battery cable block before connecting to a resistor located in the A15 Start/Generator battery cable access cover.

5.8. Verify the terminal integrity of the 5 V reference and signal circuits as they pass through the A15 Starter/Generator and the A15 Starter/Generator battery cable block. Verify none of these terminals are not damaged in a manner that would cause them to be open.

⇒ If any of the terminals are damaged, repair or replace the appropriate component as necessary.

↓ If none of the terminals are damaged

5.9. Replace the A15 Starter/Generator.

↓ If between 2.5k – 3.5k Ω

6. Test or replace the K59 Starter/Generator Control Module

Component Testing

1. Ignition OFF, disable high voltage at the A4 Hybrid/EV Battery Pack. Refer to [High Voltage Disabling](#).

2. Remove the A15 Starter/Generator battery cable access cover.

3. Test for 2.5k–3.5k Ω between the A15 Starter/Generator battery cable access cover high voltage interlock 5 V reference terminal and the A15 Starter/Generator battery cable access cover high voltage interlock signal terminal.

⇒ If not between 2.5k–3.5k Ω

Replace the A15 Starter/Generator battery cable access cover

↓ If between 2.5k–3.5k Ω

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Starter Generator Replacement](#)
- [Control Module References](#) for Starter/Generator Control Module replacement, programming, and setup

RQ13-003

GM

10/7/2013

Q 09 C

BPIM_672 Ctrl PCB



J59

28145149
DC X 281408

28145149
DC X 281408

28145149
DC X 281408

1000

1000

1000

1000

RQ13-003

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Q 09 C

BPIM_672 PCB



RQ13-003

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10/7/2013

Q 09 C

BPIM-672 Tag



S92 24259673

9673



(20T) LP96734112269166

(1P) 28318909

Made in USA

2269

Internal Tracking Label



647022540255

RQ13-003

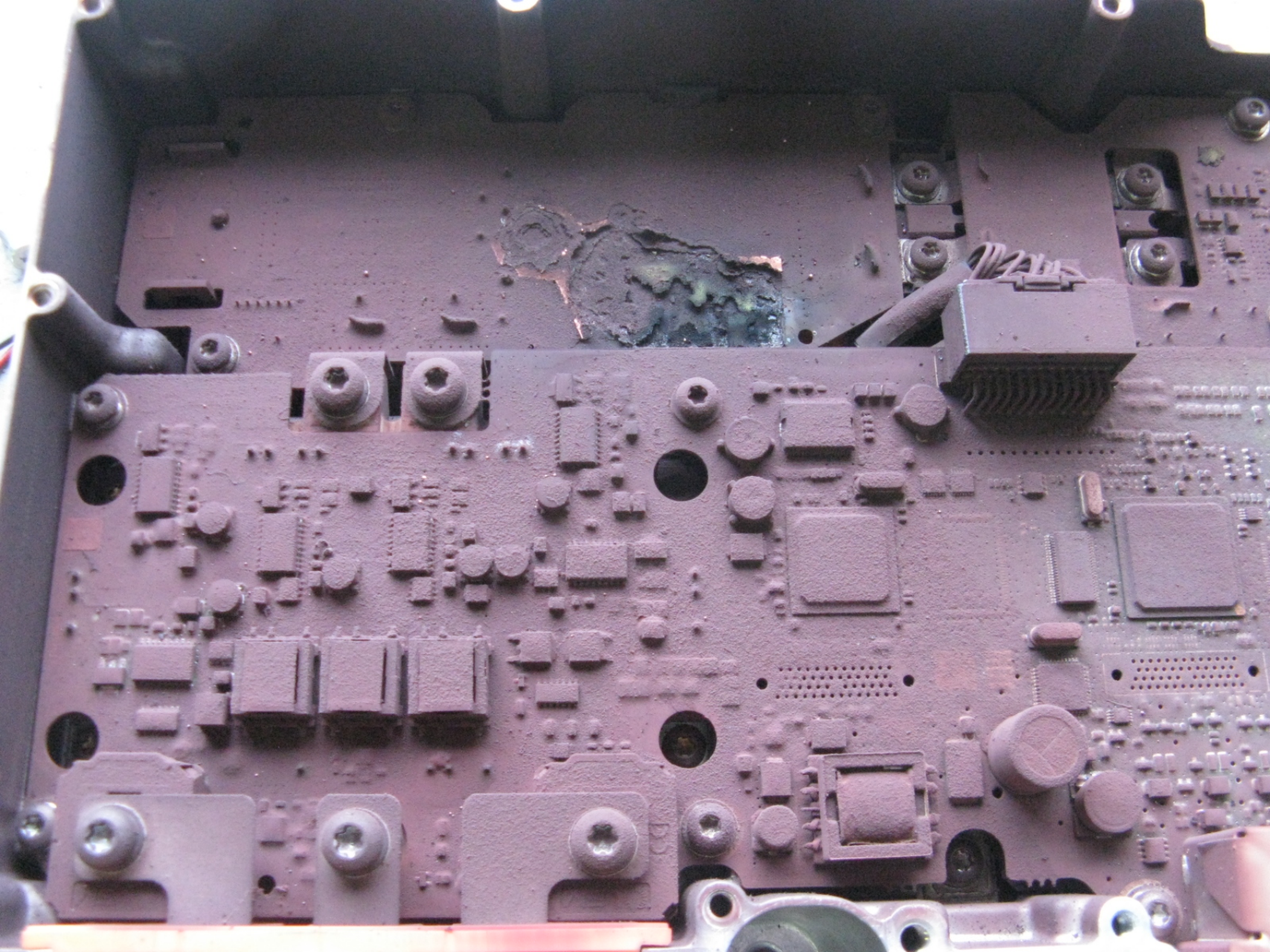
GM

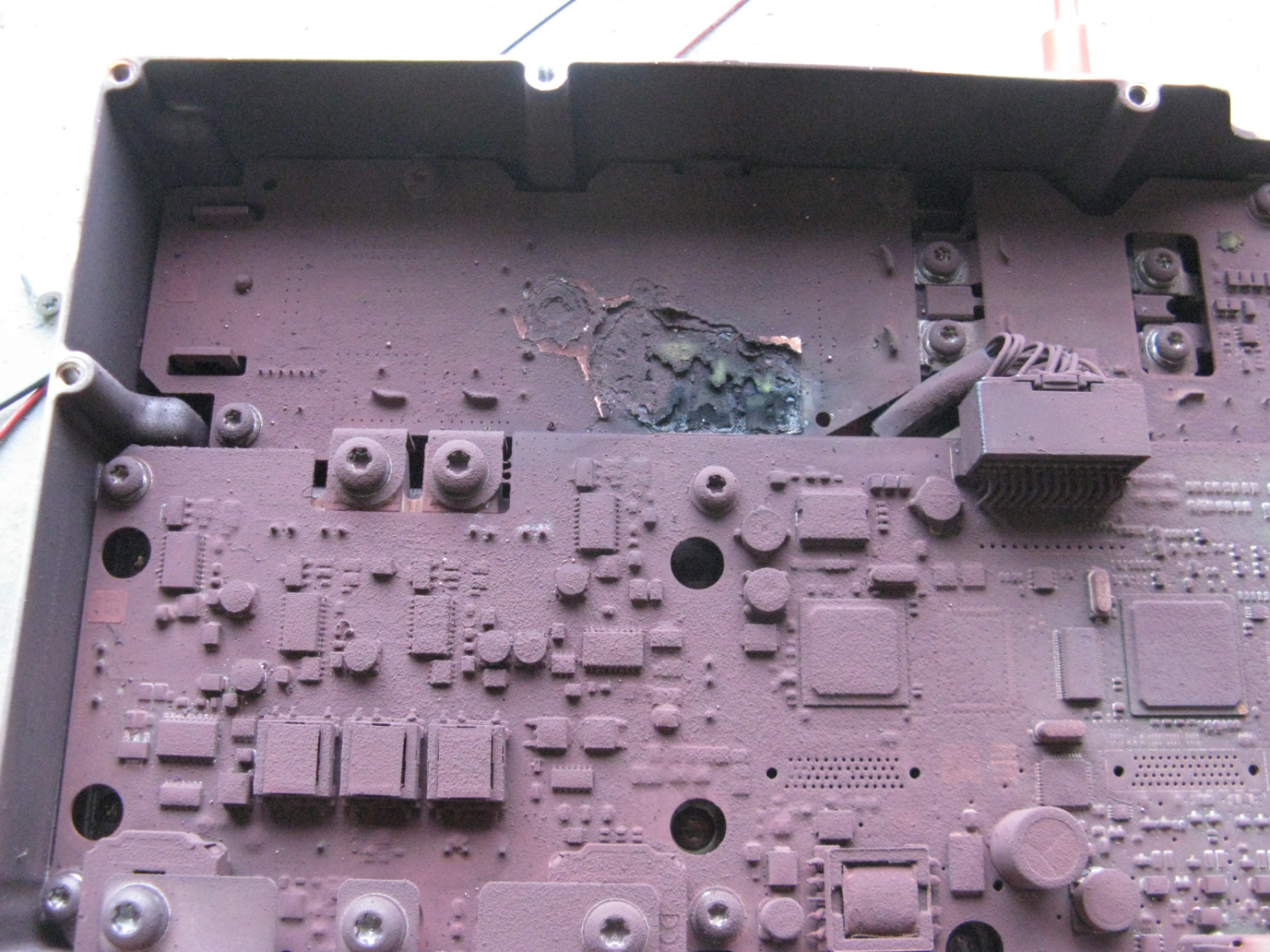
10/7/2013

Q 09 C

BPIM Testing 11-1-2012









RQ13-003

GM

10/7/2013

Q 09 C

BPIM Testing 11-2-2012







MADE IN USA
2215

[Barcode]

[Redacted]











RQ13-003

GM

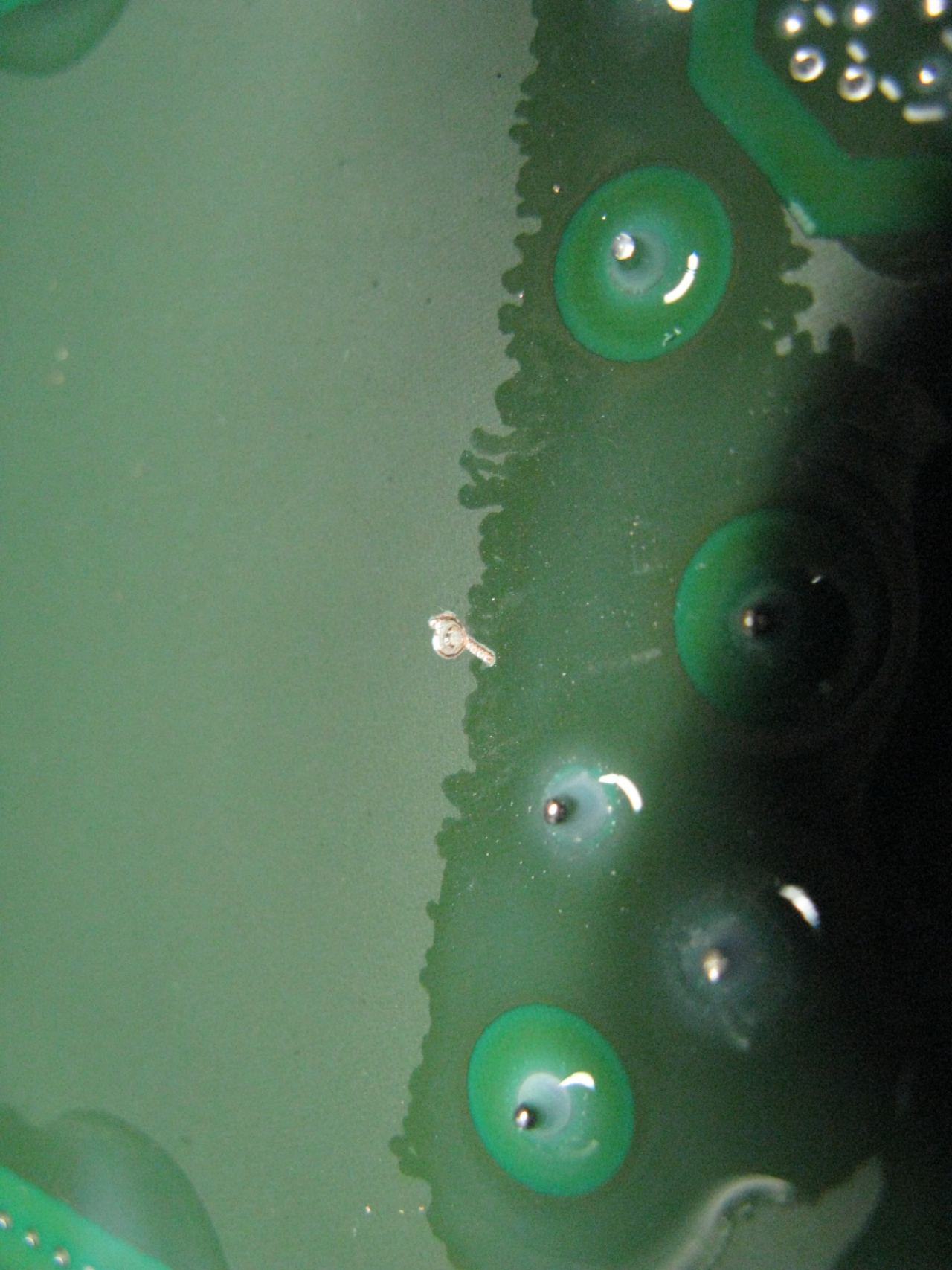
10/7/2013

Q 09 C

BPIM Testing 1-31-2012







1209

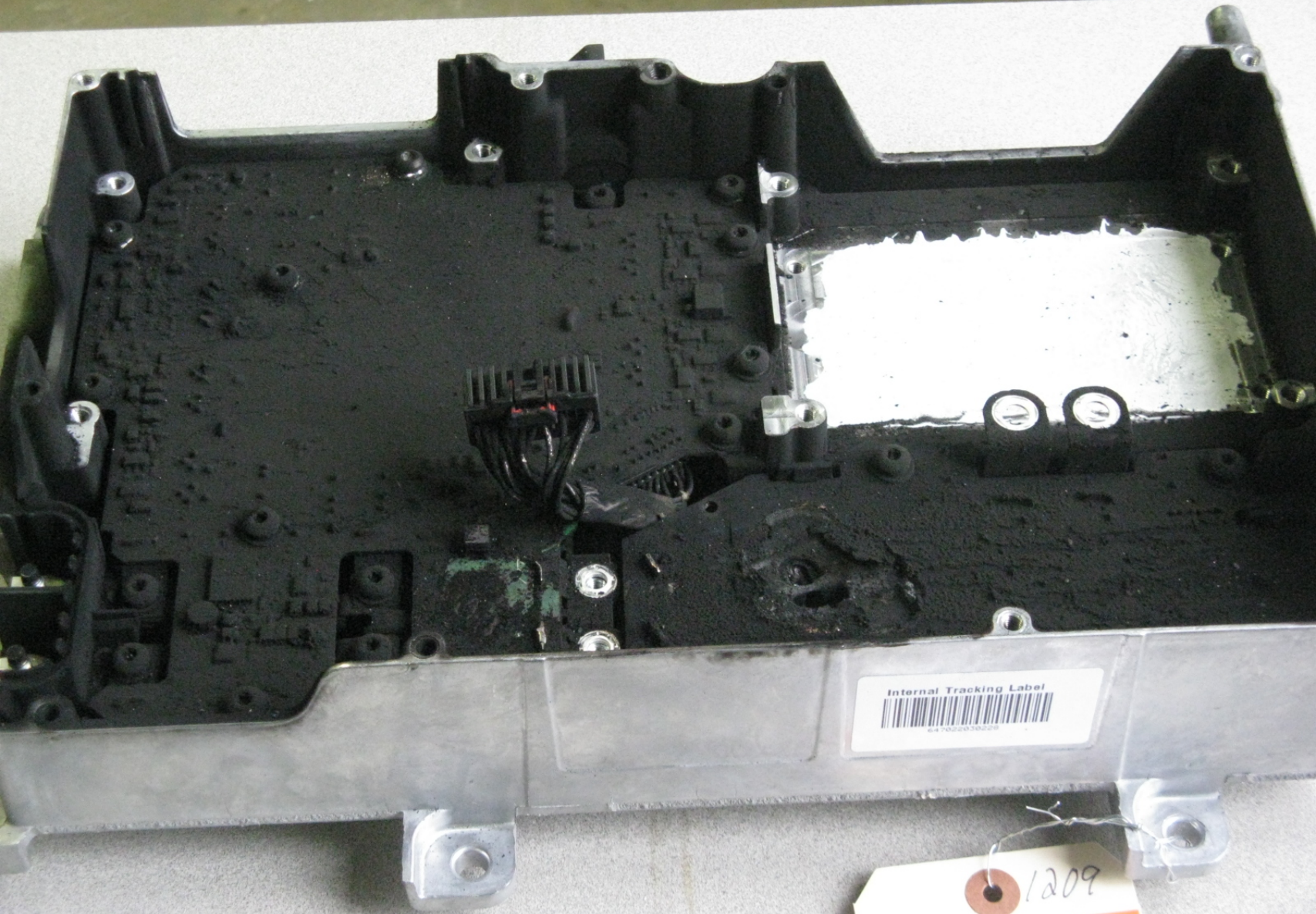
e-Assist CPE Ticket

Date-start (month): 5-19-12

Survey: SAPE:
Issuing with: MISSISSAUGA [REDACTED]

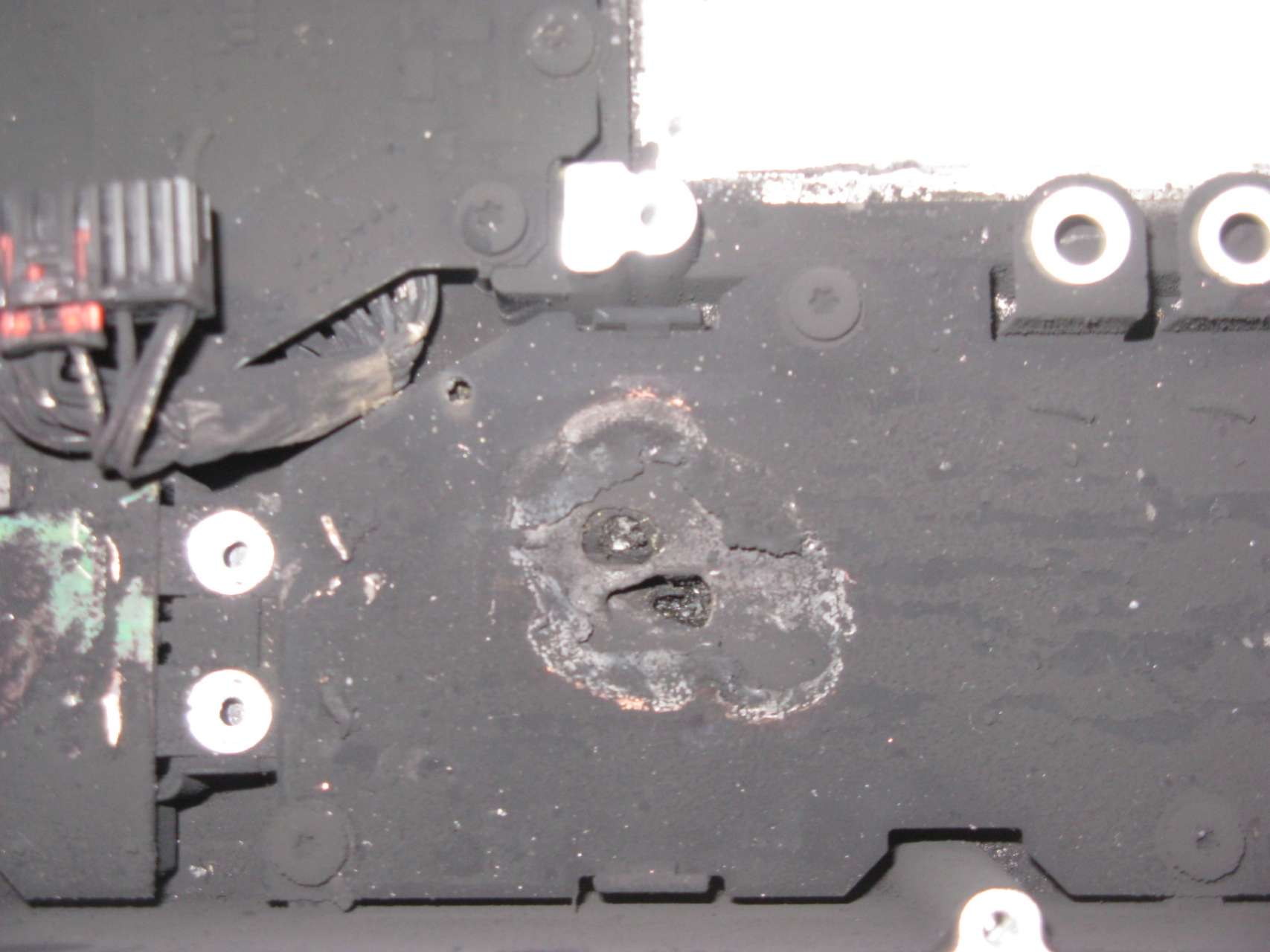
Fail Station: Code & Description

Code	Description
1510	1510 - BLAKE -
108	108 - TEMP
105	105 -

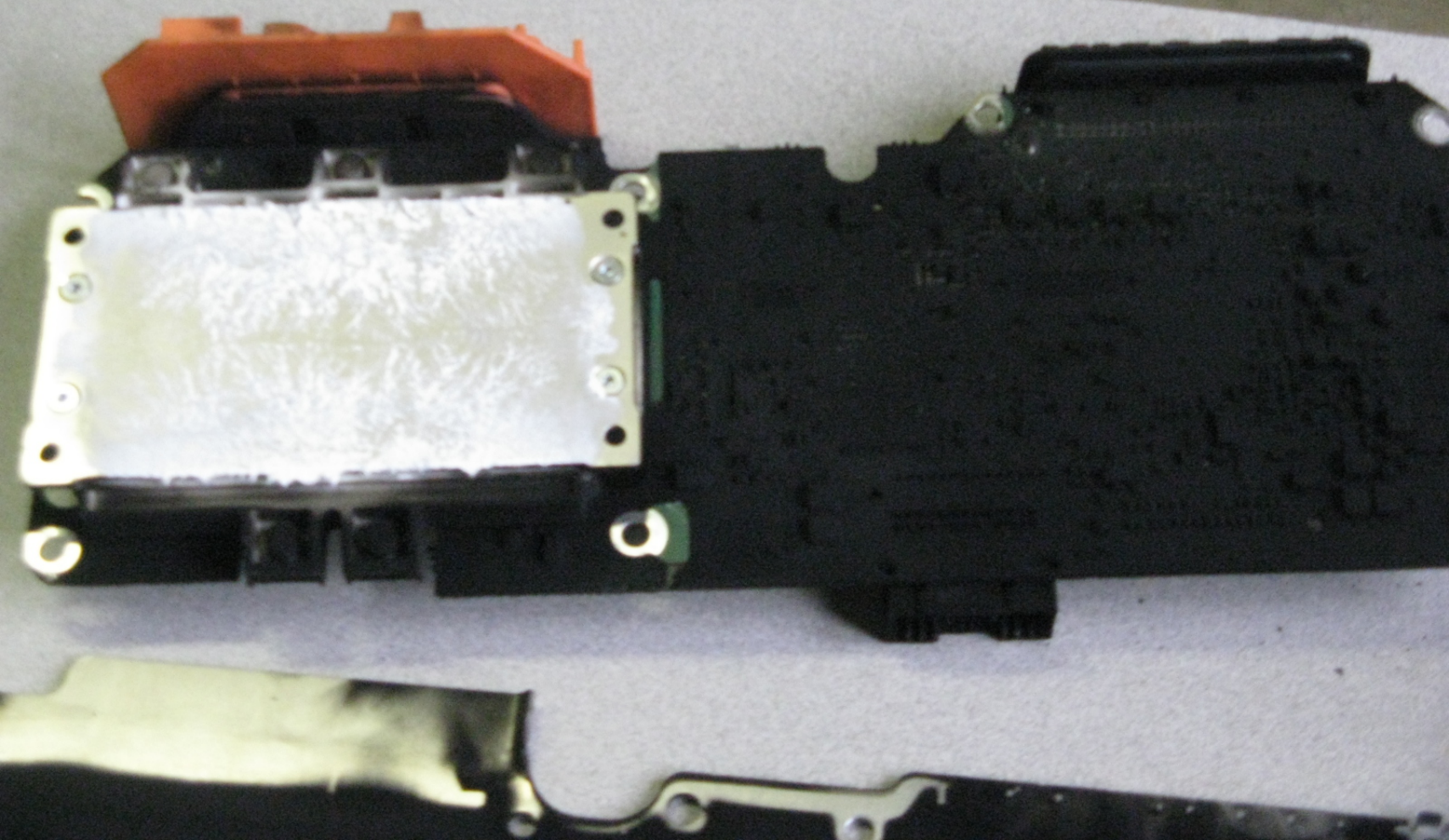


Internal Tracking Label
64 740000700000

1209
eAssist CPE Ticket











FRONT VIEW







1195

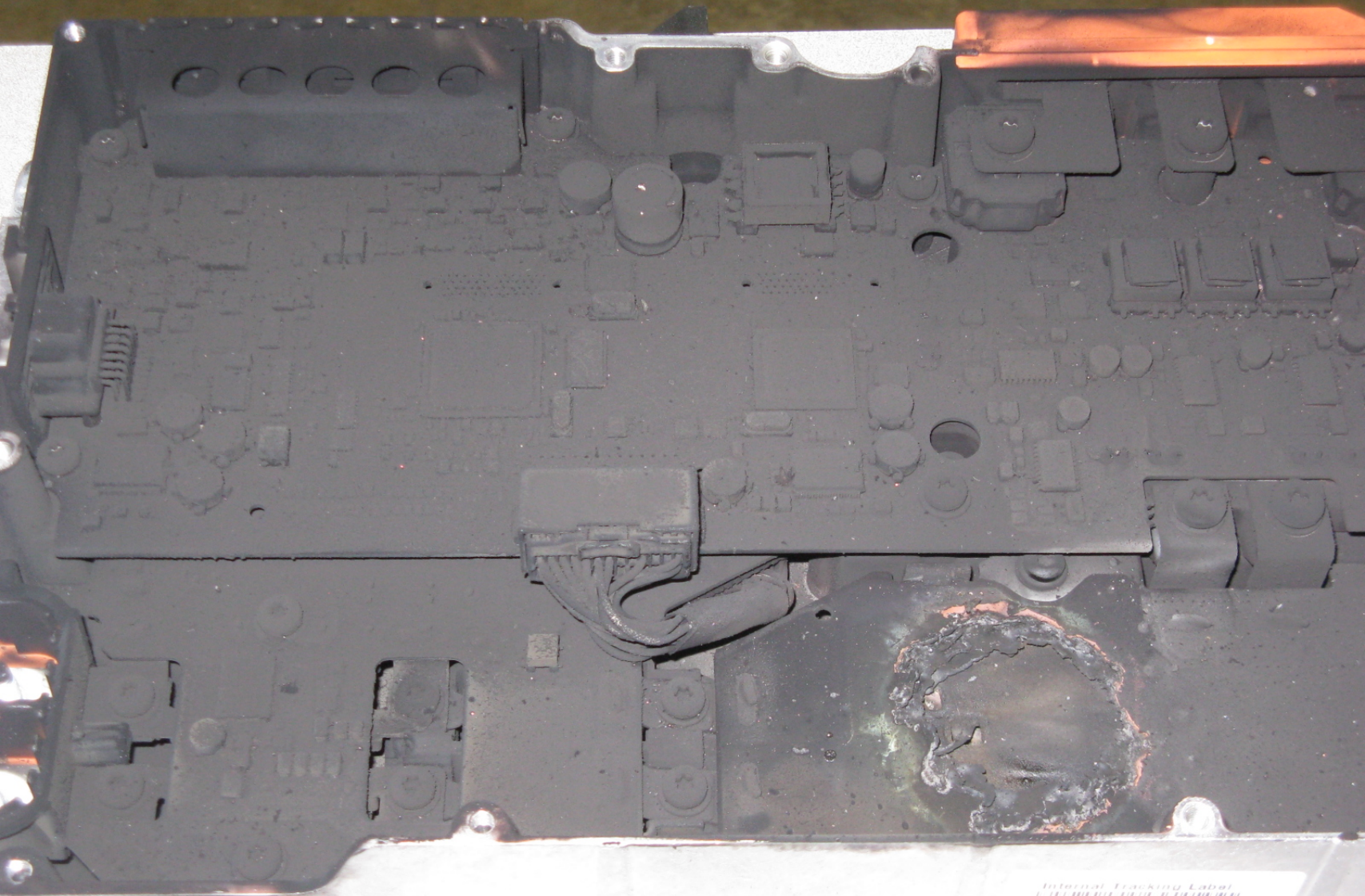
Advanced CPC Form

Date of last inventory: 8-12-12

Group Name: _____
Inventory #: [REDACTED]

Part Station Code & Description

Part	Description
101-1000	[REDACTED]
101-1001	[REDACTED]
101-1002	[REDACTED]



Internal Tracking Label
[Barcode]



eAssist BPIM Update

Dan Cottrell
7/22/13

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eAssist BPIM Update

DRAFT

Dan Cottrell Update
7/31/13

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eAssist BPIM Campaign Update

5August13

















