

{*} Indicates GM Confidential Business Information Redacted

INFORMATION Redacted PURSUANT TO THE FREEDOM
OF INFORMATION ACT (FOIA), 5 U.S.C. 552(B)(6)

{*}







BACK UP









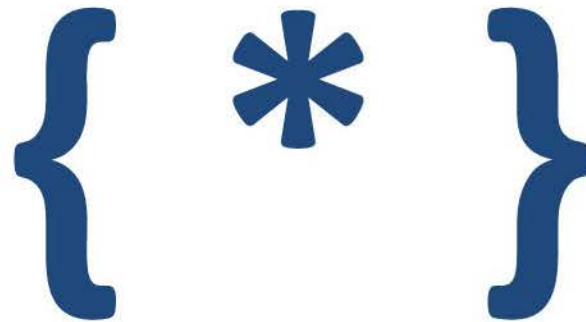
BACKUP







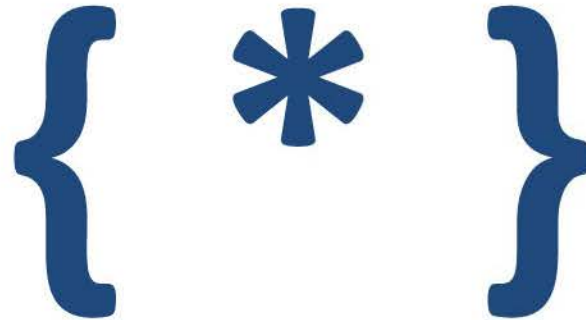








BACKUP

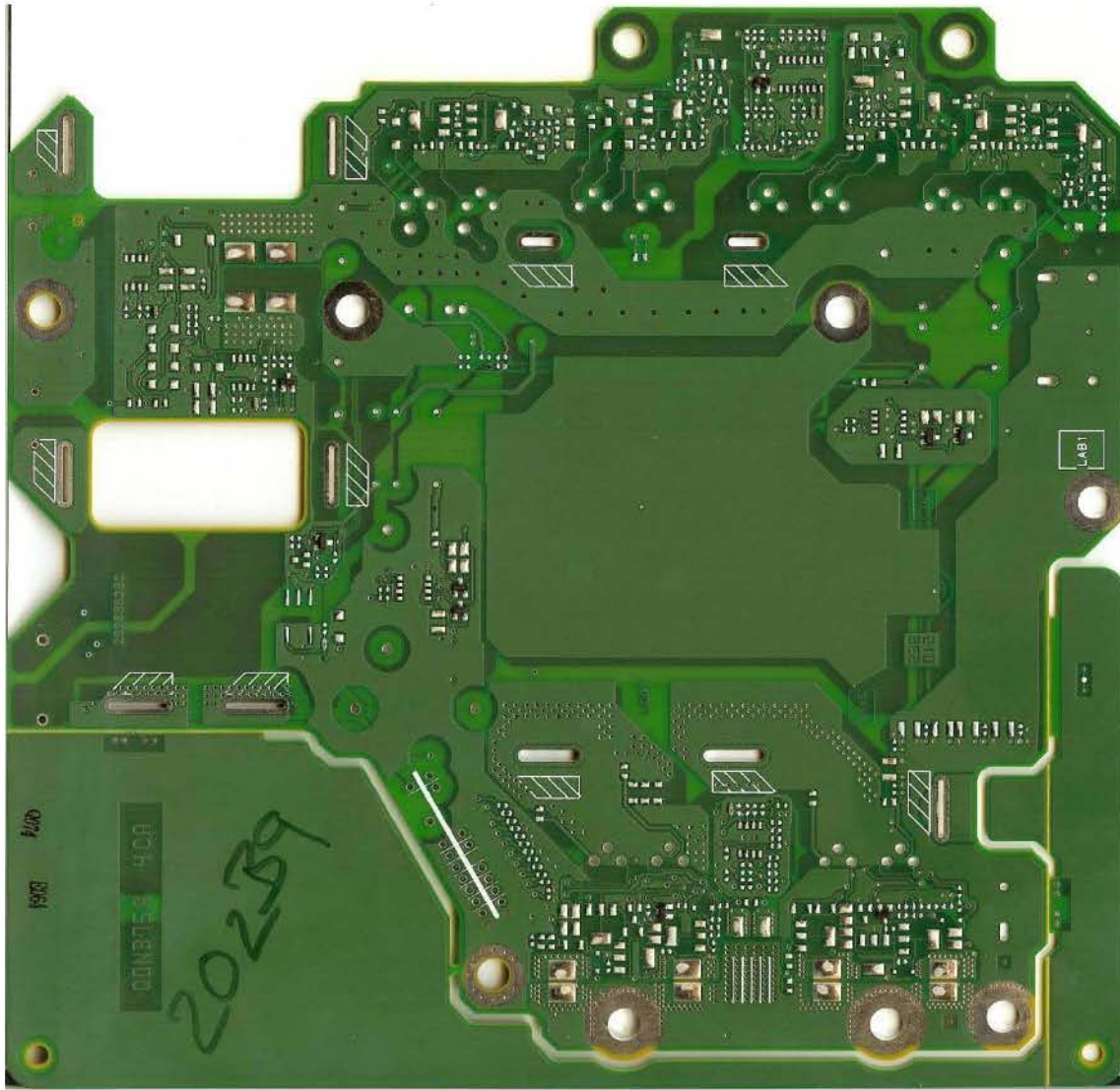






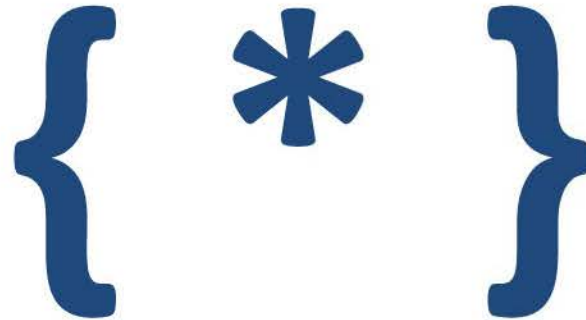


GMCH Power Board 28268628 NY PN#NNN006







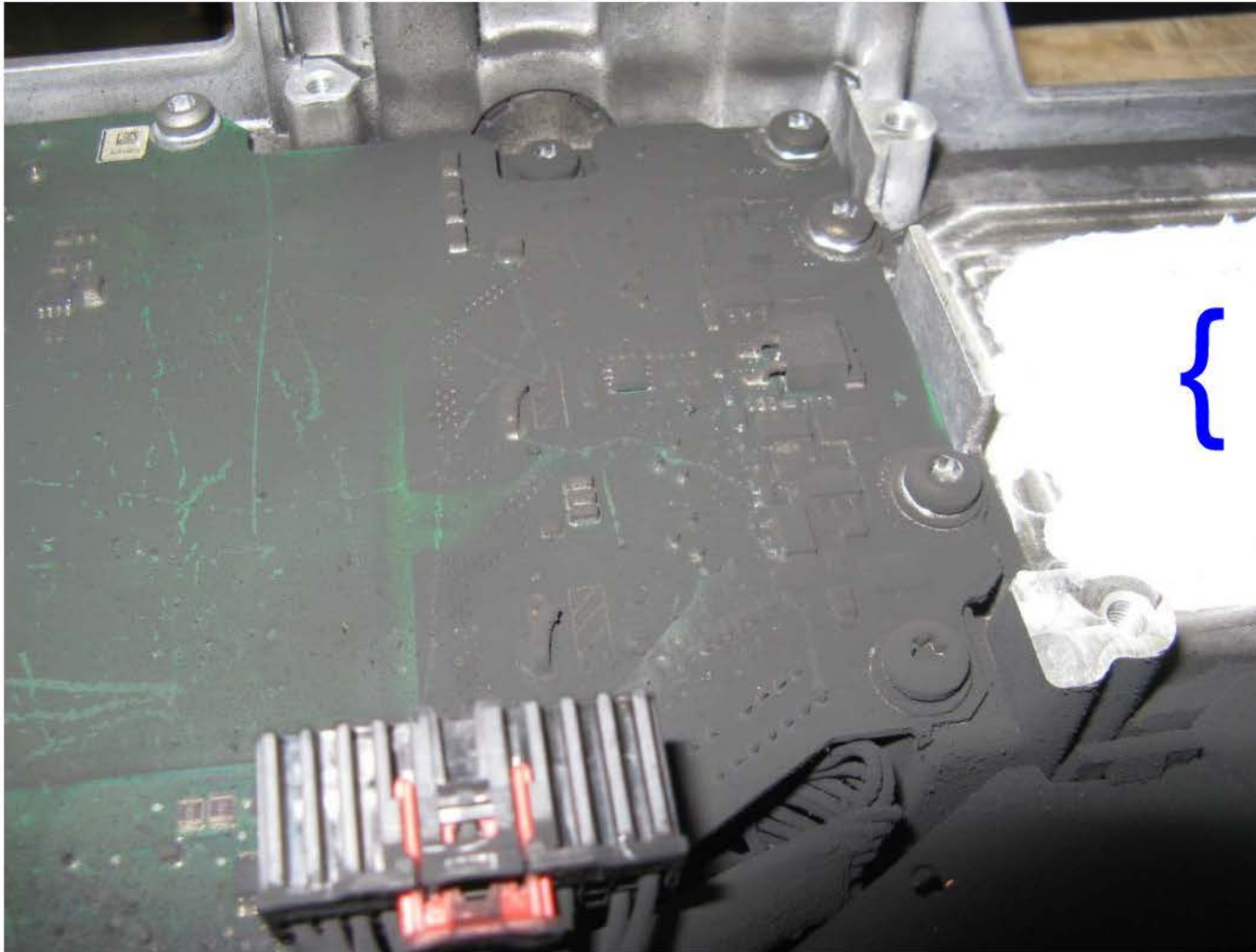


{*} Indicates GM Confidential Business Information Redacted



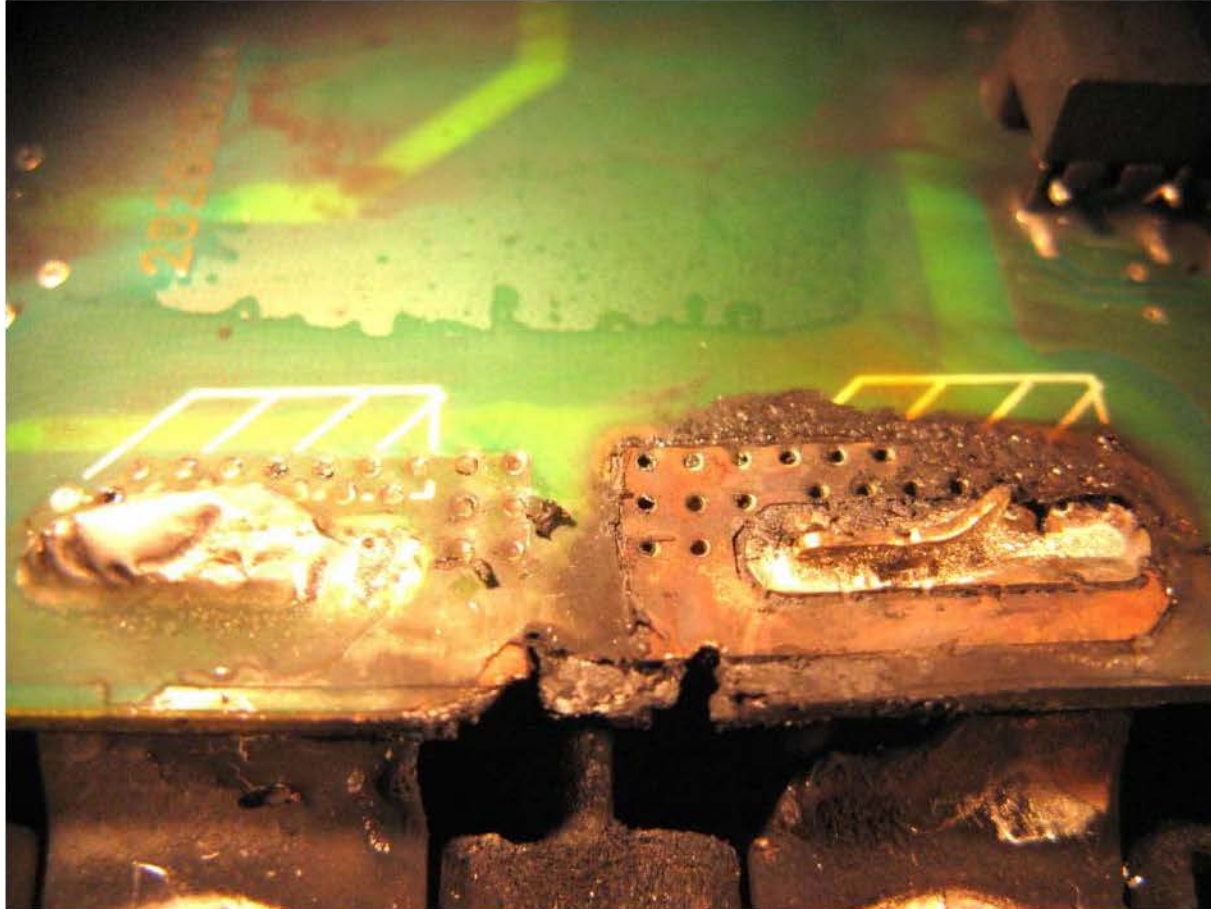
E-Assist Warranty Analysis

Warranty Return 70 – Initial Observations



E-Assist Warranty Analysis

Warranty Return 70 – Initial Observations

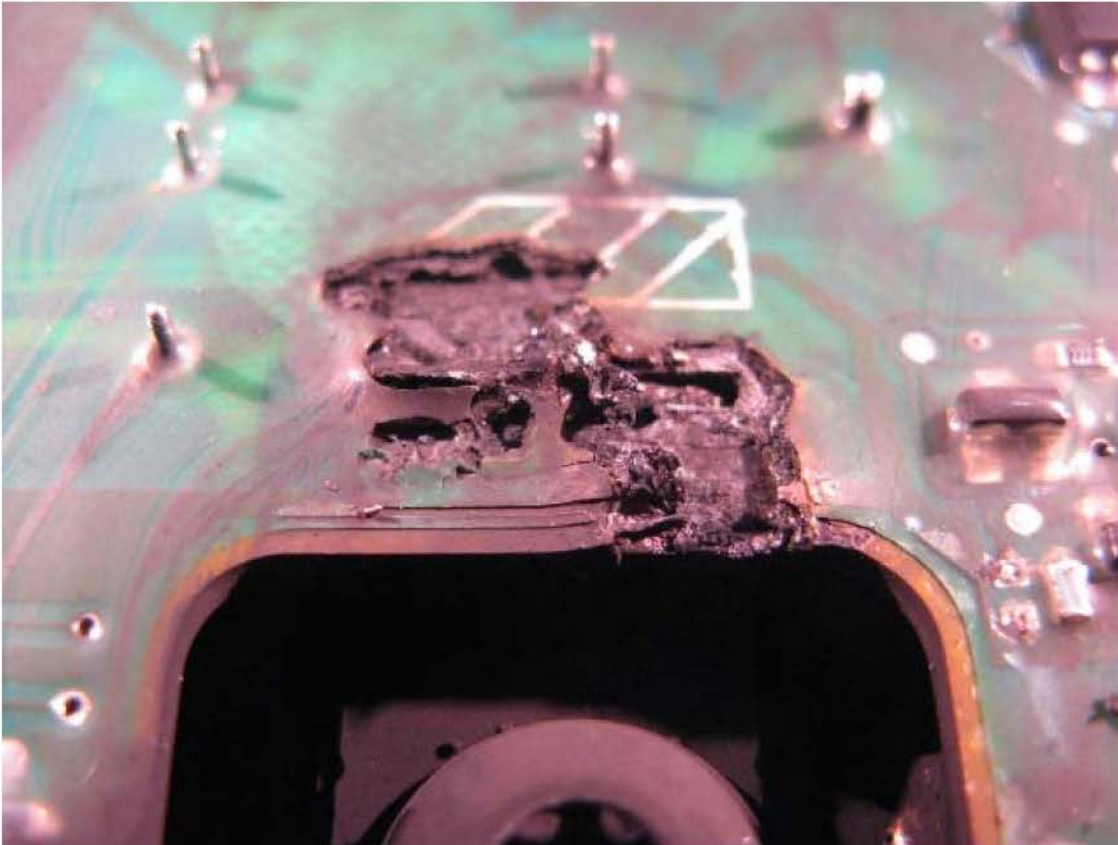


{ * }



E-Assist Warranty Analysis

Warranty Return 70 – Initial Observations

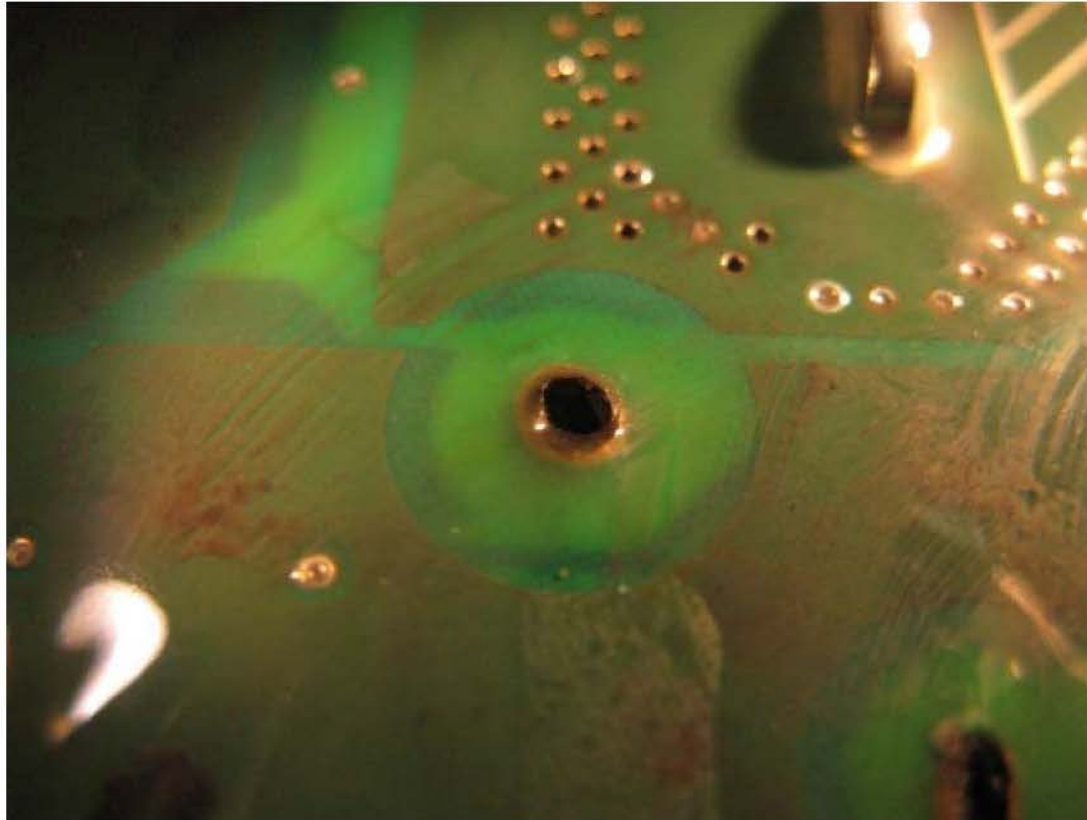


{ * }



E-Assist Warranty Analysis

Warranty Return 70 – Initial Observations

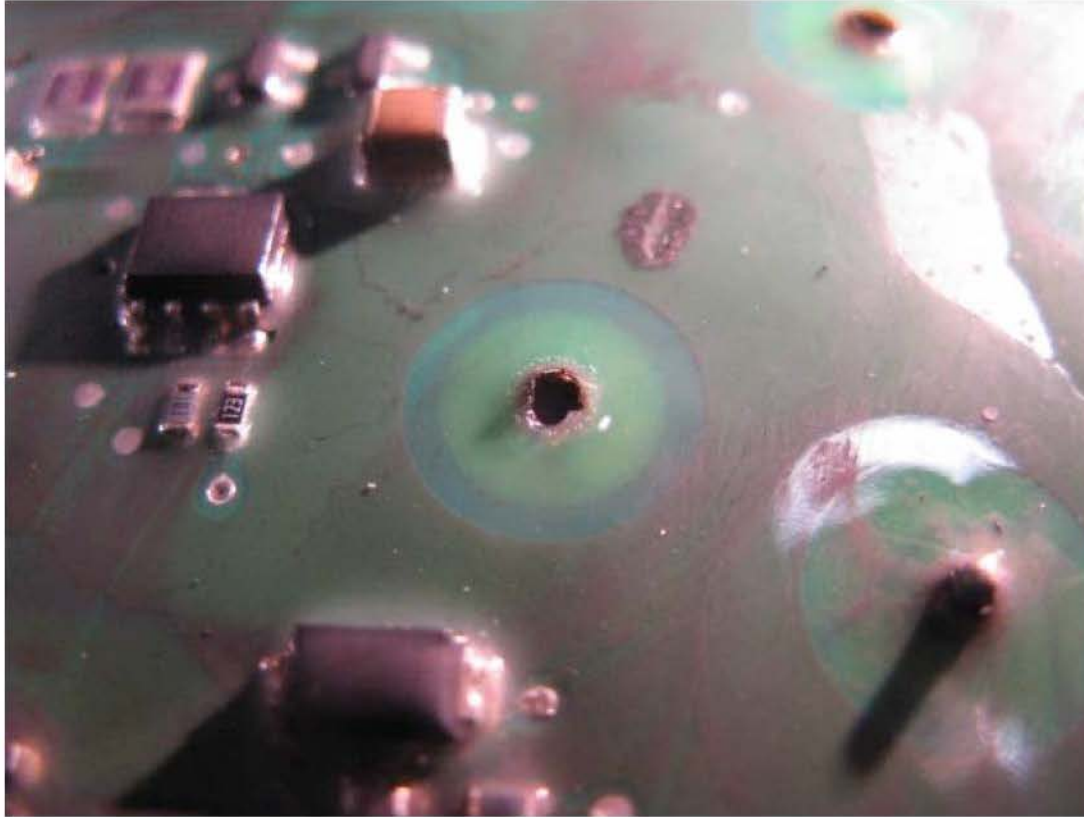


{ * }



E-Assist Warranty Analysis

Warranty Return 70 – Initial Observations

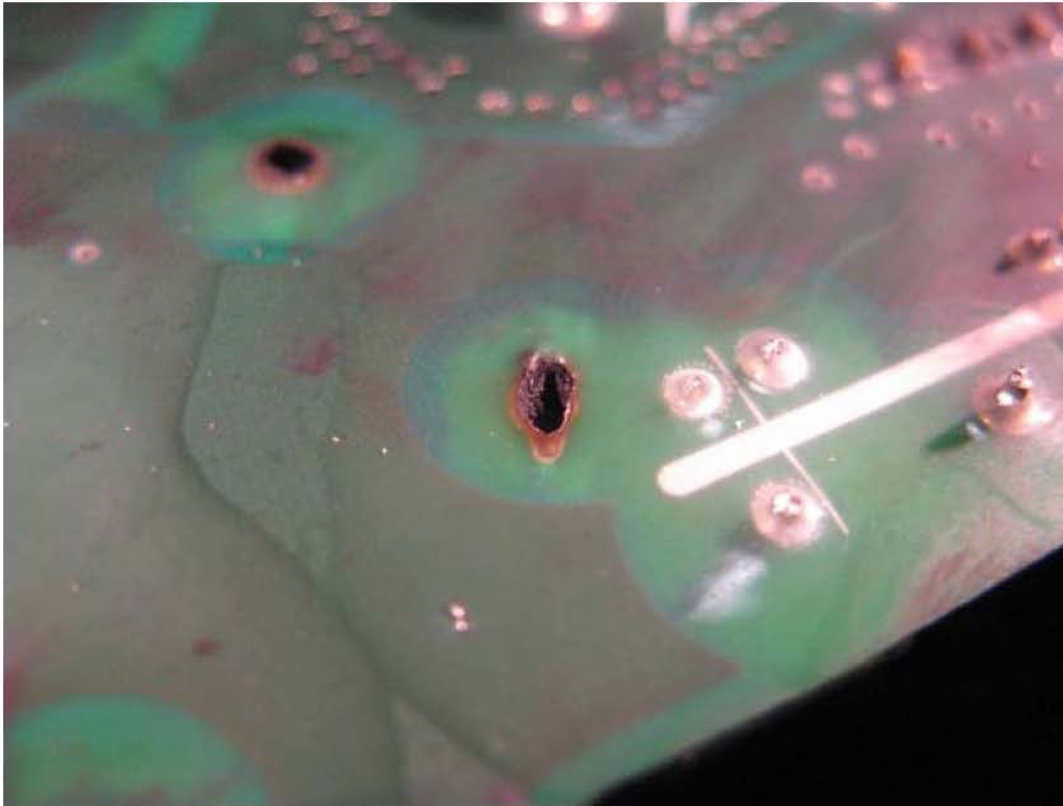


{ * }



E-Assist Warranty Analysis

Warranty Return 70 – Initial Observations



{ * }



E-Assist Warranty Analysis

Warranty Return 70 – Initial Observations



GM Components Holdings, LLC

8

J. Thompson

Kokomo Operations

#12238 Analysis

Kristin Curran – Brand Quality

April 19, 2013

#12238 Analysis

- Completion Status
- Results to Date
- Screening Effectiveness
- VIN Buckets
- Mileage Distribution
- Next Steps







VIN Buckets

- 57,102 eAssist vehicles built in GMNA
 - Build dates: 11/16/10 – 4/5/13
 - Includes “EX” VINs

Bucket	Description	Build Date Range	VIN Count
A	Expanded #12238 VIN list	11/16/10 – 3/19/12	20,032
B	Initial #12238 VIN list	3/20/12 – 7/19/12	18,821
C	Expanded #12238 VIN list – “Option 1”	7/20/12 – 12/4/12	14,672
D	Not covered by #11238 – “Option 2”	1/9/13 – Present	3,577
TOTAL			57,102

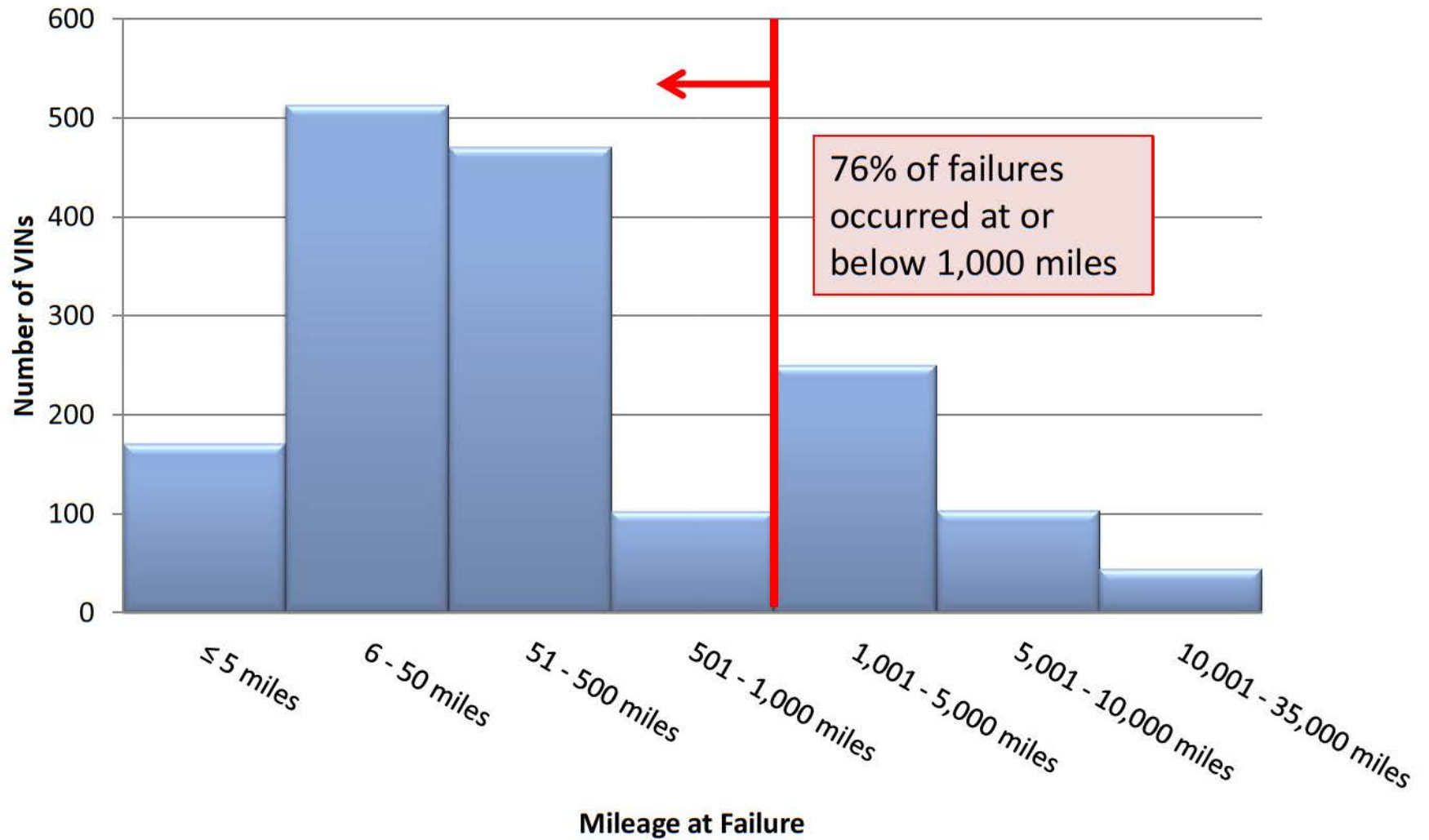
Note: The VIN counts above reflect the entire eAssist population. Only 22,908 VIN were actually included in #12238.

Mileage Distribution – Whole Population

- 1,652 of the 57,102 eAssist VINs produced (Buckets A – D) have warranty claims for BPIM/Powerpack replacements
- Mileage at failure (RO mileage) ranges from 1 to 32,801 miles
- 1,255 failures occurred at or below 1,000 miles

Mileage Distribution at Time of Failure

Includes Entire eAssist Population



GM CONFIDENTIAL

Next Steps

- Verify VIN bucket dates
- Finish integrating GMCH data into master file
- Detailed analysis of each VIN bucket
 - Screened/unscreened
 - Mileage distribution at failure
 - Service part screening
- Integrate results of plant screening
- Obtain consensus on GMCH warranty return buckets

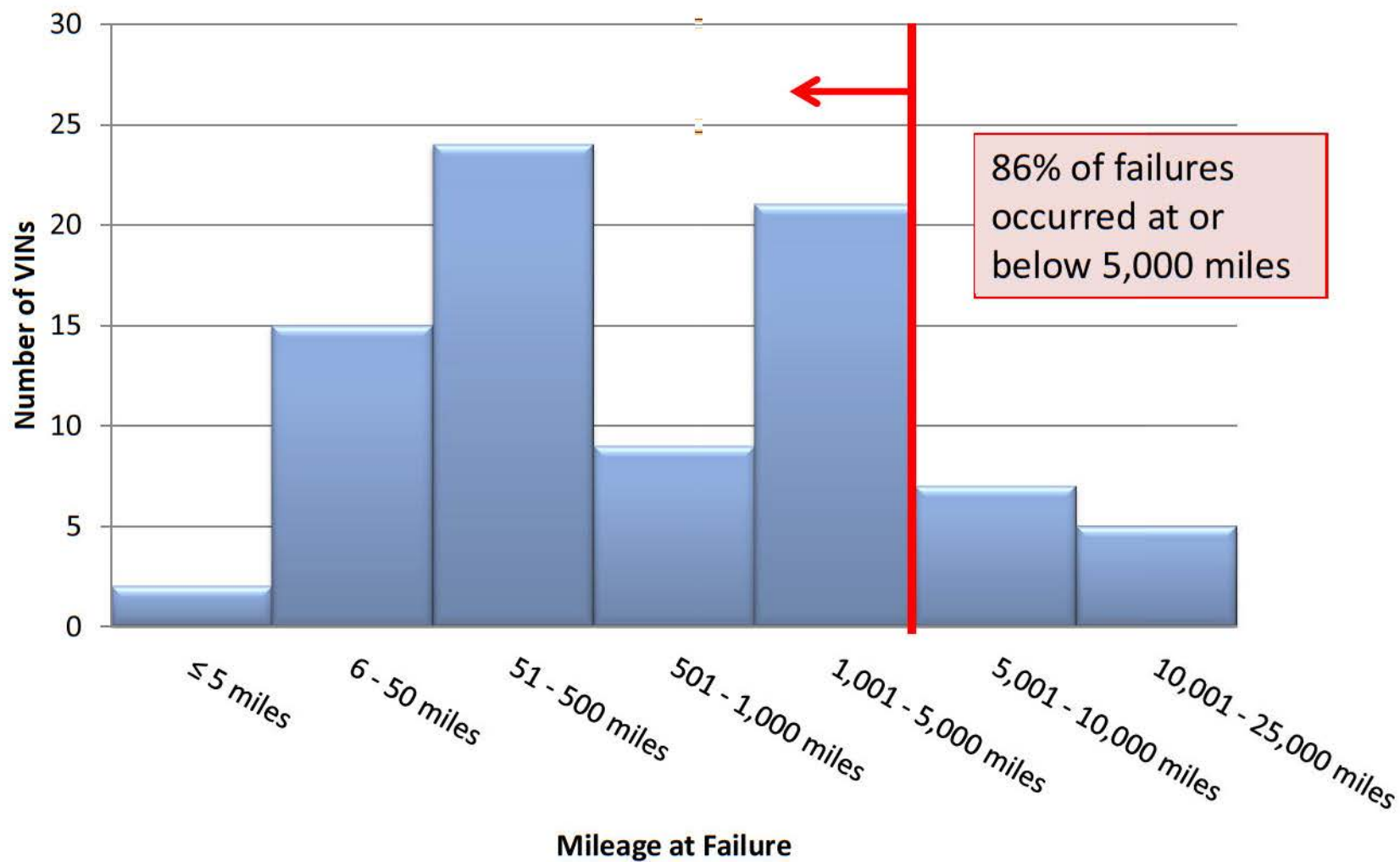


Back Up



Mileage Distribution at Time of Failure

Completed, Post Sale VINs



BAS+ Battery Not charging

Hybrid Integration Team

Vs300 Battery Discharge warranty claim status



Program	Service Procedure	Count		Comment
Issue Type 1 (P0C78, P1B0B)	Replace Pack	4->7	Field	HW Change (GMCH production BP : 19 Sep)
		1	Factory	
Issue Type 2 (P0606)	BCP reflash	1		Sent recent Archieve to AS
Others	Jump the Battery	2		
Total		8->11		

- ✓ Service Action :
HV Battery Pack exchange (7 Cases are already replaced)



1 Jump
to Best

Action Plan & Help Needed



- ✓ PE : Battery Pack DRE will communicate with GMNA to get new part for factory application
- ✓ A/S : Follow the service procedure (PE will provide) DTC before cleared need to be provided to PE.
- ✓ Part transfer to GMCH – GMK do not have budget to transfer.



1 Jump
to Best

Open Issue Tracking



- ✓ **Communicate with Tony Blower who is the Advanced Global Aftersales Engineer.**
 - **GMNA also replace pack for the issues we have in GMK.**
 - **It is the GMK launch plan to service assembly for the first year.**
 - **Tony also agreed for concern of the high warranty cost.**
 - **He will discuss with GMK A/S leadership.**



CPIT minutes
follow up



1 Jump
to Best

BACK UP







{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }

{ * } Indicates GM Confidential Business Information Redacted

{ * }



Fred Billotto
Senior Project Engineer

Mobile Ph: (248) 904-9949
Mail Code: 480-210-411
email: frederick.billotto@gm.com

Hybrid Energy Storage

General Motors Corp.

Warren Technical Center
30001 Van Dyke Avenue
Warren, Michigan 48090
VEC 4AV23

Warranty Return #	WAR2	WAR 71	War79	WAR-80	SPIM103	SPIM 102	SPIM 104	War 73
Location of incident	Kilgus, NJ	Roanoke, VA	Rockport, VA	Chickamauga, GA	North Myrtle Beach, SC	Atlanta, GA	Phoenix, AZ	Rocky Hill, CT
Location of Powerpack	Kilgus, NJ	Altoona, PA	Altoona, PA	Altoona, PA	Altoona, PA	Altoona, PA	Altoona, PA	Altoona, PA
Incident Date	18-Nov-2011	11-May-2012	30-May-2012	31-May-2012	31-May-2012	31-May-2012	31-May-2012	30-May-2012
ITAC Case #								
Powerpack S/N	LV1056111701003	LV1056111701008	LV1056111701009	LV1056111701009	LV1056111701003	LV1056111701003	LV1056111701003	LV1056111701003
VIN	1G42DSEPC1000000000	1G11DSRRXD1000000000	1G11DSRRXD1000000000	1G11DSRRXD1000000000	1G42DSEPC1000000000	1G42DSEPC1000000000	1G42DSEPC1000000000	1G11DSRRXD1000000000
Vehicle	LACrosse	Malibu	Malibu	Malibu	LACrosse	LACrosse	LACrosse	Malibu
General Information	Site of incident vehicle maneuvers prior to event	PEI Drive at Dealer						
mileage	235	2	210	21	431	44	100	482
ambient temp / conditions								
*based on internet searches								
Built Date Fact								
DTC	P0C05, P0C06, P1A06, P1AF0, P1B0B, P1E0C, P1E12	P1AF0, P1B0B, P1E0C, P1E12	P1AF0, P1B0B, P1E0C, P1E12	P1AF0, P1B0B, P1E0C, P1E12	P1B0B, P1E0C, P1E12	P1AF0, P1B0B, P1E0C, P1E12, P1AC4	P1AF0, P1B0B, P1E0C, P1E12	P1E12, P1E0C, P1AC4, P1AF0, P1B0B
Power Board Lot #								
GMCH APN/SPM Test		{ }	{ }	{ }	{ }	{ }	{ }	{ }
GMCH Power Board Assembly & Test								
Power Pack Test								
Additional Information	Voltage found at 5 phase terminals after H/ disabling		No MGU shots,	No open fuses,				replaced cooling fan
Vehicle Actions Taken		Replace Powerpack	Powerpack eplboard, customer vehicle	Powerpack replaced, Dealer car	Replace GCM	Replace GCM	Replace GCM	Replace Powerpack
Delay / GMCH Analysis	{ }	{ * }						{ * }
Notes / CA								
Failure Analysis								
Root Cause	{ }							

Warranty Return #	BPM 105	BPM 105	BPM 105	BPM 105	BPM 105	BPM 105	BPM 07		
Location of Incident	Okaloosa, FL	Sumner, VA	Arroyo, TX	Libre, GA	Southport, TN	Denise, TX	North Jackson, OH		
Location of Powerpack	Dealer	Dealer	Dealer	AT GMCH 627-17	Dealer	AT GMCH 627-12	Dealer		
Incident Date	30-May-2012	30-May-2012	25-May-2012	7-Jun-2012	7-Jun-2012	8-Jun-2012	8-Jun-2012		
TAC Case #									
Powerpack S/N									
VIN	204GSRER2C	1011DSRR2C	1011DSRR2C	1011DSRR2C	204GSRER2C	1011DSRR2C	1011DSRR2C		
Vehicle	Regal	Malibu	Malibu	Malibu	Regal	Malibu	Malibu		
General Information	site of incident mileage vehicle maneuvers prior to event ambient temp / conditions* *based on internet searches Buick Date Parc	292	36	50	1313	8	103	124	169
DTC	P18B8, P1E0C, U182A, U1847	P0AC4 P1AF9 P1B0B P1E0C P1E12	P1AF9 P1B0B P1E0C P1E12	P1AF9 P1E0C P1E12 CEL LAMP ON	P0AC4 P1AF9 P1B0B P1E0C P1E12 CURRENT	P0AC4 P1AF9 P1B0B P1E0C P1E12 P1E13	P1AF9 P1B0B P1E0C P1E12	P1AF9 P1B0B P1E0C P1E12 P0AB0	
Power Board Lot #									
GMCH APW/BPM Test		{ }	{ }	{ }	{ }	{ }	{ }	{ }	
GMCH Power Board Assembly & Test									
Power Pack Test									
Additional Information				Contacted tech to update the case. Tech states that when testing from the Phase Cable Studs at the OGCM to ground he has between .85 k ohms and .28 m ohms on the studs. Advised tech to replace the SOCM for an internal shot with part number 1263717.	SII investigating at Dealer possible SOCM replace		Tech states he had the cables of the battery and has 550 mega ohms to ground on each terminal	The dealer called back in to advise that he has done all the testing. The dealer advised that the phase cables are showing at CL to ground. The dealer advised that he then tested the battery lugs for the phase cable to ground and has over 11128 ohms.	
Vehicle Actions Taken	Replaced BPM Vehicle is now showing U182A and U187A with new BPM. still open possibly replacing Powerpack	Replacing Powerpack	Replacing BPM	Replacing BPM		Replacing BPM			
Delphi / GMCH Analysis								{ }	
Status / CA									
Failure Analysis									
Root Cause									



eAssist BPIM/APM 2Ply Cap and Control PCBs Verification Test Review

Stephen Farris (BPIM DRE)
December 10, 2012



 General Motors Company



THE WORLD'S BEST VEHICLES

Summary

- GMCH verification testing complete – no failures/issues
- GM HPED lab testing complete – no failures/issues
- Vehicle (PMD) testing ongoing – no issues to date
- PV3 testing ongoing – no failures/issues to date

- Option 1 Power Boards – no failures/issues to date
 - Production breakpoint 11AUG12
- EWO 181431 BAS+ BPIM/APM Update Capacitor and Control PCBs with 2 Sheets of Prepreg
 - At PROC 20 – Prod Spec (R. Husted)

BPIM/APM PDT Recommendation: Approve change 10DEC12
eAssist HPIT Recommendation: Approve change 10DEC12







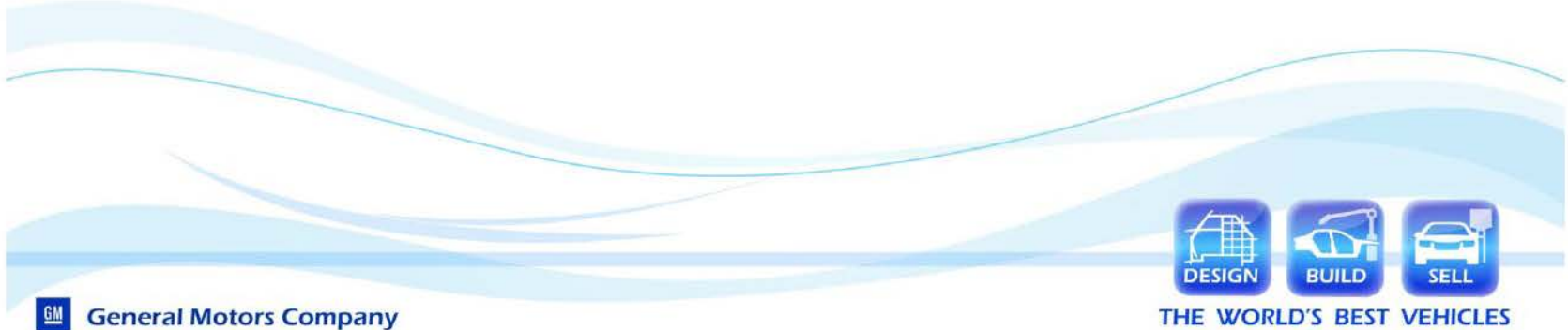






Vehicle Testing

- Unit put on PMD vehicle 07DEC12 - Testing ongoing
 - No issue/failures to date approaching 300 miles



PV3 Testing Status

- Testing ongoing no issues/failures to date.



PV3 Status
06DEC12



Backup Slides













{ * } Indicates GM Confidential Business Information Redacted

{ * }



cap board failures.xlsx

Dan W/Kristin,

Let me know if you have any other relevant information to add to the summary.

Regards,



Kevin Diviney

Global Program Quality Manager /
Robust Engineering Specialist

Mobile Ph: (248) 343-9311
Mail Code: 483-710-201
email: kevin.diviney@gm.com



**Global Electrification -
Engineering Quality**

General Motors Corp.

Pontiac North CET
895 Joslyn Avenue
Pontiac, Michigan 48340
Cube 2K08

BAS + High Voltage Short Potential Software Mitigation

Rick Schroeder

May 1, 2013









BACK-UP





BAS + E56410

Service Release/Field Action

Rick Schroeder
05/07/2013

10/15/2013

GM Confidential

1





Design















Agenda 05/03/13

- Explain the reason for this change - Rick Schroeder
- Determine what work needs to be done and by who – All
- Discuss workloads – All
- Create timeline - Rick Schroeder







BAS + E56410

Service Release/Field Action

Rick Schroeder
05/14/2013

10/15/2013

GM Confidential

1



















Validation Planning



Design















Agenda 05/03/13

- Explain the reason for this change - Rick Schroeder
- Determine what work needs to be done and by who – All
- Discuss workloads – All
- Create timeline - Rick Schroeder







BAS + E56410

Service Release/Field Action

Rick Schroeder
06/03/2013

10/15/2013

GM Confidential

1





















Validation Planning



Design















Agenda 05/03/13

- Explain the reason for this change - Rick Schroeder
- Determine what work needs to be done and by who – All
- Discuss workloads – All
- Create timeline - Rick Schroeder

Problem Statement

- Detect and mitigate a high voltage short in the BAS + BPIM within 3 seconds.
 - Open contactor
 - Turn off inverter
 - Turn off APM
- Must be able to detect during normal vehicle operation
 - When high voltage is present on the bus
- Use existing hardware/sensors to determine fault











CAP Board Severely Damaged

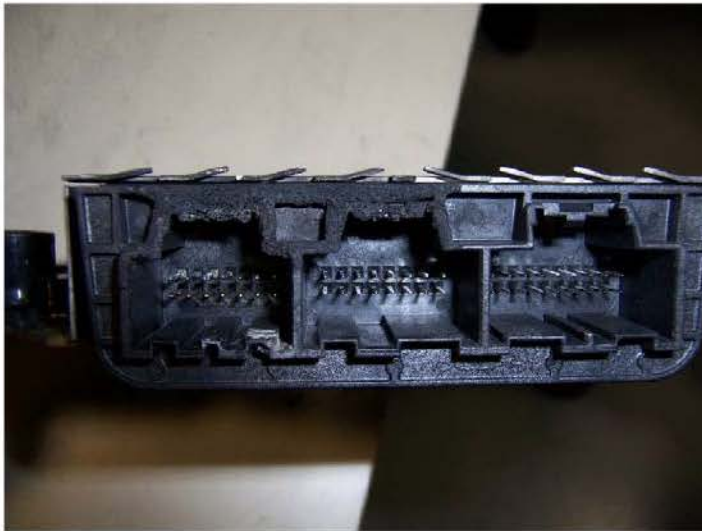


Control Board Only Collateral Damage / Sooted



Power Board Only Collateral Damage / Sooted











BACKUP



Attorney Client Privileged Communication

GM Template 04.08.02

8





Note: Perform the Generator Control Module inspection to determine if the Generator Control Module requires replacement. The inspection will take about 3 hours to complete.

If module replacement is required, the parts, diagnostic time, and repair time is to be submitted using the normal warranty labor code. Submit for the inspection using the labor code contained in this bulletin.

1. Start engine and confirm the vehicle has enough fuel for the drive cycle and 2 hour idle test. A quarter-tank of fuel is required to complete the test. Add fuel as required.
2. If the Service Hybrid System DIC message is displayed at any time, follow service instructions in SI for the particular DTC or tell tale that is set.
3. Change the driver information center to show Power Flow Display or use center console display.
4. Set parking brake and place shifter in Neutral position. Increase engine speed to 2,000 RPM.
5. Run in this mode until battery shown in Power Flow Display is completely filled.
6. Shift back to Park and release parking brake.
7. Turn on 12V loads.
 - Head lamps on with high beams
 - Air conditioning set to 78 oF (25 oC), Eco mode (green snowflake LED), recirc., BiLevel (foot / floor -- do not want Defrost enabled)
 - Cabin blower to high speed
 - Radio on
 - Heated seats, if equipped
 - Rear defog, it will time out, no need to reinitiate
8. Allow vehicle to idle for approximately 15 minutes.
9. Perform drive cycle maintaining high 12V loads and air conditioning settings specified in Step 7.
10. The drive cycle should contain the following maneuvers.
 - Perform at least 10 moderate to heavy accelerations followed by, brake regen events, with 15% brake apply (light to moderate). Perform these tasks from a vehicle speed of greater than 30 mph down to at least 5mph.
 - Perform at least 3 key off / key on cycles with a 2 minute off time, spread out throughout drive cycle. Note: you will need to turn high beams and heated seats back on after each key cycle.
11. Return vehicle to garage. Set parking brake and place shifter in Neutral and operate engine at 2,000 RPM until hybrid battery display shows full.



12. Place shifter in Park, release parking brake, and allow vehicle to idle for 2 hours with the following 12V loads on:
 - Head lamps with high beams
 - Cabin blower on highest setting
 - Air conditioning set to 78 deg. F, Eco mode (green snowflake LED), recirc., Bi Level (foot / floor -- do not want Defrost enabled)
 - Heated seats on high
 - Windows up
 - Radio on
 - 4 way flashers on
 - Dome lights on
13. Turn off engine and all 12 V loads, headlamps, dome lamps, and hazard lamps. Wait 2 minutes, then restart engine.
14. If the Service Hybrid System DIC message is displayed at any time, follow service instructions in SI for the particular DTC or tell tale that is set.







Global Product Quality

Hybrid Sector CPIT – e-Assist

23Jan13



GM Powertrain







BACKUP SLIDES



eAssist Sales & Production

2/18/13

Model Year	Platform	VPPC	Model	Production	Sales
2013	GLOBAL EPSILON	E11	LaCrosse	18	9
		GMX-350	Regal	1,368	856
		GMX-353	LaCrosse	6,881	3,372
		Platform Total		8,267	4,237
	GLOBAL EPSILON II	GMX-351	Malibu	28,873	18,231
		Platform Total		28,873	18,231
	Global Mid-Size Vehicles	Vs300	Alpheon	95	73
	Platform Total		95	73	
	Model Year Total		37,235	22,541	
2012	GLOBAL EPSILON	E11	LaCrosse	287	98
		GMX-350	Regal	2,732	2,214
		GMX-353	LaCrosse	14,625	13,854
		Platform Total		17,644	16,166
	Global Mid-Size Vehicles	Vs300	Alpheon	1,129	1,105
		Platform Total		1,129	1,105
	Model Year Total		18,773	17,271	
2011	GLOBAL EPSILON	E11	LaCrosse	477	424
		Platform Total		477	424
	Model Year Total		477	424	



GM Powertrain

6

{ * } Indicates GM Confidential Business Information Redacted



Global Quality

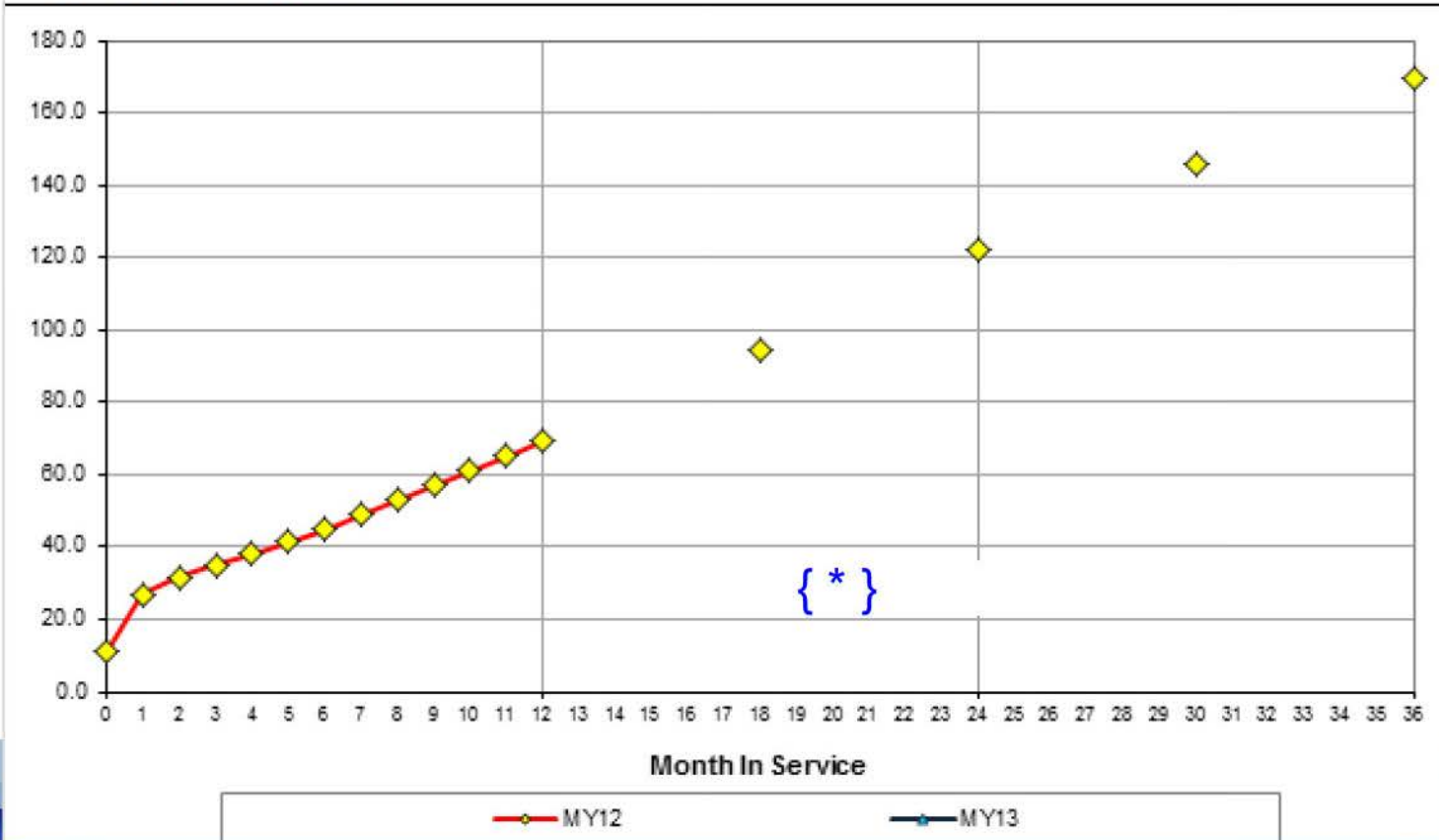
Fixed Model Year (August - July)

Status: 10Feb-2013 (TG)

eAssist/BAS Hybrids - PPEC B - ELECTRIFICATION

GM Global - Specification: Hybrids

Accumulated Chart - IPTV



GM Powertrain





“NPTCMP” Hybrid E-squared Process



GM Powertrain













“NPTCMP” EDR Process & Supplier Drawing Approval/Release Procedure



GM Powertrain





Date: October 25, 2012

Vehicle: 1G11F5RR0DF [REDACTED] MY2012 Malibu Dealer owned. Moran Chevrolet located on Gratiot Ave. in Clinton Township

Incident description: One hour into the idle portion of test procedure called out in service bulletin 12238 observer noticed smoke coming from trunk. The fire was extinguished by dealership personnel with a dry chemical extinguisher. The fire damage was confined to the interior compartment/cargo (trunk) compartments.

The 12V battery was disconnected some time after incident. FPE took photos. Arrangements were made to have vehicle shipped to MPG. Vehicle arrived at MGP on Oct. 26th at 12:00 pm



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES







GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES

R SAFETY RATINGS	PARTS CONTENT INFORMATION	
<p>rated by the government frontal crash, side crash</p>	<p>FOR VEHICLES IN THIS CARLINE: U.S./CANADIAN PARTS CONTENT: 62%</p> <p>NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.</p> <p>FOR THIS VEHICLE: FINAL ASSEMBLY POINT: KANSAS CITY, KS U.S.A. COUNTRY OF ORIGIN: ENGINE: UNITED STATES TRANSMISSION: UNITED STATES</p>	<p>This label has been applied pursuant to Federal law - Do not remove prior to delivery to the ultimate purchaser. *Includes Manufacturer's Recommended Pre-Delivery Service. Does not include dealer installed options and accessories not listed above, local taxes or license fees.</p>
<p>Safety Administration (NHTSA) or 1-888-327-4236</p>	<p>ORDER NO QHZQ7S SALES CODE E SALES MODEL CODE 1GC69 DEALER NO 44239 FINAL ASSEMBLY: KANSAS CITY, KS U.S.A. VIN 1G11F5RR0DF118790 DEALER TO WHOM DELIVERED MORAN CHEVROLET, INC. PO BOX 827 MOUNT CLEMENS, MI 48046-0827</p>	<p>© 2009 General Motors LLC GMLBL_PROD_0026 - 05/20/2012</p>  <p>NZ 1AG1990816</p>



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE

WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



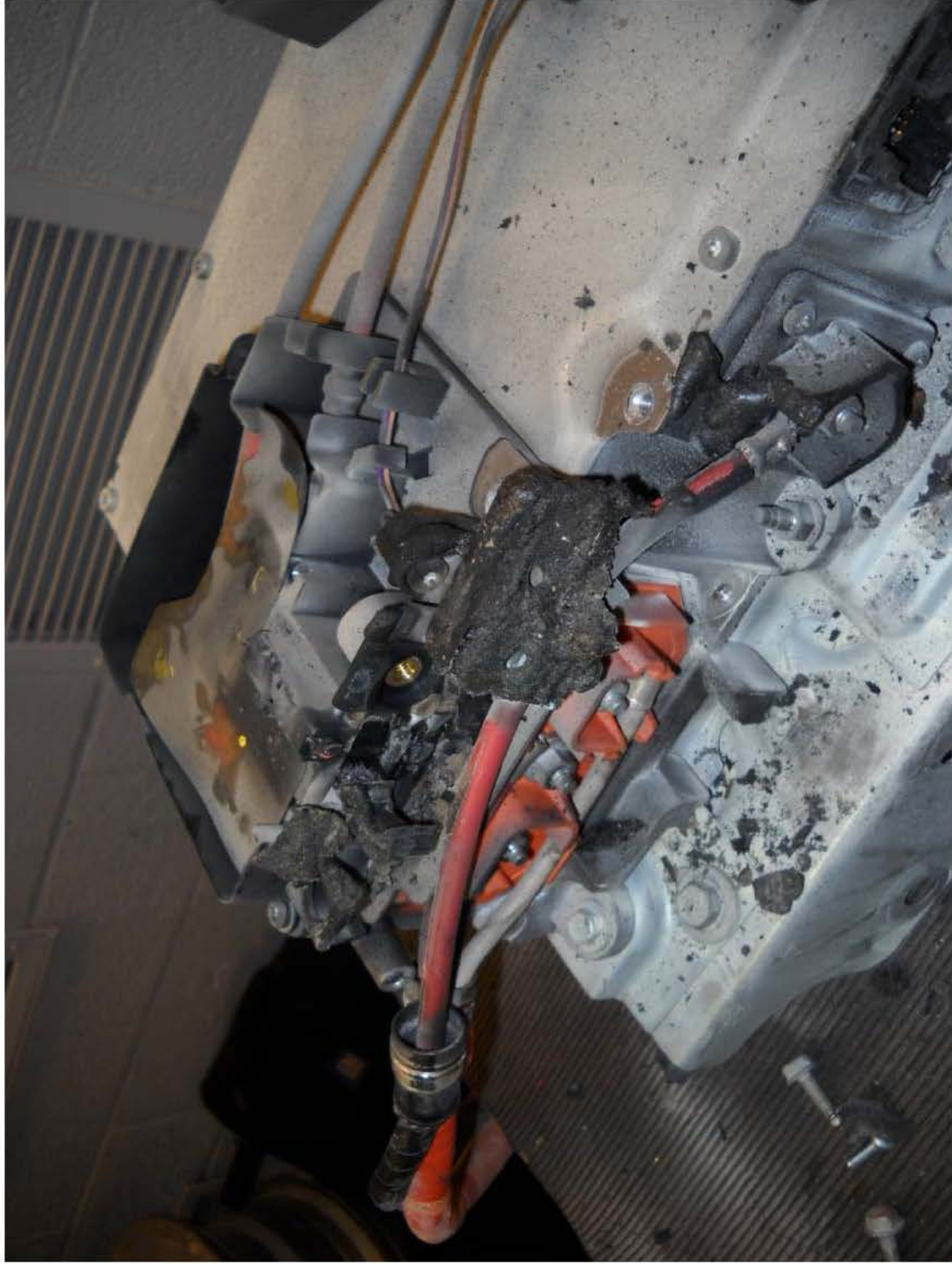
GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



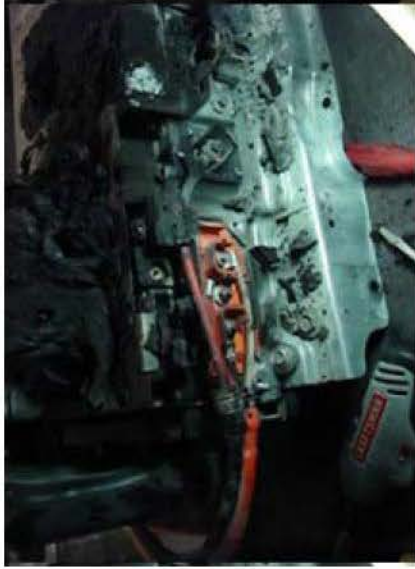
GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES



GM Confidential

DESIGN, BUILD & SELL THE
WORLD'S BEST VEHICLES

Isolation Description

- ◆ Pack 89 – Pwr LV Isolation – No damage described
- ◆ Pack 123



- ◆ Pack 141
 - No Photo described as “White Marsh Type” same as Pack 123 above

- ◆ Pack 143



- ◆ Pack 156



“White Marsh Type”



Isolation Description

- ◆ Pack 157



- ◆ Pack 164



- ◆ Pack 167



- ◆ Pack 168



Isolation Description

- ◆ Pack 182



- ◆ Pack 183



- ◆ Pack 188

- No photo

- ◆ BPIM 208



Isolation Description

- ◆ Pack 195 - Pwr PCB HV Isolation
- ◆ Pack 211 - Pwr PCB HV Isolation
- ◆ Pack 212 - “White Marsh Type” Pwr PCB
- ◆ Pack 214 - “White Marsh Type” Pwr PCB
- ◆ Pack 226 - Pwr PCB HV Isolation smoke damage
- ◆ Pack 232 - Pwr PCB HV Isolation smoke damage
- ◆ Pack 234 - Pwr PCB HV Isolation smoke damage
- ◆ Pack 250 - Pwr PCB HV Isolation smoke damage
- ◆ Pack 262 - Pwr PCB HV Isolation smoke damage
- ◆ Pack 265 - Pwr PCB HV Isolation smoke damage
- ◆ Pack 290 - Pwr PCB HV Isolation smoke damage
- ◆ Pack 308 - Pwr PCB Thermal damaged to multiple layers of PCB
- ◆ Pack 326 - “White Marsh Type” Pwr PCB
- ◆ Pack 334 - “White Marsh Type” Pwr PCB
- ◆ Pack 359 - “White Marsh Type” Pwr PCB
- ◆ Pack 370 - “White Marsh Type” Pwr PCB
- ◆ Pack 395 - Pwr PCB HV Isolation

“White Marsh Type”



“Smoke damage”



Isolation Description

- ◆ Pack 370 - “White Marsh Type” Pwr PCB
- ◆ Pack 395 - Pwr PCB HV Isolation
- ◆ Pack 400 - Pwr PCB HV Isolation
- ◆ Pack 446 - Pwr PCB HV Isolation
- ◆ BPIM 556 - Pwr PCB HV Isolation
- ◆ Pack 632 - “White Marsh Type” Pwr PCB

“White Marsh Type”



2012 – 2013 Malibu, Regal, LaCrosse – eAssist – BPIM/APM Circuit Boards



TBD Vehicles (or less if mileage / days in use limits are used)

U.S. – TBD Canada – TBD

N-130136

Condition:

Certain eAssist vehicles were built with a generator control module (“BPIM/APM”) that **may not function properly**. **A shorting between layers of one of three multi-layer circuit boards** may cause the **loss of 12V battery charging** and/or MIL illumination. If loss of battery charge occurs, the vehicle will operate solely from 12V battery power, and the red battery indicator light will illuminate. The battery saver system starts reducing certain features of the vehicle that the driver might notice and BATTERY SAVER ACTIVE will appear in the DIC(Driver information system). If the vehicle continues to operate with the BAS system disabled, **the 12V battery will eventually discharge and the vehicle will stall or will not start**.

Effect of the Condition:

The vehicle may gradually lose battery charge, which will illuminate the MIL and ultimately result in an engine stall/no-start condition. A thermal event within the metal-encased BPIM that may extend to the surrounding trunk trim may also occur.

Suspect Population:

All vehicles built from SOP to the targeted implementation of fully updated circuit boards with additional interlayer isolation in Jan, 2013 are suspect.

Technical Root Cause:

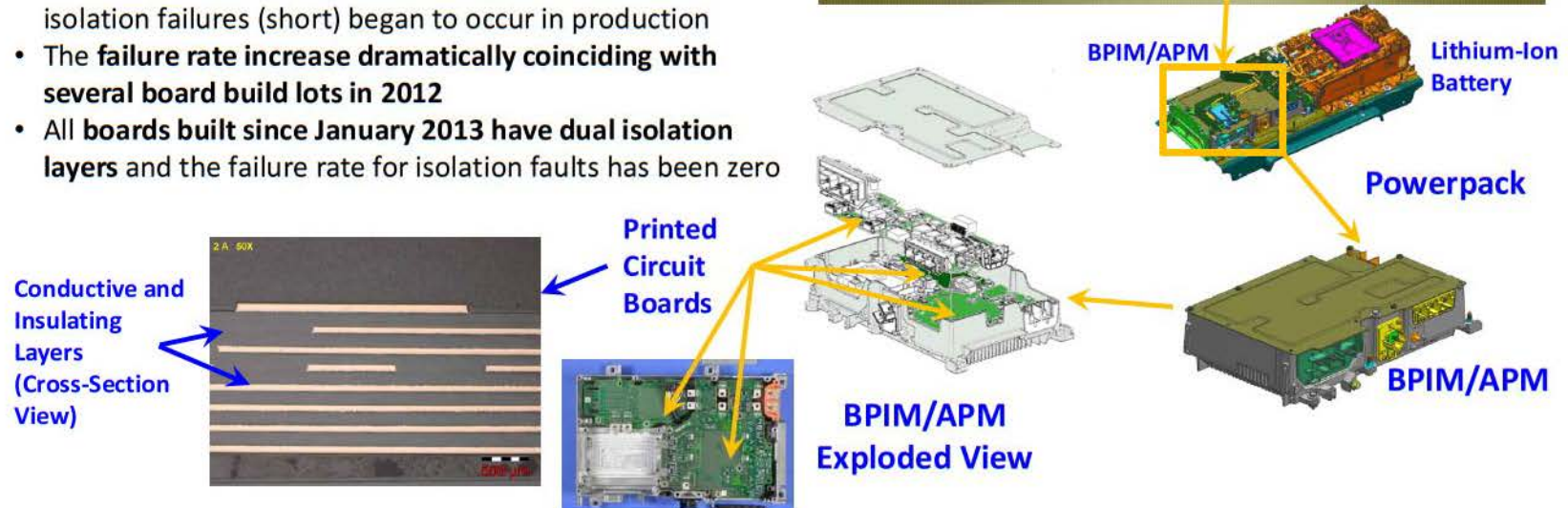
Shorting between layers of multi-layer circuit boards in the BPIM/APM.

GM Confidential

eAssist: BPIM/APM Circuit Board Failures

Technical Summary:

- All eAssist vehicles have a **Powerpack** which contains a **BAS Power Inverter Module (BPIM) / Accessory Power Module (APM)**, and a **115-V Lithium-Ion battery**
- The BPIM/APM contains three multi-layered **Printed Circuit Boards (PCBs)** comprised of conductive layers separated by isolating layers
- General practice is for two layers of isolation between conductive layers or one layer of adequate thickness.
- The three PCBs in the eAssist BPIM/APM have **at least one instance of conductive layers separate by only one isolating layer**
- This design showed **no issues during validation** but some isolation failures (short) began to occur in production
- The **failure rate increase dramatically coinciding with several board build lots in 2012**
- All boards built since January 2013 have dual isolation layers and the failure rate for isolation faults has been zero



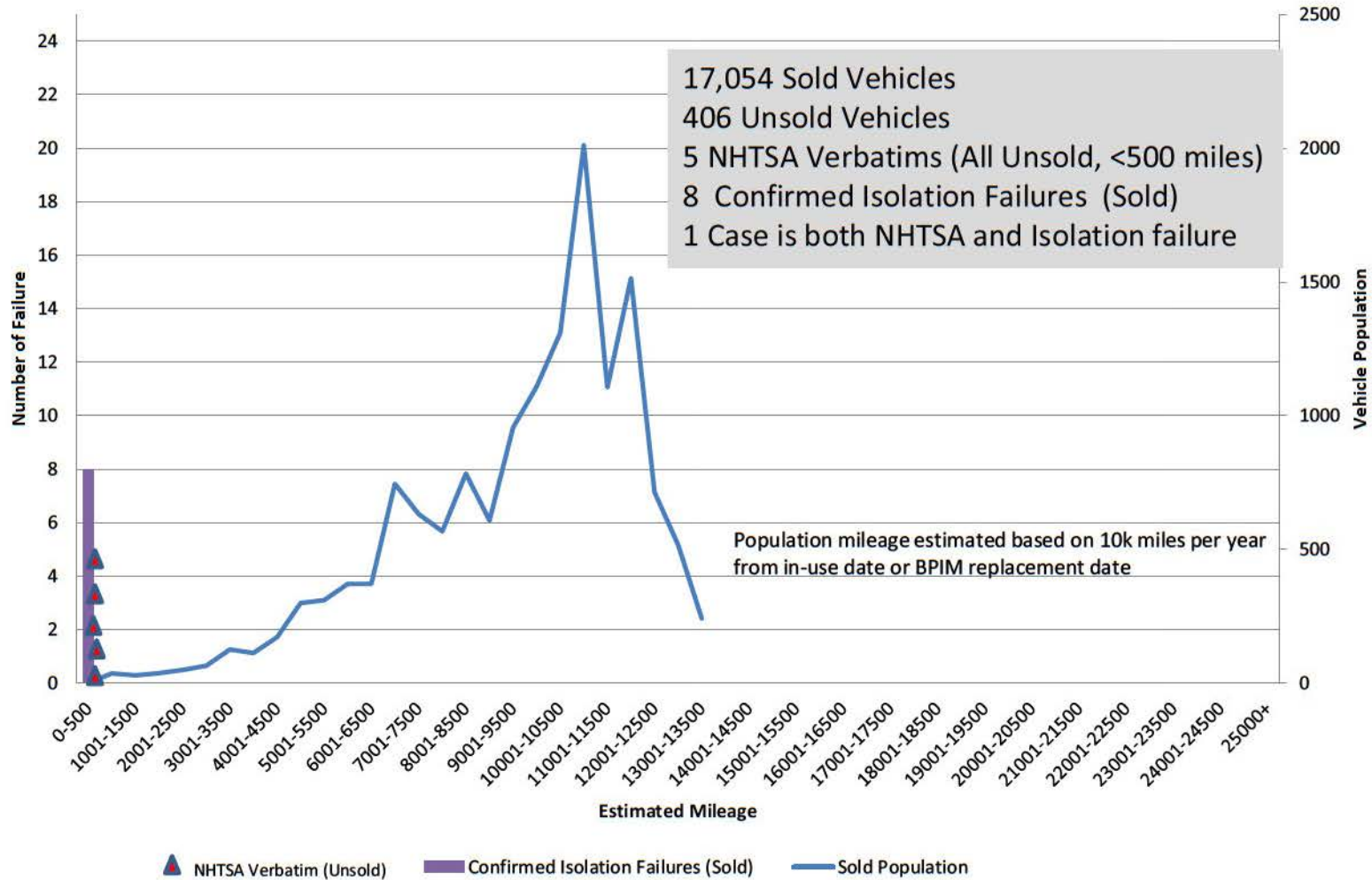
GM Confidential

2

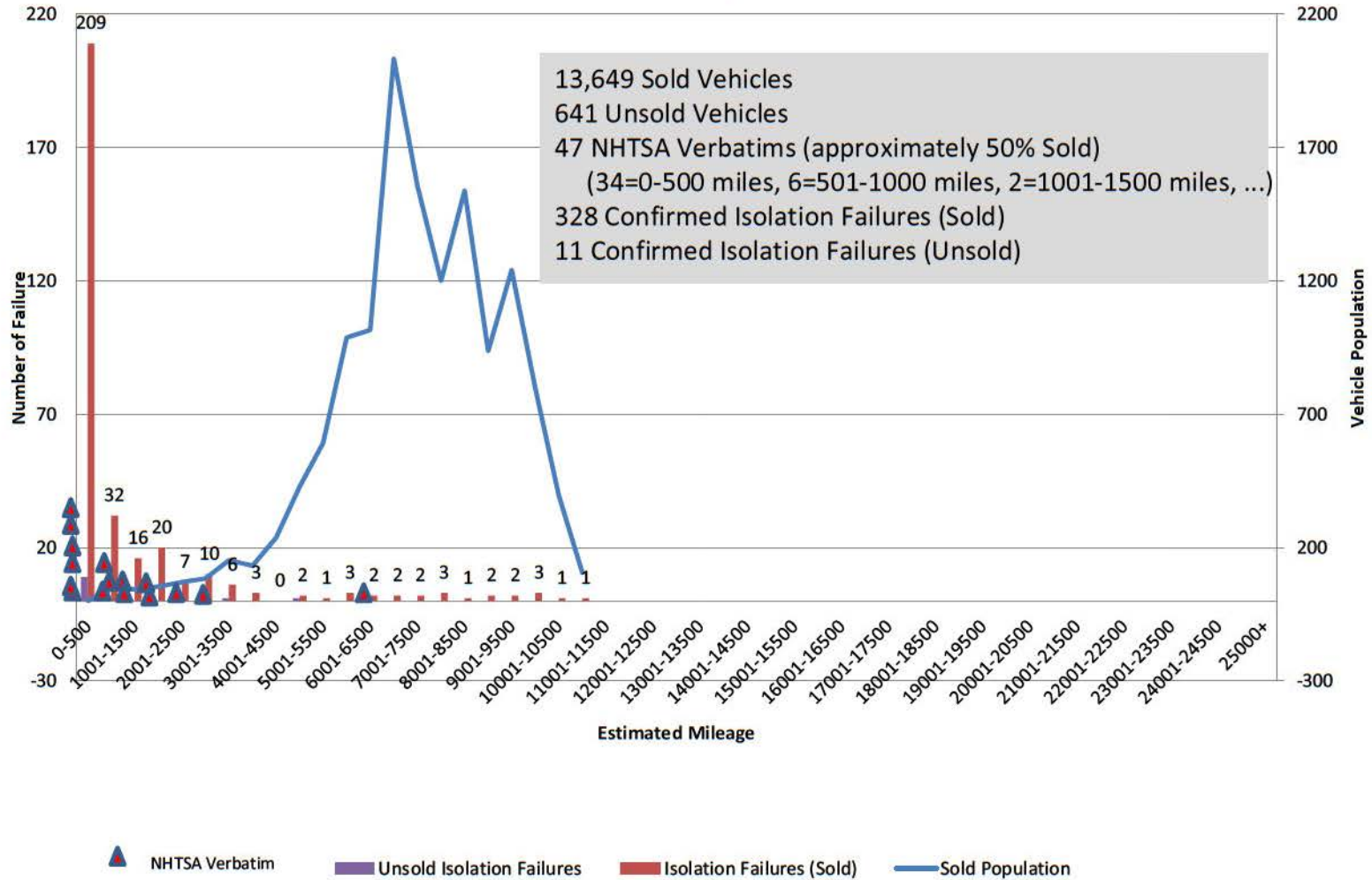




Bucket A - 11/16/10 - 3/19/12 (Before the Spike)
Unscreened - 17,459 Vehicles



Bucket B - 3/20/12 - 8/20/12 (Manufacturing Spike) Unscreened - 14,290 Vehicles









eAssist Affected Applications

North America



21.1K



4.0K



28.5K

China



0.8K

Korea



1.2K

Fall 2012

GM CONFIDENTIAL

Background

GM Confidential



eAssist BPIM Isolation Fault Timeline

- July 5, 2011 – SGM vehicle with shorted APM output (unknown root cause)
- November 2011 – First failure in field for shorted APM output
- January 2012 – Second TAC case for isolation related issues
- March 2012 – Contained thermal event in Fairfax LQ68414112056516
- March 2012 - SGM TAC that an E11 eAssist in one Beijing dealership had a burned fuse #23.
- April 2012 - Design review indicated some PCBs did not have full double layer insulation
- May/June 2012 - Spike in TAC cases for isolation related issues
- July/August – Escalation of issue due to increased rate in the field
- August 8, 2012 – 20 minute conditioning screen added at GMCH (sample basis)
- August 2012 – Power board ‘Option 1’ changes implemented at GMCH
- Vehicle screening at the assembly plants
- October 19, 2012 - Service bulletin 12238 issued to screen ‘limited’ population (7,166)
- October 24, 2012 – Thermal event during vehicle screening (cap board)
- November 14, 2012 - Stop build / ship order issued, all vehicles screened prior to shipping
- November 15, 2012 - Service bulletin 12238B updated to expand vehicle population (22,908)
- January 10, 2013 – Service bulletin 12238C updated to include 2013 LaCrosse/Regal part number
- January 16, 2013 – All BPIM PCBs (cap and control boards) have double layer insulation
- February 13, 2013 – Service bulletin 12238D updated to include new parts and clarify instructions
- March 25, 2013 – Letter from customer requesting a buy-back due to a thermal incident

GM Confidential





Working Outline

- *Executive summary – 1 page*
- *Issue Background*
- *Explanation of buckets (timeline and technical)*
- *Explanation of risk profile vs. all-in data history*
- *Show risk profiles by bucket*
- *Part availability*
- *Options*
- *Recommendation*
- *Backup*

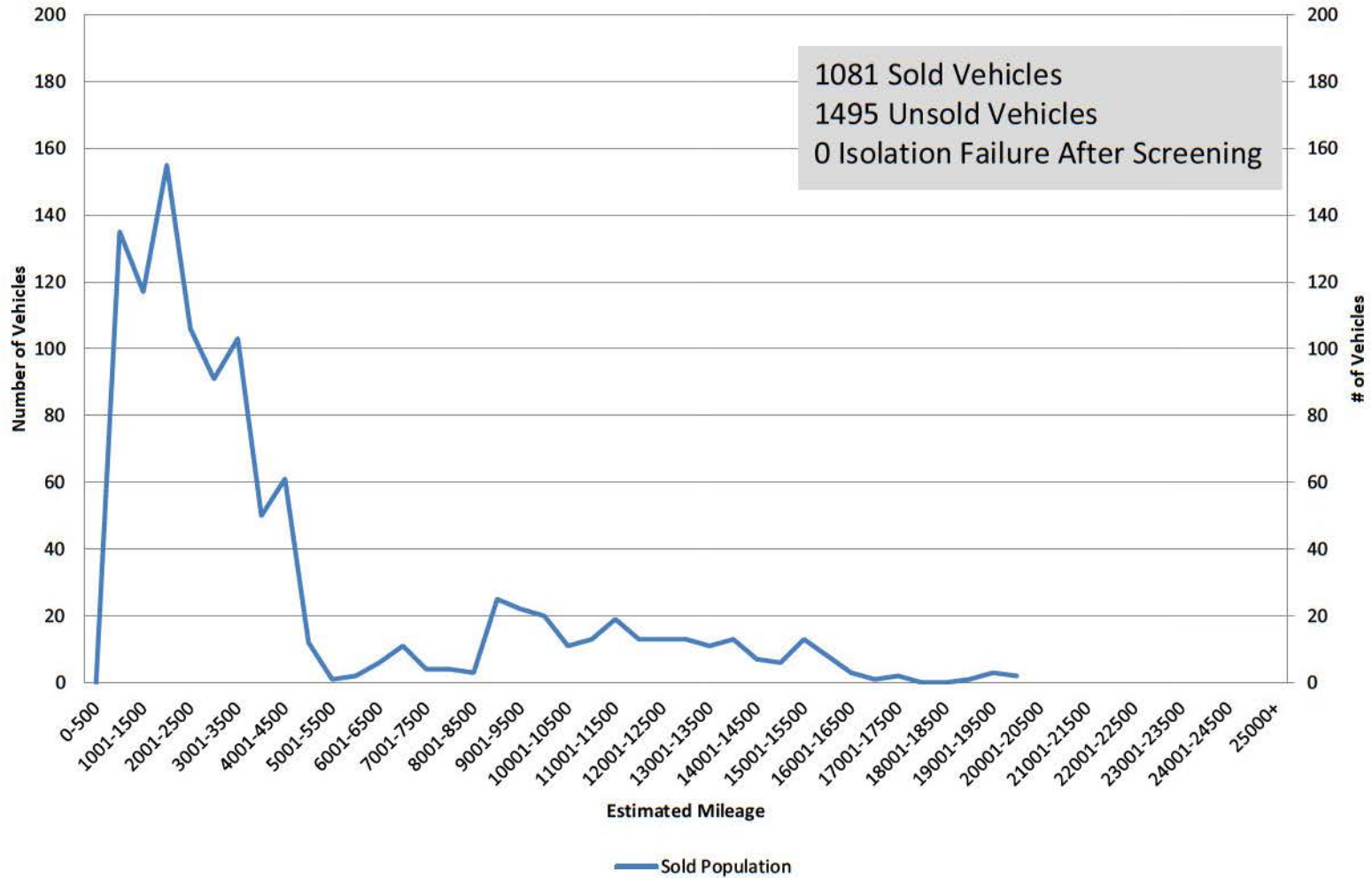
GM Confidential



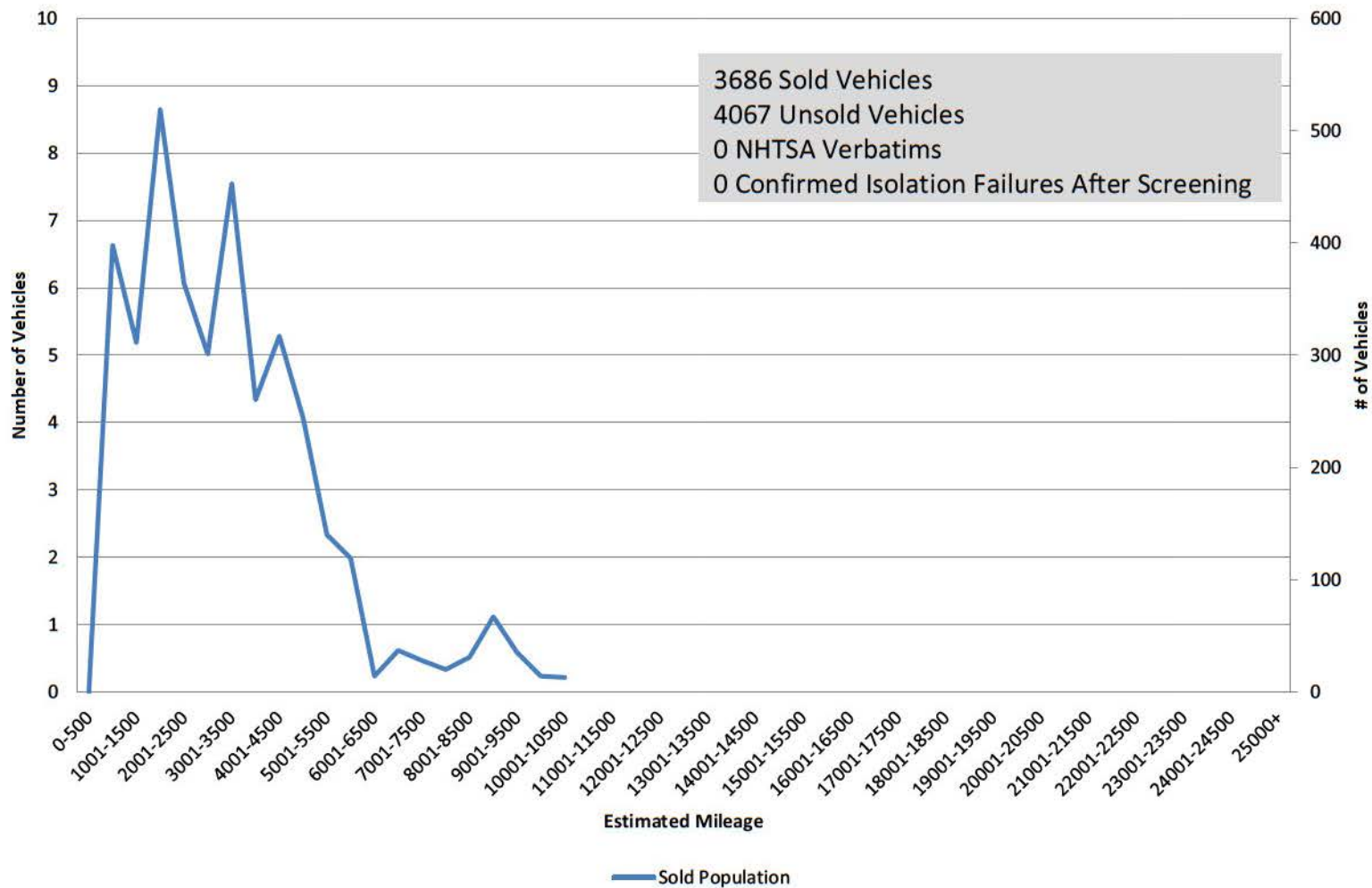
Buckets of Vehicles and Risk Profiles for Each Bucket

GM Confidential

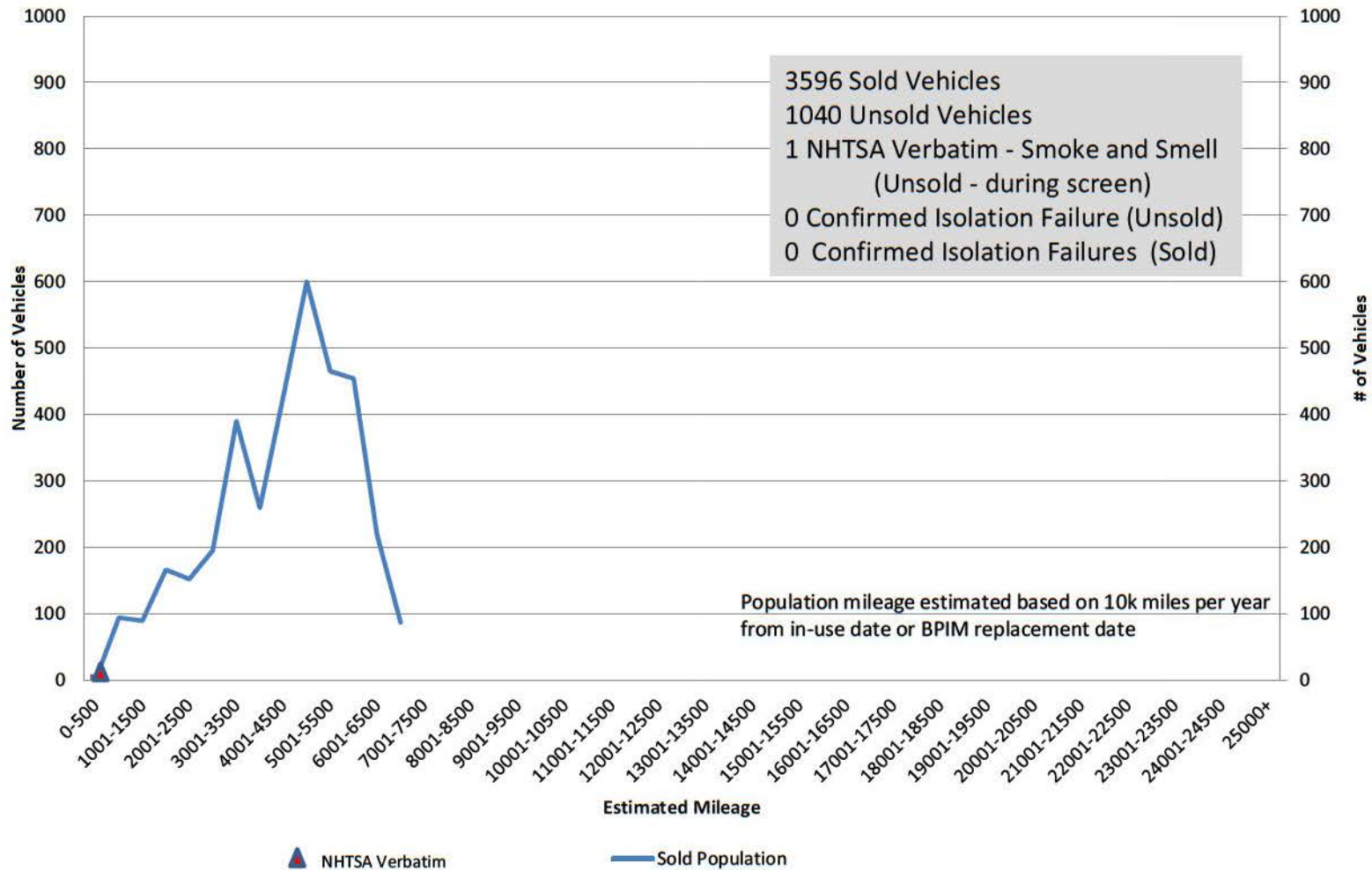
**Bucket A - 11/16/10 - 3/19/12 (Before the Spike)
Screened - 2576 Vehicles**



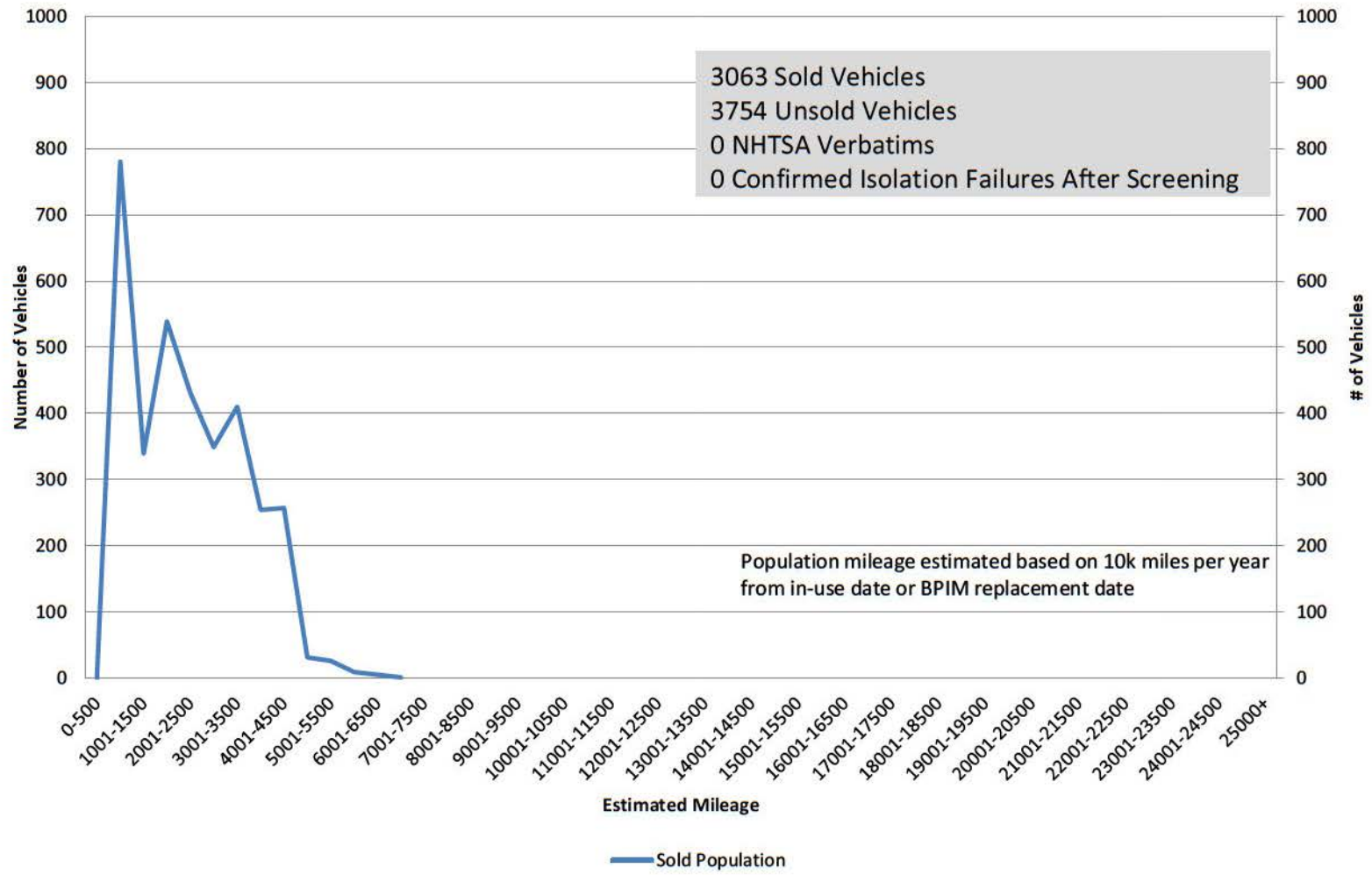
Bucket B - 3/20/12 - 8/20/12 (Manufacturing Spike) Screened



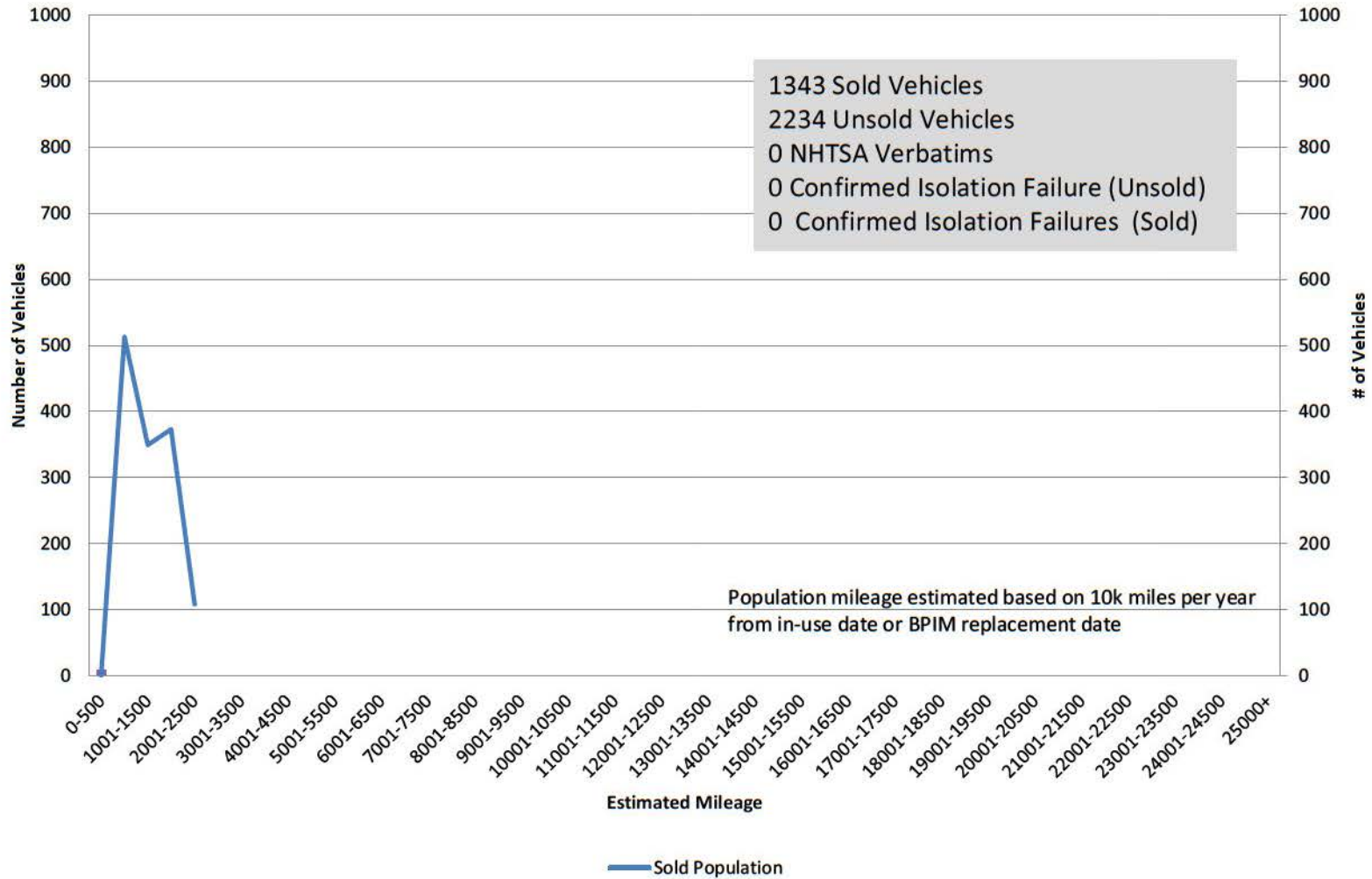
Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board) Unscreened - 4636 Vehicles



Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board)
Screened - 6817 Vehicles



Bucket D - 1/1/13 - Present (All Boards Updated) Unscreened - 3577 Vehicles



Replacement Part Availability

GM Confidential

Options and Recommendation

GM Confidential

Backup ...

GM Confidential

2012 – 2013 Malibu, Regal, LaCrosse – eAssist – BPIM/APM Circuit Boards



TBD Vehicles (or less if mileage / days in use limits are used)

U.S. – TBD Canada – TBD

N-130136

Responsibility: Supplier (GMCH)

Frequency:

Potential Field Action Category: Safety or Customer Satisfaction Recall

Potential Field Remedy:

1. Screen all vehicles similar to Service Update 120238a, or
2. Replace the BPIM/APM on all involved vehicles, or
3. Some combination of 1 and 2, to maximize fix effectiveness and speed of implementation.

GM Confidential

Service Bulletin (Excerpts)

**SUBJECT: Service Update for Inventory Vehicles Only
Loss of Battery Charge – Inspect Generator Control Module
Expires October 31, 2013**

**MODELS: 2012 Buick Regal
2012-2013 Buick LaCrosse
2013 Chevrolet Malibu Eco
Equipped with eAssist**

*The Caution Statement in the service procedure has been revised to the following: **Caution: The service procedure contained in this bulletin is intended to fully stress the generator control module beyond normal customer use. This stress, in rare cases, may result in smoke and thermal damage to the generator control module. For the extended idle portion of the service procedure (Steps 8 and 12), the vehicle should be located outdoors, with the right rear seat back down, and with the location of the power pack in view of an observer in the left rear seat during the complete idle portion. Do not remove any trim panels. If smoke is observed or smelled, even a trace level, or a popping or unusual noise is heard from the power pack, immediately turn off the engine and exit the vehicle. Disconnect the 12V battery and observe for 10 minutes, then contact TAC.***

Please discard all copies of bulletin 12238, issued October 2012.

This service update involves vehicles in dealer inventory only and will expire October 31, 2013.

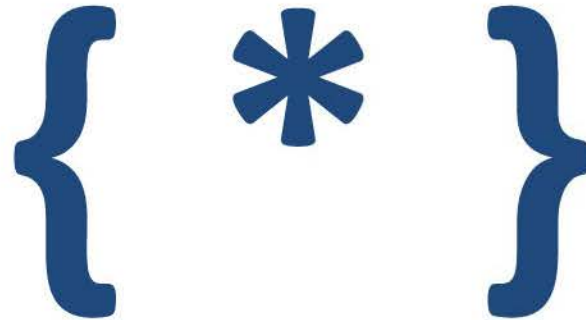
PURPOSE

This bulletin provides a service procedure to inspect and replace, if necessary, the Generator Control Module (GCM) on **certain** 2012 model year Buick Regal, 2012-2013 model year Buick LaCrosse, and 2013 model year Chevrolet Malibu Eco vehicles, equipped with eAssist. The GCM may not function properly, resulting in the gradual loss of battery charge, illumination of the MIL, and eventual engine stall or no start condition.

DEALER PROGRAM RESPONSIBILITY

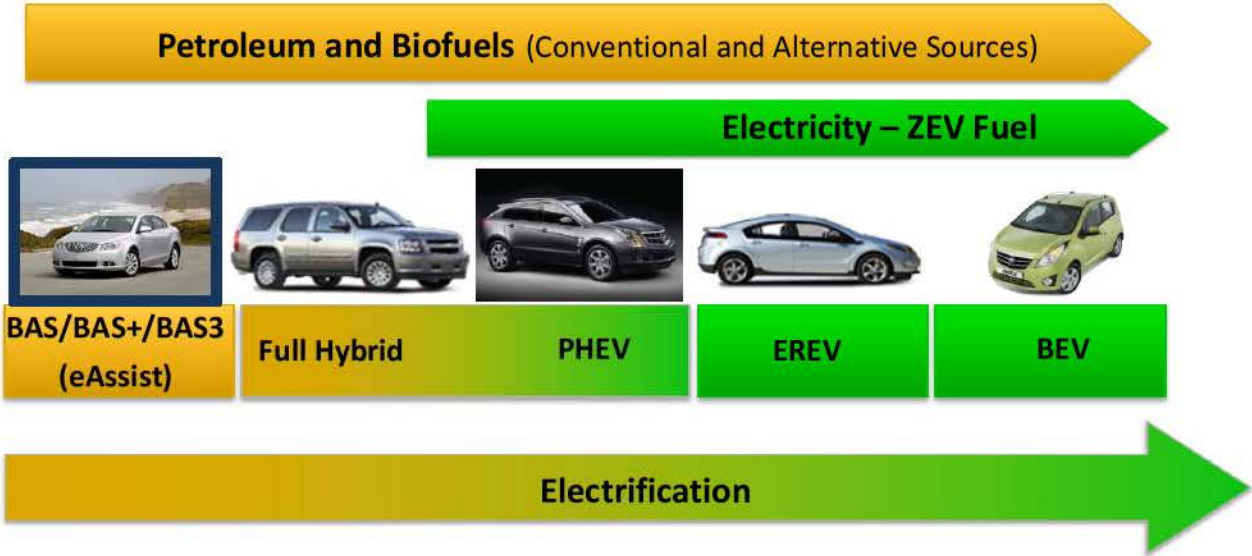
Dealers must take the steps necessary to ensure that the service update correction has been made to all involved vehicles in dealer inventory before selling or dealer-trading the vehicle, but no later than October 31, 2013.

GM Confidential



eAssist Role in GM Electrification Portfolio

- “Light Electrification” – apply “low-hanging fruit” offered by electrification
- 10-15 kW system
- Potential future base powertrain content
- Marketed as eAssist – not “Hybrid”



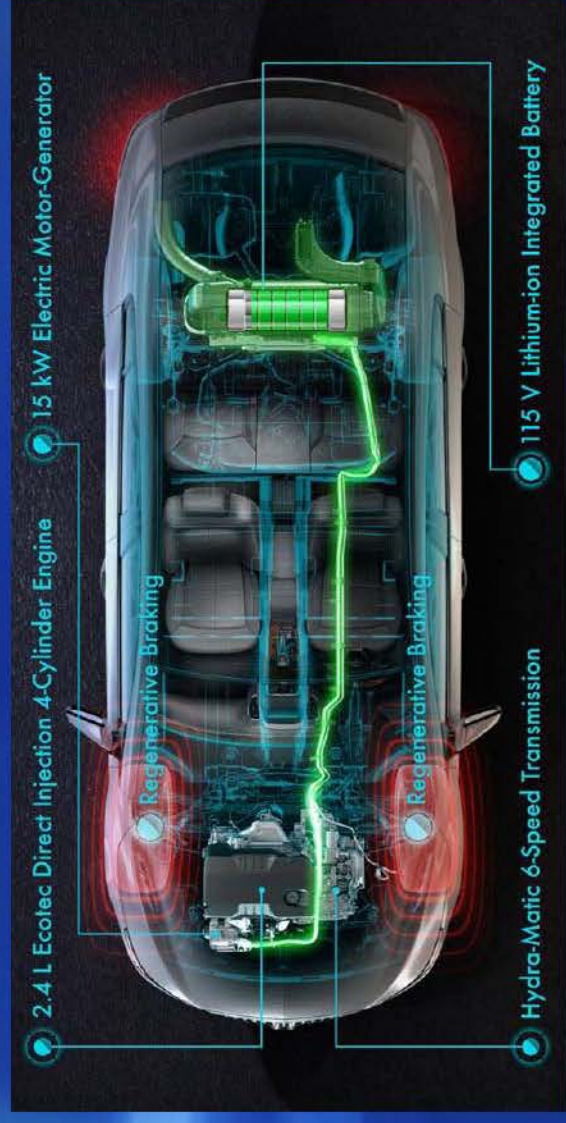
The Elements of eAssist™



- 15-kW belt-driven induction motor/generator
- Engine accessory drive with a patented dual tensioner
- Air cooled power electronics integrated with a compact, light-weight 115-V lithium-ion battery pack
- Direct-injection 2.4 liter 4-cylinder gasoline engine and slightly modified 6-speed automatic transmission
- Specific features to reduce road load, which work synergistically with the eAssist™ propulsion system to maximize regenerative braking:
 - Low-rolling resistance tires
 - Underbody aero panels
 - Actively controlled grill shutters



How Does eAssist™ Save Fuel?



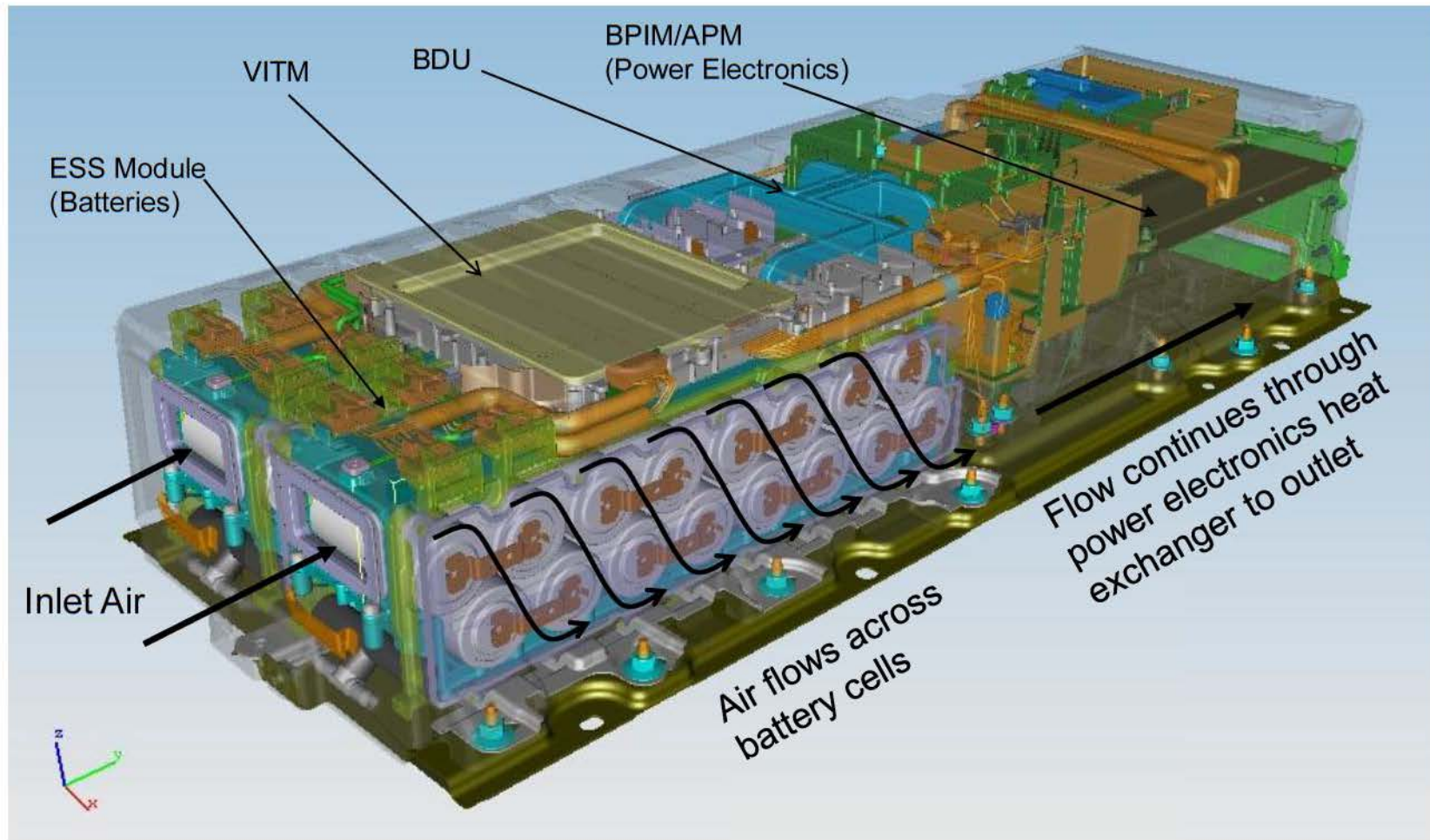
2012 LaCrosse 2.4L Ecotec with eAssist™ Technology

- Smooth engine stop/start
- Regenerative braking
- Full deceleration fuel cut-off
- Electric boost to maintain acceleration and gradeability with more efficient axle ratio

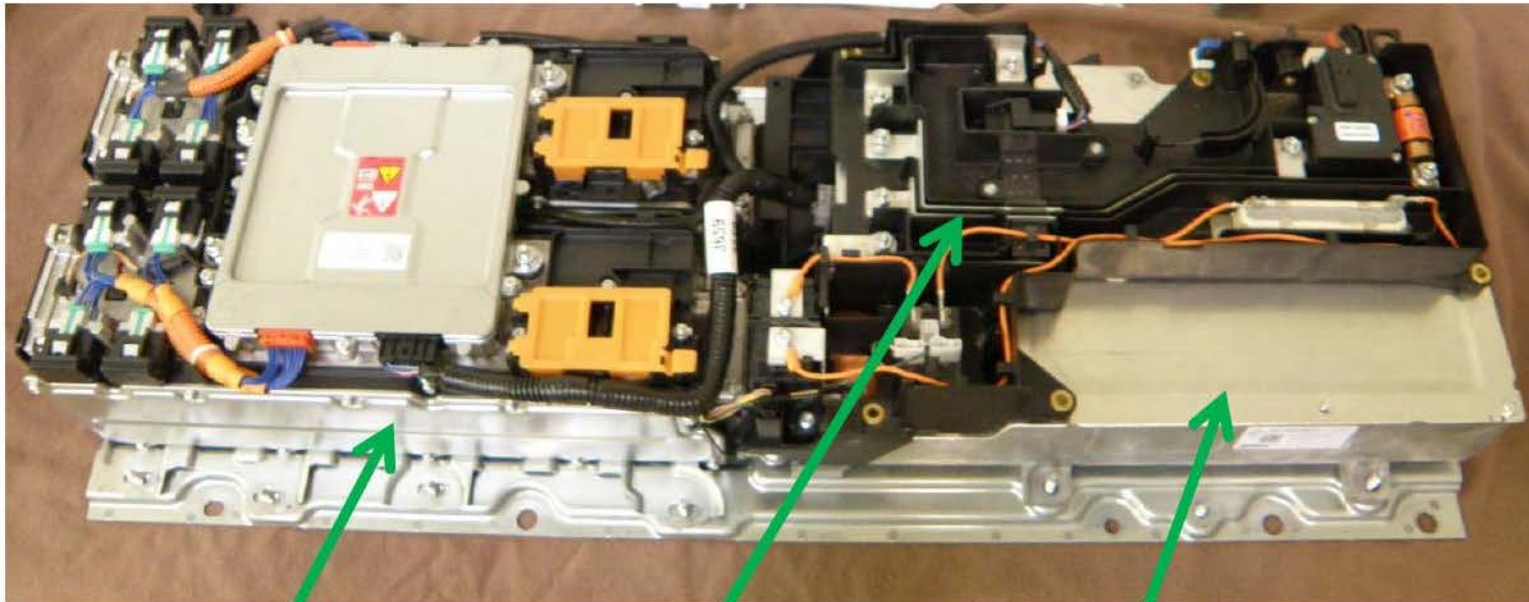
eAssist



Powerpack – Basic Layout



eAssist Powerpack (Cover Removed)



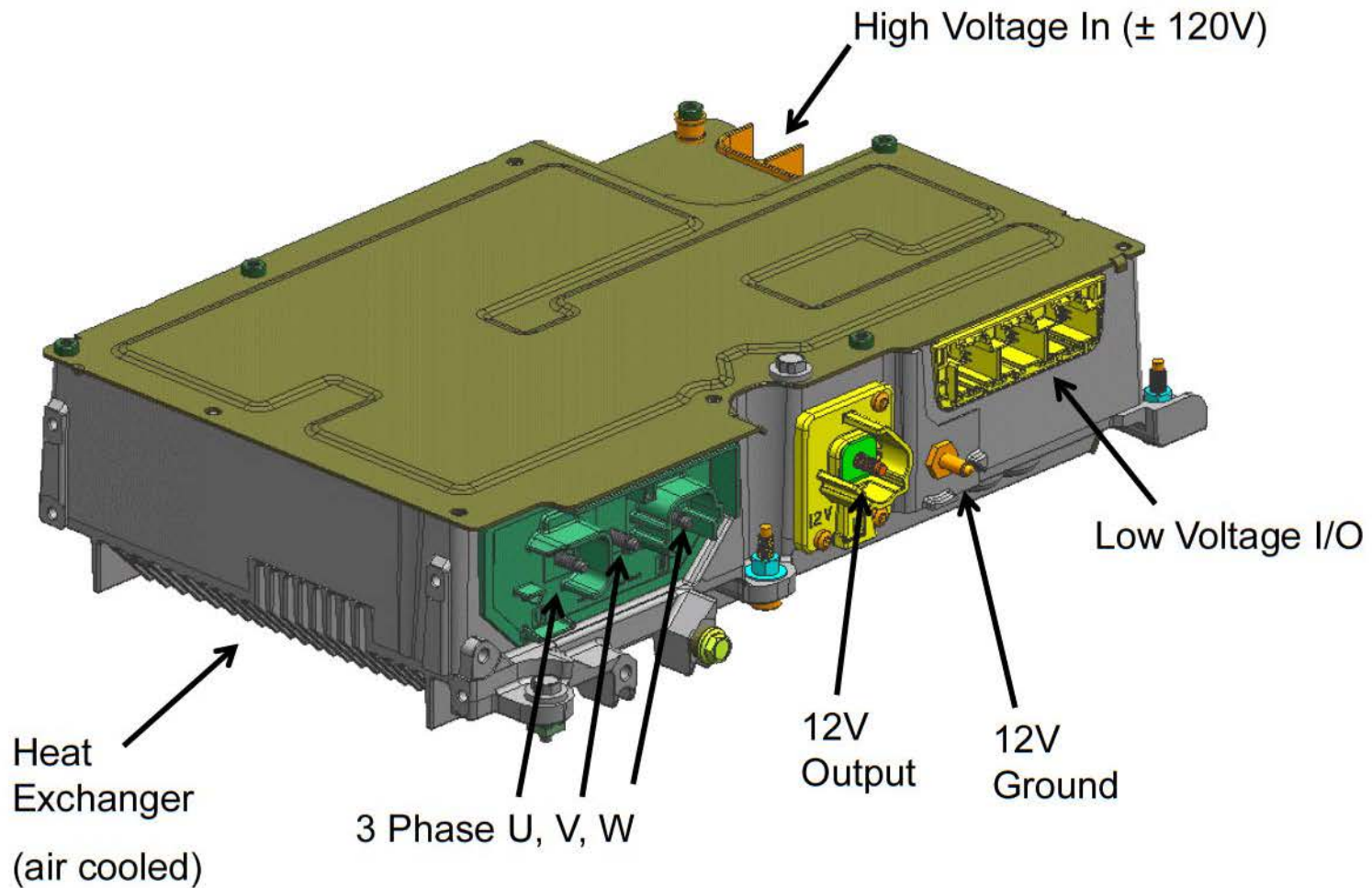
Battery

Battery Disconnect Unit

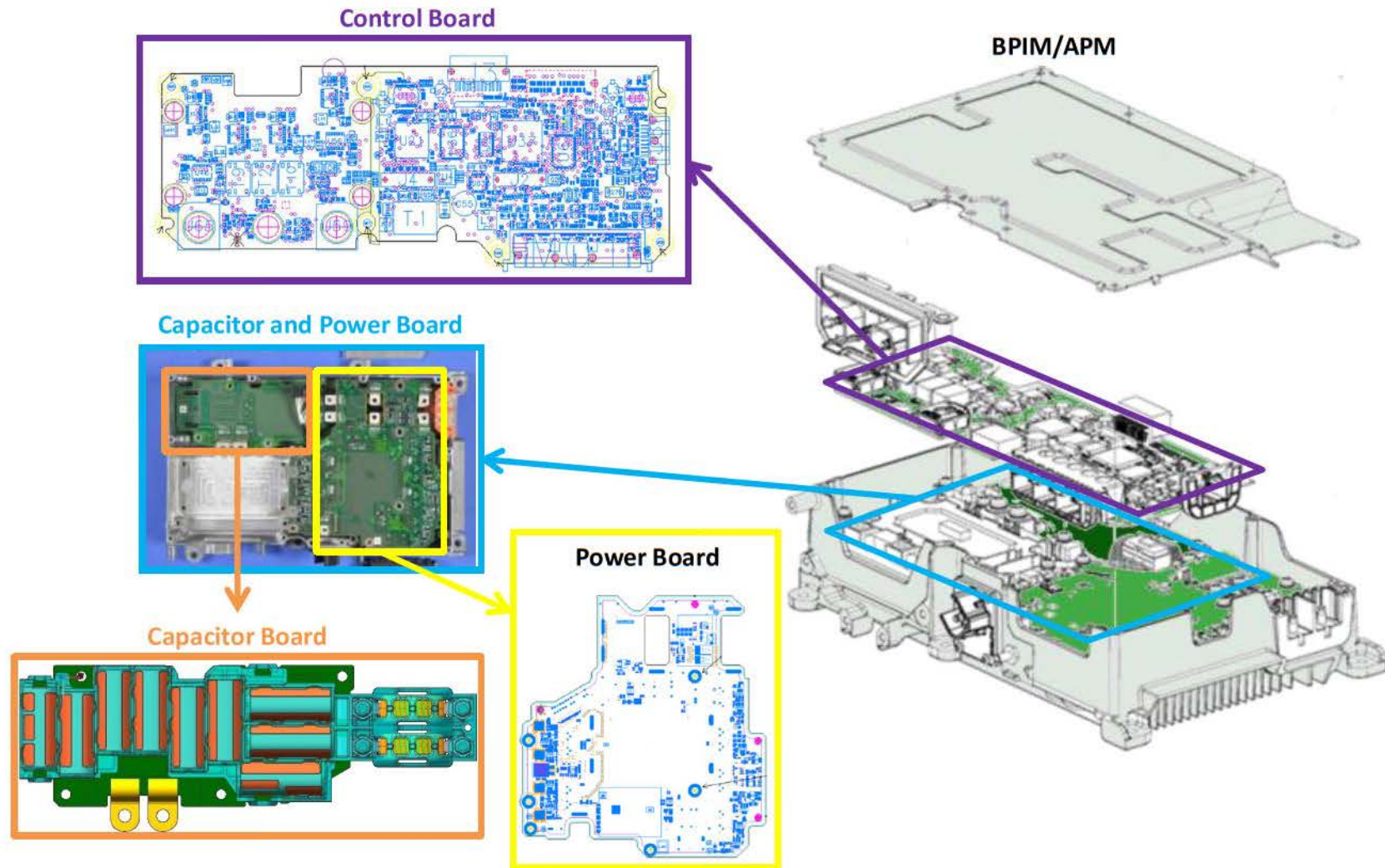
BPIM/APM

(Starter/Generator Control Module)

eAssist BPIM/APM – External View



eAssist: BPIM/APM Printed Circuit Boards



GM Confidential

37

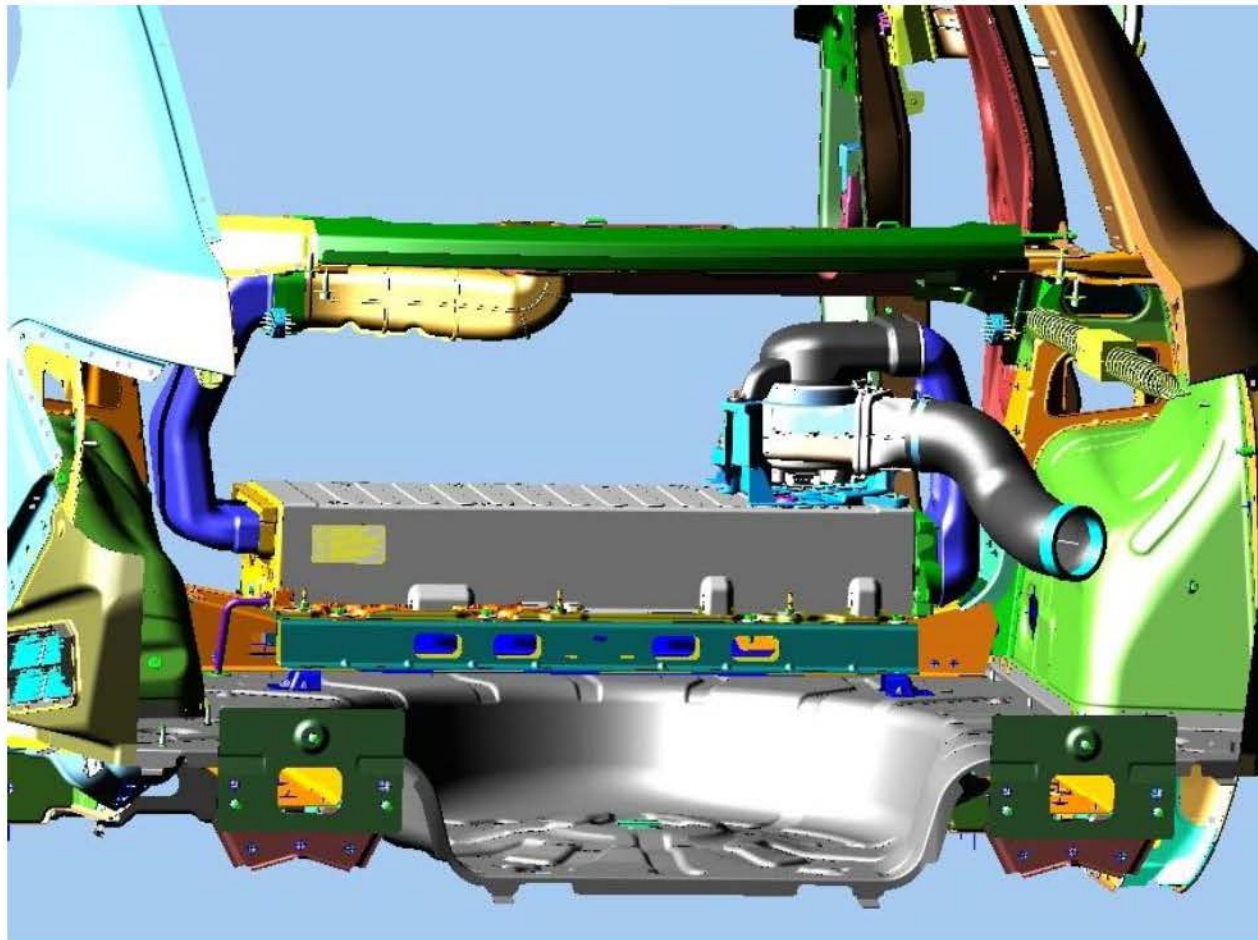








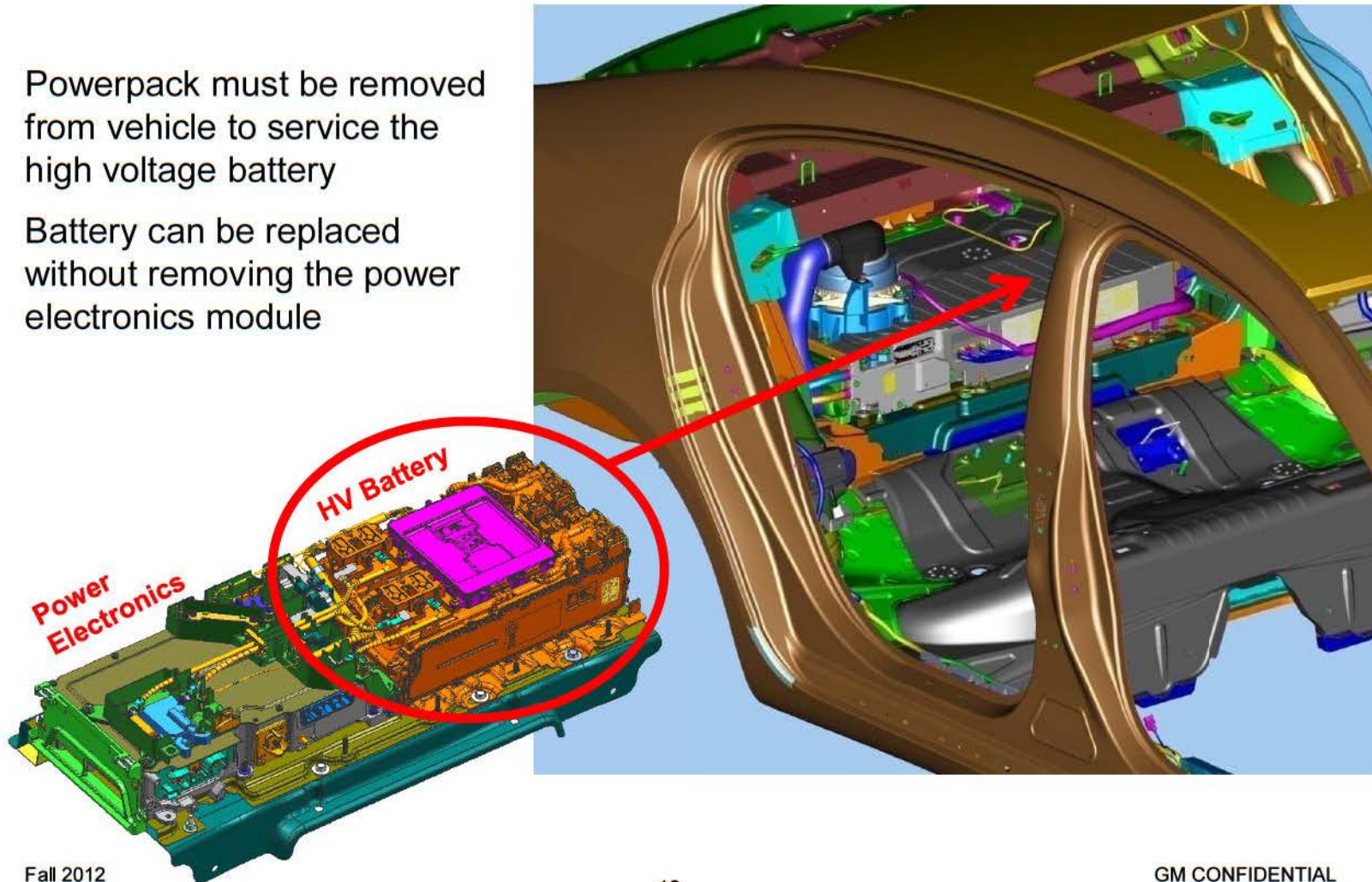
Vehicle Packaging (seen from rear of vehicle) eAssist Powerpack



Serviceability (seen from side of vehicle) eAssist Powerpack

Powerpack must be removed from vehicle to service the high voltage battery

Battery can be replaced without removing the power electronics module



Fall 2012

43

GM CONFIDENTIAL







eAssist APM/BPIM

KDS Crystal Replacement / Cost Savings Implementation

Technical Review March 11, 2013

Kokomo Operations



Agenda / Results /
Followup Activities

Attendance March 12, 2013

On Phone:

- Dave Tasky
- Bryan Ludwig
- Todd York
- John Meyer
- Tony Saliga

In Room:

- Bill Barrett
- Gary Backs
- Fred Foxworthy
- Mehrdad Teimor
- Hoss Lotfalian
- Joe Thompson
- Tim Funk
- Steve Farris
- Reena Datta
- Bill Whitlock

























1206 Capacitor Commonization















Kokomo Operations

Output Inductor / Toroid Resourcing



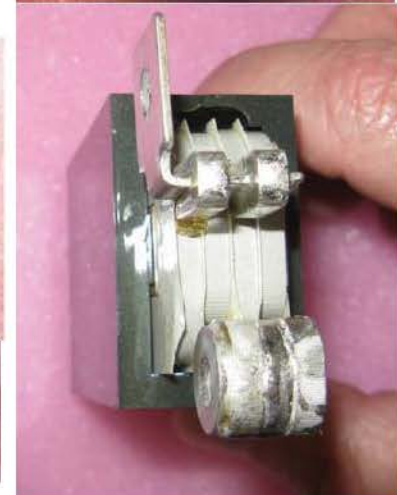
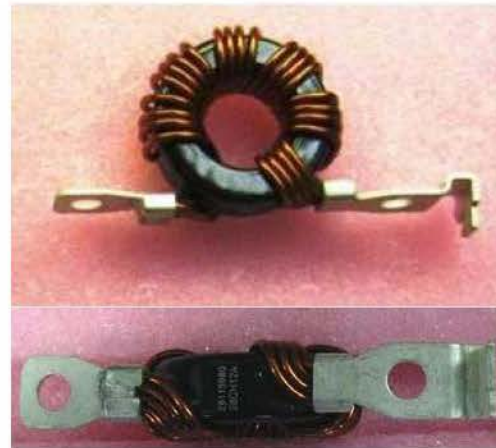
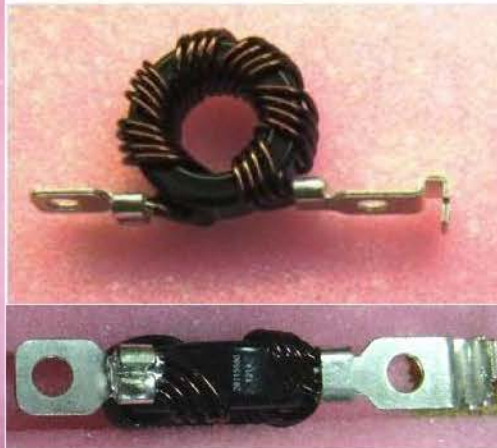
Kokomo Operations



New Supplier



Current Production



























Kokomo Operations

Commonize Current Sense Transformer









Qualification Testing







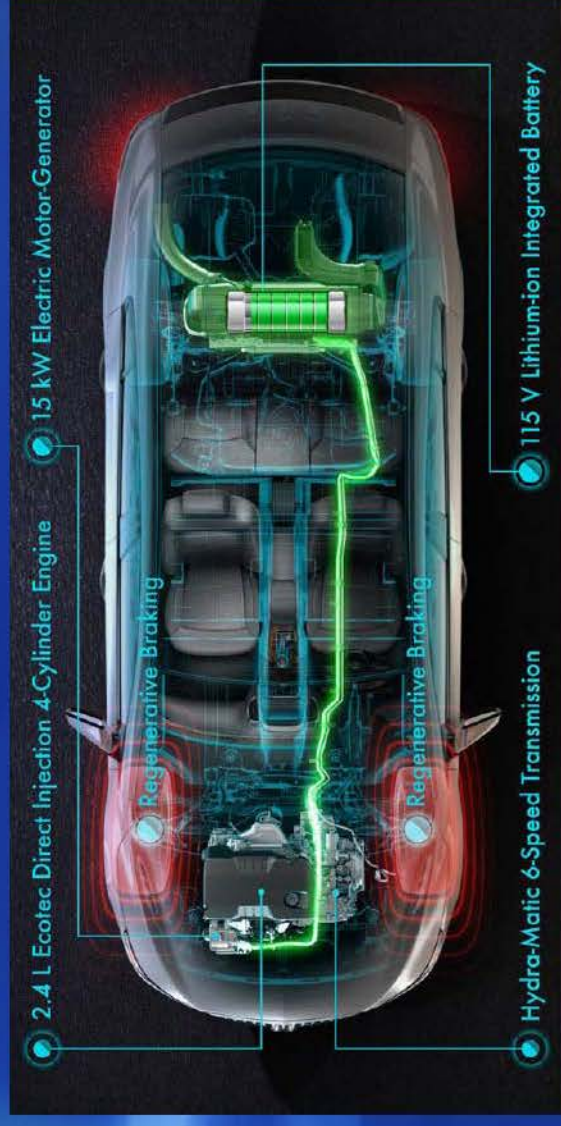
The Elements of eAssist™



- 15-kW belt-driven induction motor/generator
- Engine accessory drive with a patented dual tensioner
- Air cooled power electronics integrated with a compact, light-weight 115-V lithium-ion battery pack
- Direct-injection 2.4 liter 4-cylinder gasoline engine and slightly modified 6-speed automatic transmission
- Specific features to reduce road load, which work synergistically with the eAssist™ propulsion system to maximize regenerative braking:
 - Low-rolling resistance tires
 - Underbody aero panels
 - Actively controlled grill shutters



How Does eAssist™ Save Fuel?



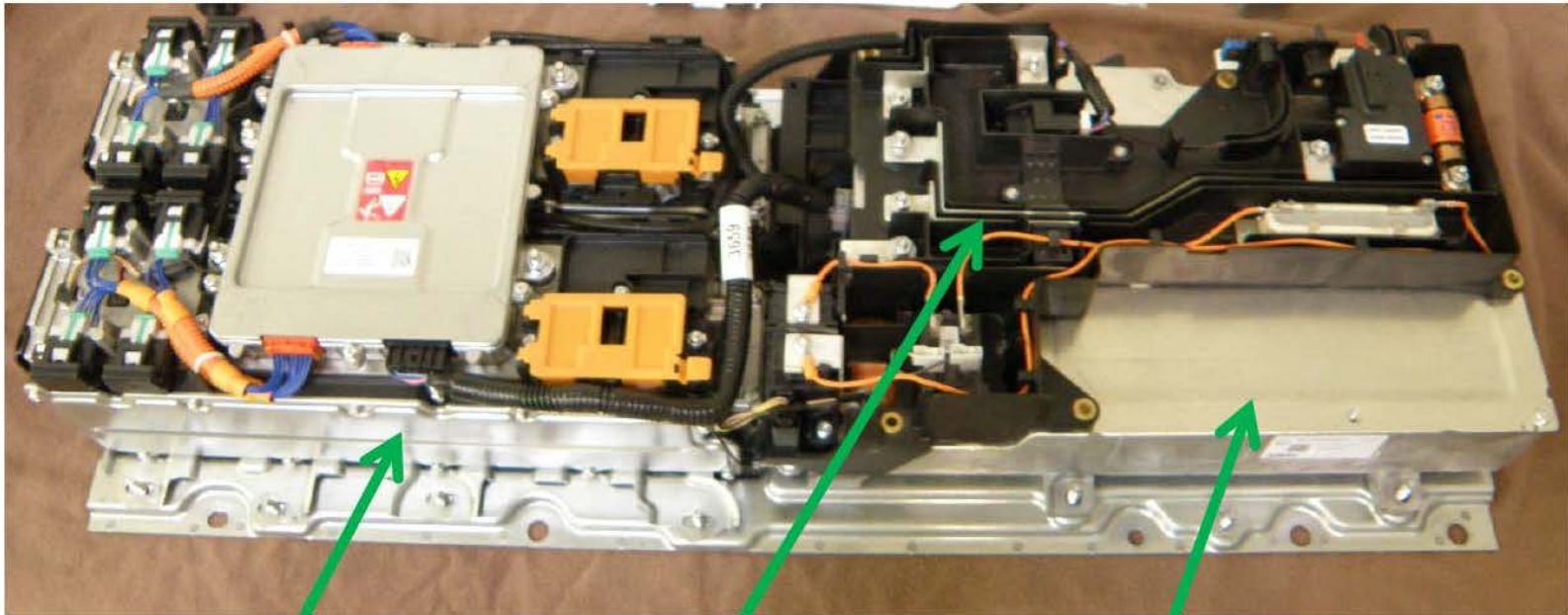
2012 LaCrosse 2.4L Ecotec with eAssist™ Technology

- Smooth engine stop/start
- Regenerative braking
- Full deceleration fuel cut-off
- Electric boost to maintain acceleration and gradeability with more efficient axle ratio

eAssist



eAssist Powerpack (Cover Removed)



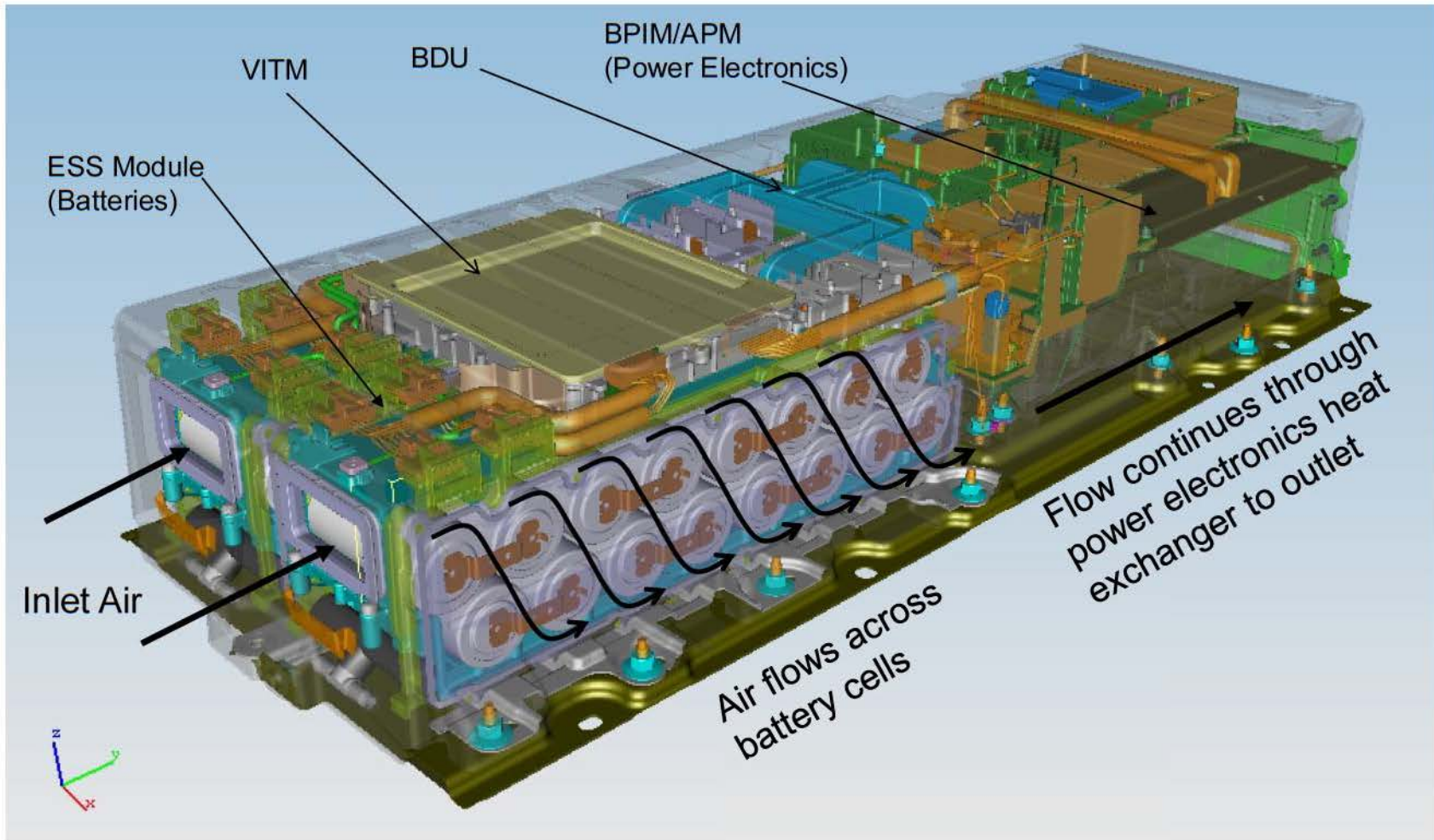
Battery

Battery Disconnect Unit

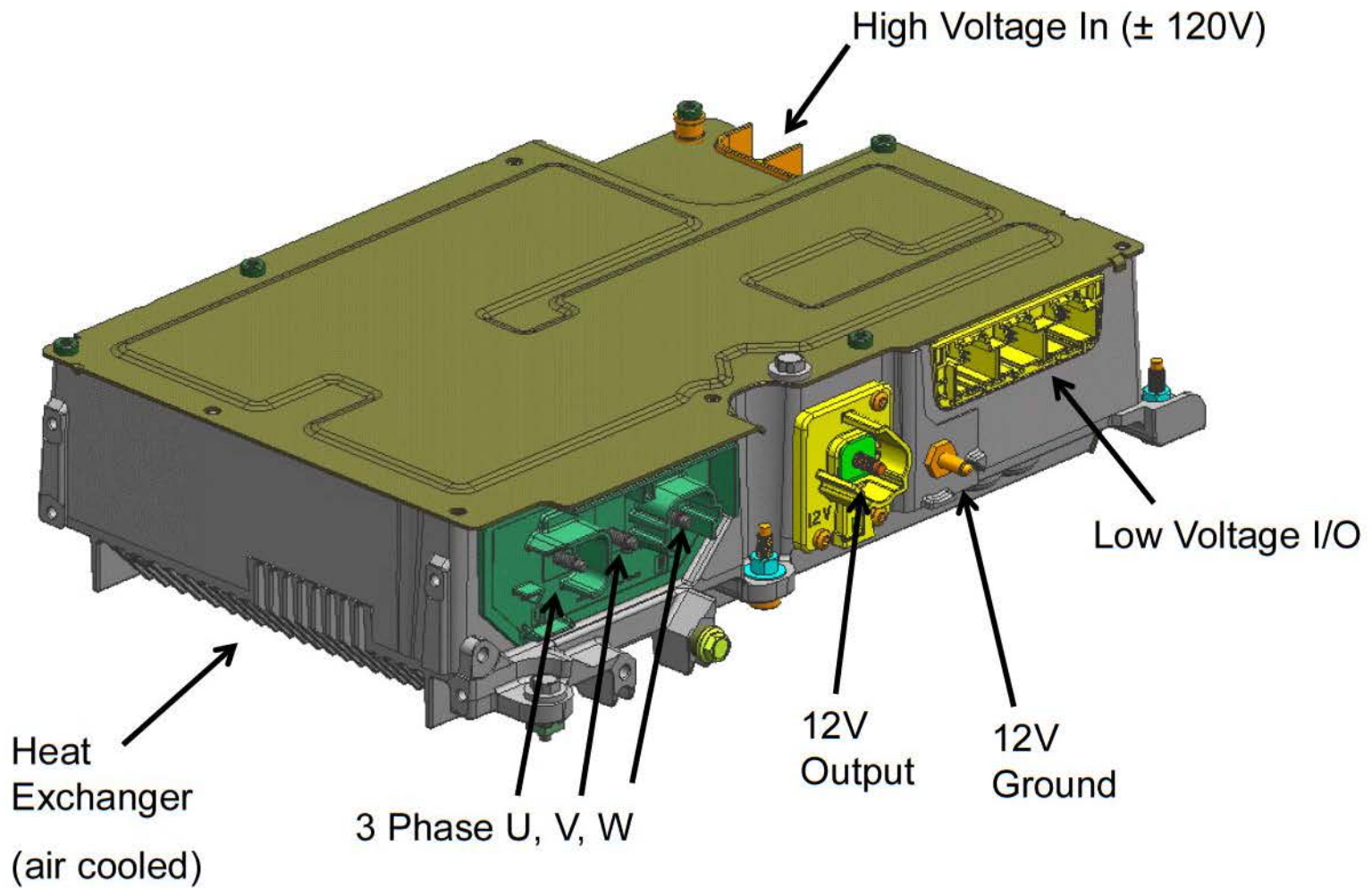
BPIM/APM

(Starter/Generator Control Module)

Powerpack – Basic Layout



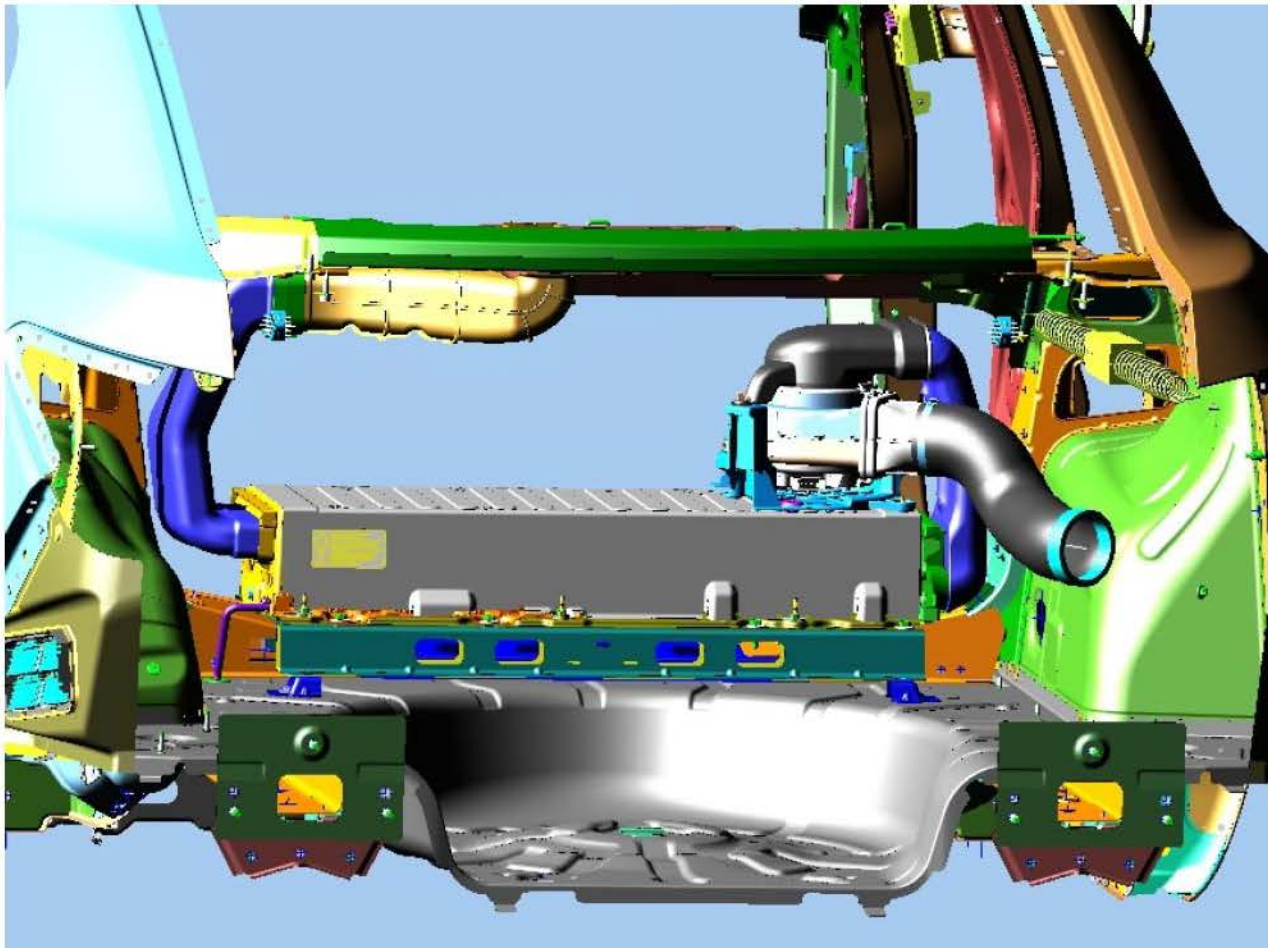
eAssist BPIM/APM – External View







Vehicle Packaging (seen from rear of vehicle) eAssist Powerpack



Fall 2012

9

GM CONFIDENTIAL

Serviceability (seen from side of vehicle) eAssist Powerpack

Powerpack must be removed from vehicle to service the high voltage battery

Battery can be replaced without removing the power electronics module

