

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





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*

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Executive Summary

- NHTSA has contacted GM in regard to (est.) 82 cases of thermal verbatims included in TREAD reports for eAssist vehicles
- Root cause is shorting between layers of printed circuit boards inside metal-encased eAssist inverter / DC-DC converter (“BPIM/APM”), which is part of the eAssist “Powerpack” (metal box in trunk that contains BPIM/APM and Lithium-Ion battery)
- Approximately 54,000 LaCrosse/Regal/Malibu vehicles built prior to January 2013 have potential for this issue. There are three different “buckets” of vehicles with different risk profiles, one higher than the other two.
- Dealer screen of all affected unsold vehicles has been underway and is near completion, but a few incidents on sold vehicles continue to occur
- Team made up of FPE, Engineering, Program Management, Quality, and GMCH have collaborated to better define the risk profiles for each vehicle build bucket and to develop options for a voluntary field action
- Recommended voluntary field actions include a combination of expanded dealer screening and part replacements in an attempt to balance fix effectiveness with responsiveness and minimize any risk to customers

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Background

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eAssist Affected Applications

North America



21.1K



4.0K



28.5K

China



0.8K

Korea

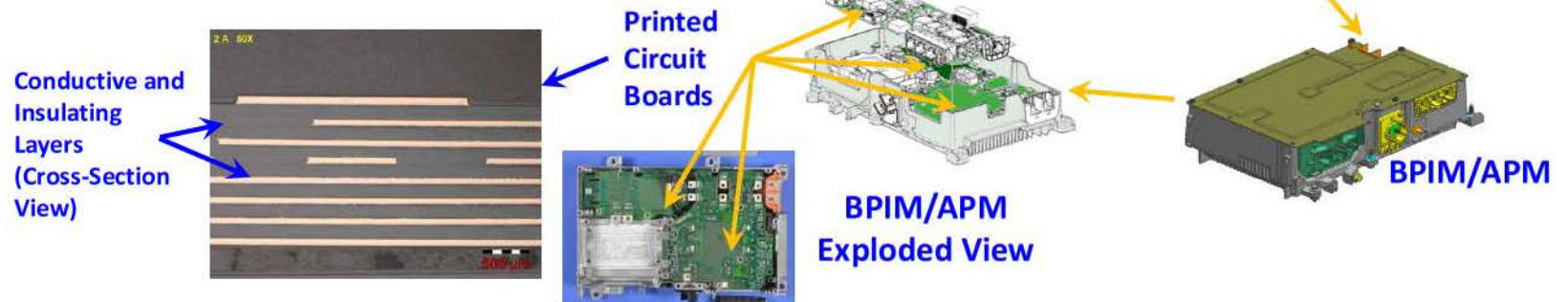


1.2K

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



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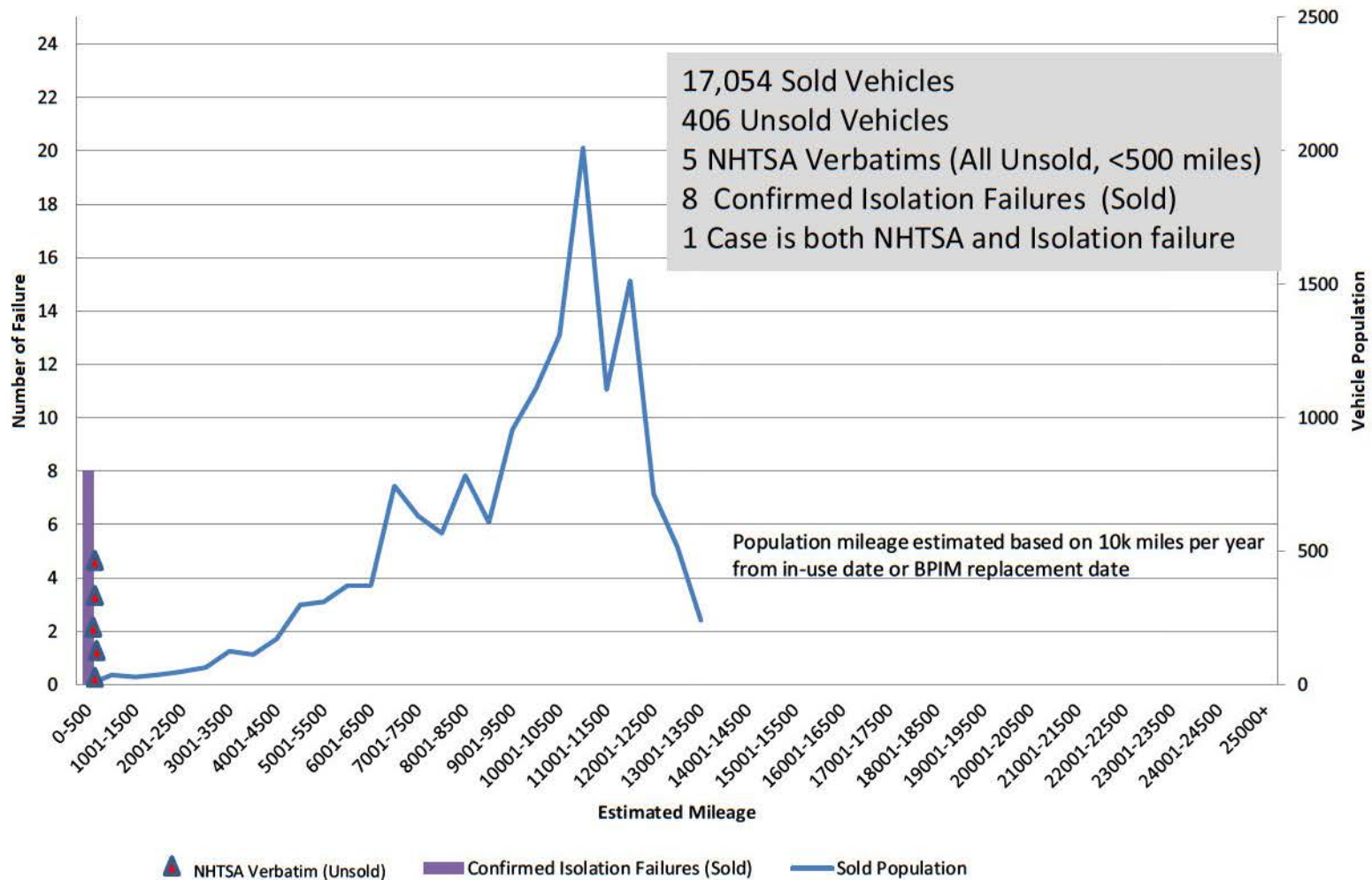
Buckets of Vehicles and Risk Profiles for Each Bucket

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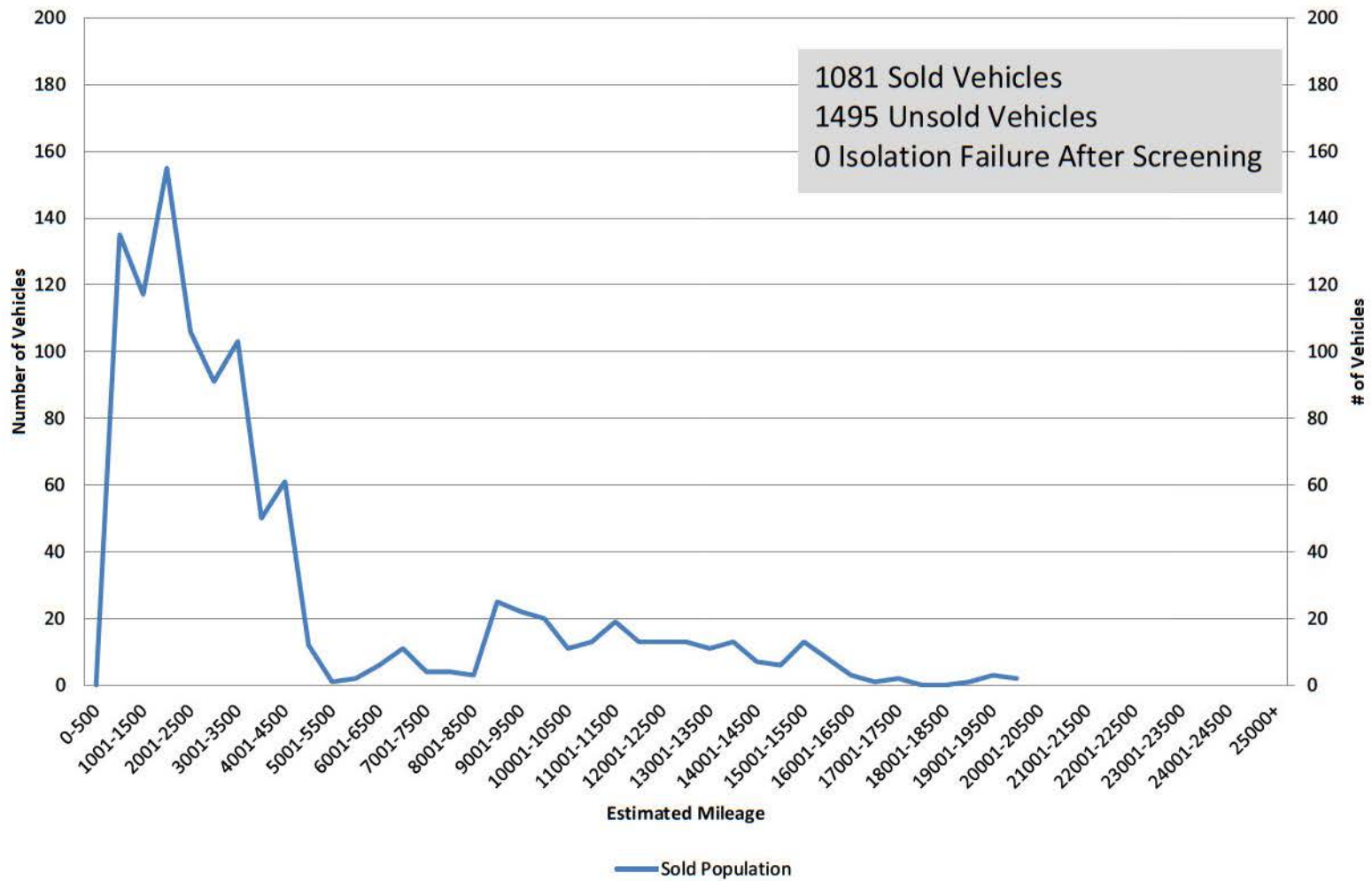




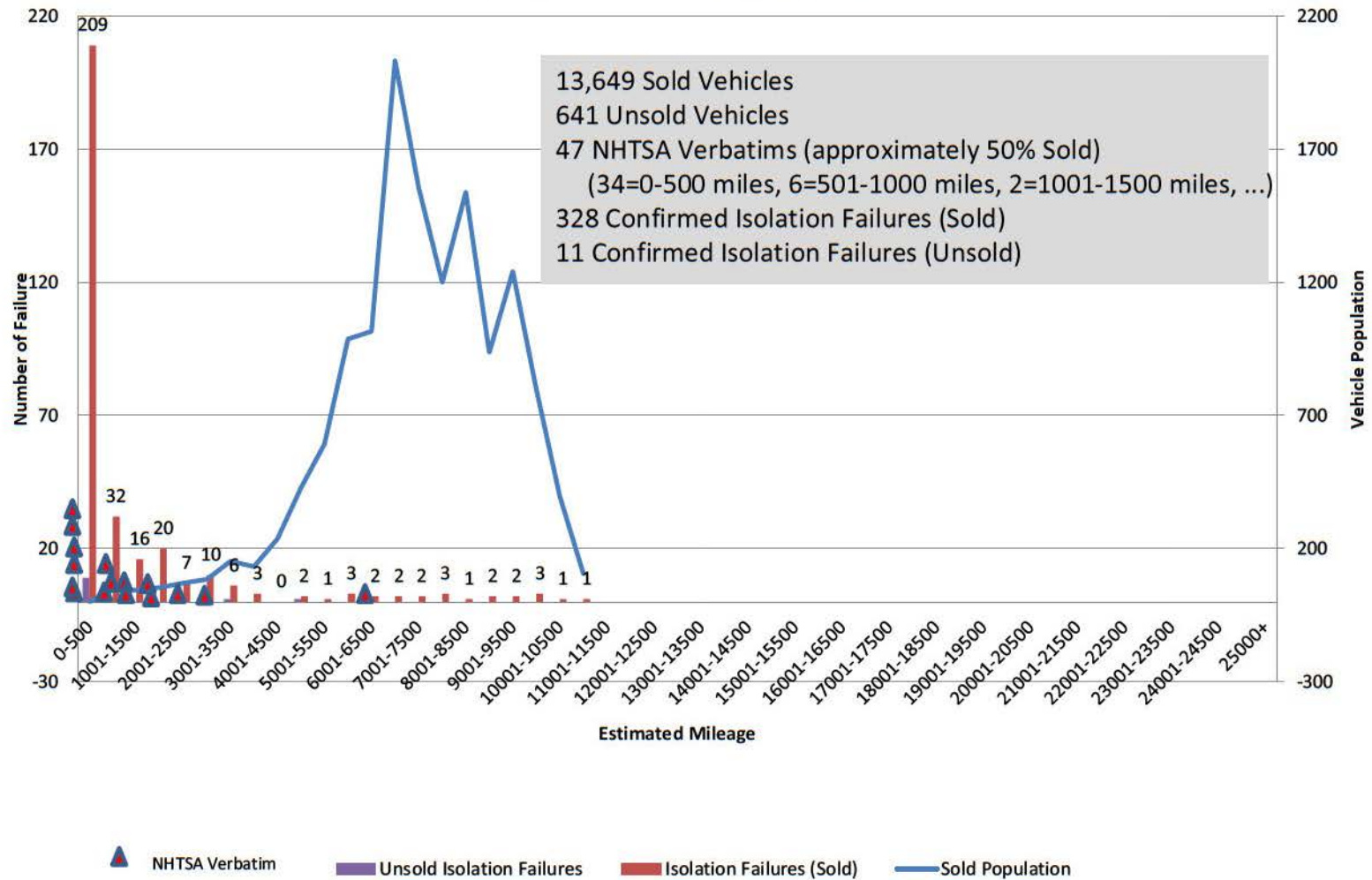
Bucket A - 11/16/10 - 3/19/12 (Before the Spike)
Unscreened - 17,459 Vehicles



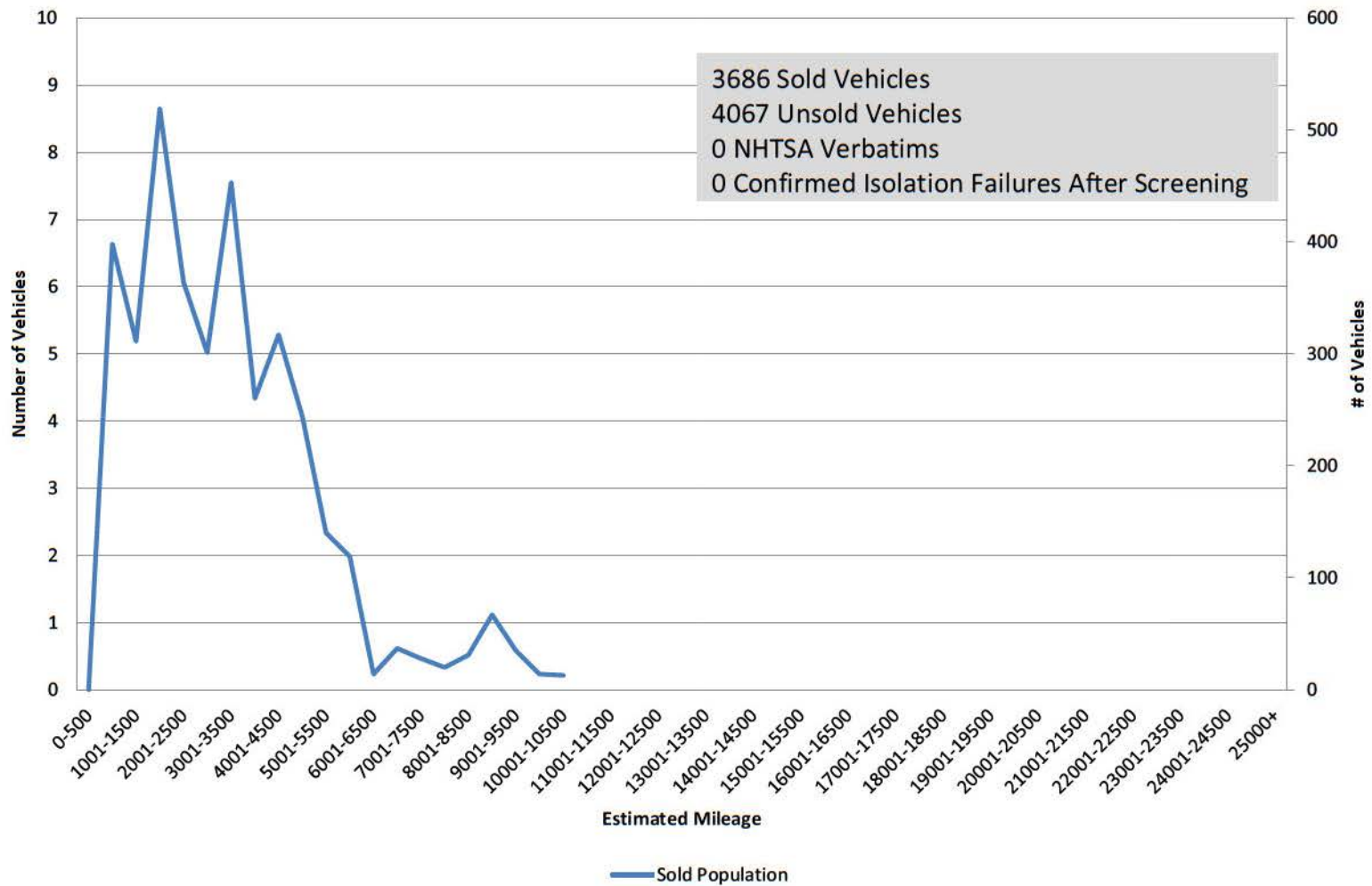
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Screened - 2576 Vehicles**



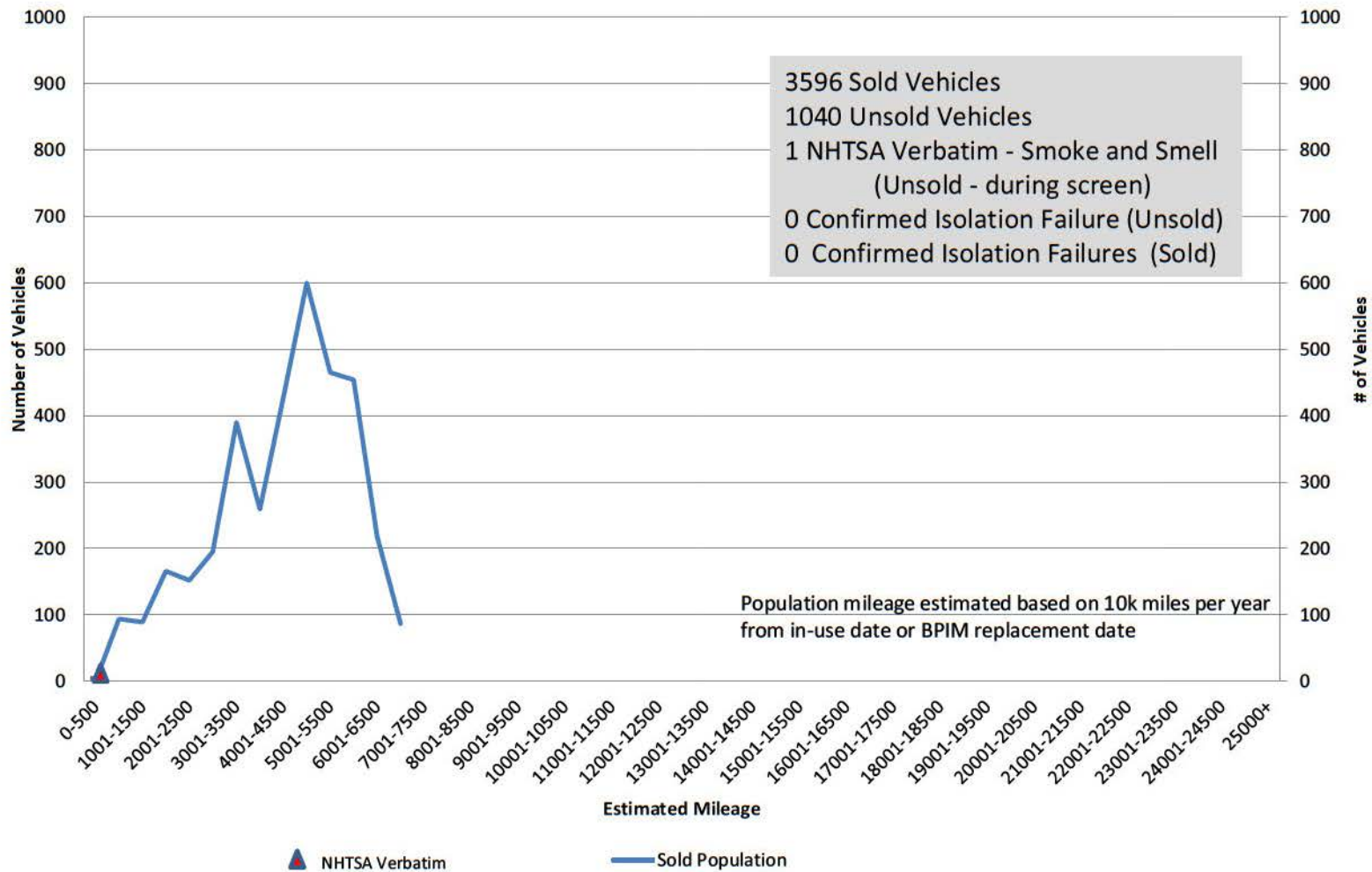
Bucket B - 3/20/12 - 8/20/12 (Manufacturing Spike) Unscreened - 14,290 Vehicles



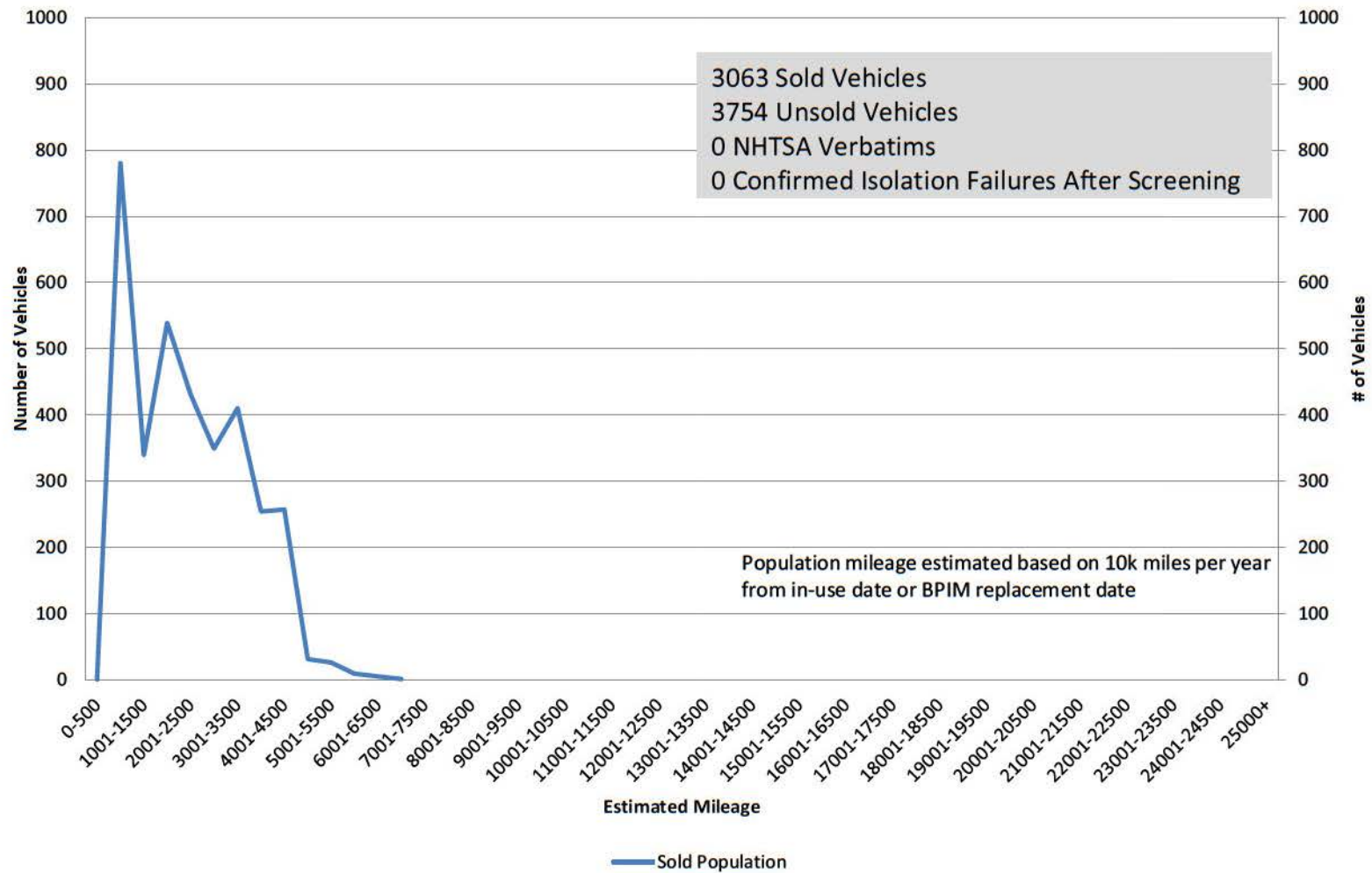
Bucket B - 3/20/12 - 8/20/12 (Manufacturing Spike) Screened



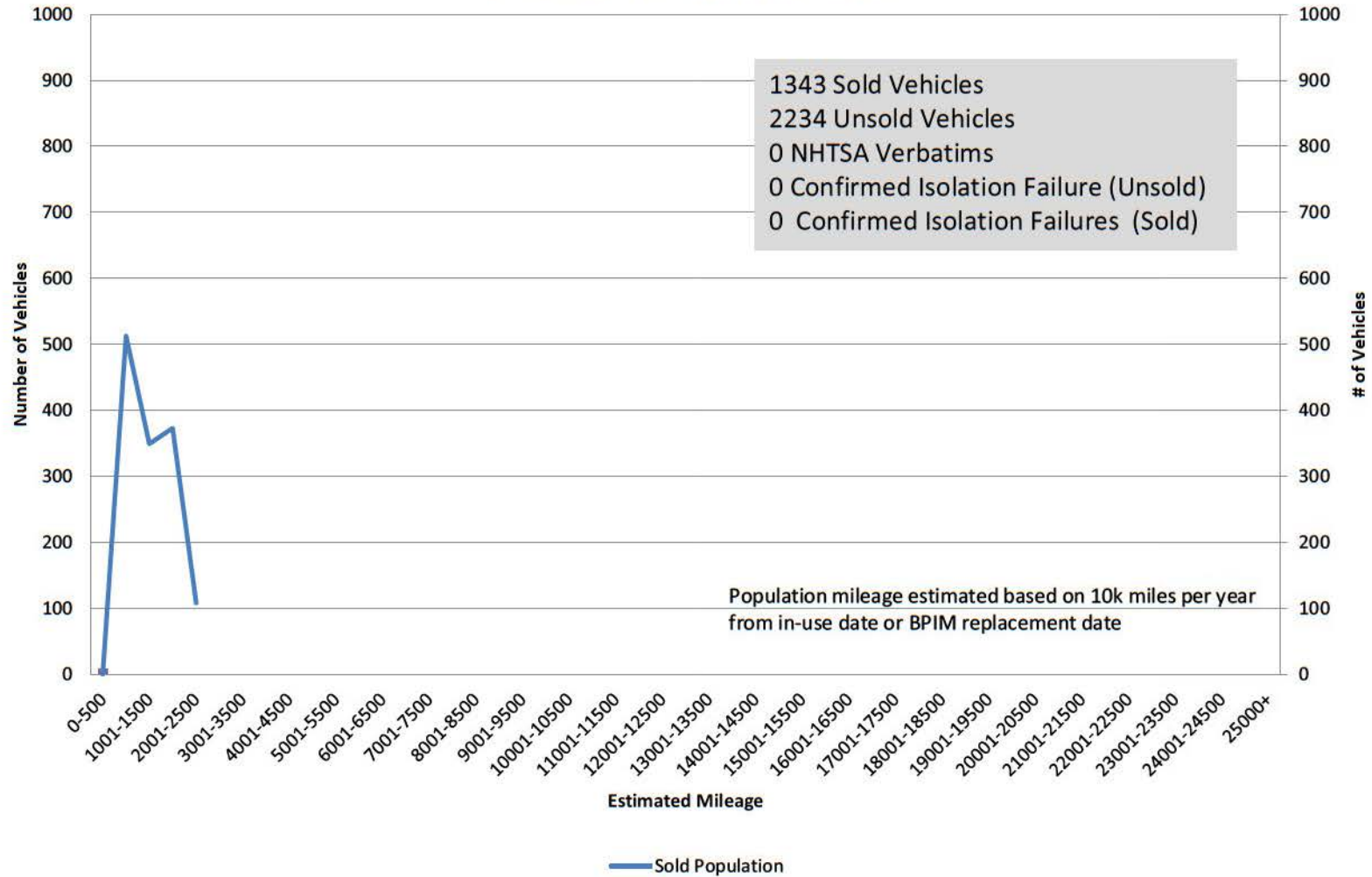
Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board) Unscreened - 4636 Vehicles



**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

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Options and Recommendation

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Backup ...

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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.

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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.

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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
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- 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)
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- 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

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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

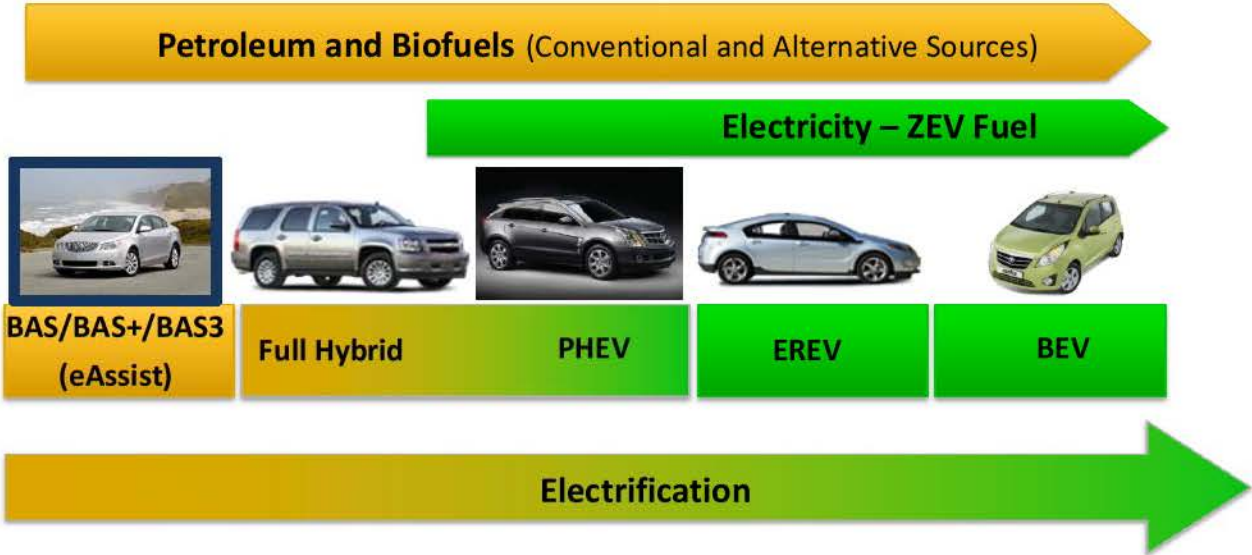
Dealers must take the steps necessary to ensure that the service update correction has been made to all involved vehicles in dealer inventory before selling or dealer-trading the vehicle, but no later than October 31, 2013.

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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”



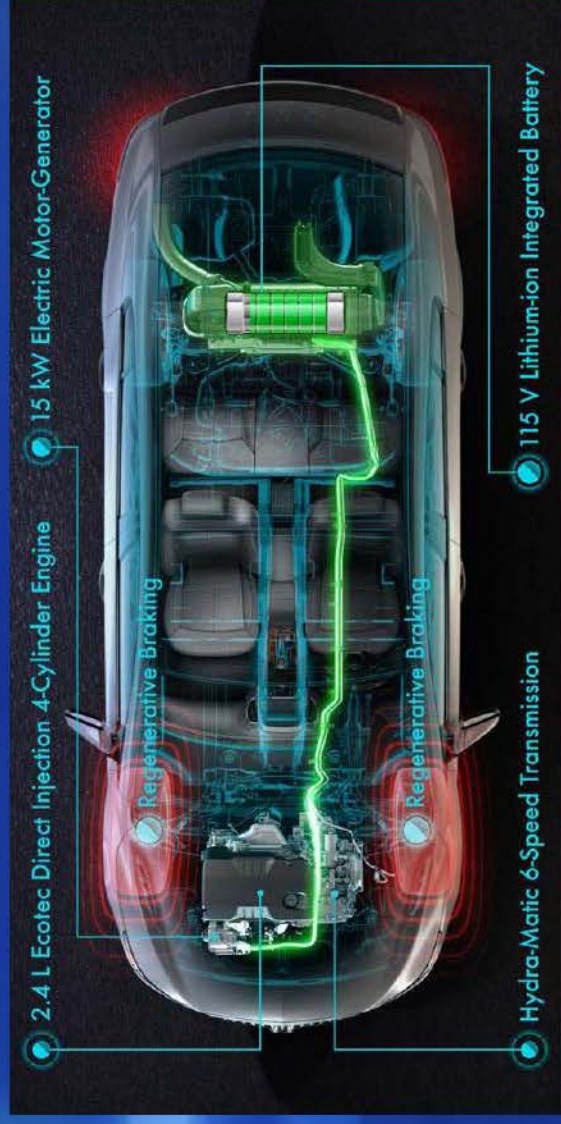
The Elements of eAssist™



- 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?



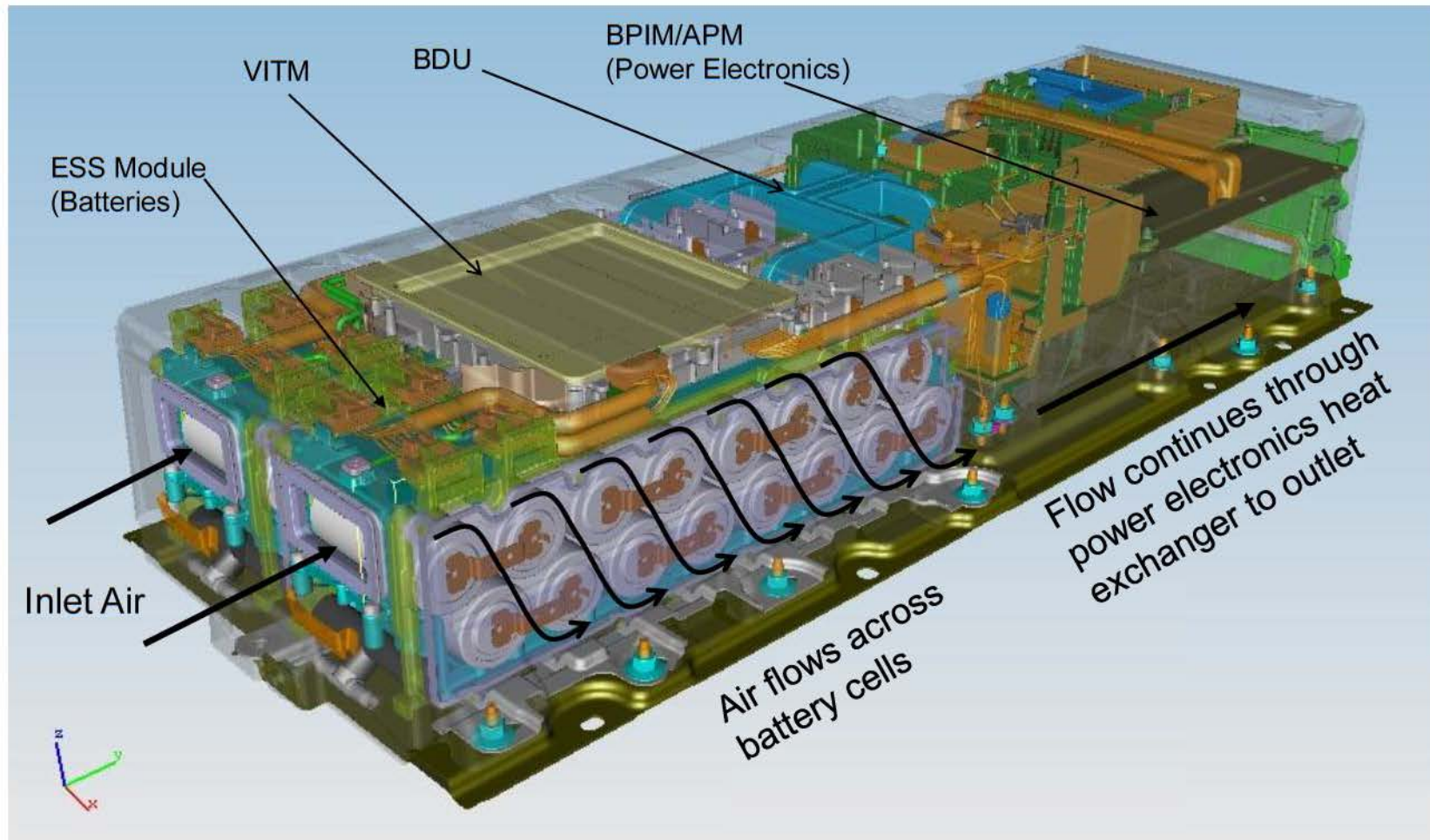
2012 LaCrosse 2.4L Ecotec with eAssist™ Technology

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

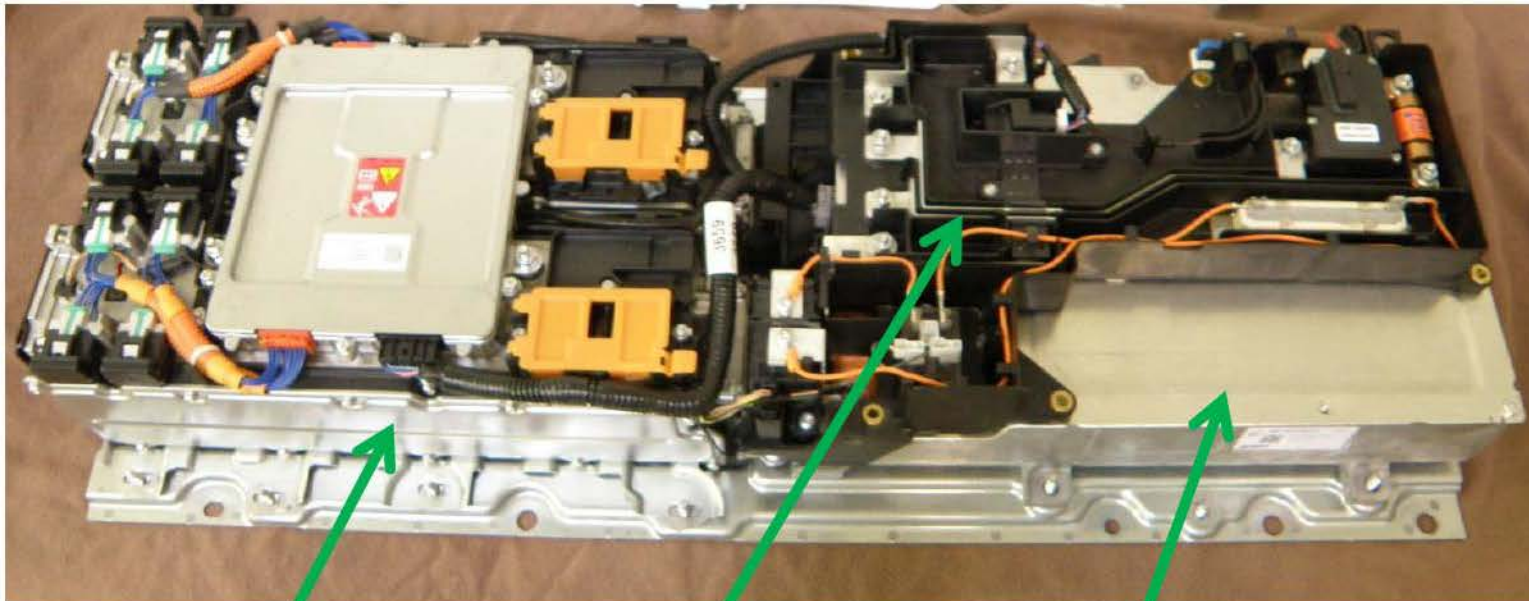
eAssist



Powerpack – Basic Layout



eAssist Powerpack (Cover Removed)



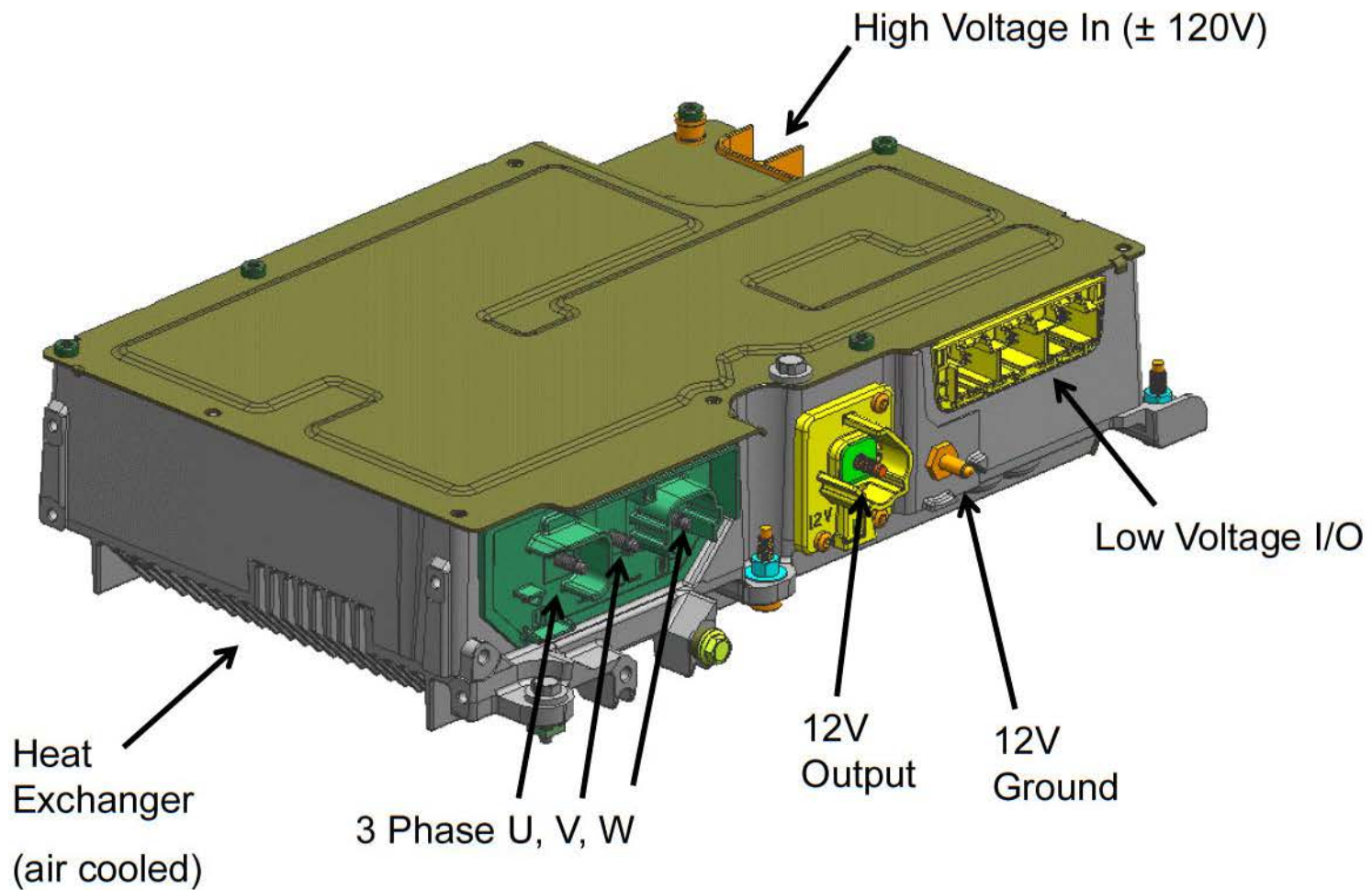
Battery

Battery Disconnect Unit

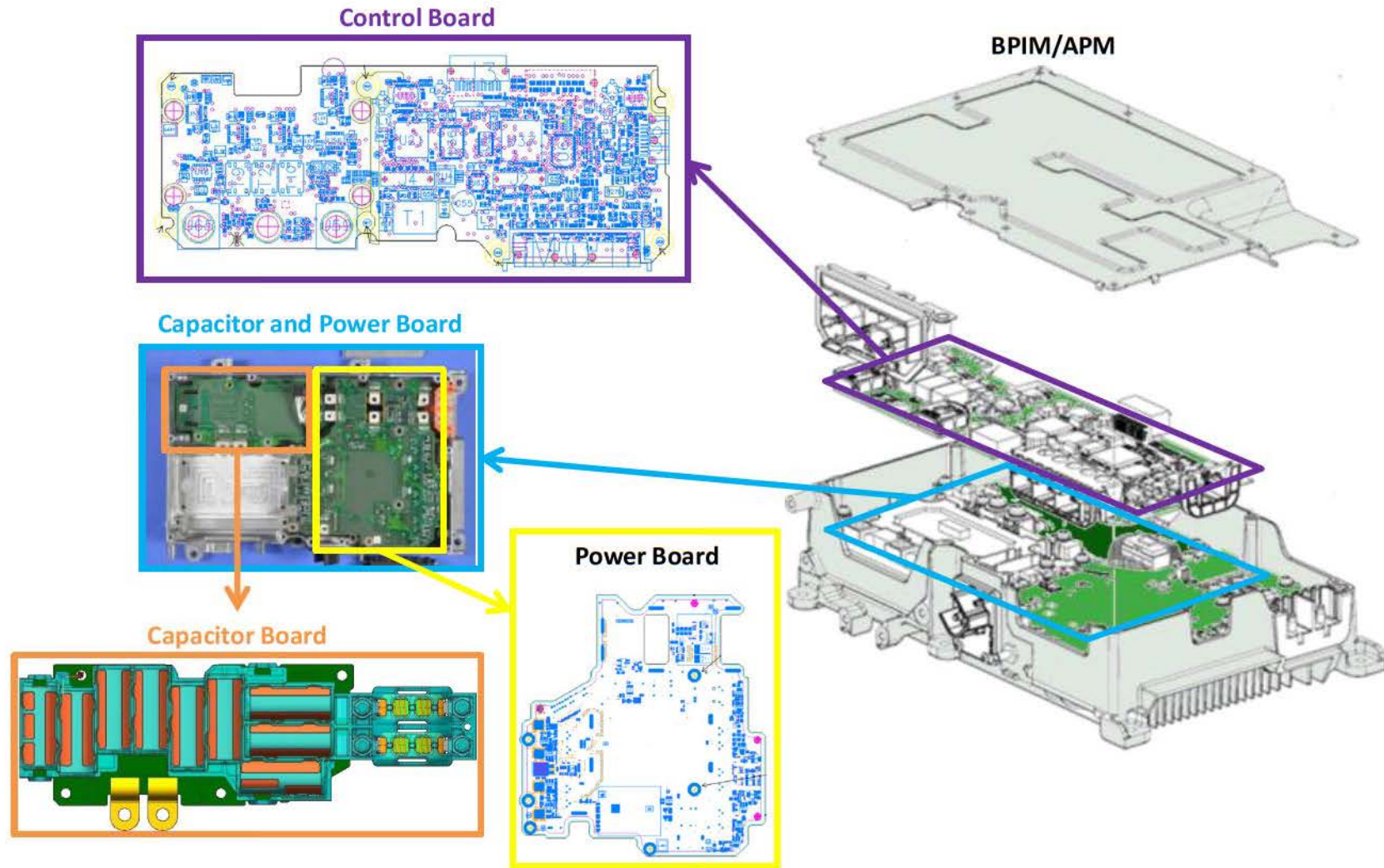
BPIM/APM

(Starter/Generator Control Module)

eAssist BPIM/APM – External View



eAssist: BPIM/APM Printed Circuit Boards



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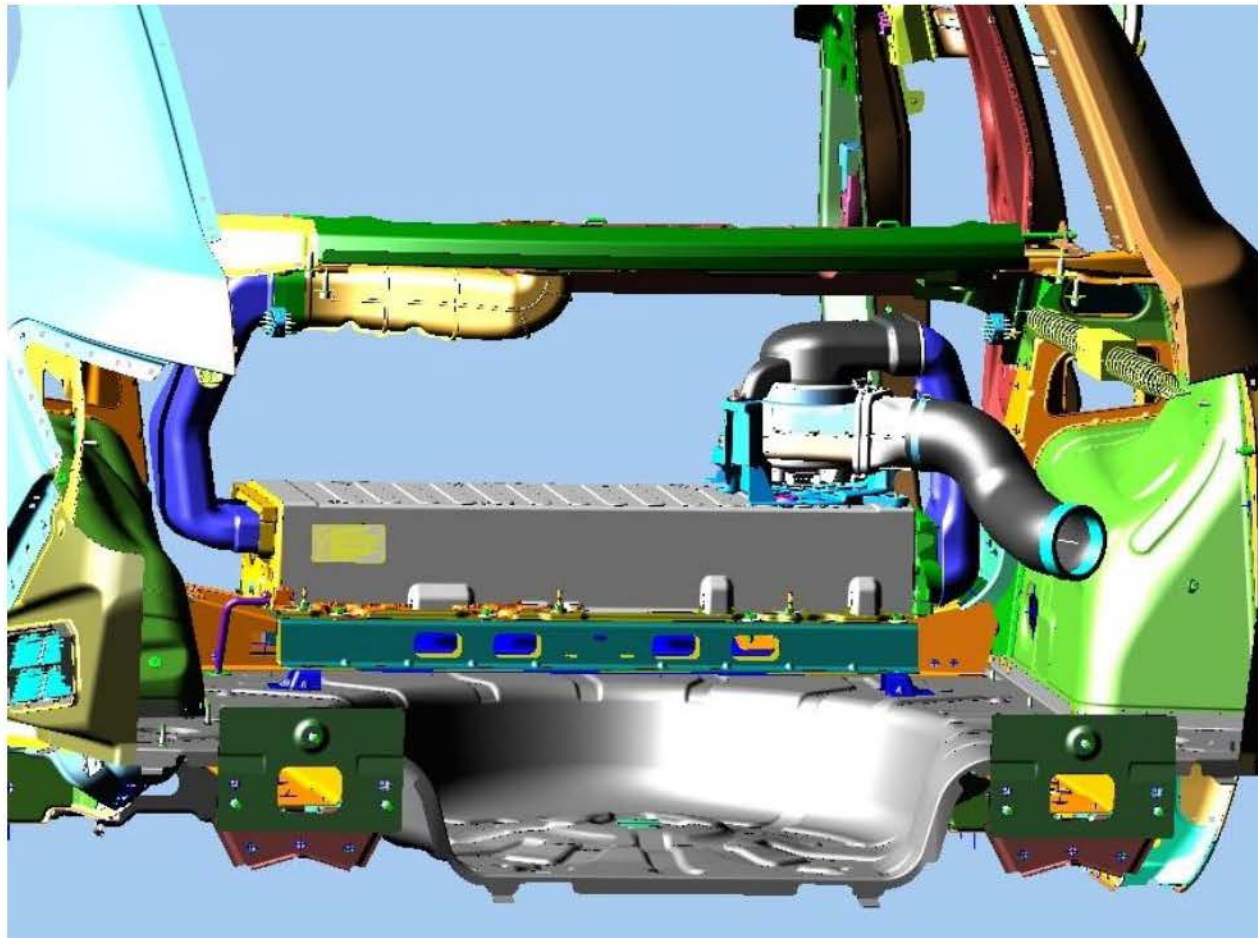








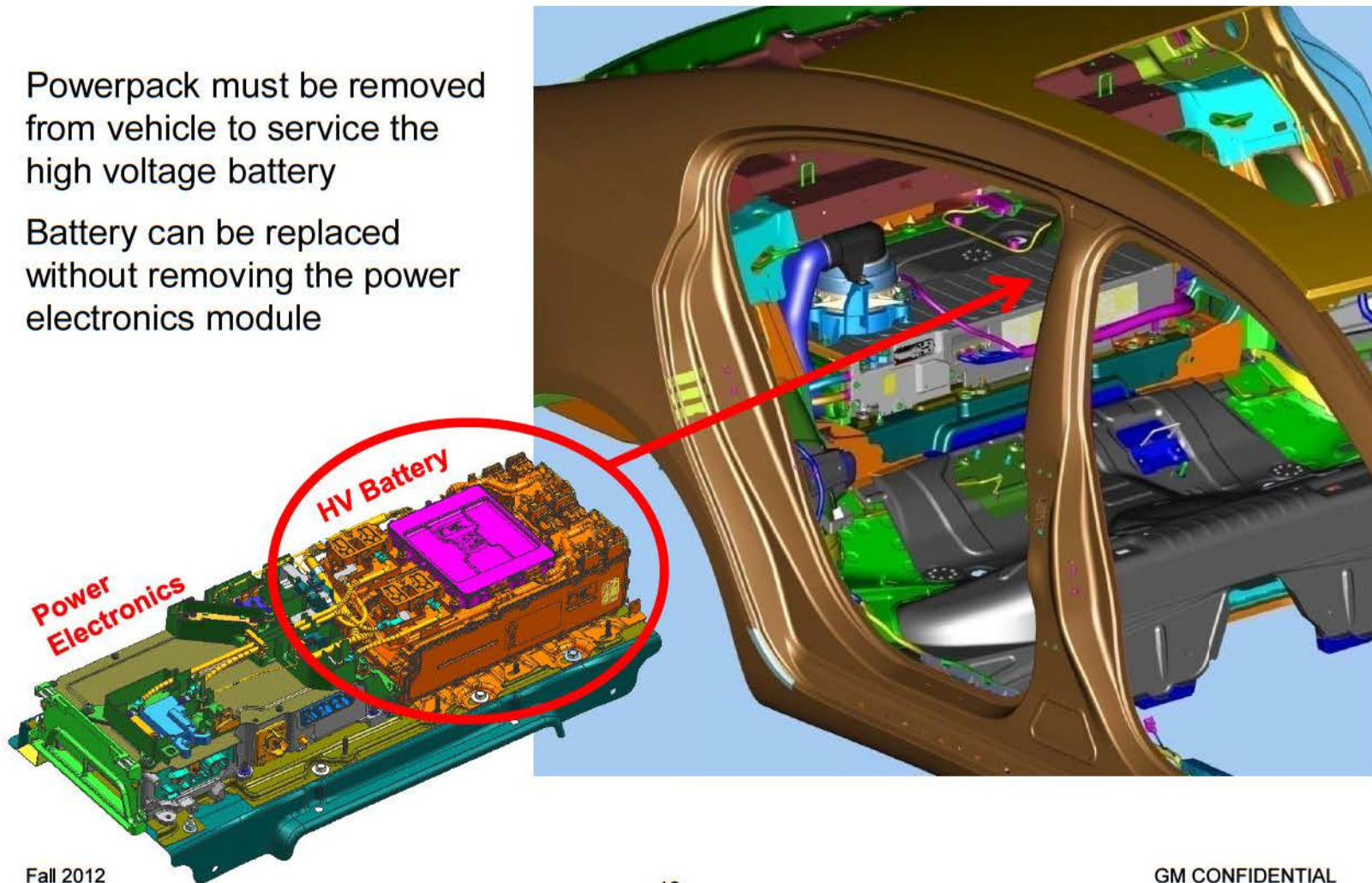
Vehicle Packaging (seen from rear of vehicle) eAssist Powerpack



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

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- *Explanation of risk profile vs. all-in data history*
- *Show risk profiles by bucket*
- *Part availability*
- *Options*
- *Recommendation*
- *Backup*

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Executive Summary

- NHTSA has contacted GM in regard to over 50 cases of thermal verbatims included in TREAD reports for eAssist vehicles
- Root cause is shorting between layers of printed circuit boards inside metal-encased eAssist inverter / DC-DC converter (“BPIM/APM”), which is part of the eAssist “Powerpack” (metal box in trunk that contains BPIM/APM and Lithium-Ion battery)
- Approximately 54,000 LaCrosse/Regal/Malibu vehicles built prior to January 2013 have potential for this issue. There are three different “buckets” of vehicles with different risk profiles, one higher than the other two.
- Dealer screen of all affected unsold vehicles has been underway and is near completion, but a few incidents on sold vehicles continue to occur
- Team made up of FPE, Engineering, Program Management, Quality, and GMCH have collaborated to better define the risk profiles for each vehicle build bucket and to develop options for a voluntary field action
- Voluntary field action options include different combinations of expanded dealer screening and BPIM/APM part replacements

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Background

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eAssist Affected Applications

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21.1K



4.0K



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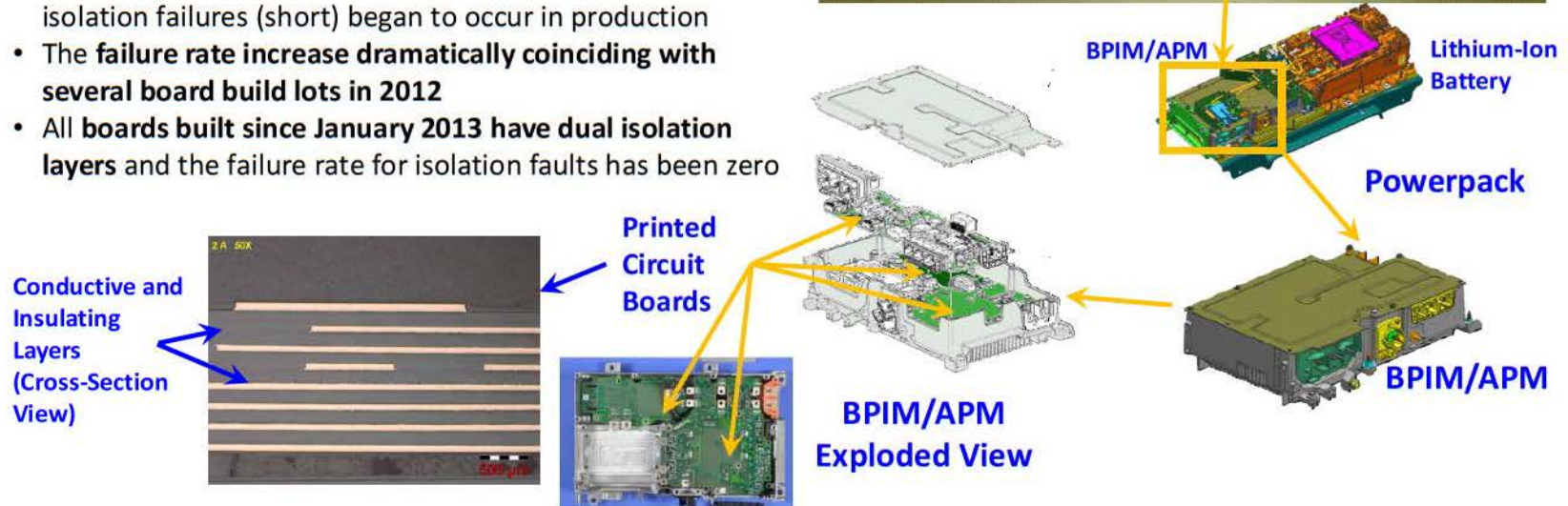


1.2K

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



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Some Characteristics of the Isolation Faults

Impact on vehicle performance:

- When a failure occurs, it results in eventual loss of 12-V power (**walk-home**)
- Many cases happen without noticeable symptoms, but others **can exhibit some odor, smoke, soot, etc.**

Frequency and timing of failures:

- **Most parts with single-layer design appear to have no issue** and are not expected to fail or have reduced reliability in service
- **Failures generally consistent with infant mortality** – typically < 100 miles, nearly all < 1000 miles
- But a **few cases have occurred at higher mileage** (up to 20-30k mi)

Effectiveness of screening methods:

- Generally requires **thermal stress to manifest**
- Difficult to screen at a part level
- 3-hour **dealer screening procedure implemented to address unsold vehicles has proven very effective** at triggering isolation faults in susceptible BPIMs

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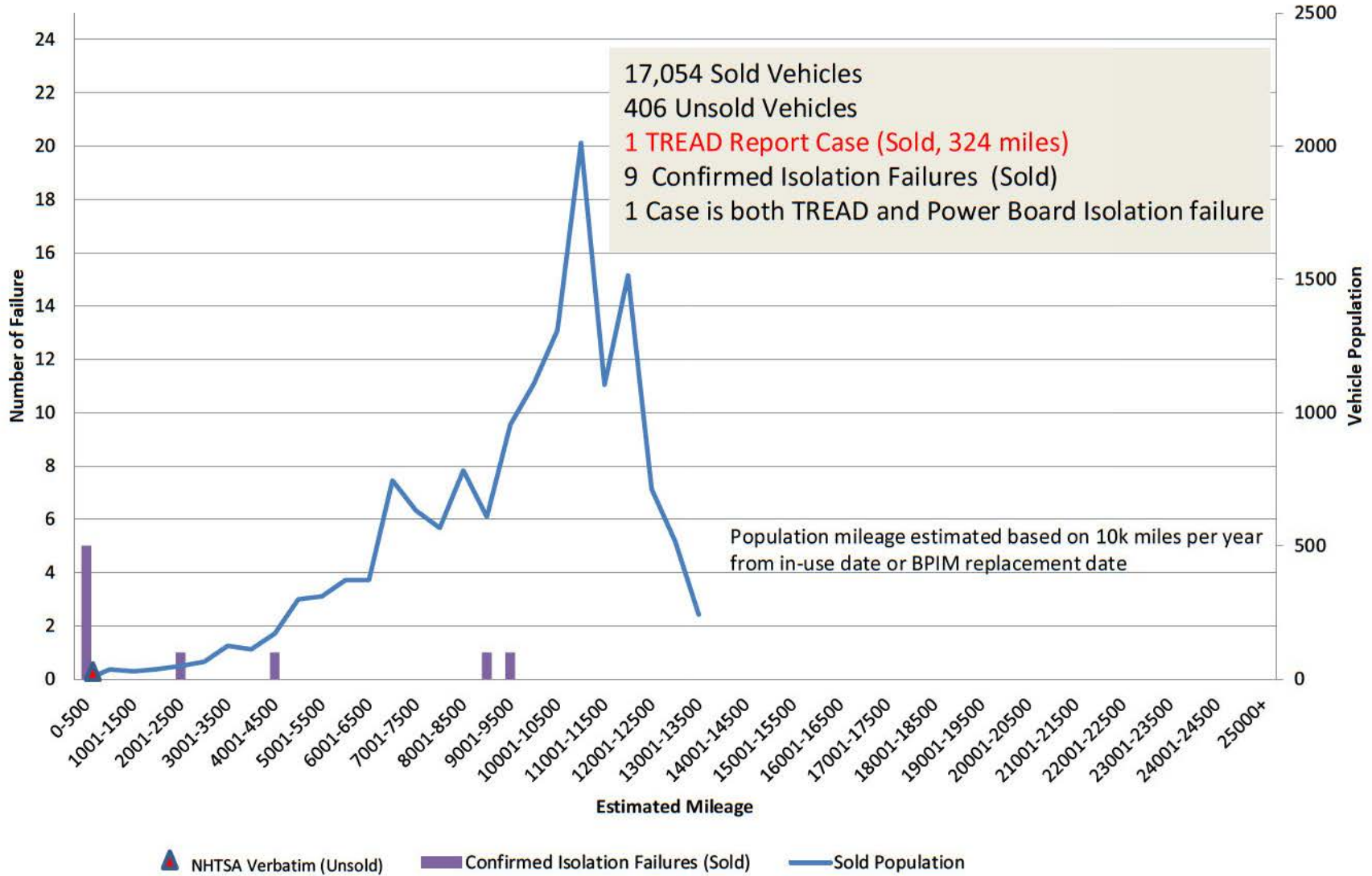
Buckets of Vehicles and Risk Profiles for Each Bucket

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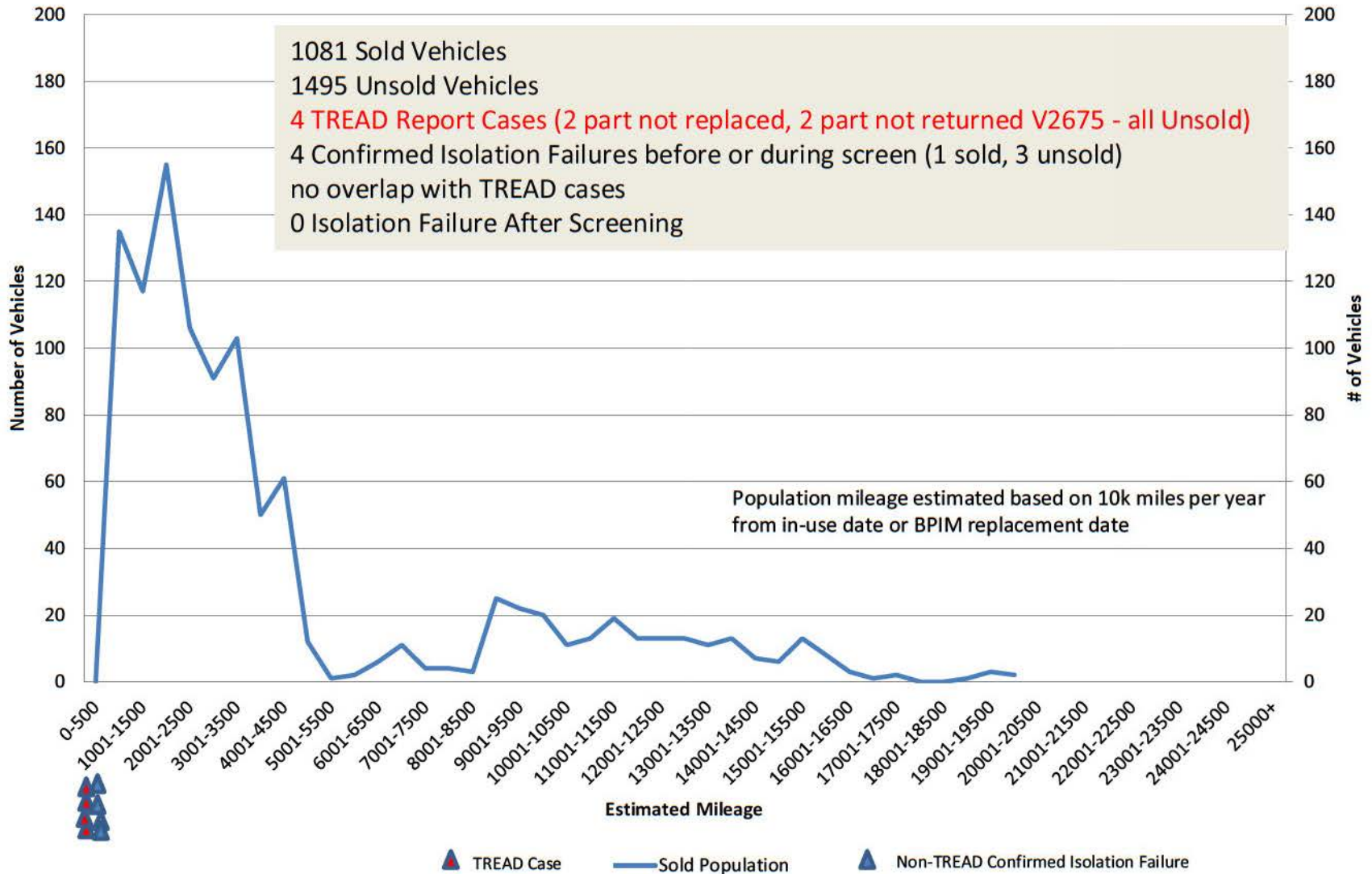




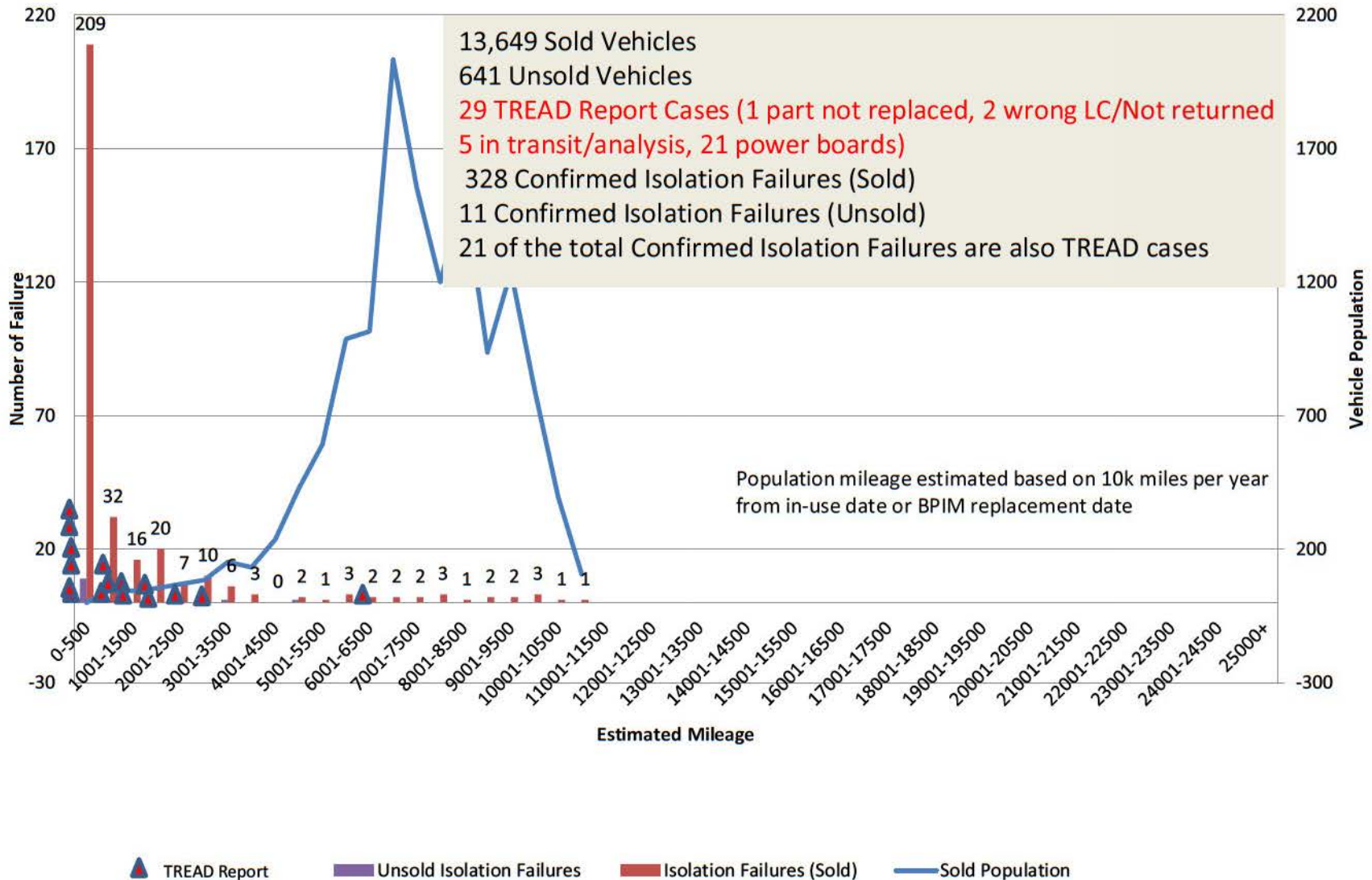
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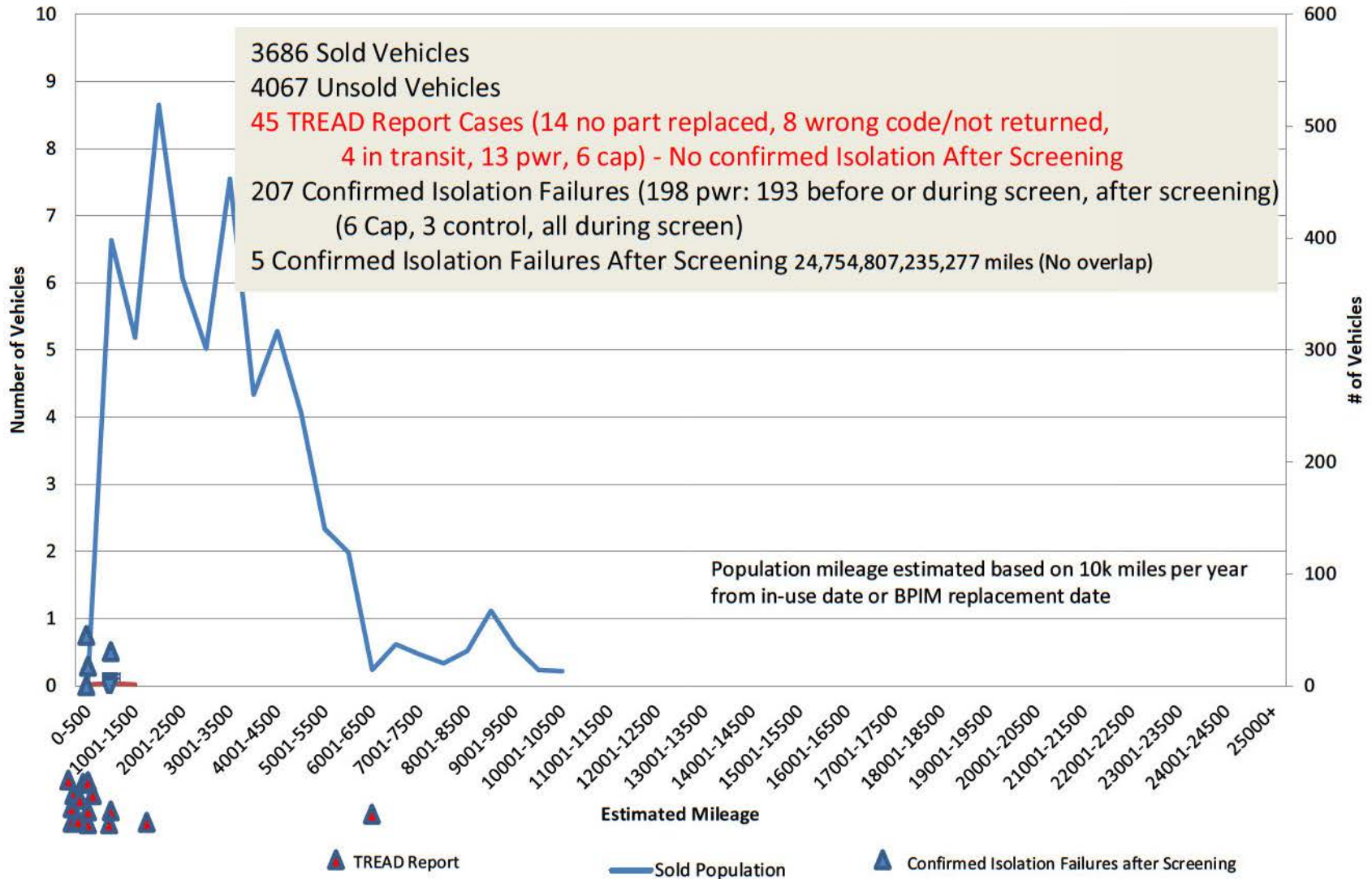
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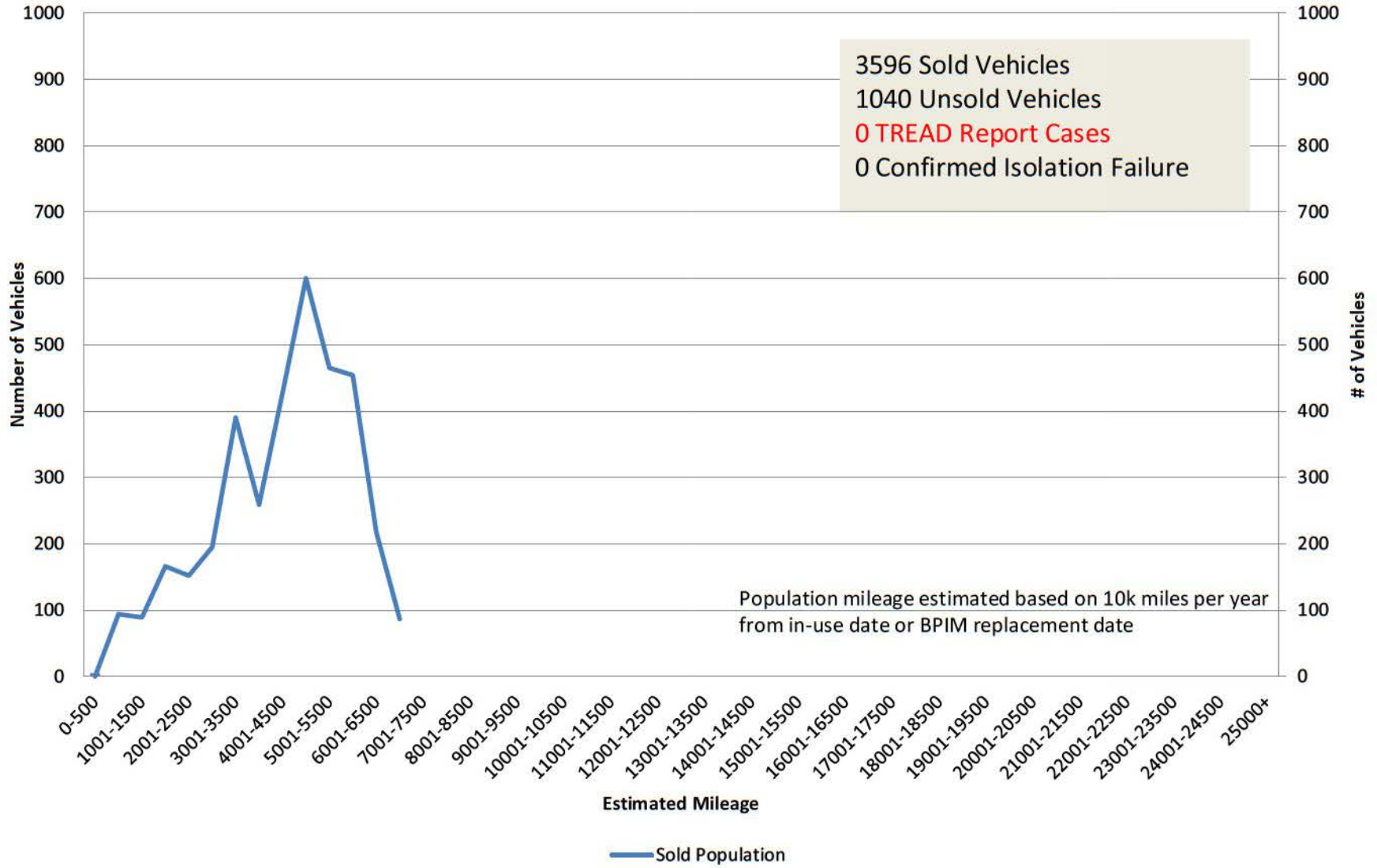
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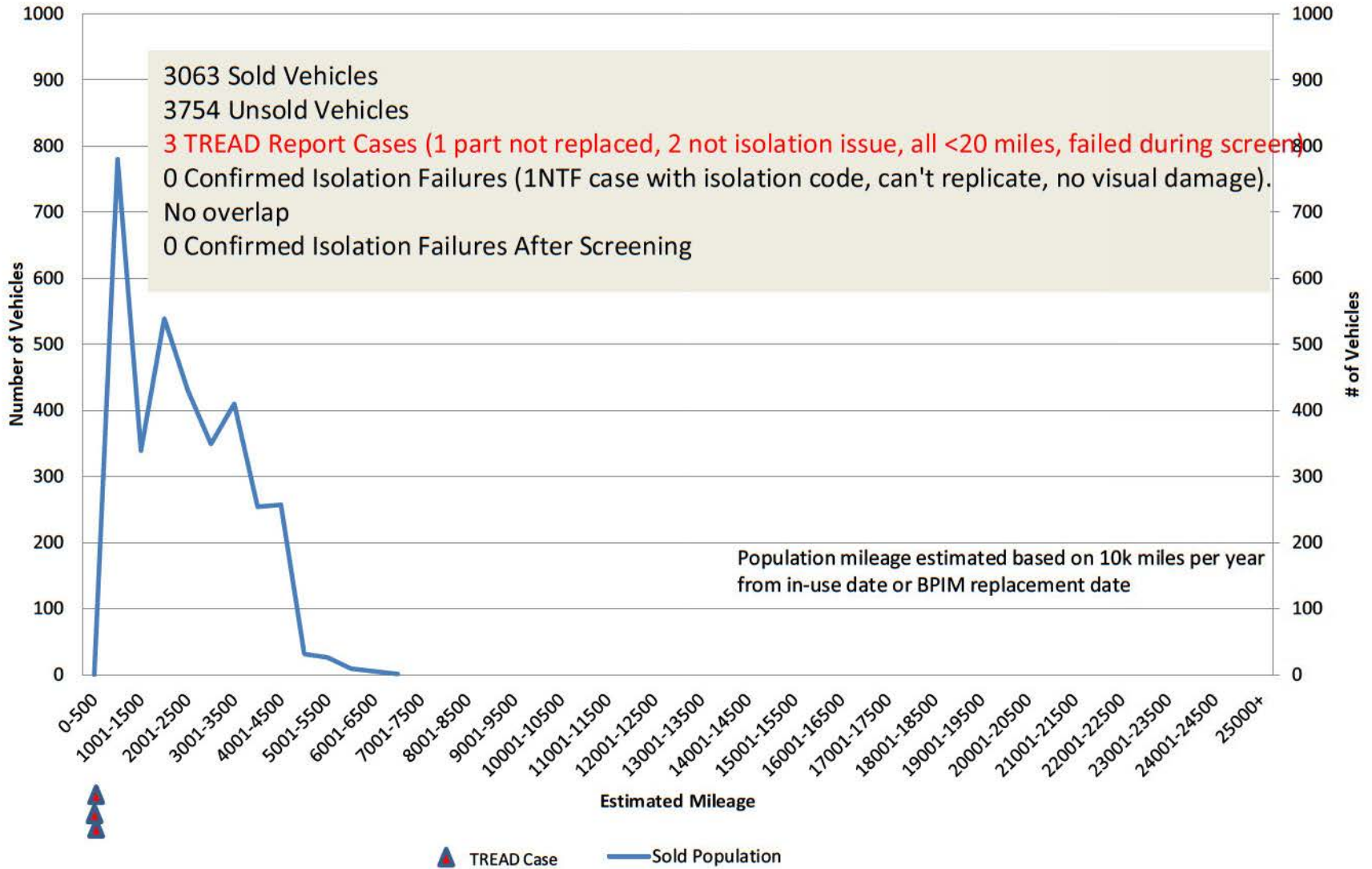
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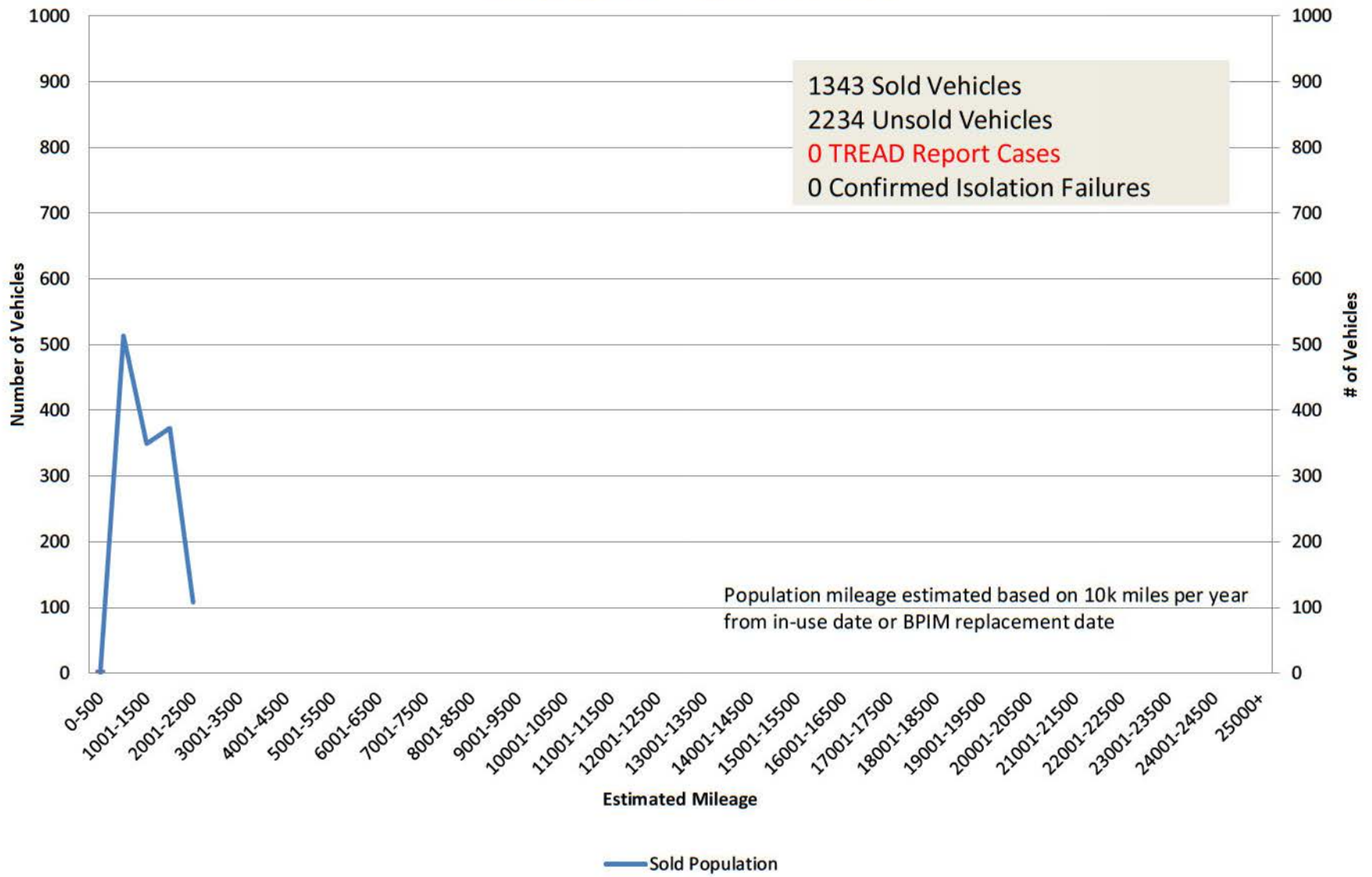
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Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board) Screened - 6817 Vehicles



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



Replacement Part Availability

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Voluntary Field Action Options

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Backup ...

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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

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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.

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



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U.S. – TBD Canada – TBD

N-130136

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Frequency:

Potential Field Action Category: Safety or Customer Satisfaction Recall

Potential Field Remedy:

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eAssist BPIM Isolation Fault Timeline

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PURPOSE

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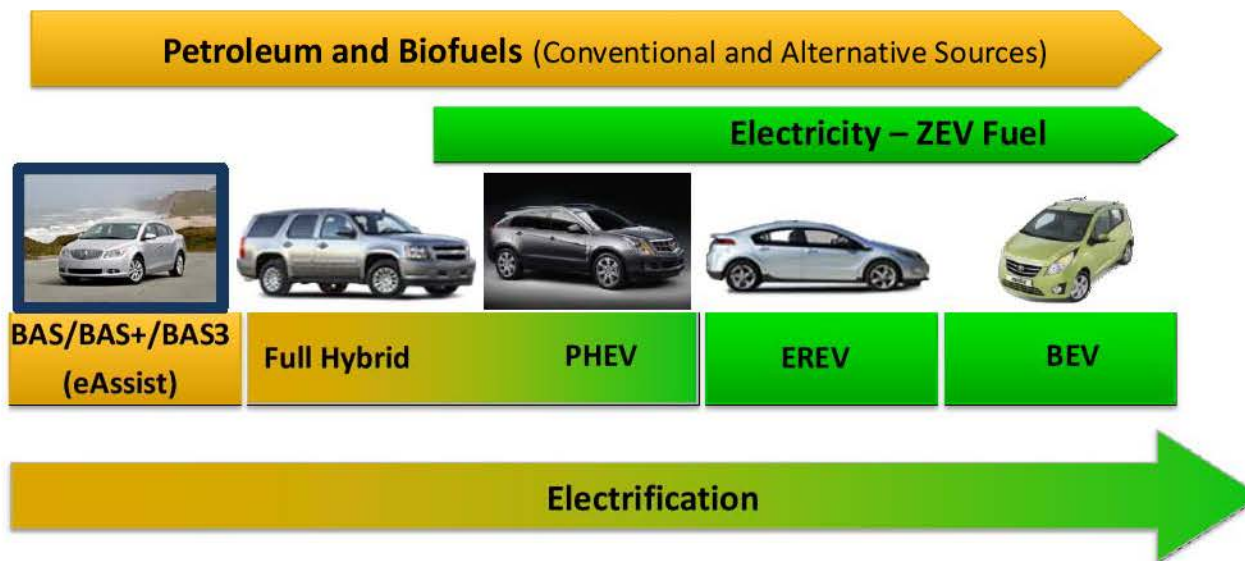
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GM Confidential



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”



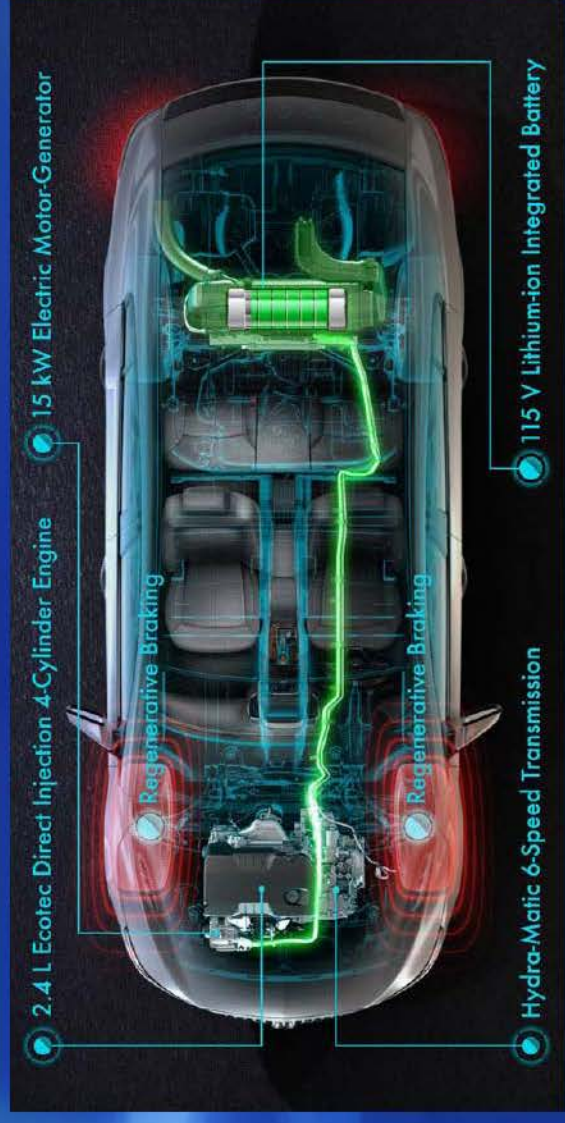
The Elements of eAssist™



- 15-kW belt-driven induction motor/generator
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How Does eAssist™ Save Fuel?



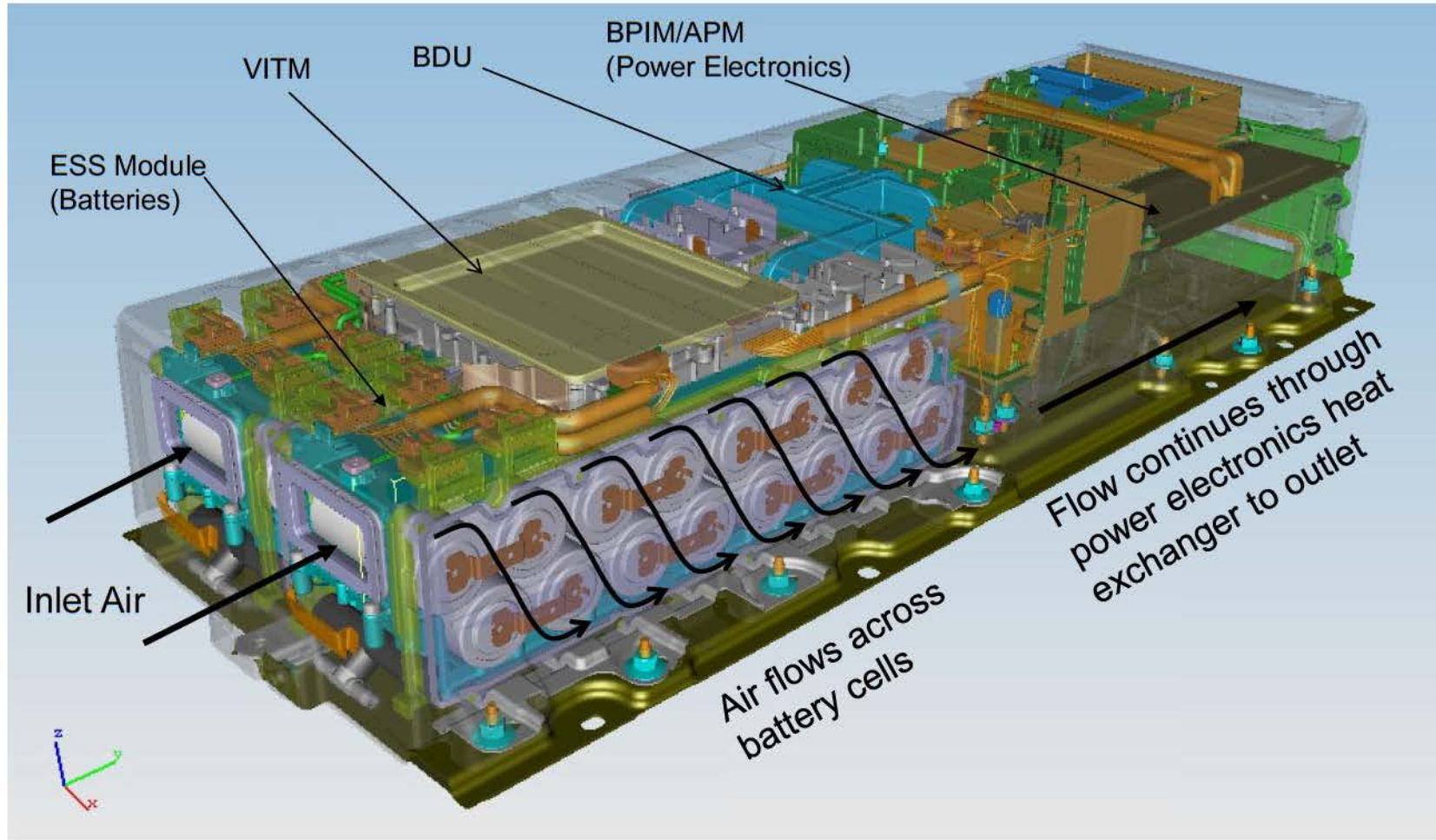
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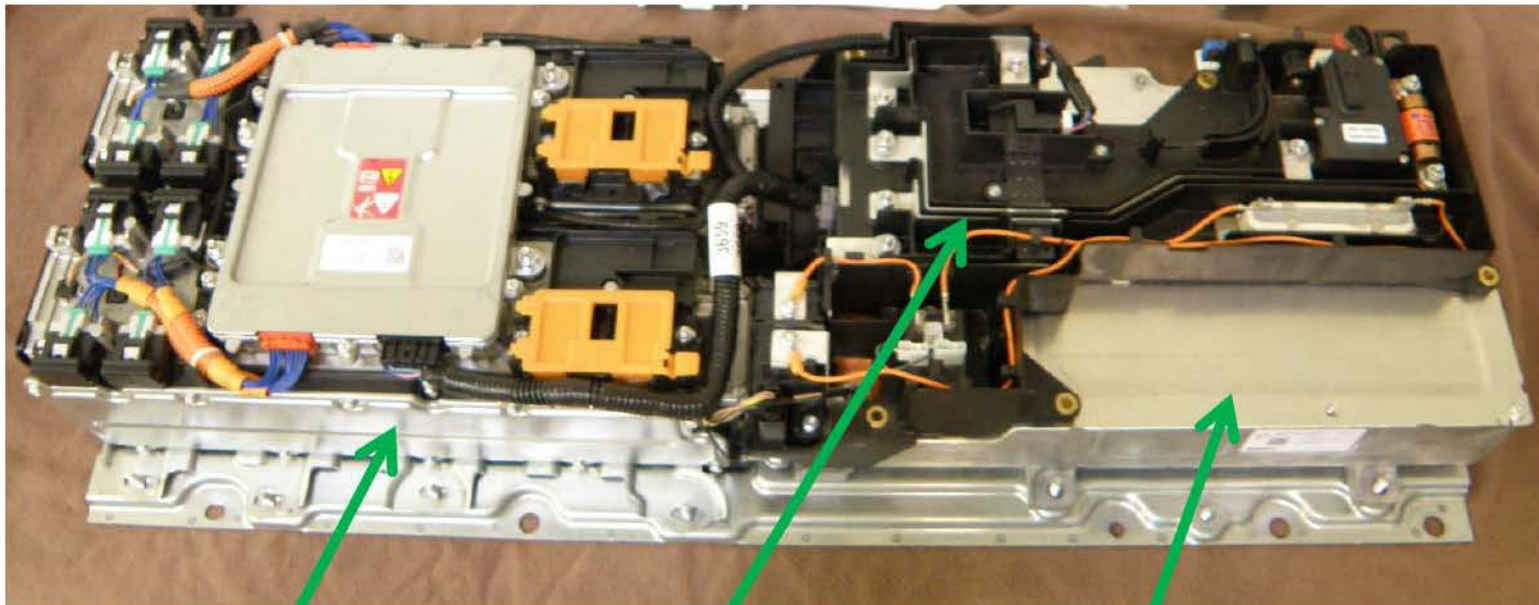
eAssist



Powerpack – Basic Layout



eAssist Powerpack (Cover Removed)



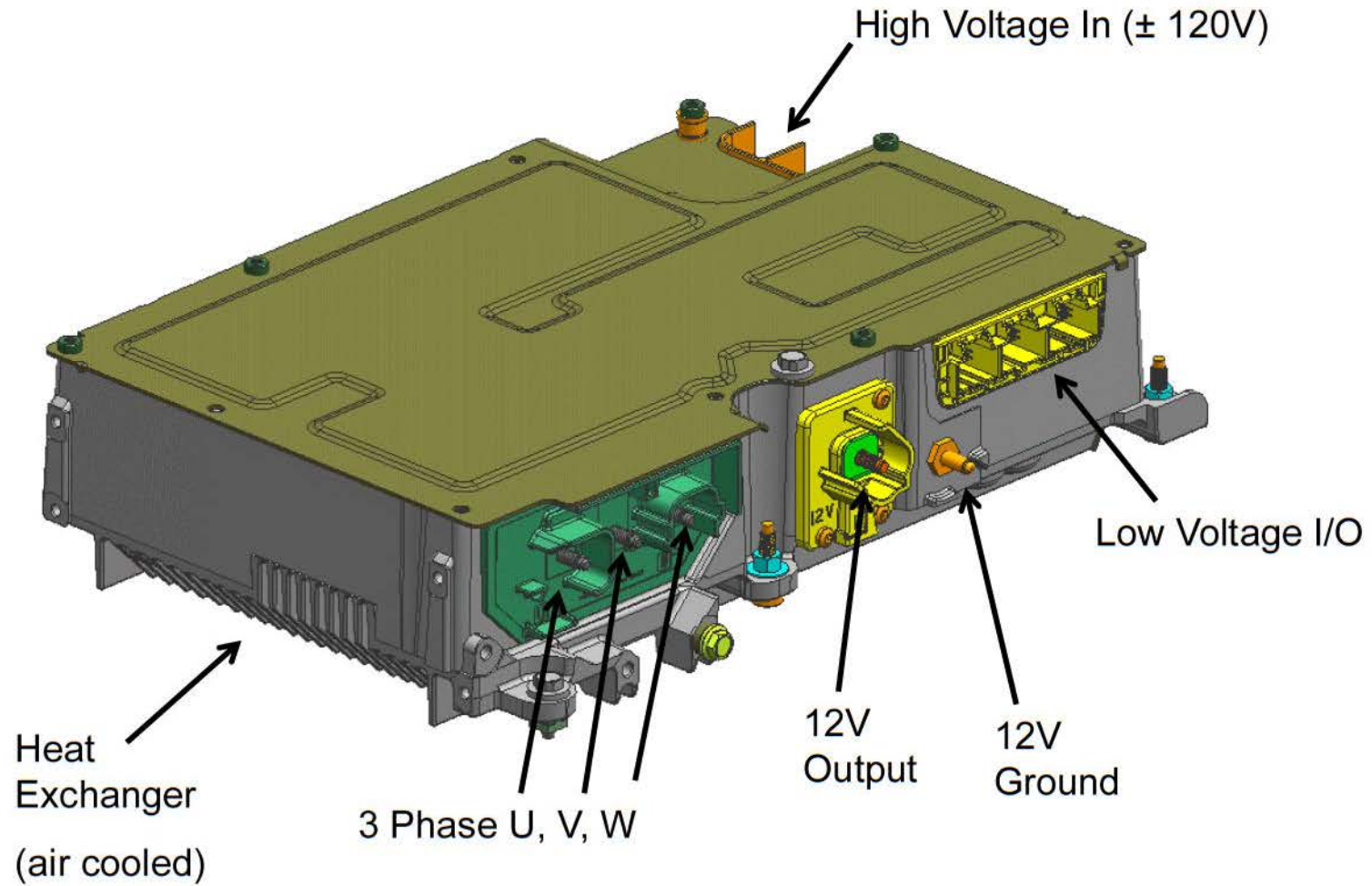
Battery

Battery Disconnect Unit

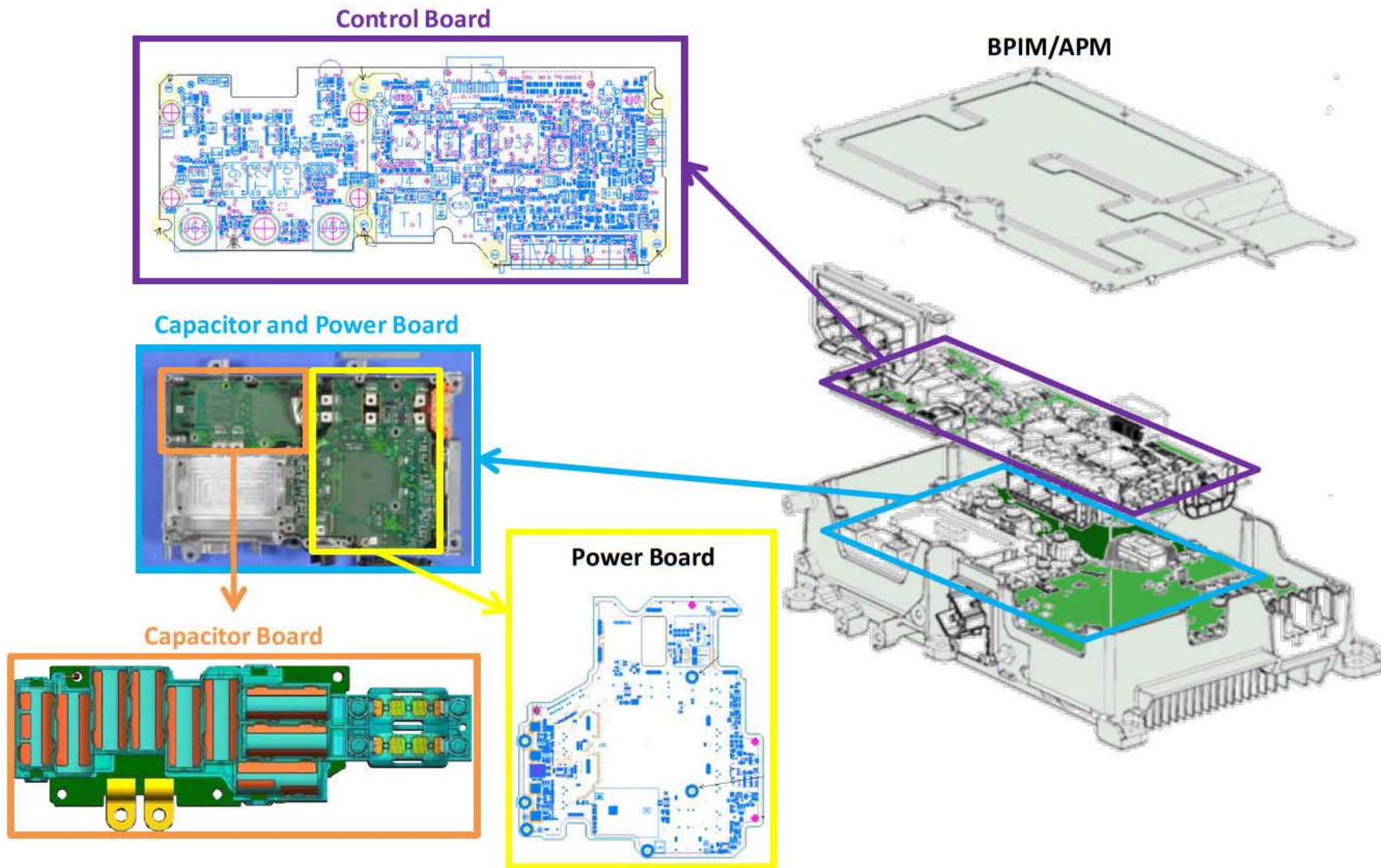
BPIM/APM

(Starter/Generator Control Module)

eAssist BPIM/APM – External View



eAssist: BPIM/APM Printed Circuit Boards



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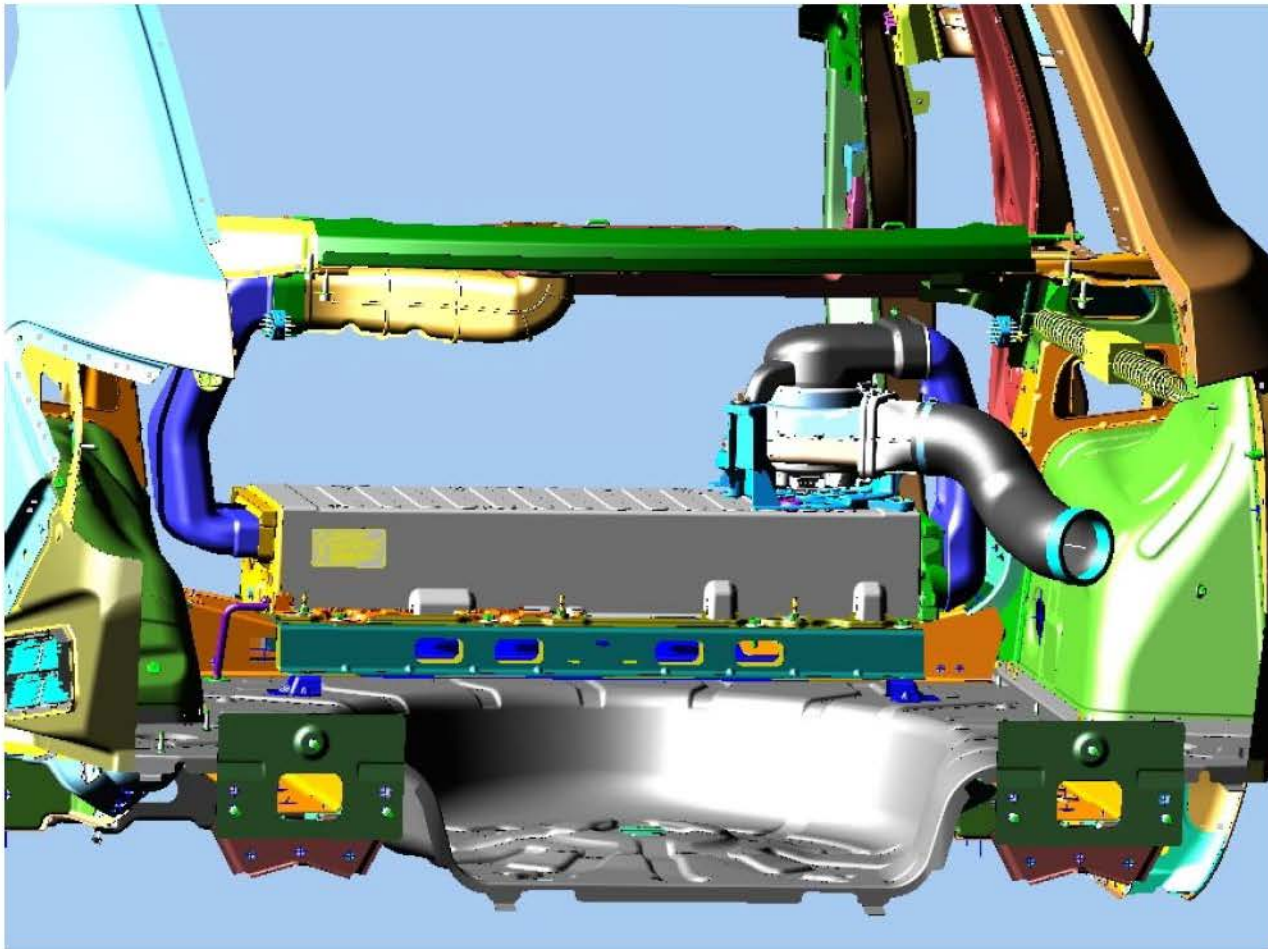








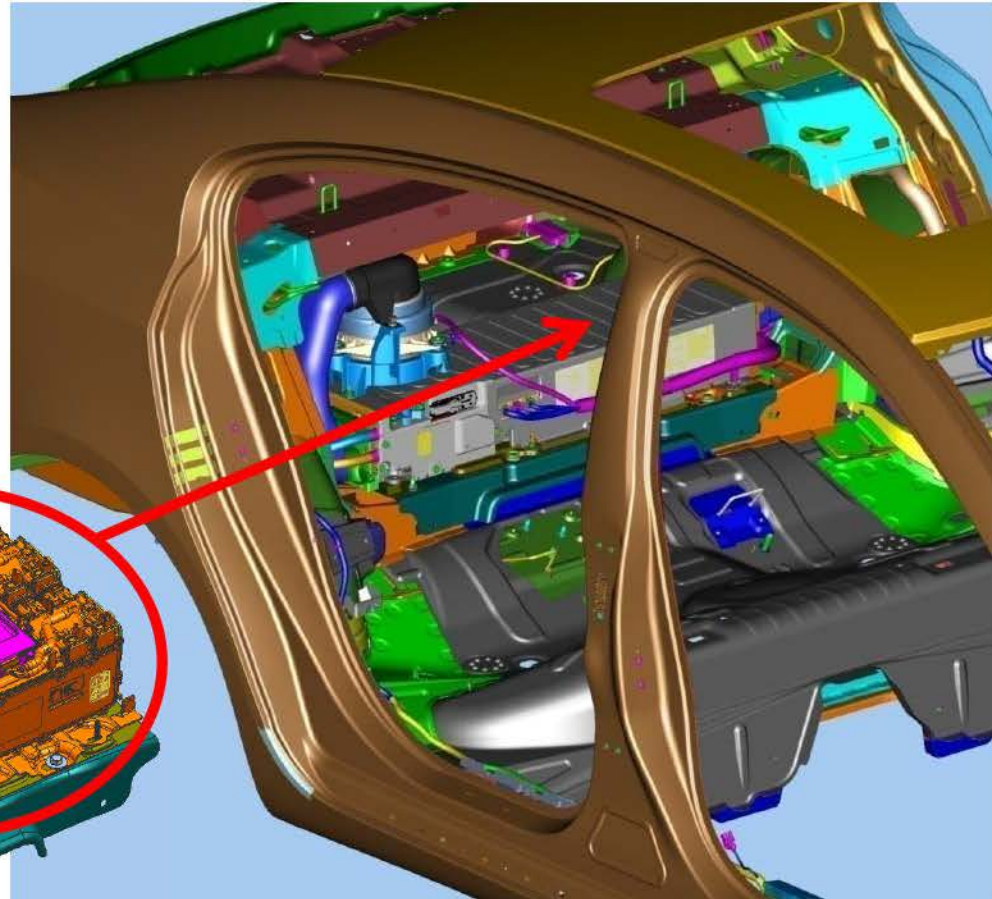
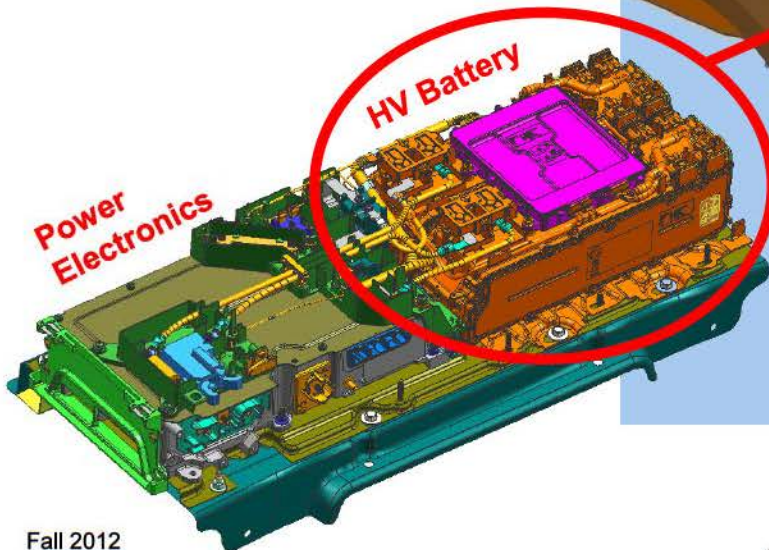
Vehicle Packaging (seen from rear of vehicle) eAssist Powerpack



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

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GM CONFIDENTIAL

eAssist BPIM Isolation Buckets

Data required to analyze field performance													
SORP to Feb 2012 VINS covered by expanded SUB 12238 prior to red box				March to August 2012 (March to May GMCH build quality issue) VINs covered by initial October SUB 12238				August - December 2012 (implement 2 layer power board) vehicle built after ~August 15 VINs covered by expanded SUB 12238 (after red box)				After December 2012 (2 layers all boards) not covered by any screen bulletin	
Unscreened		Screened		Unscreened		Screened		Unscreened		Screened		No screening required	
Board Fail	Still OK	Board Fail	Still OK	Board Fail	Still OK	Board Fail	Still OK	Board Fail	Still OK	Board Fail	Still OK	Board Fail	Still OK
# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles	# vehicles
mileage distribution @ failure	current average mileage estimate?	mileage distribution @ failure	current average mileage estimate?	mileage distribution @ failure	current average mileage estimate?	mileage distribution @ failure	current average mileage estimate?	mileage distribution @ failure	current average mileage estimate?	mileage distribution @ failure	current average mileage estimate?	mileage distribution @ failure	current average mileage estimate?
		mileage @ screen				mileage @ screen				mileage @ screen			
		rescreened after part replace?				rescreened after part replace?				rescreened after part replace?			

GM Confidential







Background

Privileged and Confidential – Prepared at the Request of Counsel

eAssist Affected Applications

North America



21.1K



4.0K



28.5K

China



0.8K

Korea



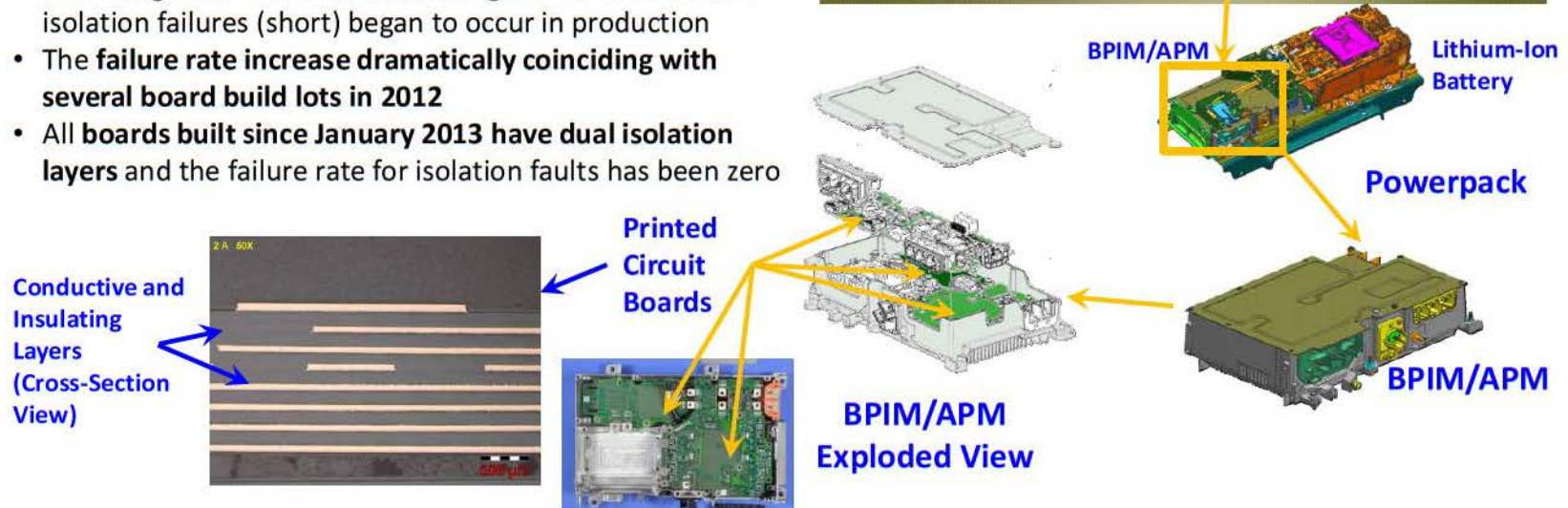
1.2K

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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



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4



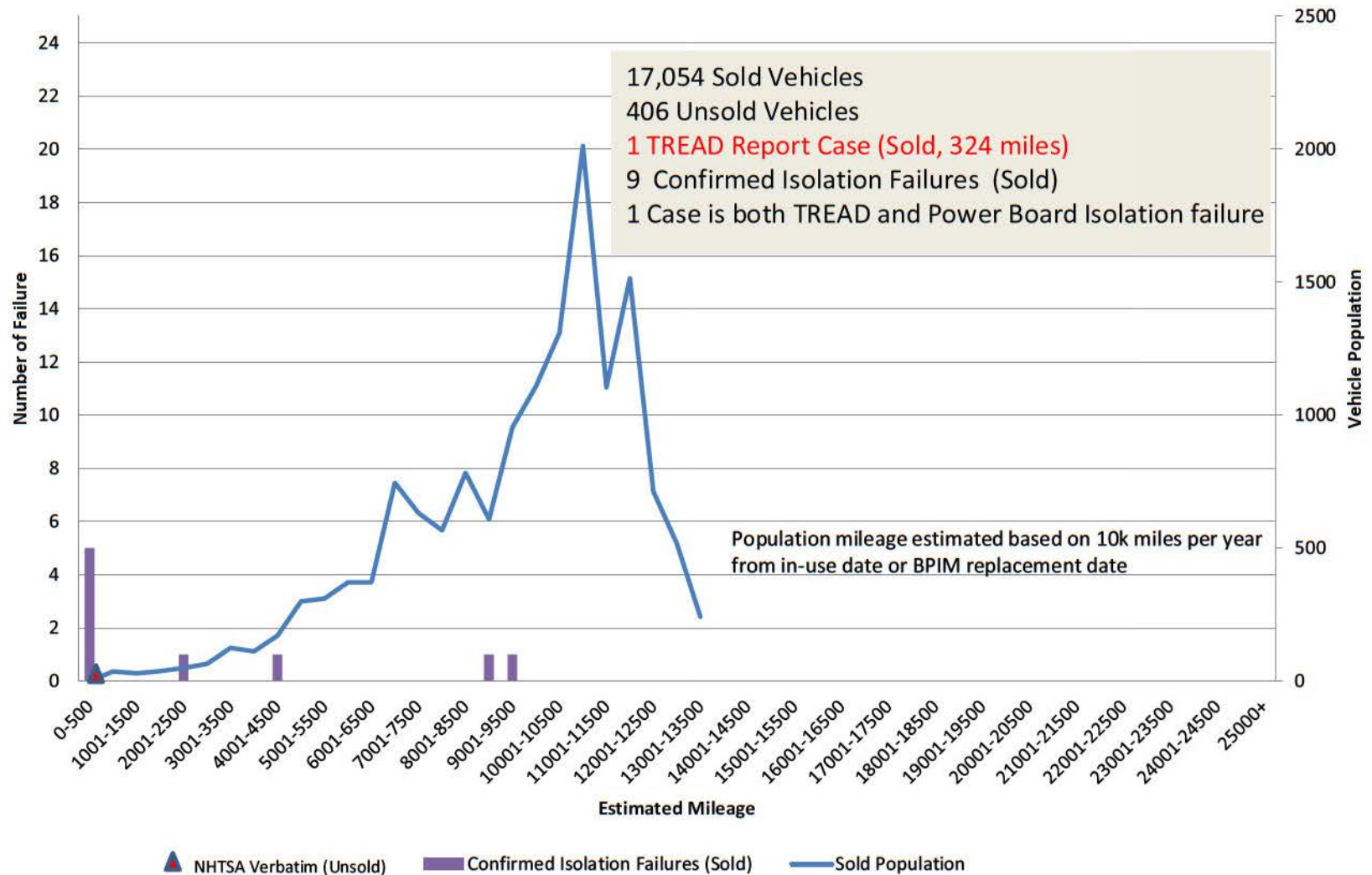
Buckets of Vehicles and Risk Profiles for Each Bucket

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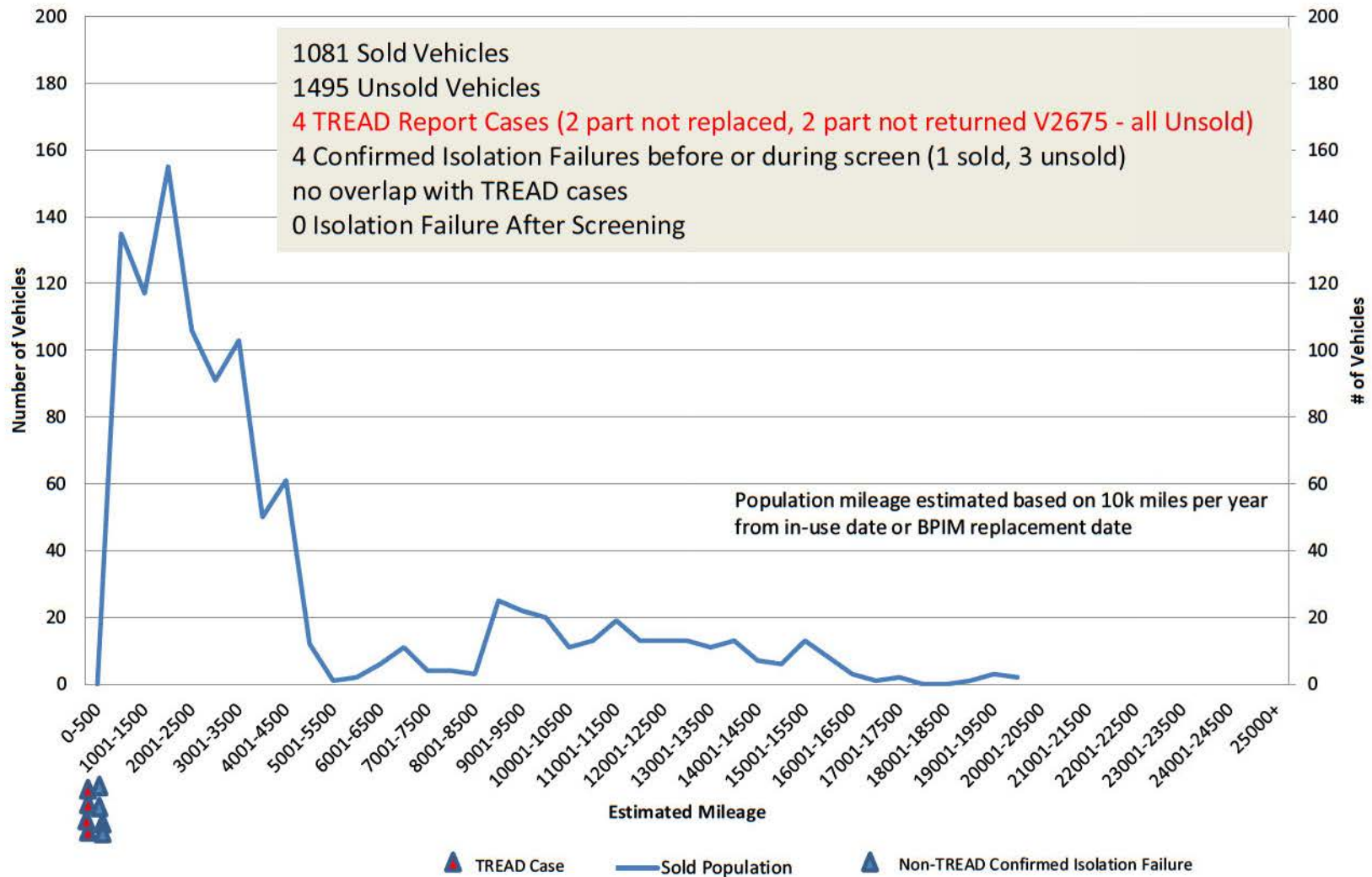


Bucket A - 11/16/10 - 3/19/12 (Before the Spike) Unscreened - 17,459 Vehicles



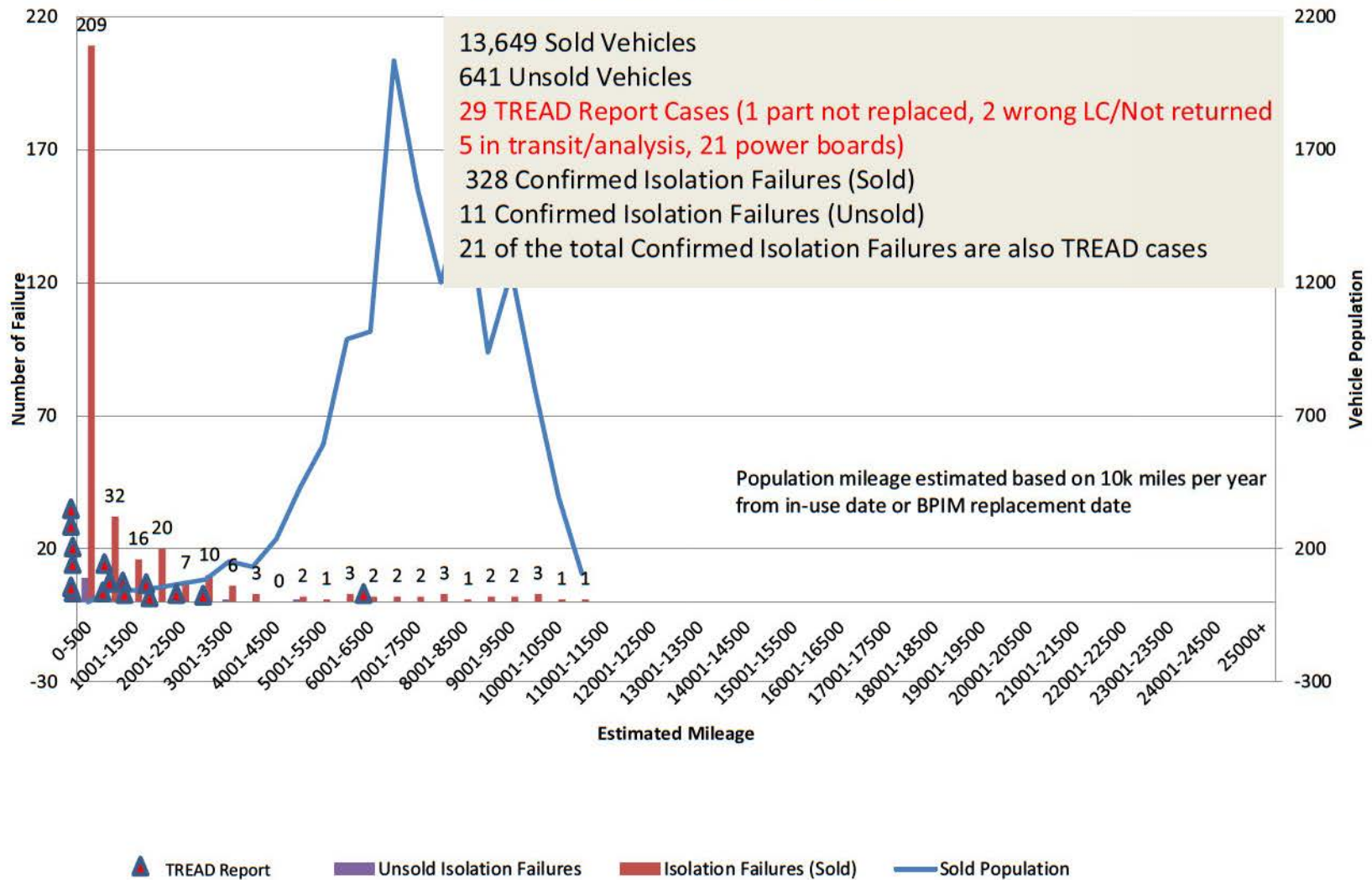
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**Bucket A - 11/16/10 - 3/19/12 (Before the Spike)
Screened – 2,576 Vehicles**



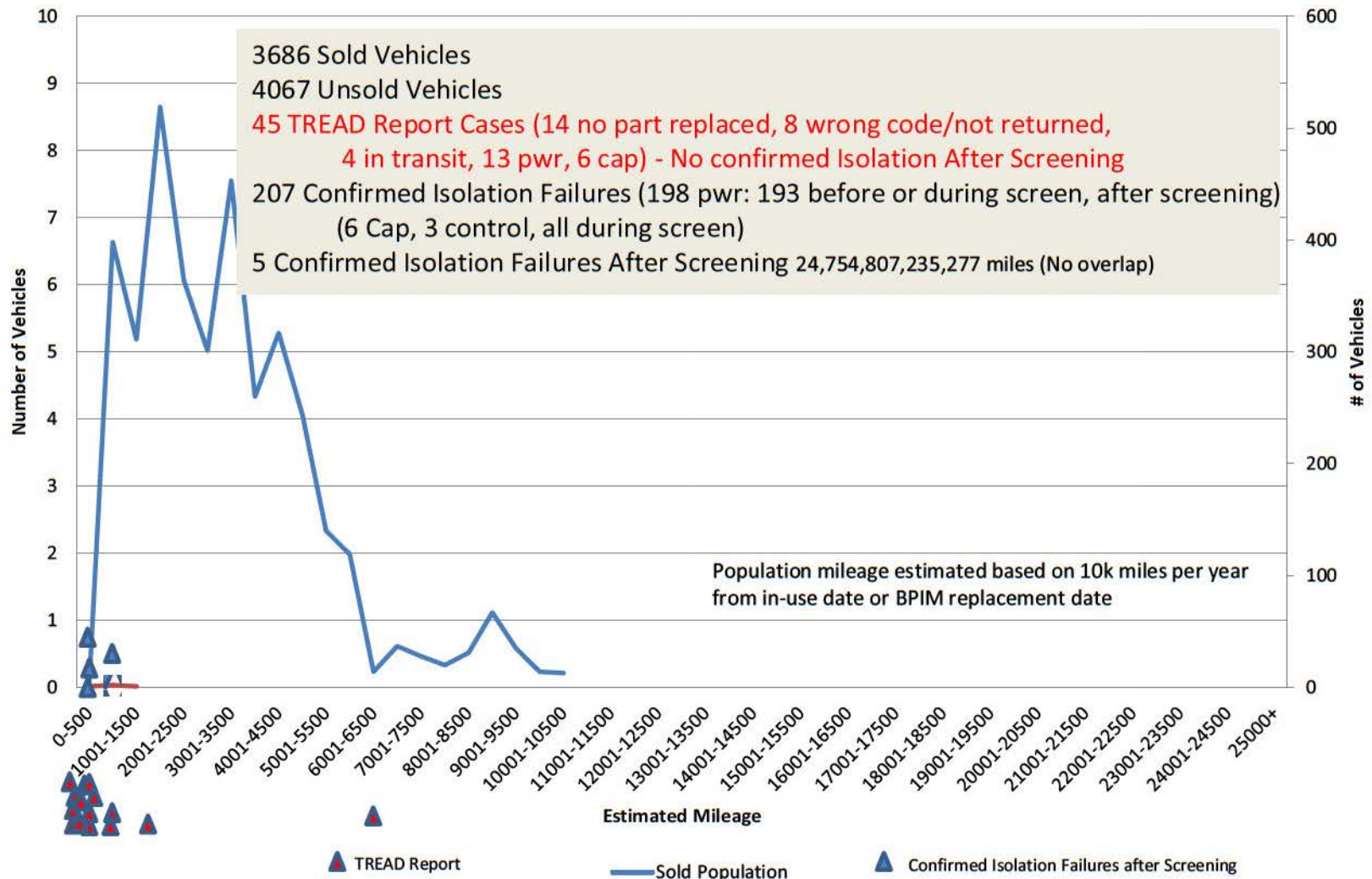
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Bucket B - 3/20/12 - 8/20/12 (Manufacturing Spike) Unscreened - 14,290 Vehicles



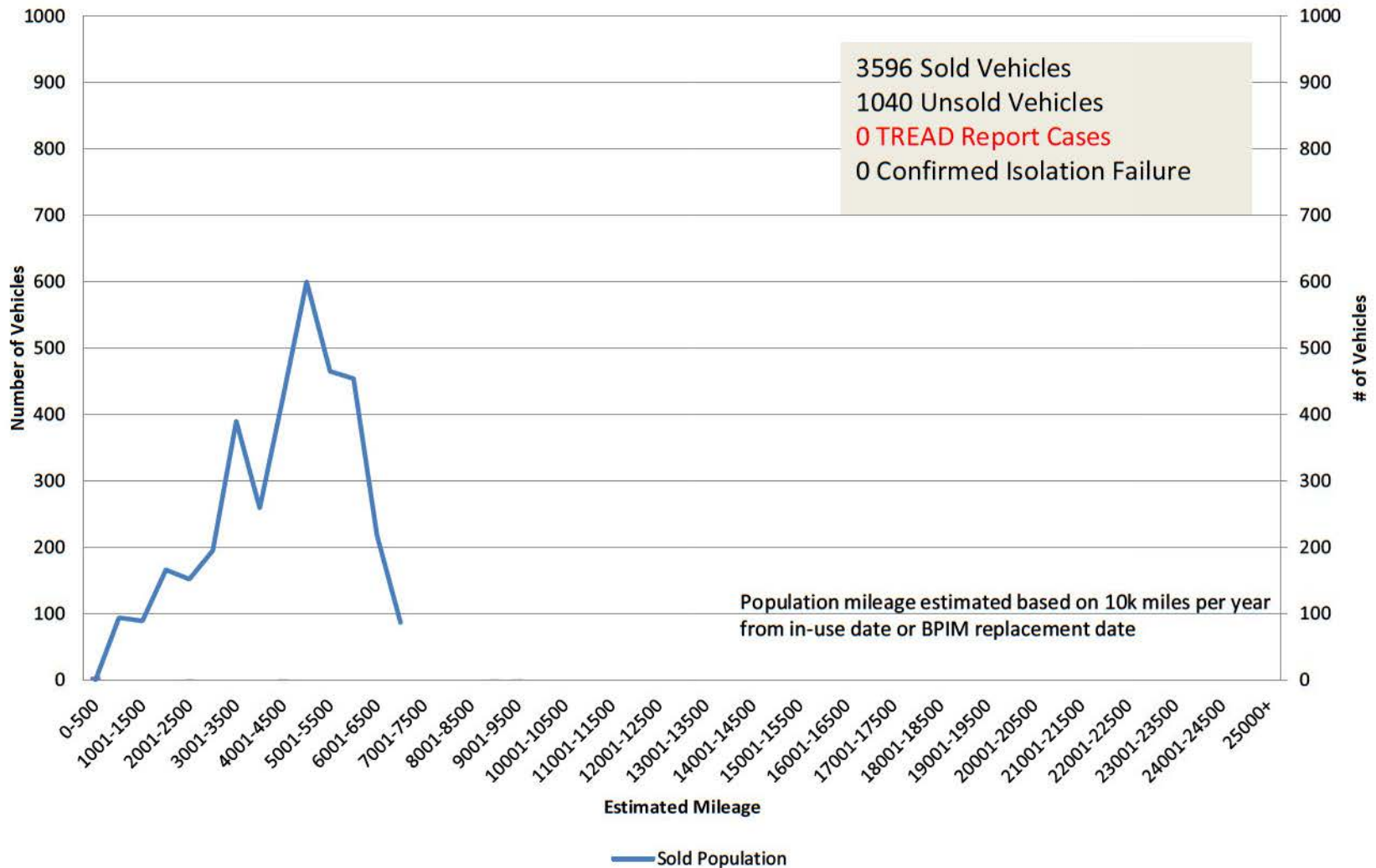
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Bucket B - 3/20/12 - 8/20/12 (Manufacturing Spike) Screened – 7,753 Vehicles



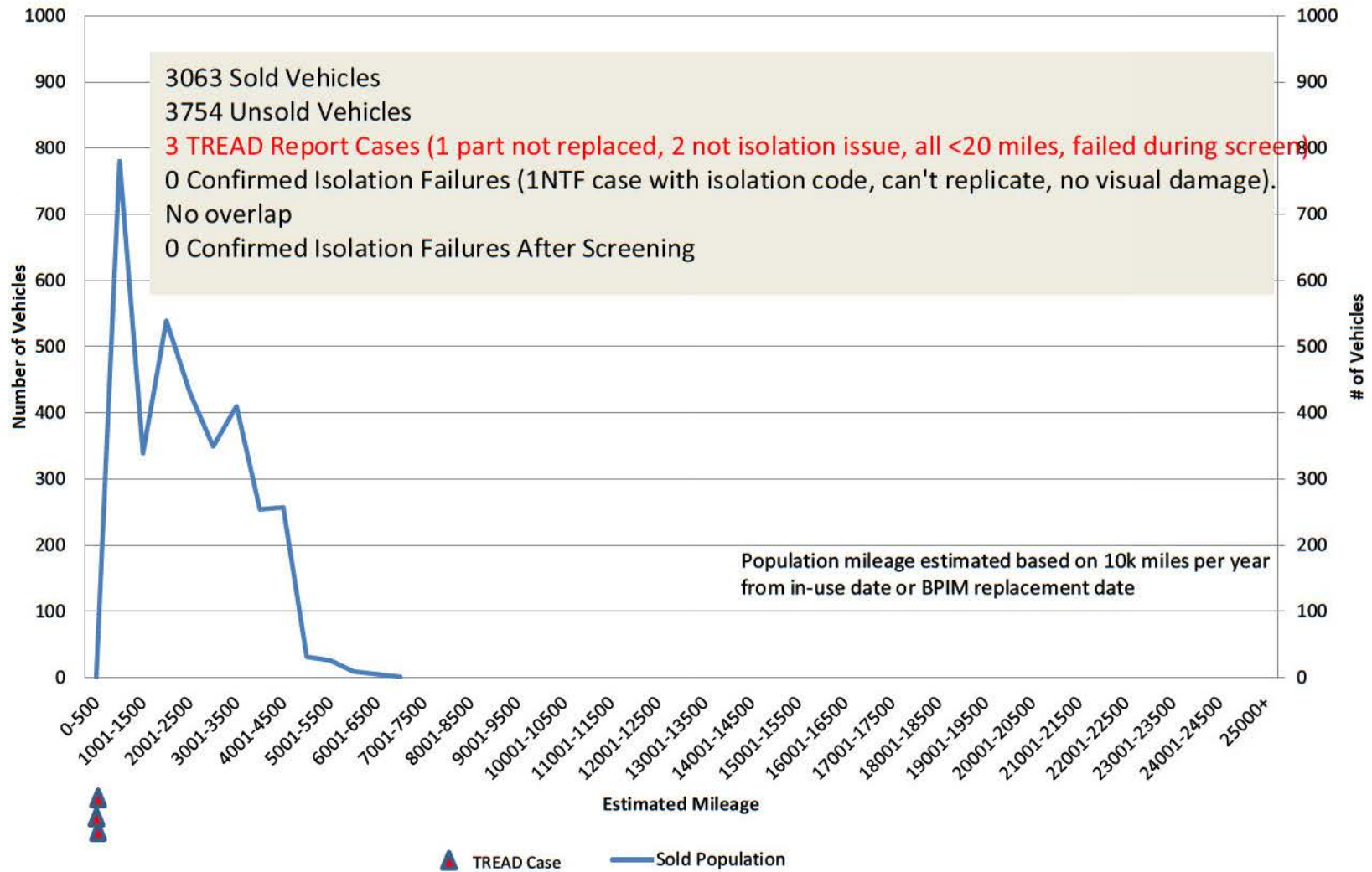
Privileged and Confidential – Prepared at the Request of Counsel

Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board) Unscreened – 4,636 Vehicles



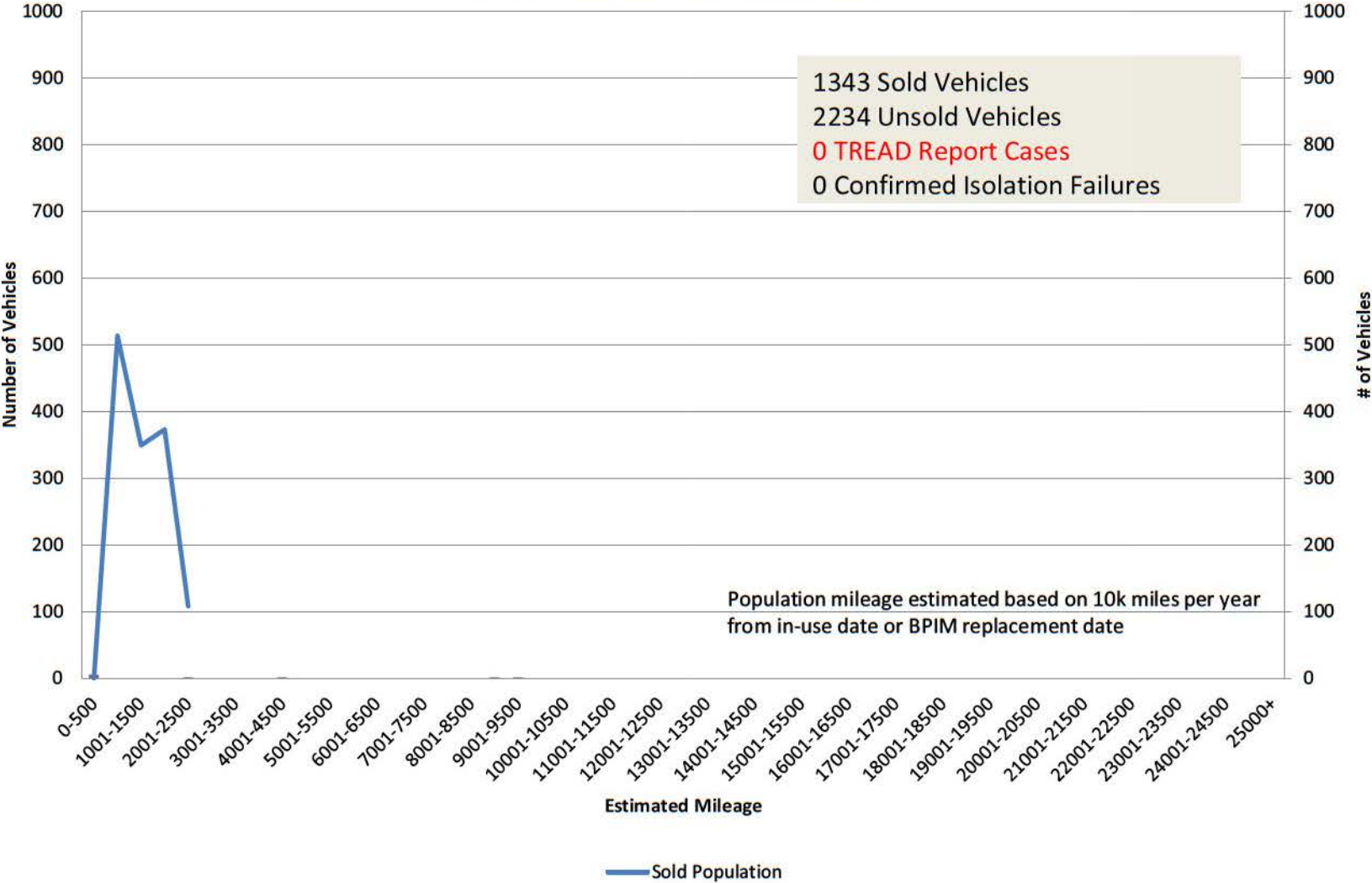
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Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board) Screened – 6,817 Vehicles



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Bucket D - 1/1/13 - Present (All Boards Updated)
Unscreened – 3,577 Vehicles



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Voluntary Field Action Options

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Backup ...

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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.

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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.

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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
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- October 19, 2012 - Service bulletin 12238 issued to screen ‘limited’ population (7,166)
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- 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

Privileged and Confidential – Prepared at the Request of Counsel

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.

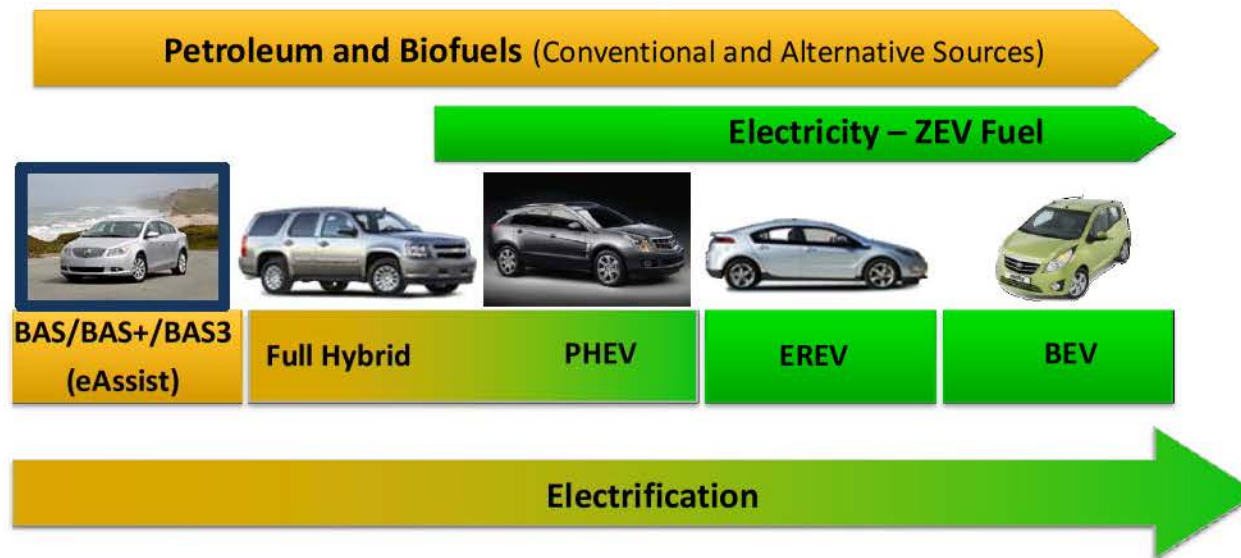
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eAssist Role in GM Electrification Portfolio

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



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The Elements of eAssist™

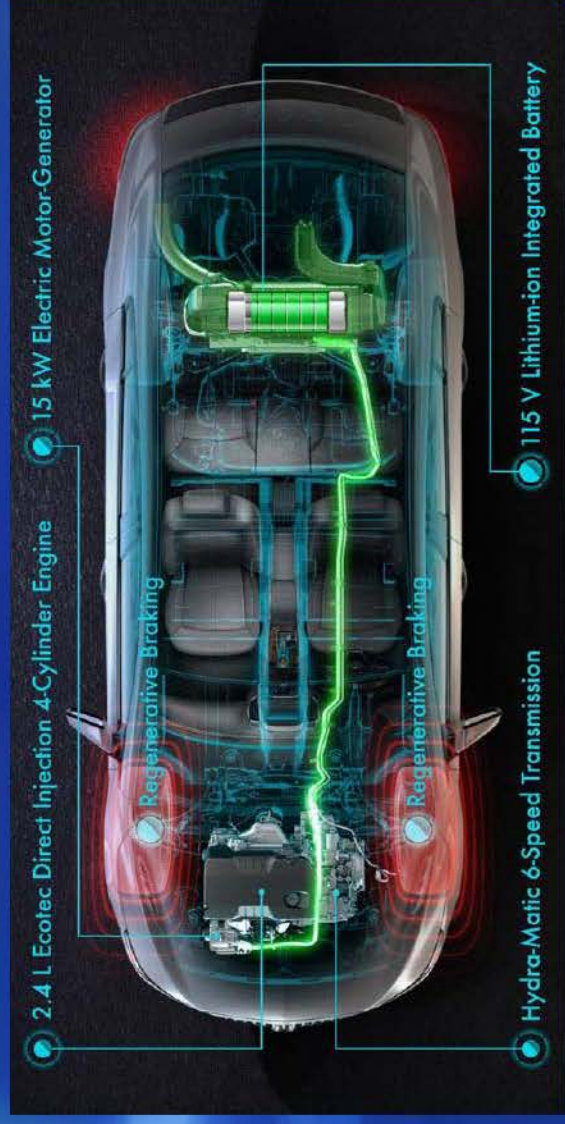


- 15-kW belt-driven induction motor/generator
- Engine accessory drive with a patented dual tensioner
- Air cooled power electronics integrated with a compact, light-weight 115-V lithium-ion battery pack
- Direct-injection 2.4 liter 4-cylinder gasoline engine and slightly modified 6-speed automatic transmission
- 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



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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

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eAssist

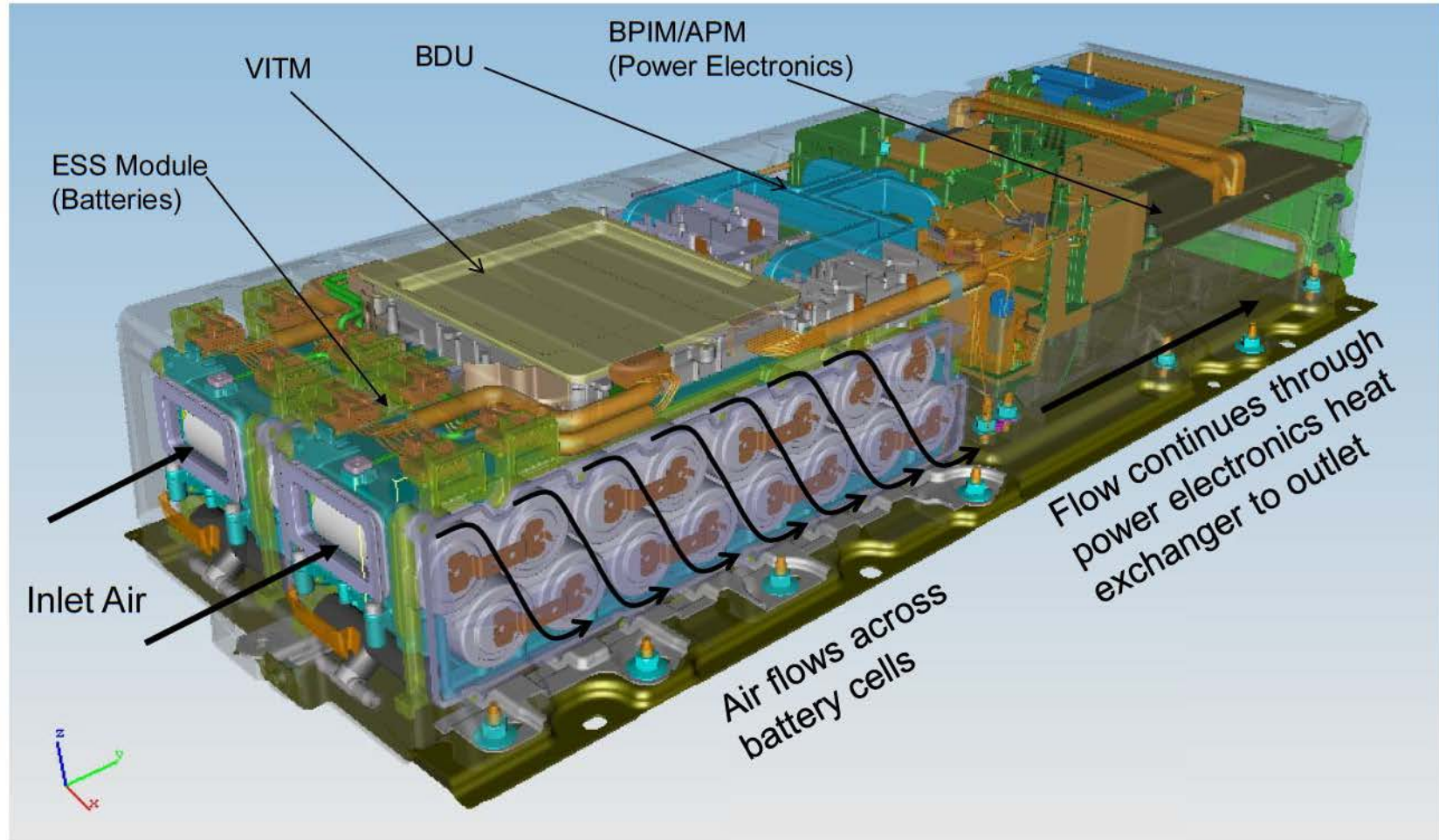


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GM Confidential

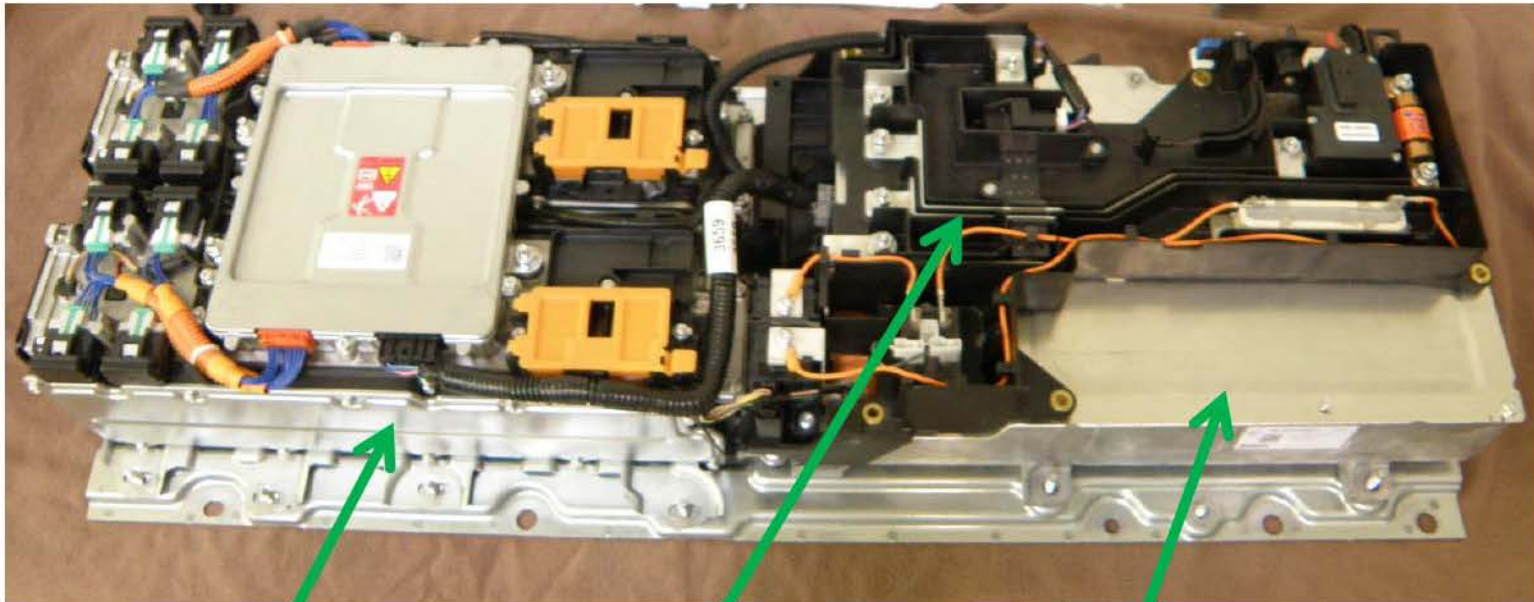
32

Powerpack – Basic Layout



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eAssist Powerpack (Cover Removed)



Battery

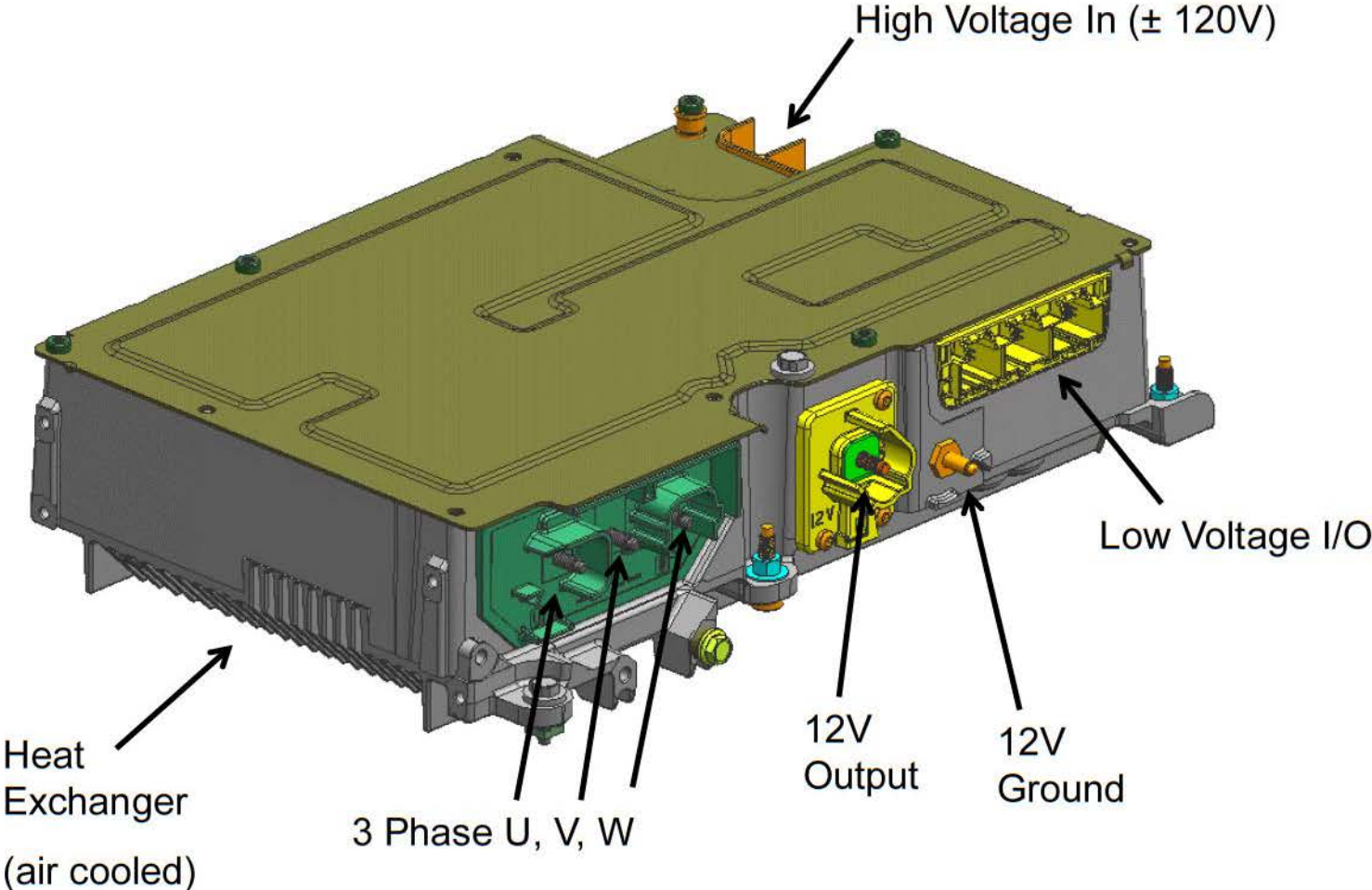
Battery Disconnect Unit

BPIM/APM

(Starter/Generator Control Module)

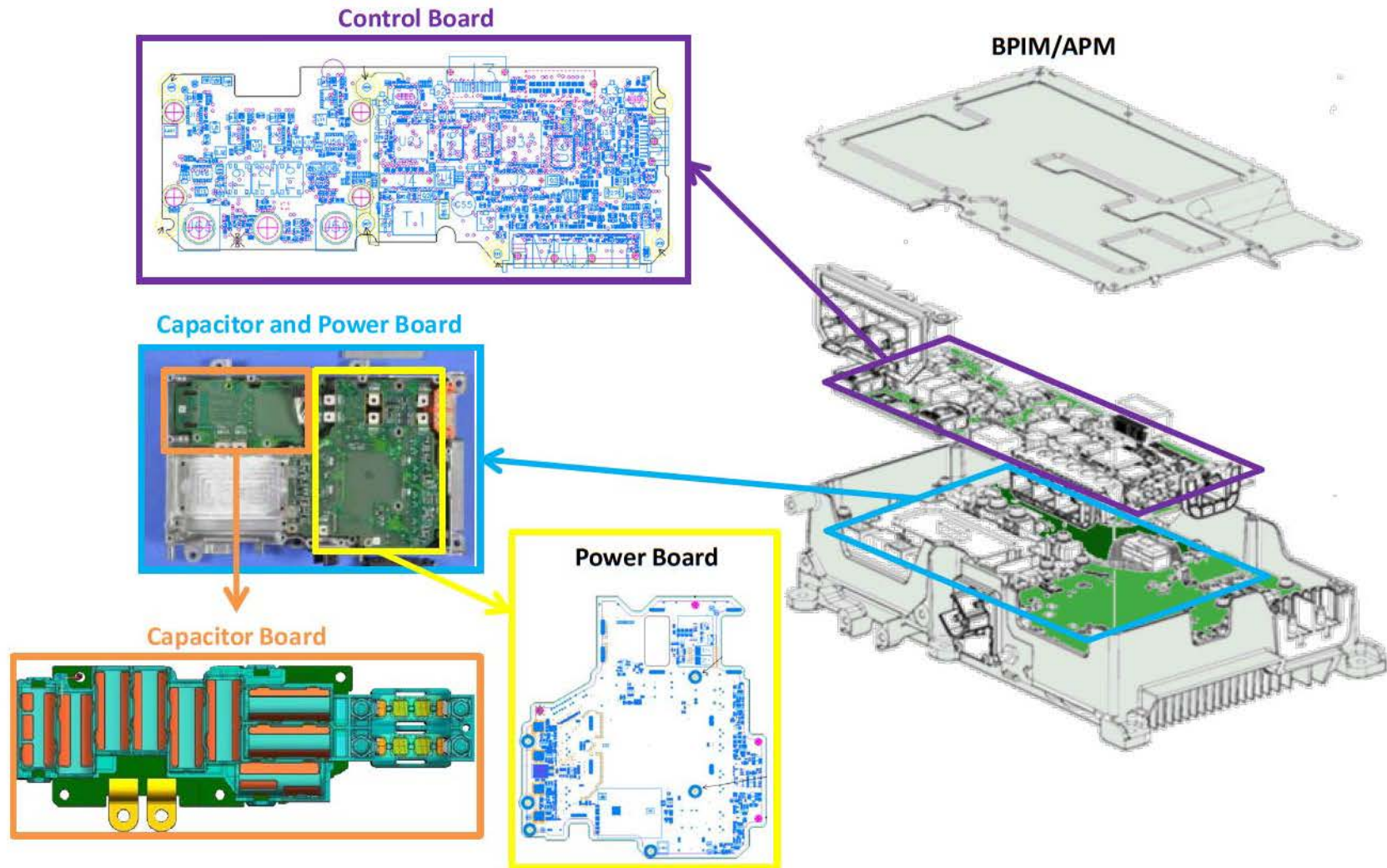
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eAssist BPIM/APM – External View



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eAssist: BPIM/APM Printed Circuit Boards



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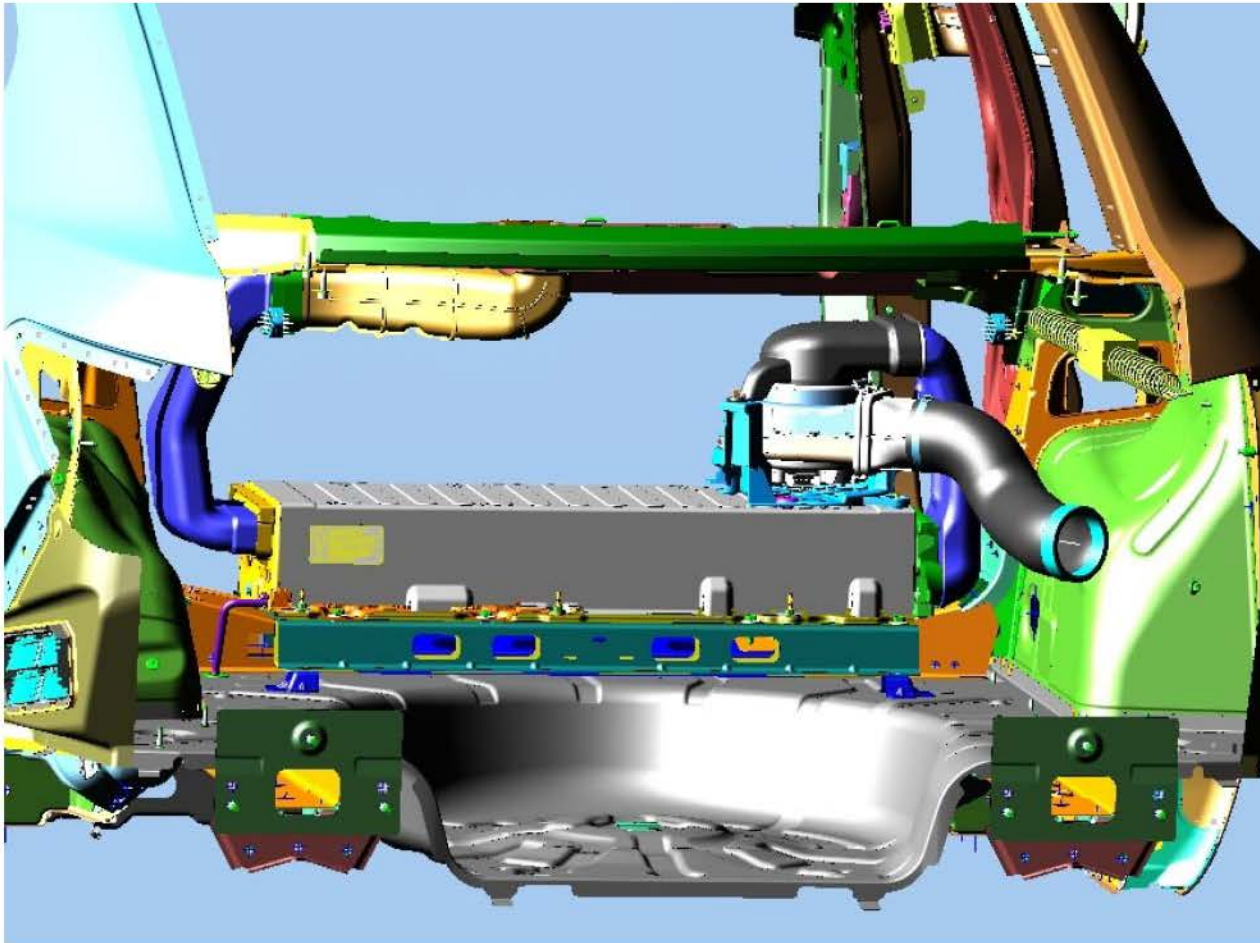








Vehicle Packaging (seen from rear of vehicle) eAssist Powerpack

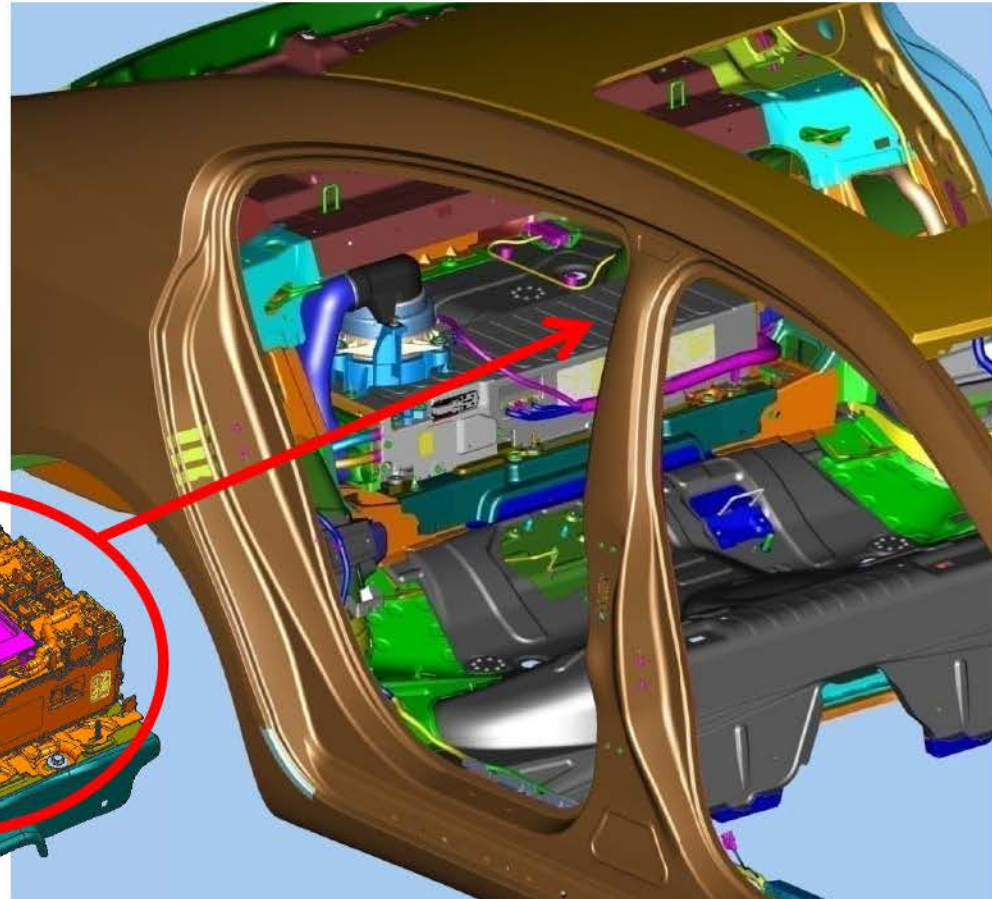
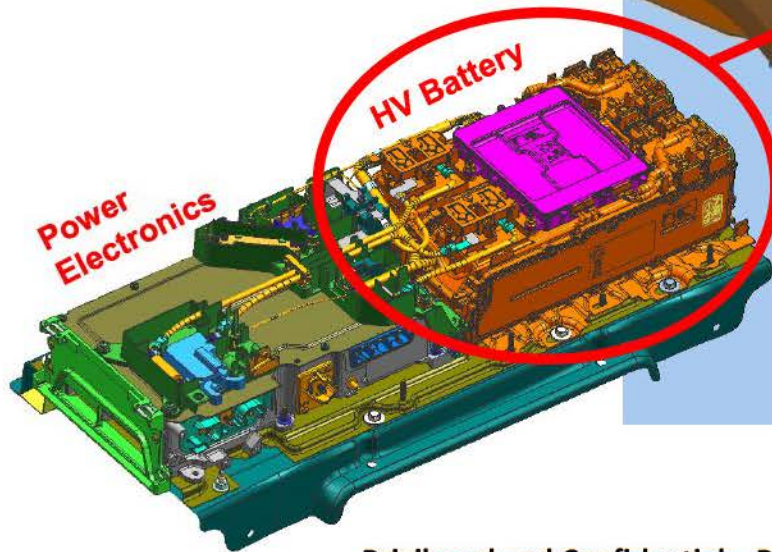


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Serviceability (seen from side of vehicle) eAssist Powerpack

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

Battery can be replaced without removing the power electronics module



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Background

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eAssist Affected Applications

North America



21.1K



4.0K



28.5K

China



0.8K

Korea



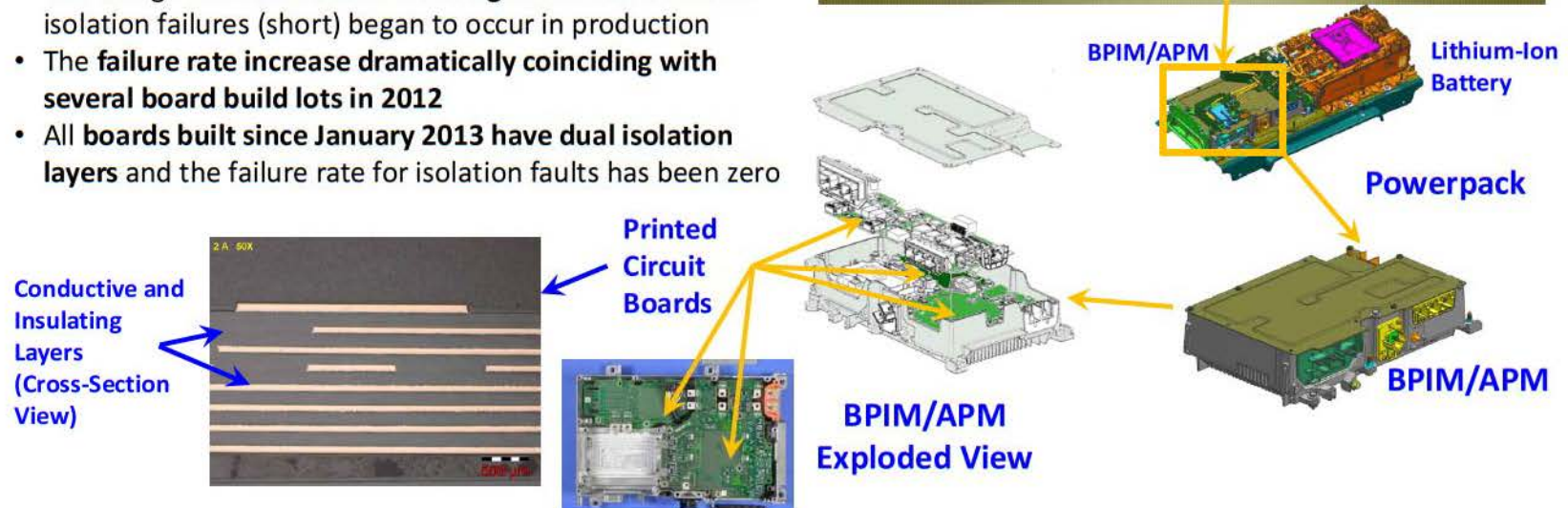
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eAssist: BPIM/APM Circuit Board Failures

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



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Some Characteristics of the Isolation Faults

Impact on vehicle performance:

- When failures occur, most result in eventual loss of 12-V power (**walk-home**)
- Many cases happen without noticeable symptoms, but others **can exhibit some odor, smoke, soot, etc.**

Frequency and timing of failures:

- **Most parts with single-layer design appear to have no issue** and are not expected to fail or have reduced reliability in service
- **Failures generally consistent with infant mortality** – typically < 100 miles, nearly all < 1000 miles
- But a **few cases have occurred at higher mileage** (up to 20-30k mi)

Effectiveness of screening methods:

- Generally requires **thermal stress to manifest**
- Difficult to screen at a part level
- 3-hour **dealer screening procedure implemented to address unsold vehicles has proven very effective** at triggering isolation faults in susceptible BPIMs

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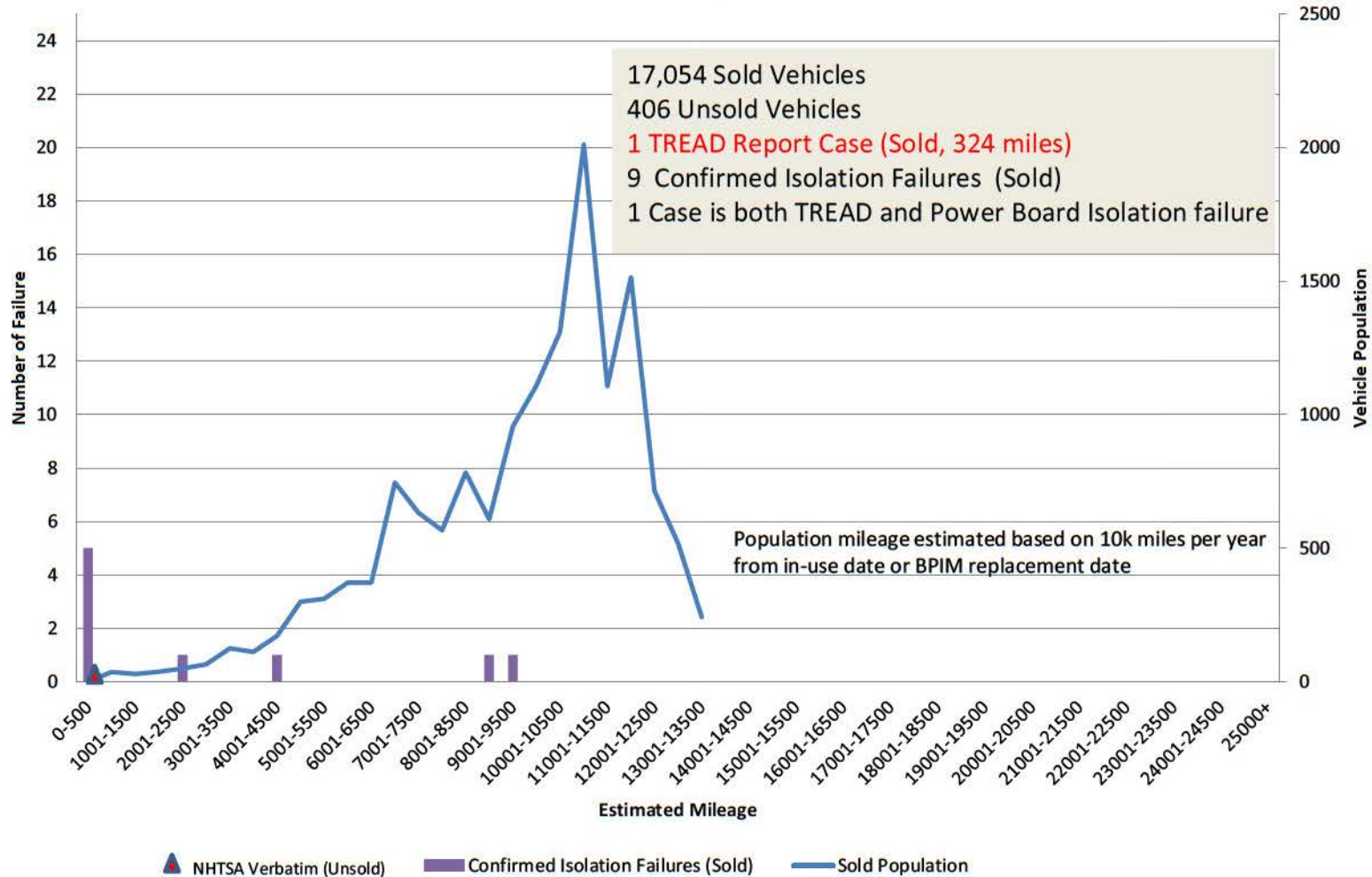
Buckets of Vehicles and Risk Profiles for Each Bucket

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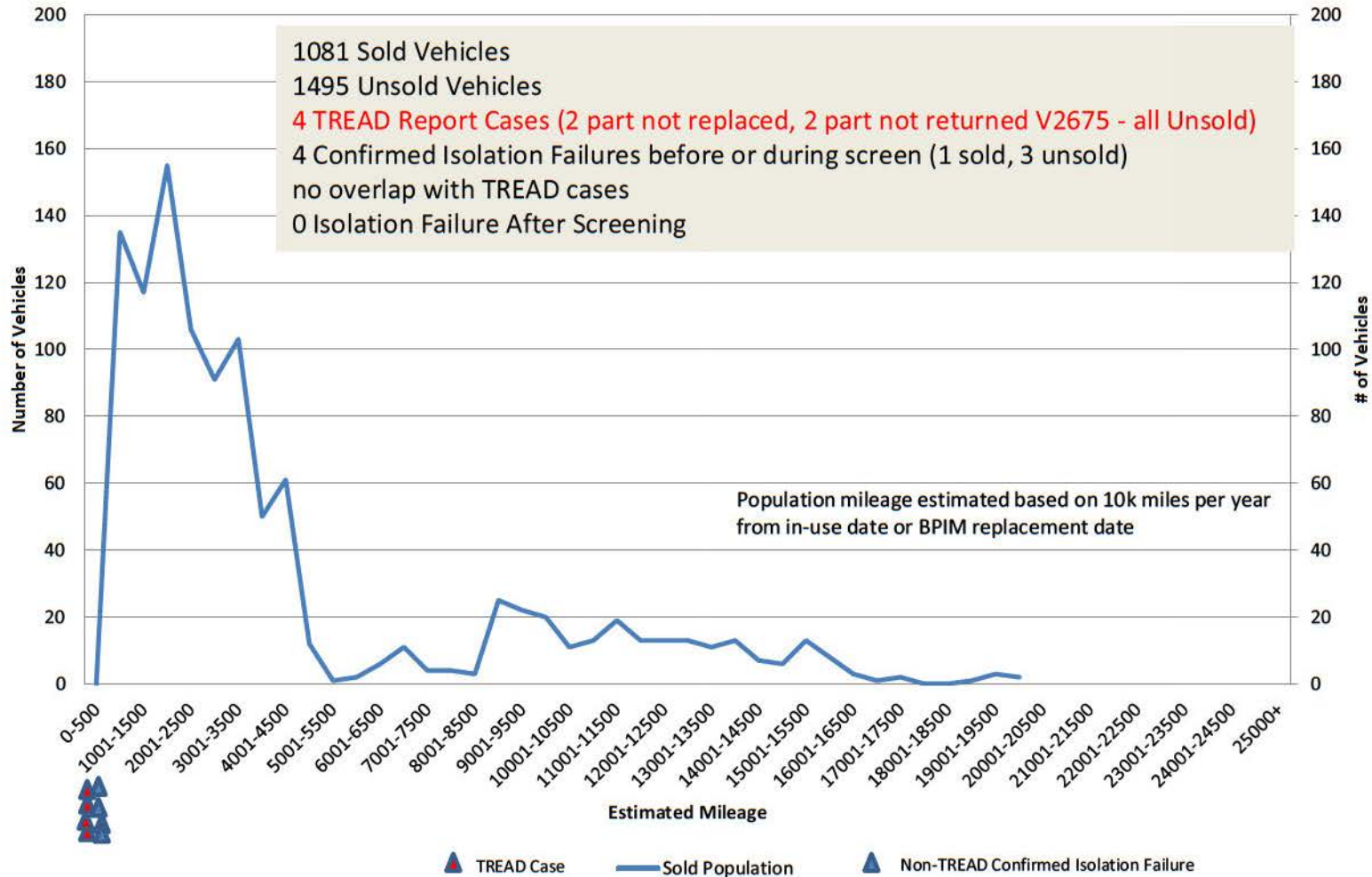


Bucket A - 11/16/10 - 3/19/12 (Before the Spike)
Unscreened - 17,459 Vehicles



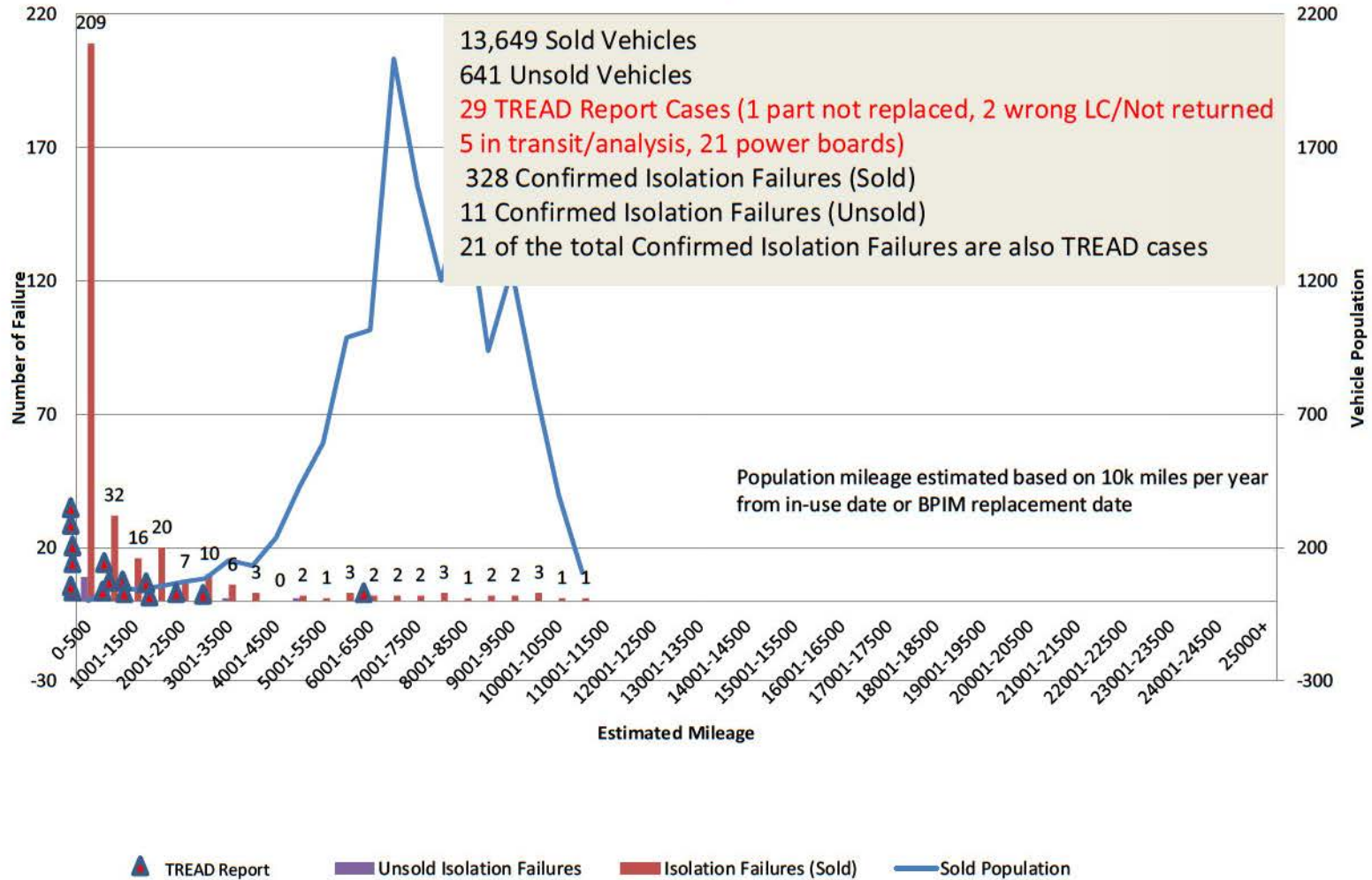
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Bucket A - 11/16/10 - 3/19/12 (Before the Spike)
Screened – 2,576 Vehicles



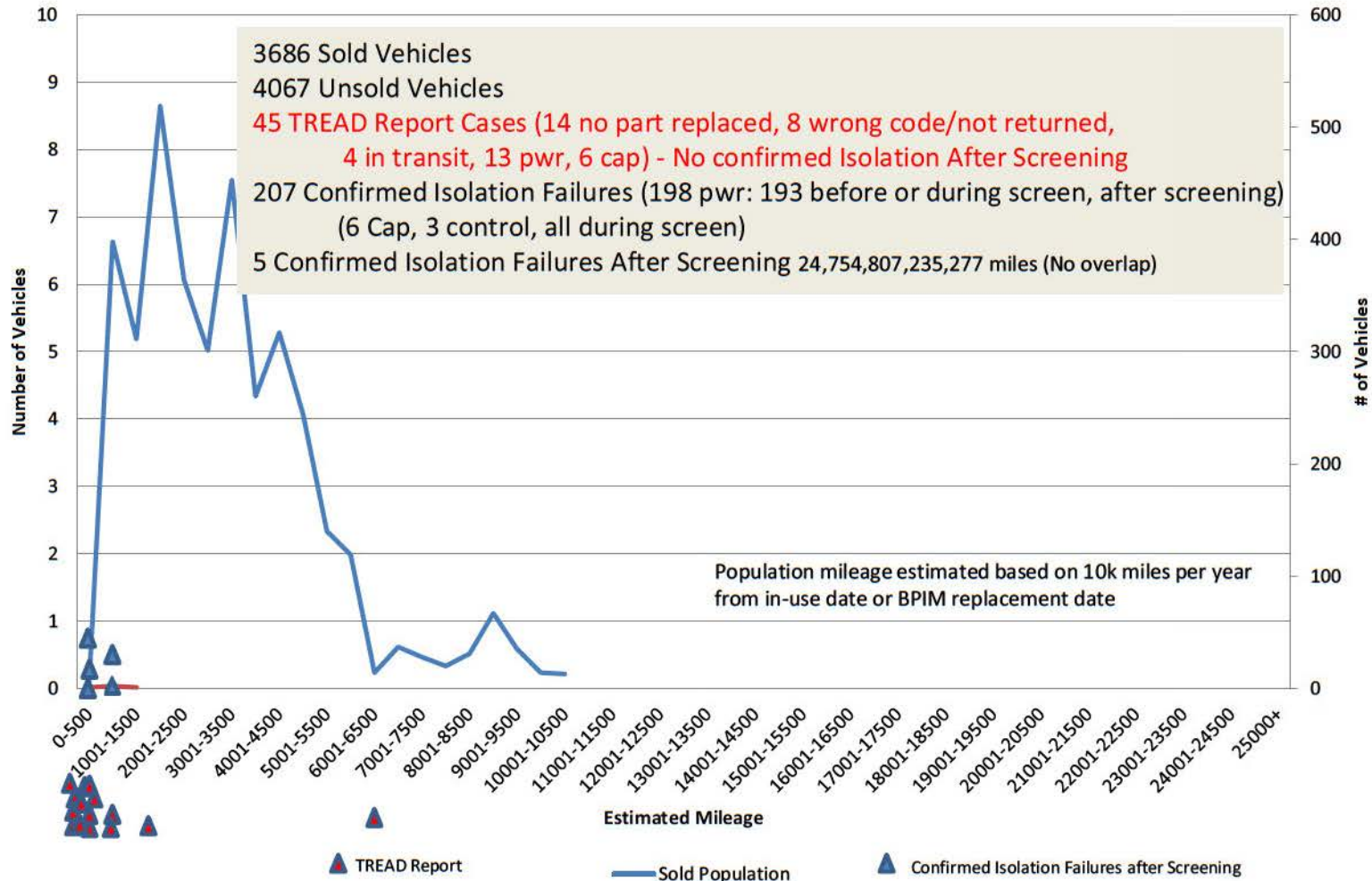
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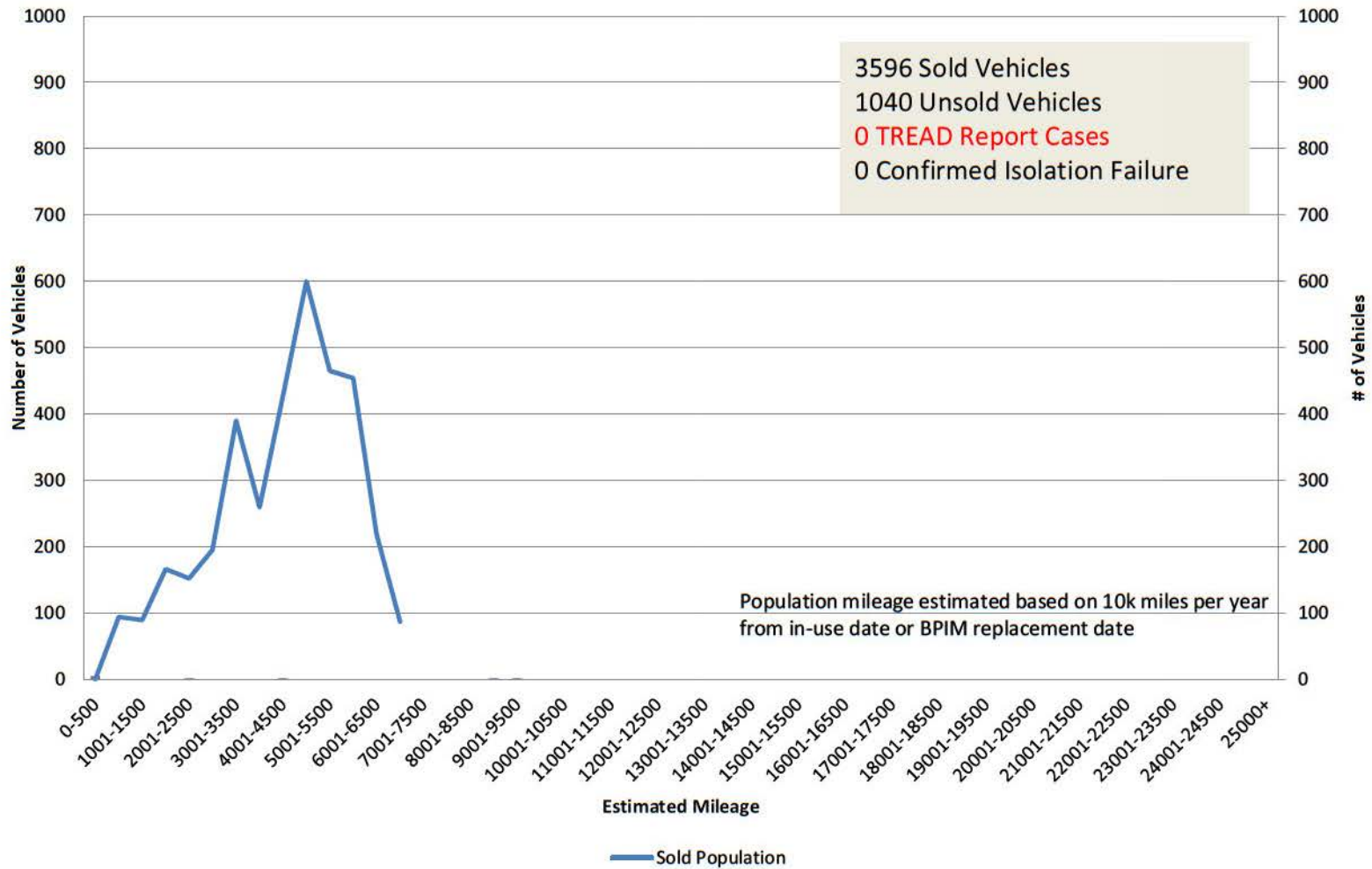
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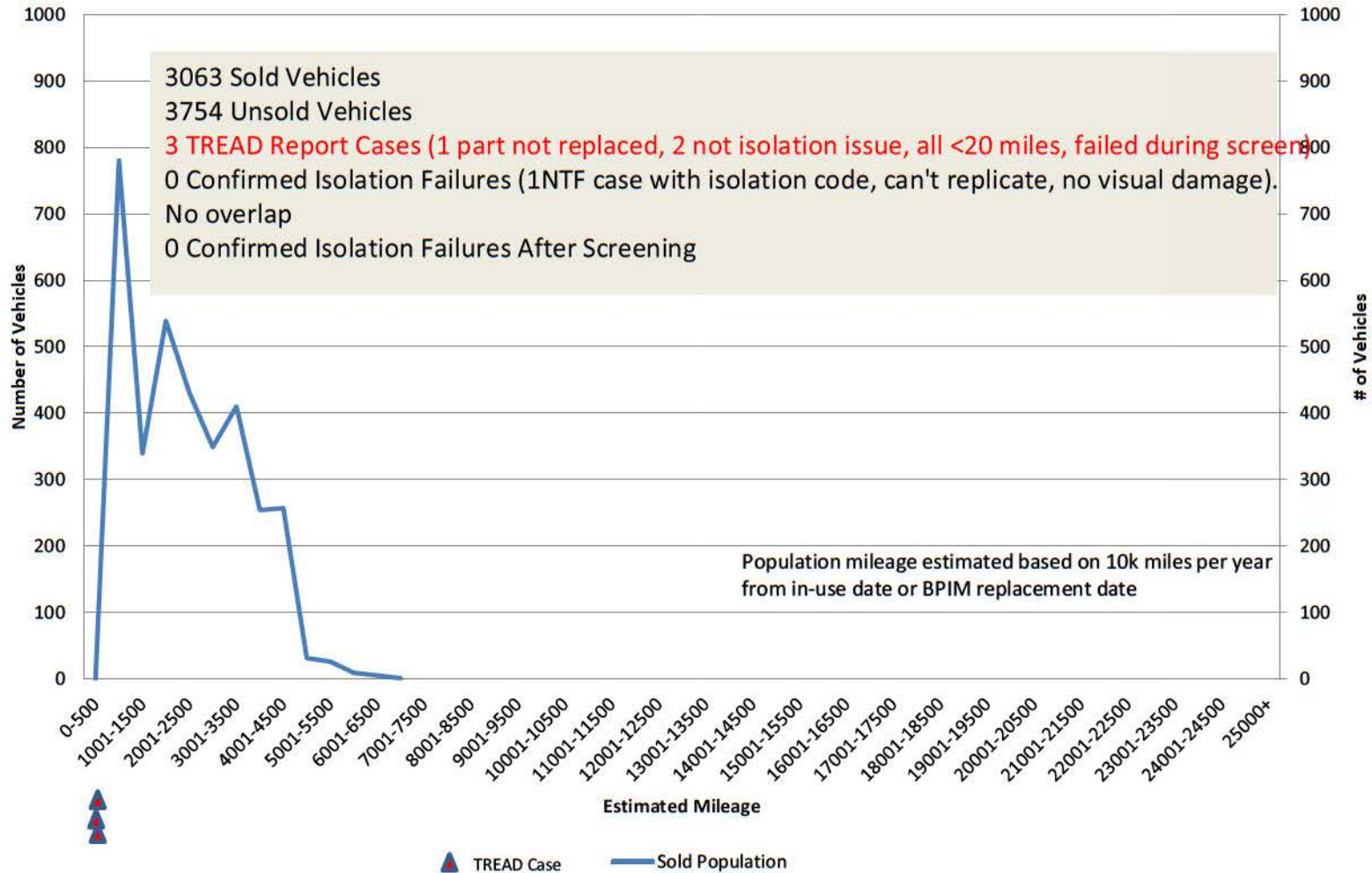
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**Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board)
Unscreened – 4,636 Vehicles**



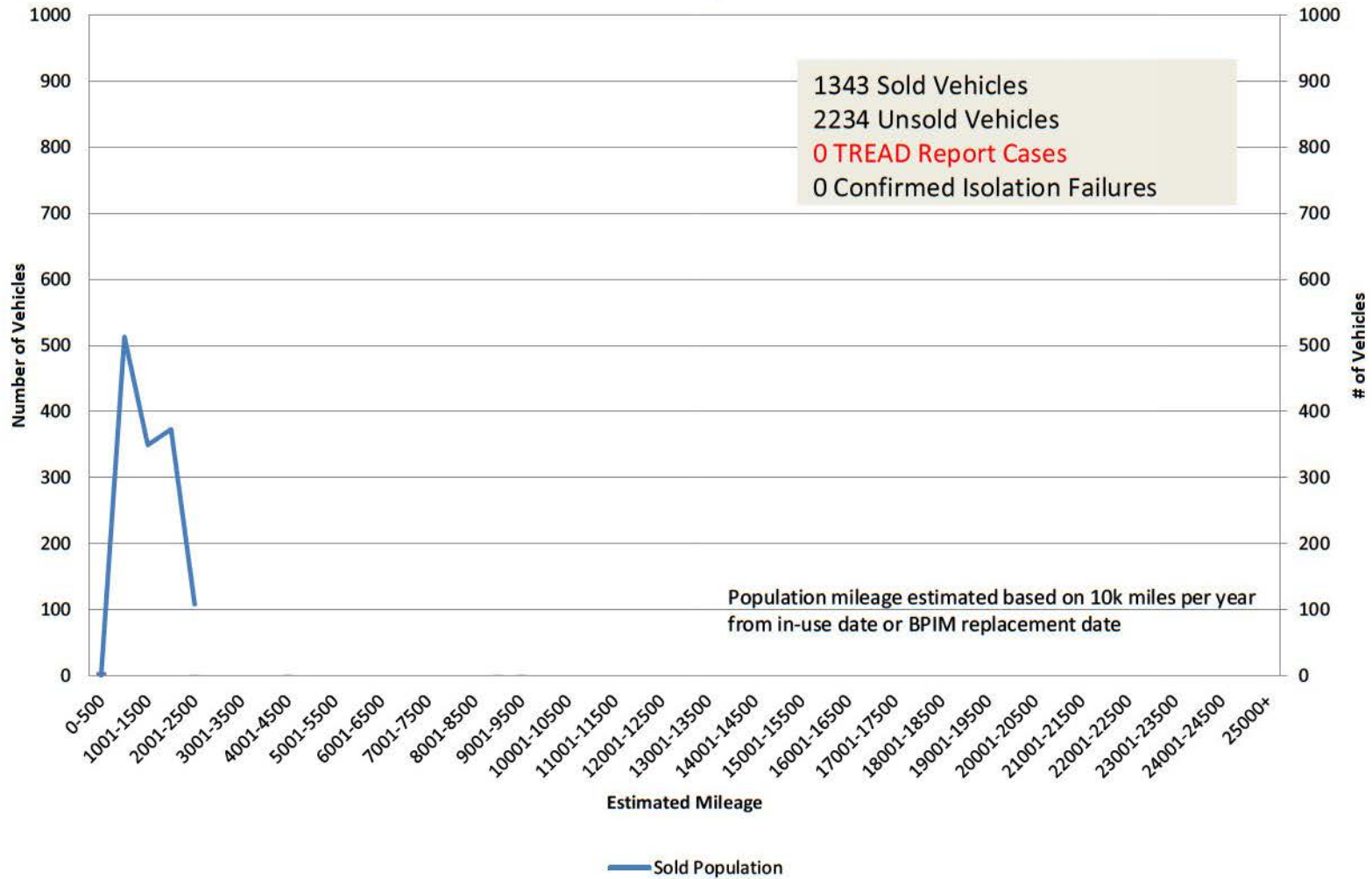
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Bucket C - 8/21/12 - 12/31/12 (Option 1 Power Board) Screened – 6,817 Vehicles



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**Bucket D - 1/1/13 - Present (All Boards Updated)
Unscreened – 3,577 Vehicles**



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Voluntary Field Action Options

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Backup ...

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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.

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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.

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eAssist BPIM Isolation Fault Timeline

- July 5, 2011 – SGM vehicle with shorted APM output (unknown root cause)
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- January 2012 – Second TAC case for isolation related issues
- March 2012 – Contained thermal event in Fairfax LQ68414112056516
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- March 25, 2013 – Letter from customer requesting a buy-back due to a thermal incident

Privileged and Confidential – Prepared at the Request of Counsel

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

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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.

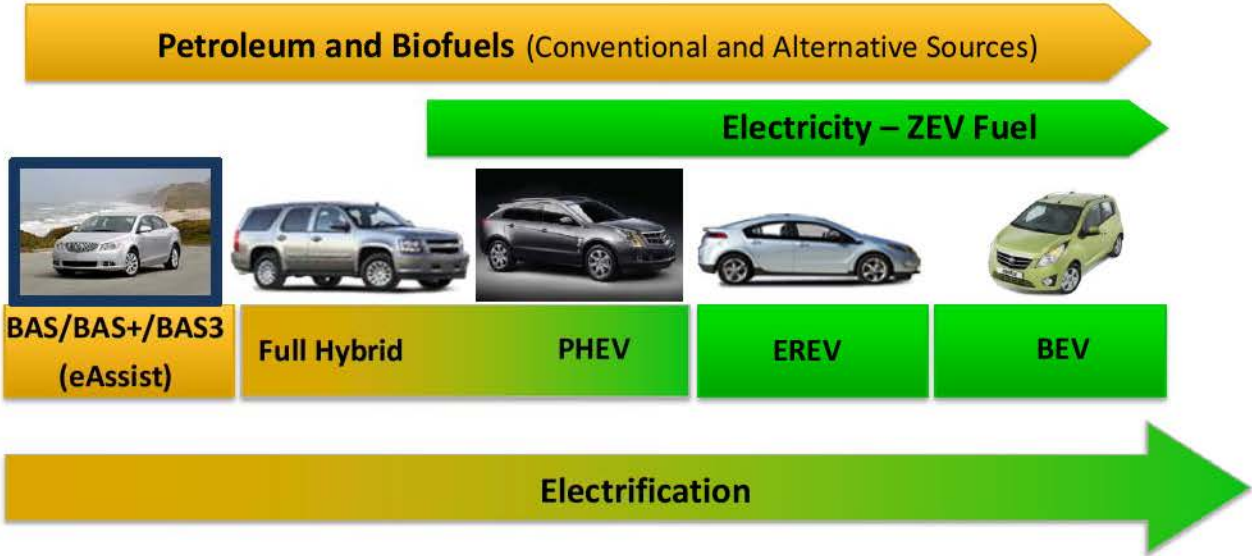
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eAssist Role in GM Electrification Portfolio

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



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The Elements of eAssist™

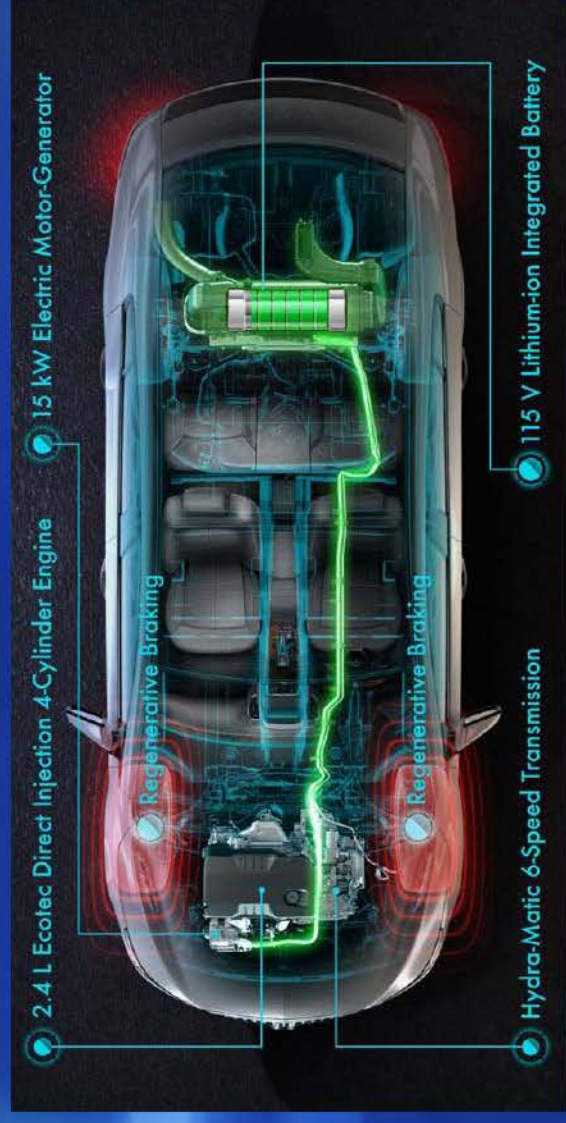


- 15-kW belt-driven induction motor/generator
- Engine accessory drive with a patented dual tensioner
- Air cooled power electronics integrated with a compact, light-weight 115-V lithium-ion battery pack
- Direct-injection 2.4 liter 4-cylinder gasoline engine and slightly modified 6-speed automatic transmission
- 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



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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

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eAssist

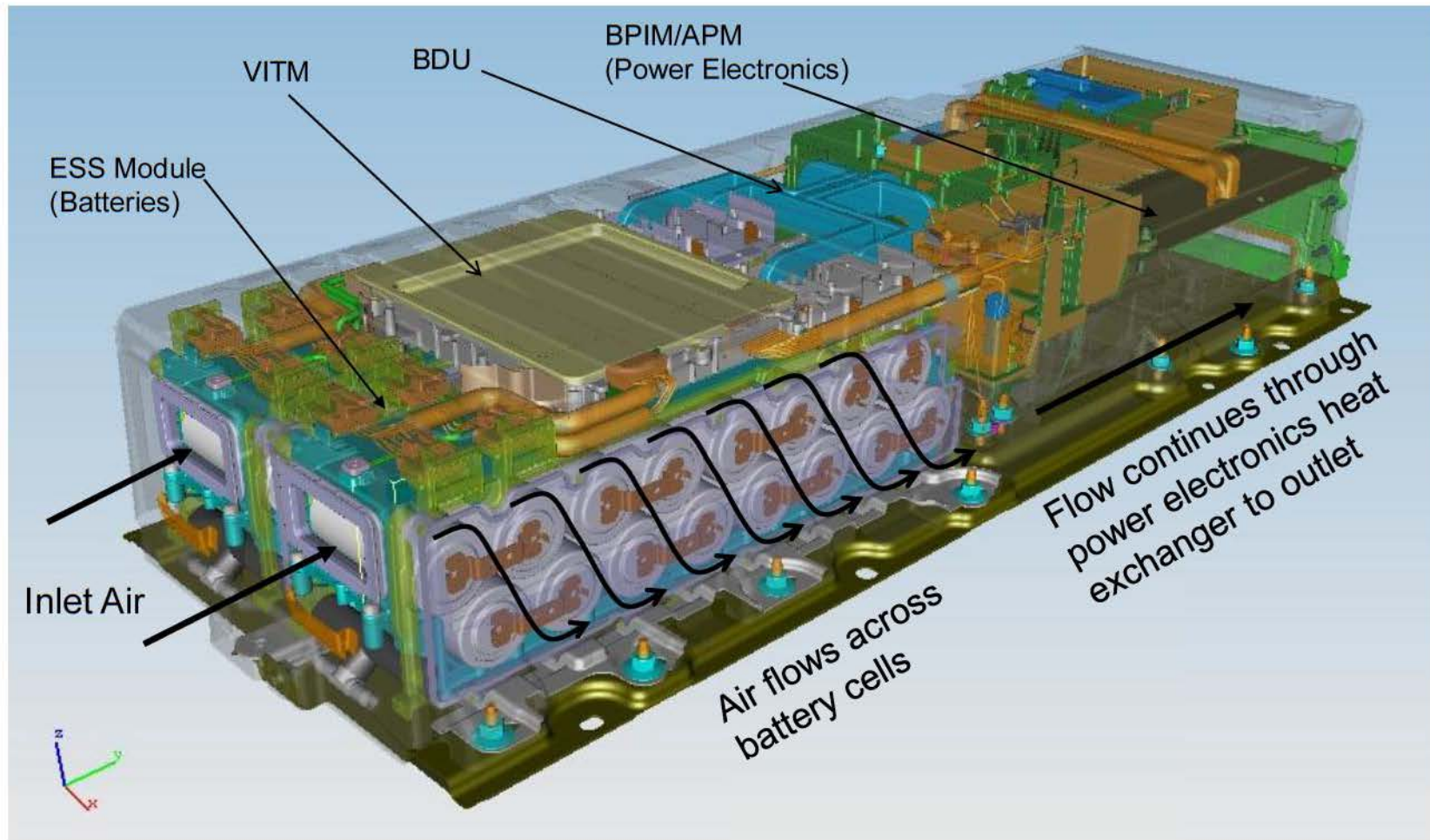


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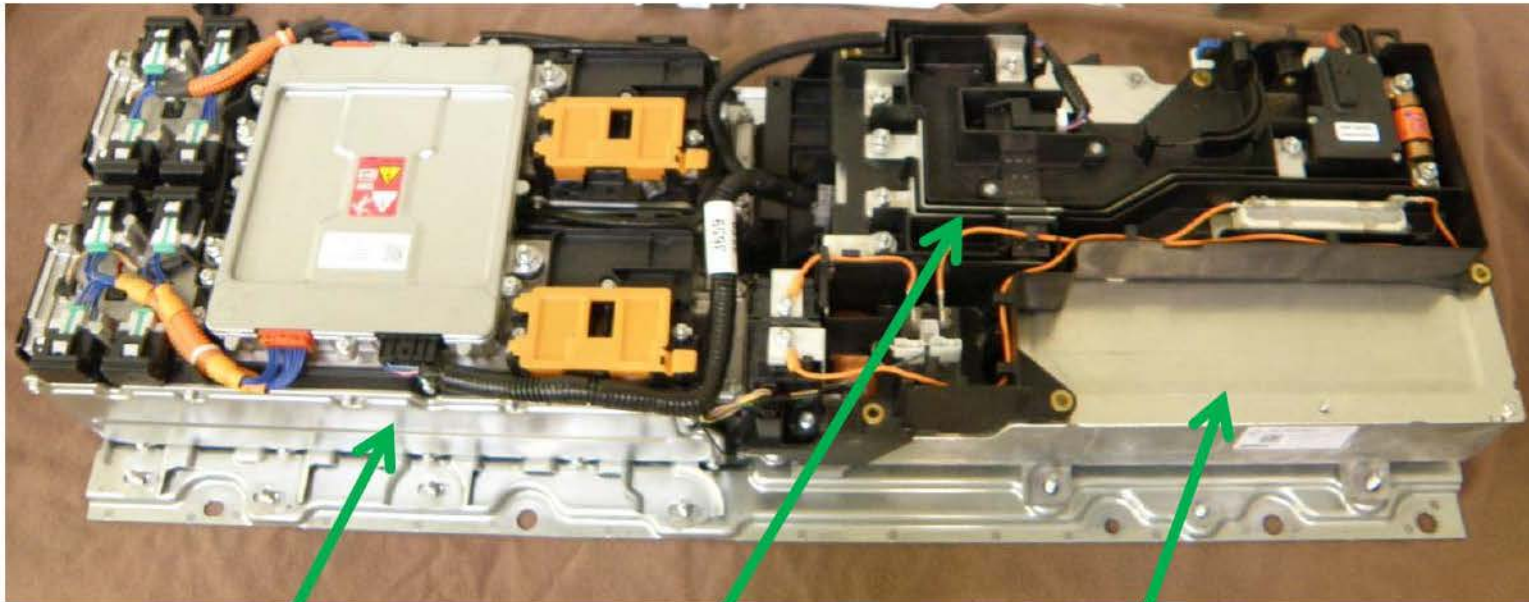
32

Powerpack – Basic Layout



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eAssist Powerpack (Cover Removed)



Battery

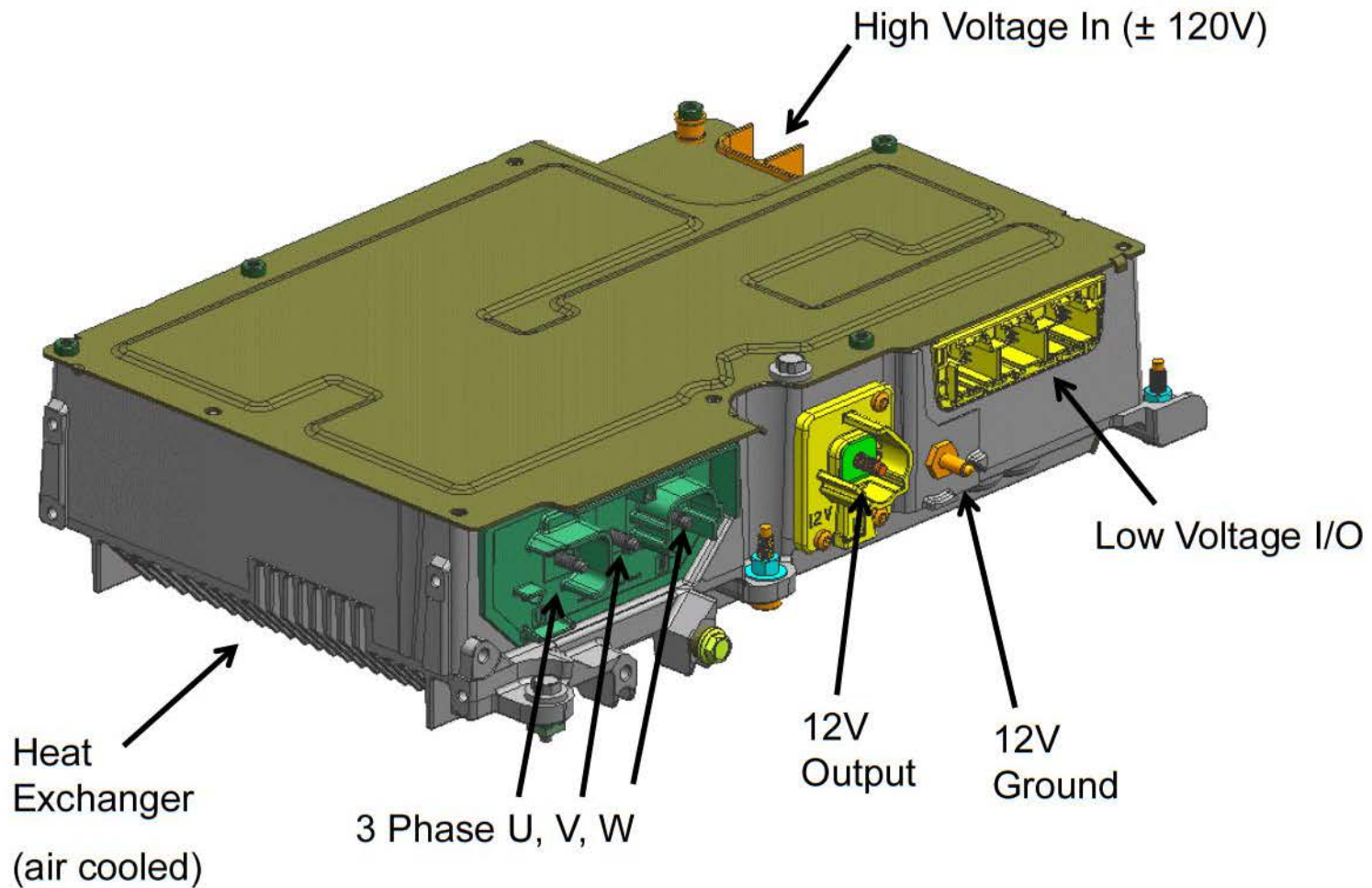
Battery Disconnect Unit

BPIM/APM

(Starter/Generator Control Module)

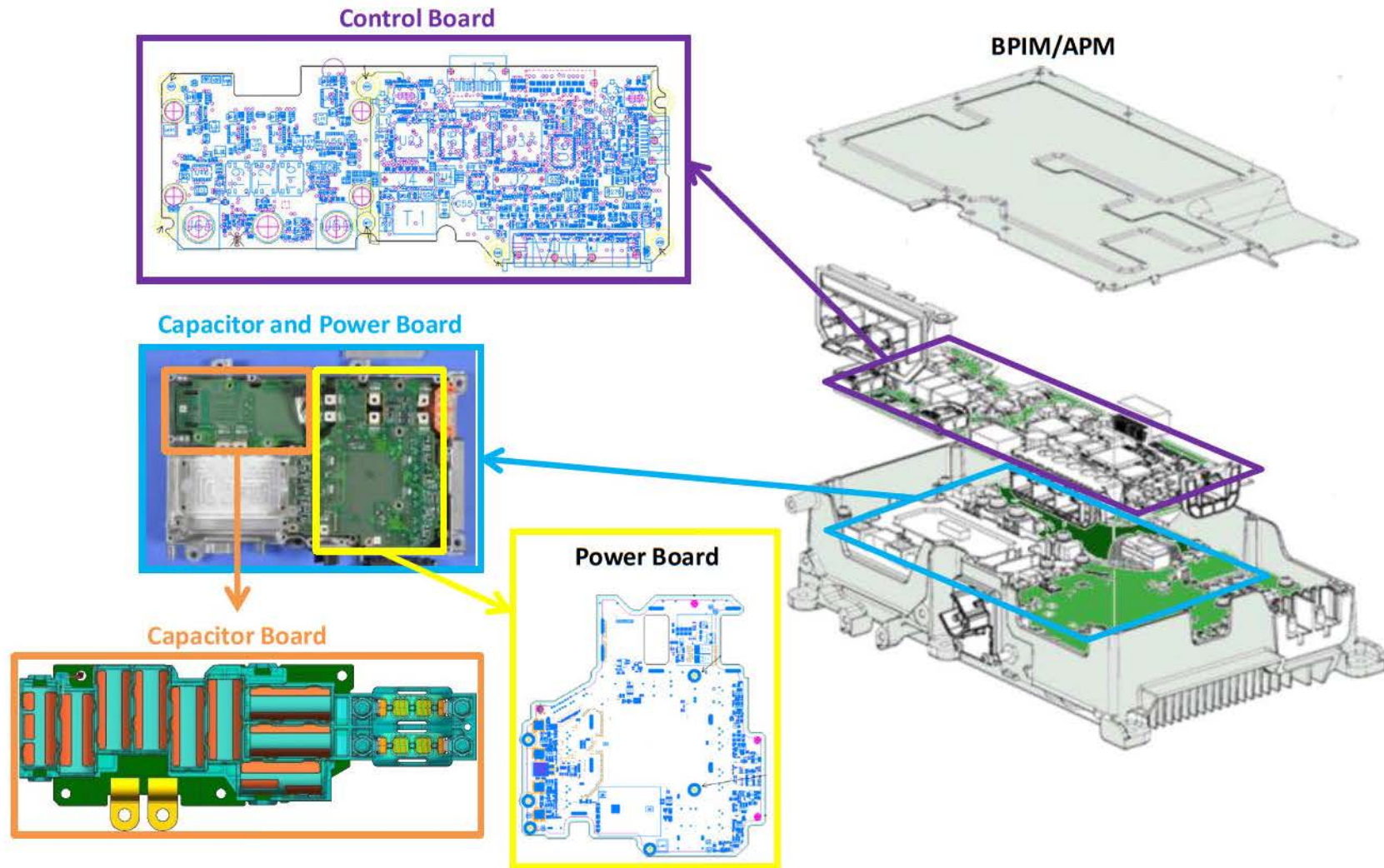
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eAssist BPIM/APM – External View



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eAssist: BPIM/APM Printed Circuit Boards



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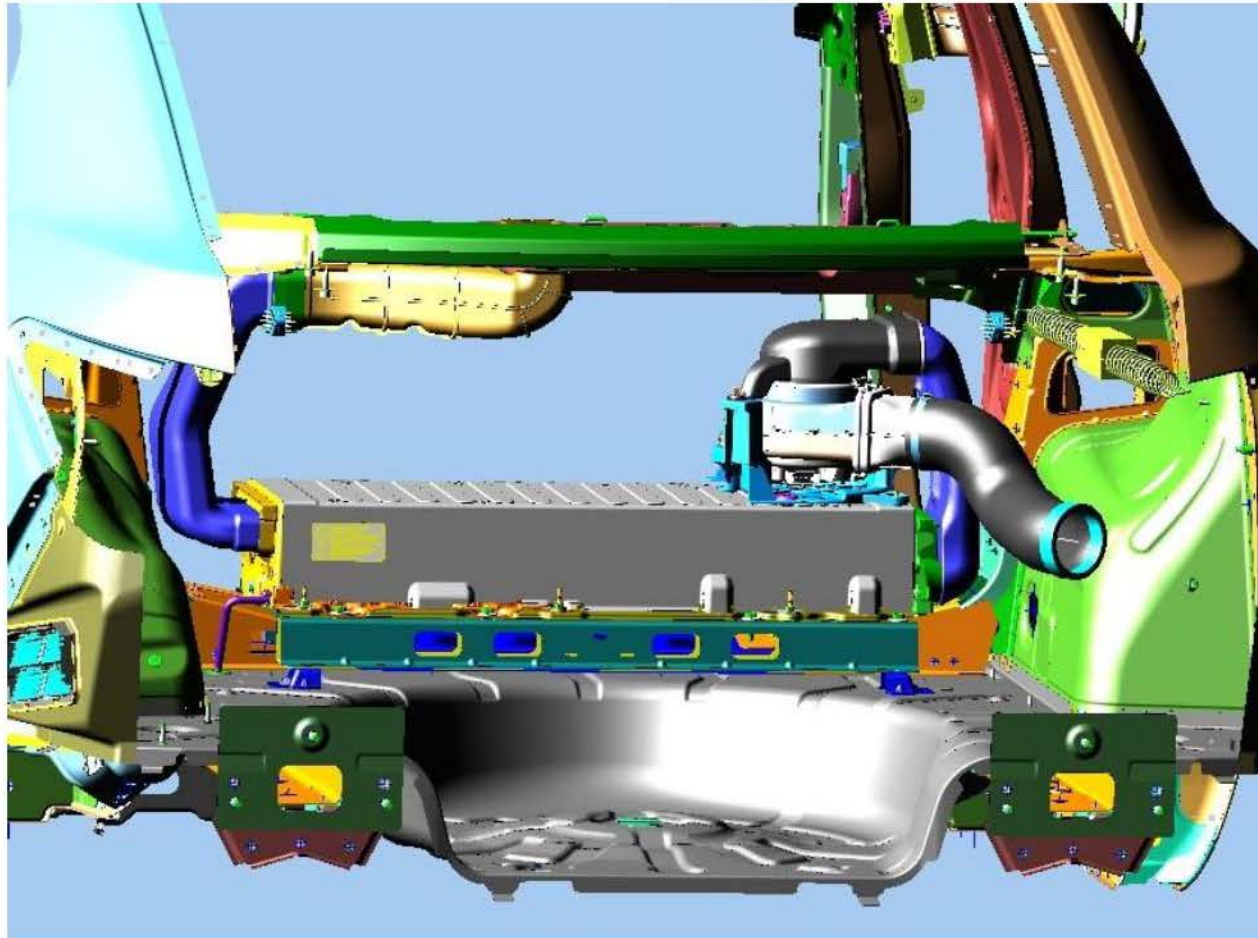








Vehicle Packaging (seen from rear of vehicle) eAssist Powerpack

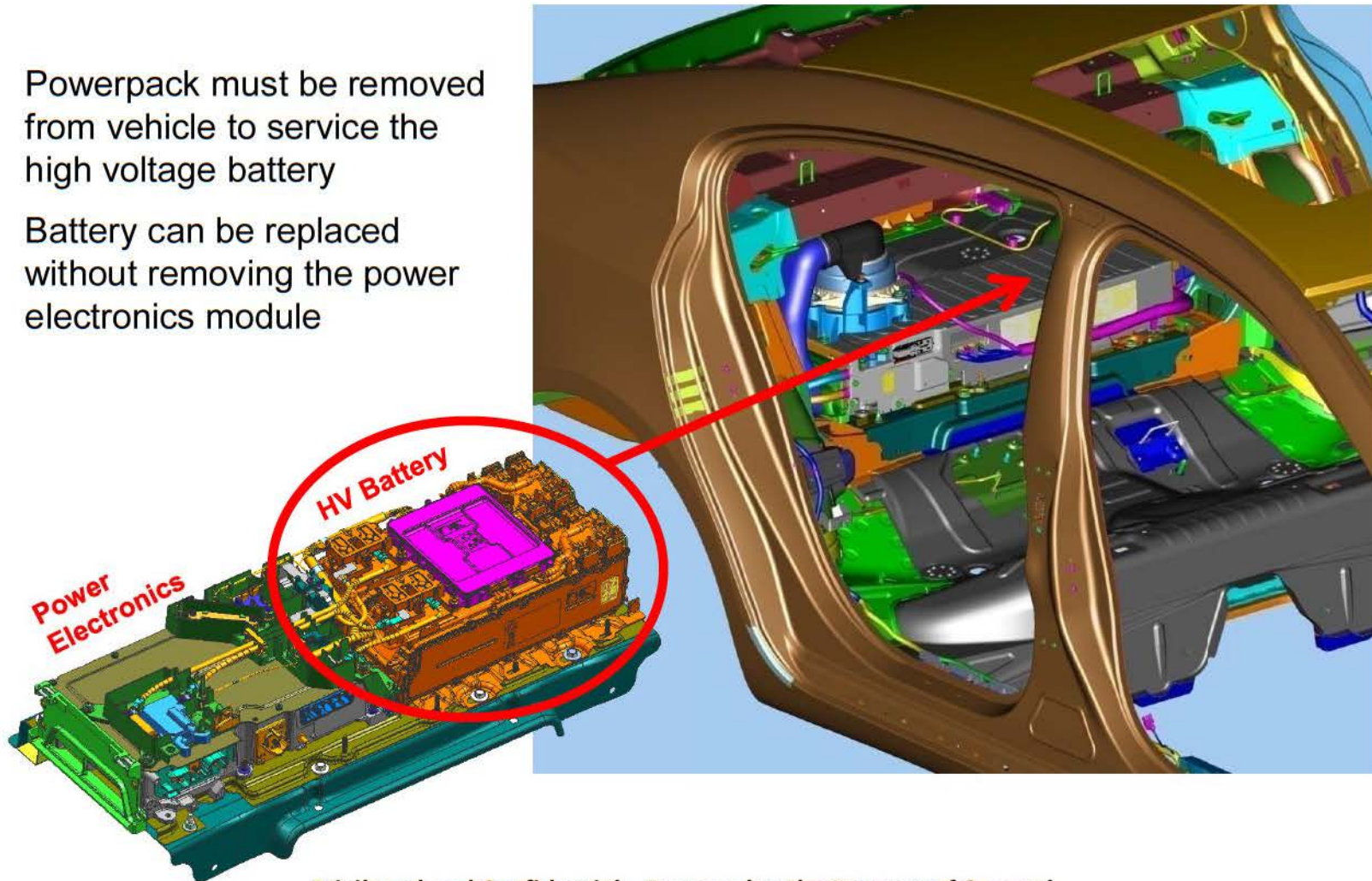


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Serviceability (seen from side of vehicle) eAssist Powerpack

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

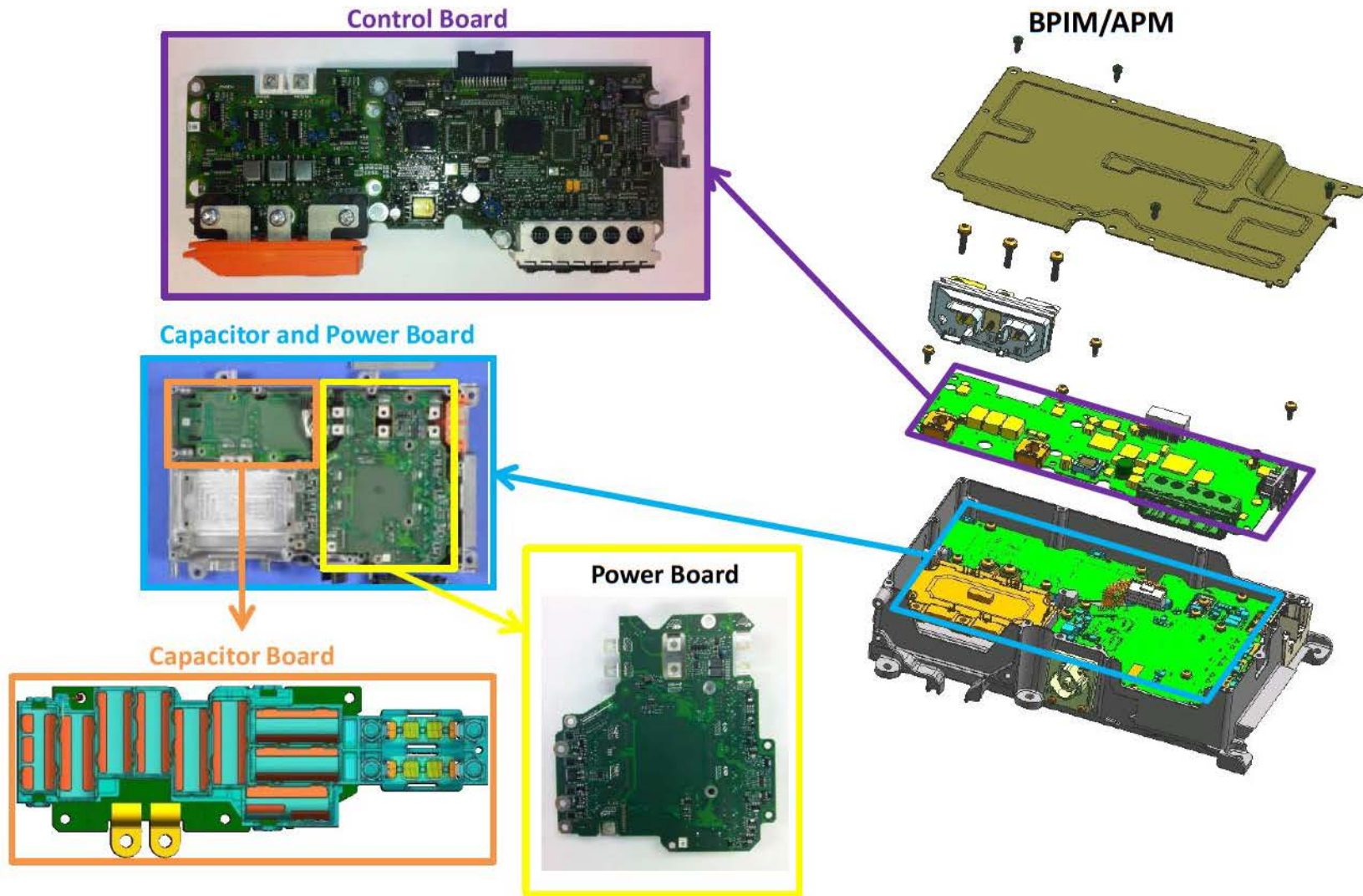
Battery can be replaced without removing the power electronics module



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eAssist: BPIM/APM Printed Circuit Boards



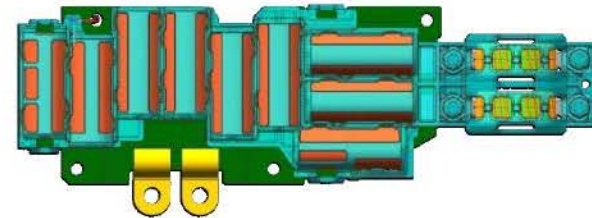
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eAssist: BPIM/APM Printed Circuit Boards

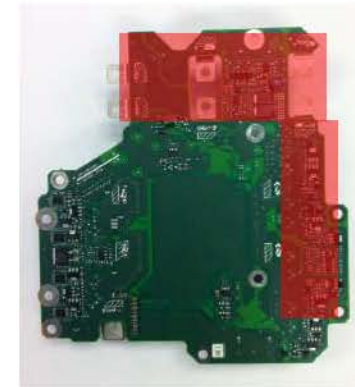
Capacitor Board

The Capacitor Board is the input of DC high voltage from the 130V Lithium Ion Energy Storage System (ESS) to the BPIM (BAS Power Inverter Module) / APM (Accessory Power Module). The Cap Board contains the input electrolytic bulk capacitors which provide the high voltage filtering to the system including the converter and the inverter. The Cap Board drives the IGBT power module (Insulated Gate Bipolar Transistor, which are high voltage switches for the inverter) and is designed for flowing large electrical currents (13kW), as it exclusively carries high voltage.



Power Board

The Power Board provides APM functionality that converts 130V, at low power, from the ESS into 14V power (1.6kW) available to service standard vehicle loads. The Power Board connects to the Cap Board to receive HV DC and manages, filters, and conducts the standard vehicle output power to the vehicle systems. Both high voltage and low voltage are present on the Power Board.

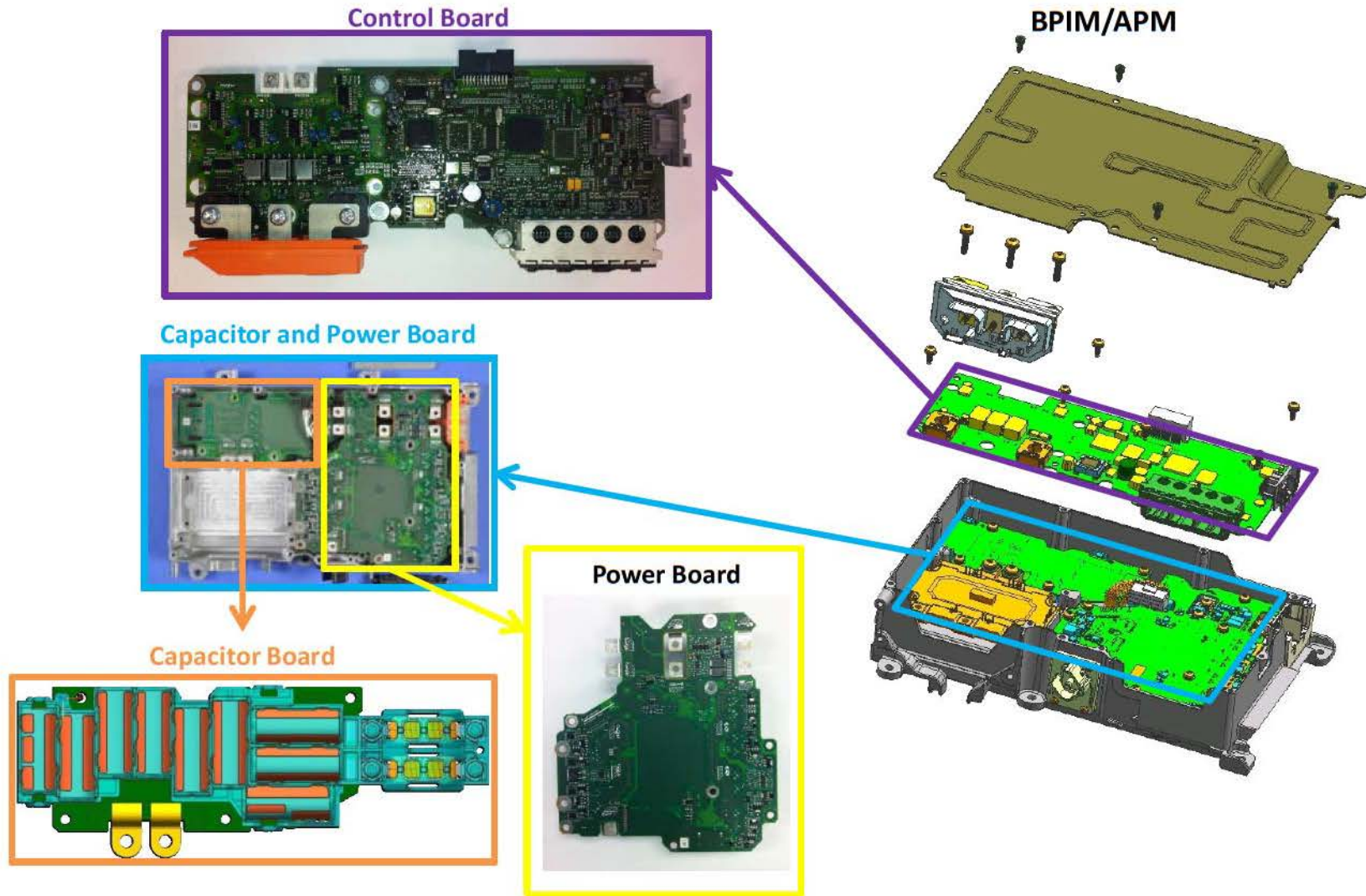


Control Board

The Control Board contains the two microprocessors which provide the control function of the APM and BPIM, including motor control. The Control Board communicates with the other vehicle modules and contains supporting circuitry for sensors, diagnostics, and 5V regulated power supply for the micros and control circuit. The inverter control, which drives the IGBT power module and MGU (Motor/Generator Unit), is also contained on the control board. High voltage is present but only at extremely low power levels.



eAssist: BPIM/APM Printed Circuit Boards



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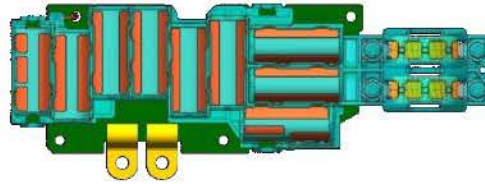
{ * } Indicates GM Confidential Business Information Redacted

eAssist: BPIM/APM PCB Failures

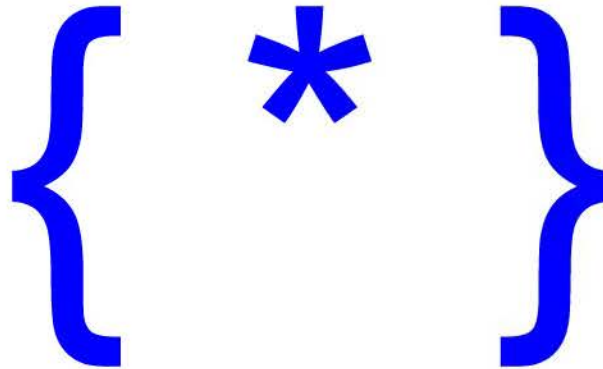
Power PCB



Capacitor PCB



Control PCB

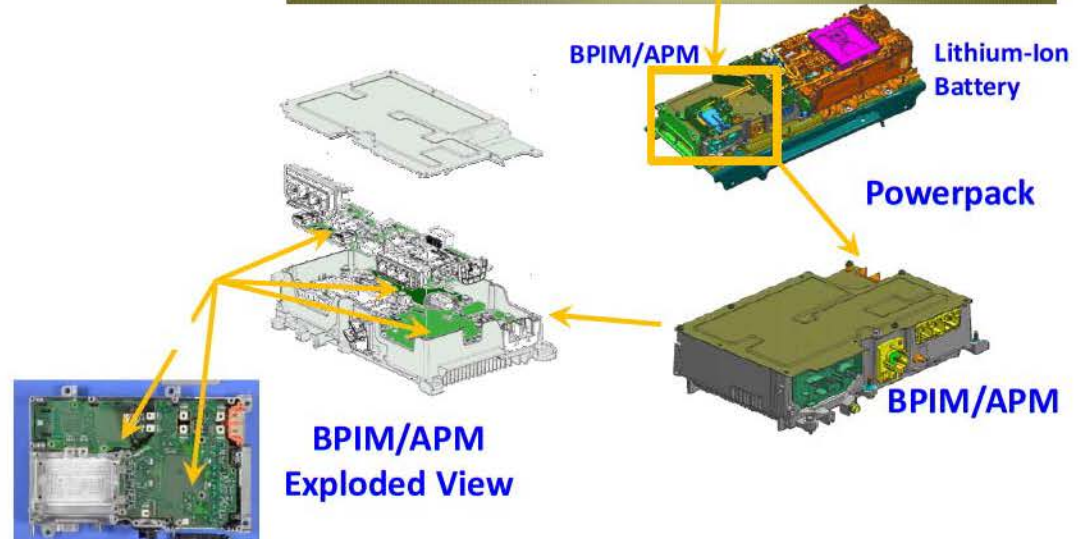
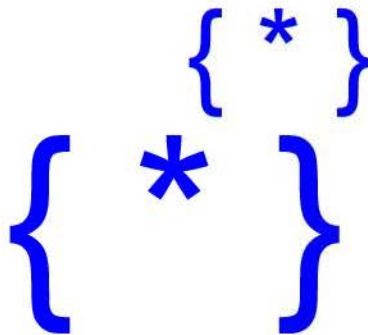


eAssist: BPIM/APM Circuit Board Failures

Technical Summary:

- All eAssist vehicles have a **Powerpack** which contains a **BAS Power Inverter Module (BPIM) / Accessory Power Module (APM)**.
- 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.

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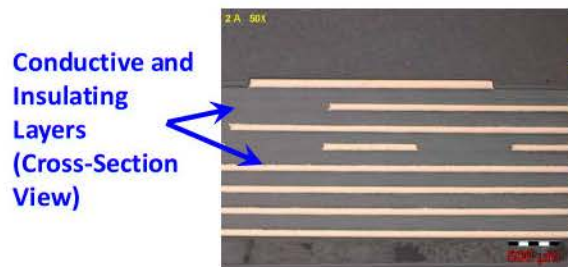
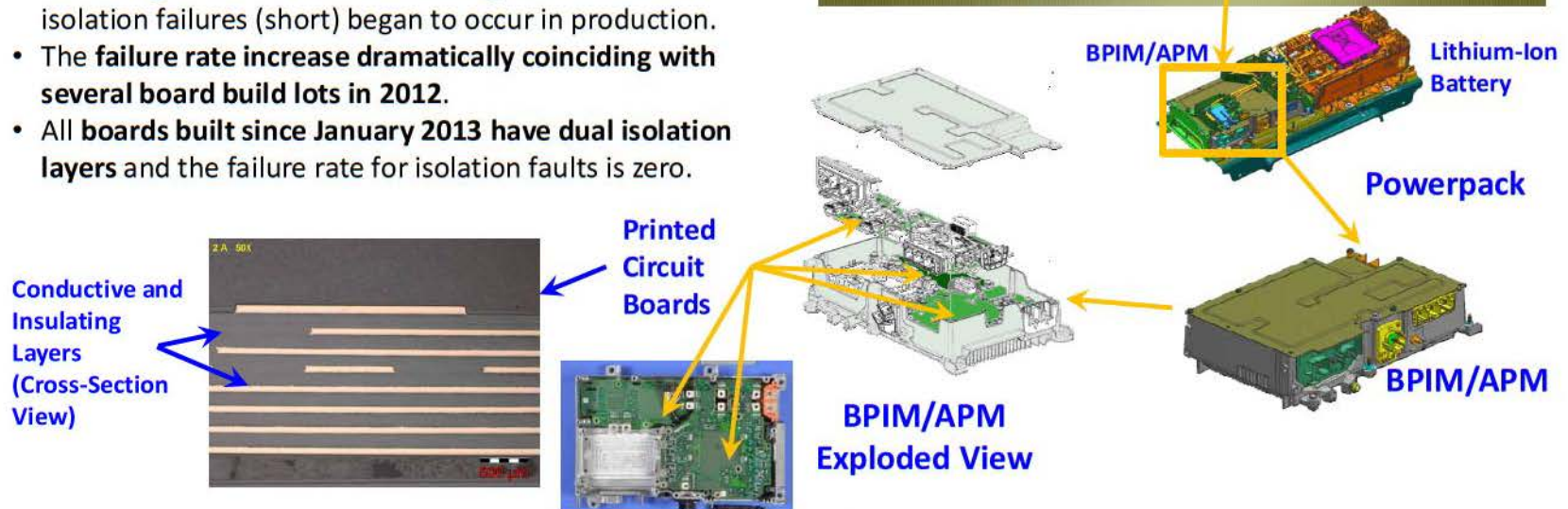




eAssist: BPIM/APM Circuit Board Failures

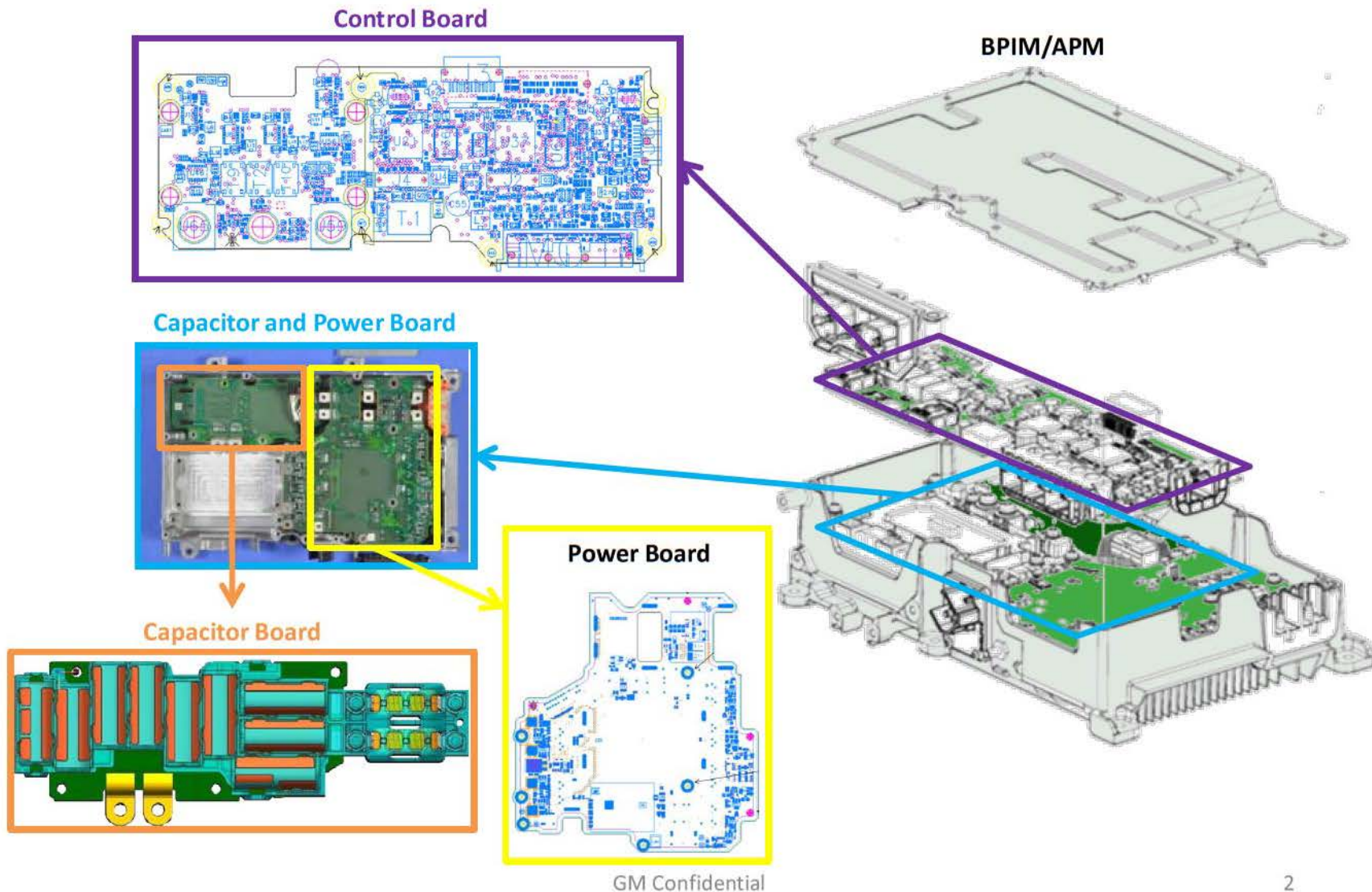
Technical Summary:

- All eAssist vehicles have a **Powerpack** which contains a **BAS Power Inverter Module (BPIM) / Accessory Power Module (APM)**.
- 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 is zero.



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eAssist: BPIM/APM Printed Circuit Boards



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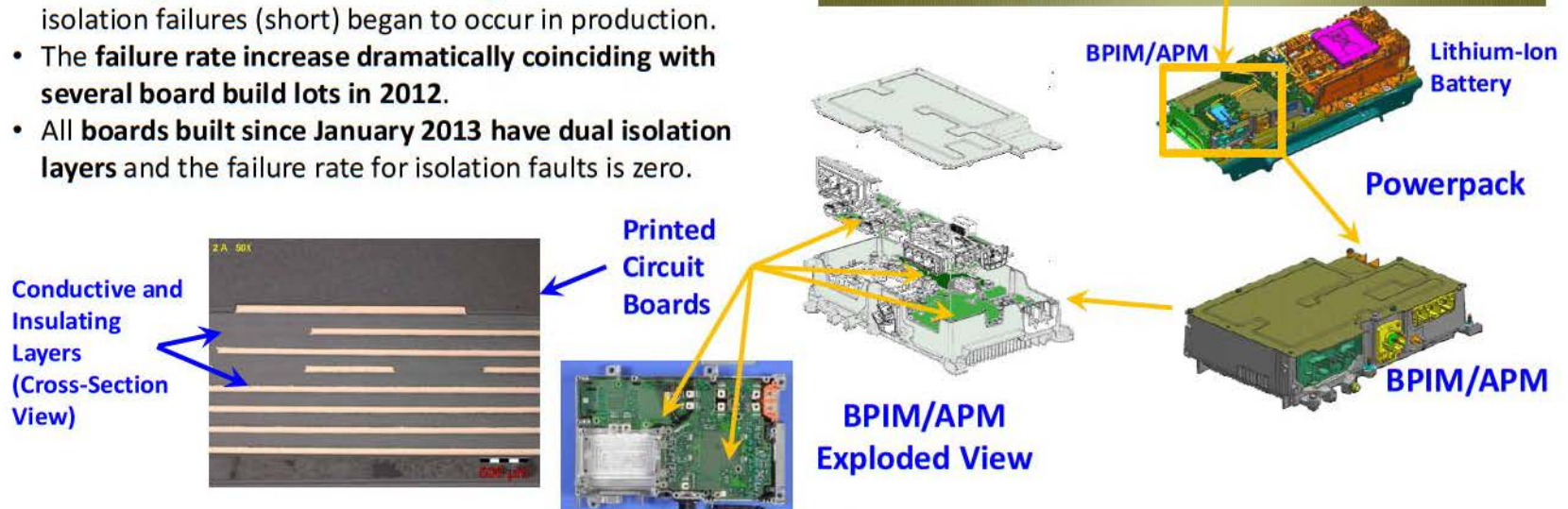
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eAssist: BPIM/APM Circuit Board Failures

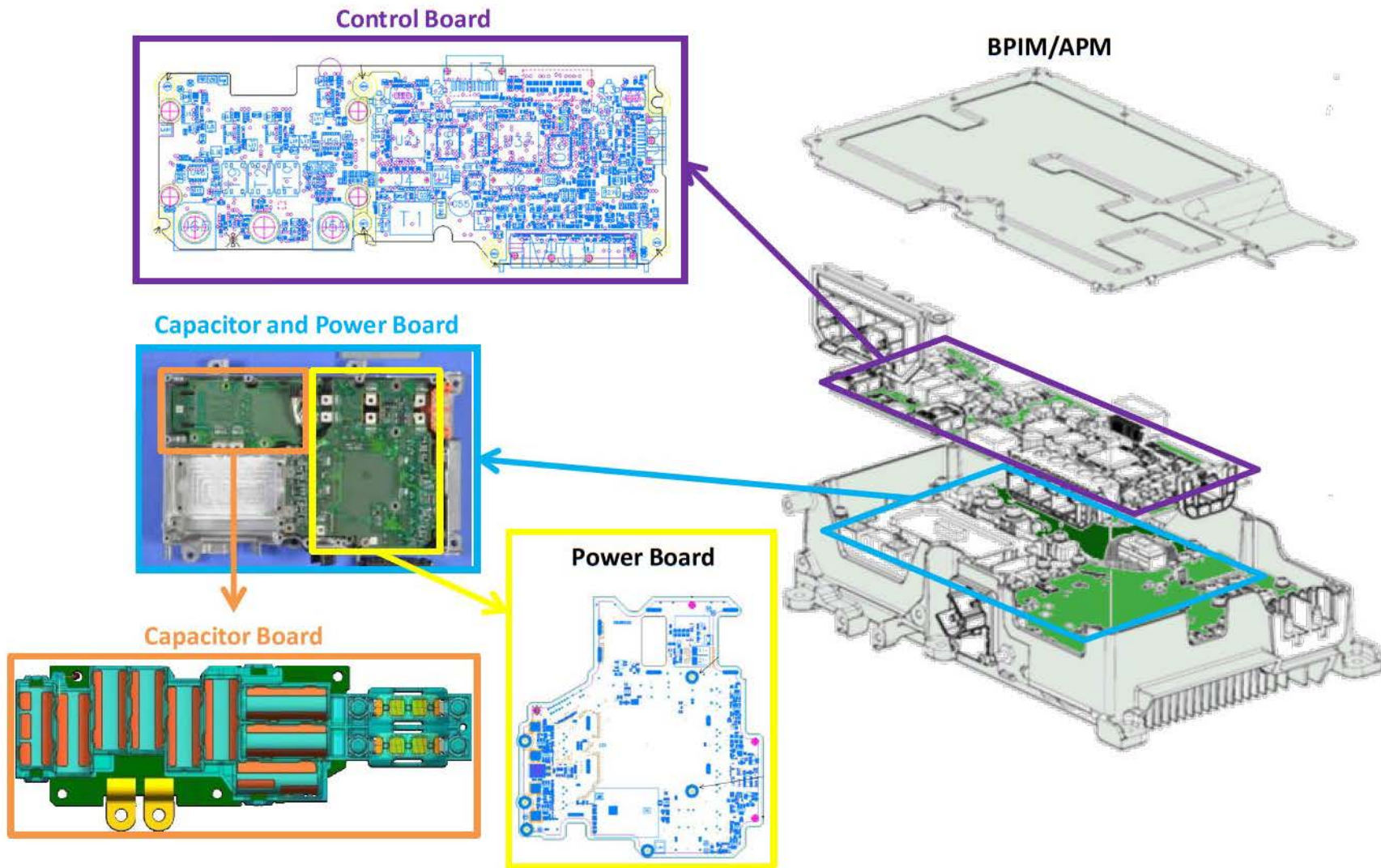
Technical Summary:

- All eAssist vehicles have a **Powerpack** which contains a **BAS Power Inverter Module (BPIM) / Accessory Power Module (APM)**.
- The BPIM/APM contains three multi-layered **Printed Circuit Boards (PCBs)** comprised of conductive layers separated by isolating layers.
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eAssist: BPIM/APM Printed Circuit Boards



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eAssist BPIM Field Action

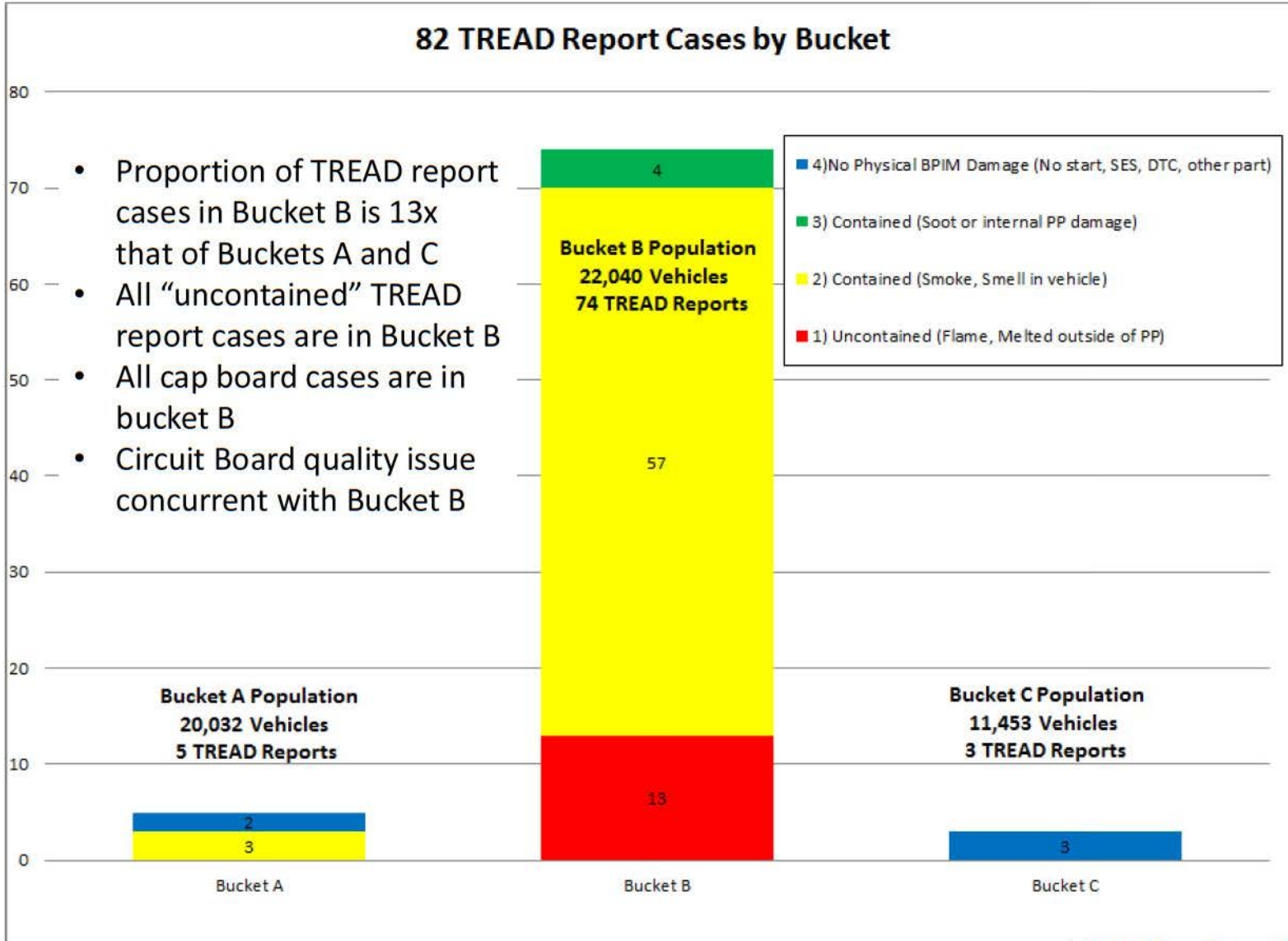
TREAD Report
Analysis by Build Bucket
&
Cap Board Isolation
Field Failure Rate Analysis

Prepared by Kevin Diviney
eAssist Global Program Quality Manager

May 6, 2013

GM Confidential

82 TREAD Report Cases by Bucket



- Proportion of TREAD report cases in Bucket B is 13x that of Buckets A and C
- All “uncontained” TREAD report cases are in Bucket B
- All cap board cases are in bucket B
- Circuit Board quality issue concurrent with Bucket B

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Analysis of All TREAD Reports in Bucket A

VIN	Warranty Claim for Screening	Warranty Claim for Repair	Severity of the Event (Vehicle and Circuit Board)	Warranty / TAC Case Information (Codes, etc)	Screening Assessment
1G11D5RR 5DF [REDACTED] In use 8/13/12 Bucket A	Open	8/13/12 (324 miles) Powerpack 156 Pwr Brd Iso	TREAD2 ; Boom noise and smoke from trunk, battery light on. GMCH: Medium damage to the power board (pic).	PEP Car Vehicle build date 2/23/12. 8/14/12 TAC (324 miles) U0293 U1817	Unscreened
1G11D5RR 3DF [REDACTED] Unsold Bucket A	1/7/13 (8 miles) 1 Screen \$ Pass	No part replaced	TREAD4 ; During 2 hr idle battery started to smoke, no codes set. Smoke described as very slight, less than a lit cigarette, tech mentioned it may have been condensation. Re-ran later and passed.	1/14/13 (8 miles) TAC case Low voltages prior to screen. Vehicle had to be jumped	Repaired at time of screen
1G11D5RR 6DF [REDACTED] Unsold Bucket A	12/21/12 (174 miles) 2 Screen \$ Failed	12/21/12 (174 miles) BPIM Replaced Part not requested (V2675)	TREAD2 ; During idle there was crackling noise in the rear and smoke in the car. Tech open PP and found soot only inside the pack	1/3/13 TAC (174 miles). Failed during screen.	Repaired at time of screen
1G4GA5ER 7CF [REDACTED] Unsold Bucket A	1/10/13 (8 miles) 1/18/13 (8 miles)	1/18/13 (8 miles) BPIM Replaced Part not Requested (V2675)	TREAD4 ; Warranty: End of test found smell of smoke, none found. Checked for burnt wiring and black burnt markings, none found. Re-ran test and passed.	1/11/12 TAC case (8 miles). Service Manager stated he saw smoke building in the cabin area. Posted comment on tech forum. TAC asked for GDM data, and to replace BPIM. .	Repaired at time of screen
2G4GR5ER 7C9 [REDACTED] Unsold Bucket A	2/1/13 (50 miles) 1 Screen \$ Complete	2/1/13 (50 miles) BPIM Replaced Part not Requested (N5875)	TREAD2 ; Warranty: smoke coming from GCM.	2/1/13 TAC case (50 miles). Heard a pop and had smoke. P062F (ECM). Vehicle build date 9/21/11.	Repaired at time of screen

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Analysis of All TREAD Reports in Bucket C

VIN In use date	Warranty Claim for Screening	Warranty Claim for Repair	Severity of the Event (Vehicle and Circuit Board)	Warranty / TAC Case Information (Codes, etc)	Screening Assessment
1G11D5SR 3DF [REDACTED] Unsold Bucket C	2/12/13 (5 miles) 1 Screen \$ Failed	2/12/13 (5 miles) Only battery fan replaced	TREAD4 ; Warranty: Hybrid battery pack fan melted. Replaced fan and re-ran test. Passed. TAC: no thermal damage found.	2/14/13 TAC case (5 miles) Tech claims that the Pack fan was replaced due to P0C32 as they were running the screen. There was no thermal damage to the harness or fan found. This contradicts the statement made of "melting" that was listed in the claim. Retest passed. Only the fan was replaced. Claim detail was inaccurate.	Repaired at time of screen
1G4GC5ER 1DF [REDACTED] In use date 2/14/13 Bucket C	11/16/12 (10 miles) 2 Screen \$ Fail	11/16/12 (10 miles) BPIM Replaced BPIM 582 NTF P1A6F	TREAD4 ; SES P1A6F during test. Harness for BPIM had melted and needed replacement. GMCH: No visible damage to the BPIM or PCBs.	12/3/12 TAC case (36 miles) SES P1A6F, grey harness that plugs into the GCM was brittle, will replace. The internal harness connector X4 that connects the SGCM was brittle, discolored and had a broken lock tab so they needed to replace the connector. The BECM wiring harness seemed to be thermally stressed at the eyelet connection. When informed that there is a shrink wrap seal at that connection he said it was melted but he may have been mistaken. No pictures available. The fuse block was replaced as well for an open fuse.	Repaired at time of screen
1G4GC5ER 5DF [REDACTED] 3/29/13 Bucket C	1/18/13 (9 miles) 2 Screen \$ Failed	1/18/13 (9 miles) BPIM 589 NTF P1A6F	TREAD4 ; Warranty: Smoking/ hot smell from pack during screen. TAC: pack started smoking and there was an odor from the trunk. The windows needed to be opened to clear smoke from the cabin. GMCH: No visible damage to the BPIM or PCBs. (pic)	1/29/13 TAC case (9 miles) smoking and hot smell from battery pack during screen. P1A6F present and repeated. QIS2 shows the following DTCs read on 2/4/13: P0A1B U0293 U1817 U1844 U1845 U1831 on the same date. The tech does not remember seeing any of these DTCs prior to making the repair. He is familiar with the normal odor that may occur when performing 12238 and considered what he saw to be excessive. These DTCs may have been induced during the repair but we are not sure.	Repaired at time of screen

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eAssist BPIM Cap Board Isolation Field Failure Rate Analysis

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Analysis of Confirmed Cap Iso. Failures –Bucket B

VIN In Use Date	Warranty Claim for Screening	Warranty Claim for Repair	Severity of the Event (Vehicle and Circuit Board)	Warranty / TAC Case Information (Codes..)	Assessment
1G11D5RR9D F [REDACTED] Unsold Bkt B	10/24/12 (5 miles) 1 Screen \$ Completed	11/5/12 (5 miles) PP Replaced PP361 Cap Brd Iso	Buy back for damage, smell and soot (Spitzer). GMCH: Cap board severely damaged (pic)	Failed during screen, popping noise and smoke.	Repaired at time of screen
1G11F5RR3D F1 [REDACTED] Unsold Bkt B	11/15/12 (5 miles) 2 Screen \$ Complete	11/27/12 (5 miles) PP Replaced PP425 Cap Brd Iso	Warranty: Vehicle caught fire, replace burnt harnesses and rear trim (McMurray) GMCH: Cap board severely damaged (pic)	PEP car failed during screen	Repaired at time of screen
1G11D5RR7D F [REDACTED] 2/28/13 Bkt B	12/6/12 (25 miles) 2 Screen \$ Complete	12/13/12 (31 miles) PP Replaced PP437 Cap Brd Iso	Noise, smoke, and soot, during screening (York) GMCH: Cap board severely damaged (pic)	12/6/12 TAC U0293 U1817	Repaired at time of screen
1G11F5RR0D F [REDACTED] Unsold Bucket B	10/22/12 (3 miles) 1 Screen \$ Failed	None PP322 Cap Brd Iso	Removed from dealer inventory. Thermal event in battery pack overheat & caught fire (Moran) Cap board severely damaged (pic)	Caught during the screen. Vehicle was scrapped	Repaired at time of screen
1G11F5RR8D F [REDACTED] Unsold Bucket B	10/22/12 (91 miles) 1 Screen \$ Failed	10/22/12 (91 miles) PP Replaced PP365 Cap Brd Iso	Burn dust all over battery module and asm. GMCH: Cap board severely damaged (pic)	P1AF4 P1B0B	Repaired at time of screen
2G4GS5ER8C 9 [REDACTED] Unsold Bucket B	11/1/12 (426 miles) 1 Screen \$ Failed	None PP405 Cap Brd Iso	Smell smoke during screening. Removed cover. Soot and odor inside pack. GMCH: Cap board severely damaged (pic)	11/1/12 TAC @ 426 miles	Repaired at time of screen
1G11D5RRXD [REDACTED] 11/9/12 Bkt B	12/18/12 (946 miles) 1 Screen \$	Buy back Cap Brd Iso No PP# yet	Extensive damage to the interior and trunk compartment of the vehicle	(South Carolina)	Failed after the screen
1G4GC5EROC F [REDACTED] 7/21/12 Bkt B	Not part of sub Vehicle Bld 5/30/12	7/23/12 (175 miles) BPIM Replaced BPIM279 Cap Brd Iso	SES. GMCH: Cap board minor damage (pic)	P1B0B P1AF0	Not Included in Service Update

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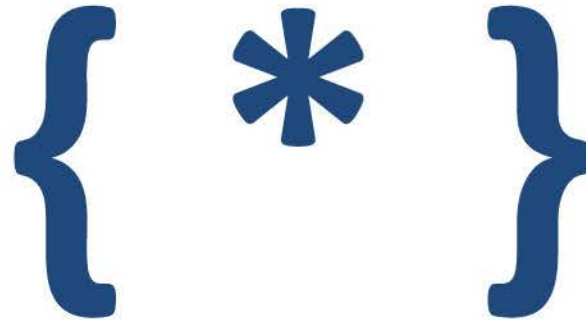
Back Up











eAssist BPIM Field Action

TREAD Report Analysis by Build Bucket & Cap Board Isolation Field Failure Rate Analysis

Prepared by Kevin Diviney
eAssist Global Program Quality Manager

May 6, 2013

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Analysis of All TREAD Reports in Bucket A

VIN	Warranty Claim for Screening	Warranty Claim for Repair	Severity of the Event (Vehicle and Circuit Board)	Warranty / TAC Case Information (Codes, etc)	Screening Assessment
1G11D5RR 5DF [REDACTED] In use 8/13/12 Bucket A	Open	8/13/12 (324 miles) Powerpack 156 Pwr Brd Iso	TREAD2 ; Boom noise and smoke from trunk, battery light on. GMCH: Medium damage to the power board (pic).	PEP Car Vehicle build date 2/23/12. 8/14/12 TAC (324 miles) U0293 U1817	Unscreened
1G11D5RR 3DF1 [REDACTED] Unsold Bucket A	1/7/13 (8 miles) 1 Screen \$ Pass	No part replaced	TREAD4 ; During 2 hr idle battery started to smoke, no codes set. Smoke described as very slight, less than a lit cigarette, tech mentioned it may have been condensation. Re-ran later and passed.	1/14/13 (8 miles) TAC case Low voltages prior to screen. Vehicle had to be jumped	Repaired at time of screen
1G11D5RR 6DF [REDACTED] Unsold Bucket A	12/21/12 (174 miles) 2 Screen \$ Failed	12/21/12 (174 miles) BPIM Replaced Part not requested (V2675)	TREAD2 ; During idle there was crackling noise in the rear and smoke in the car. Tech open PP and found soot only inside the pack	1/3/13 TAC (174 miles). Failed during screen.	Repaired at time of screen
1G4GA5ER 7CF [REDACTED] Unsold Bucket A	1/10/13 (8 miles) 1/18/13 (8 miles)	1/18/13 (8 miles) BPIM Replaced Part not Requested (V2675)	TREAD4 ; Warranty: End of test found smell of smoke, none found. Checked for burnt wiring and black burnt markings, none found. Re-ran test and passed.	1/11/12 TAC case (8 miles). Service Manager stated he saw smoke building in the cabin area. Posted comment on tech forum. TAC asked for GDM data, and to replace BPIM. .	Repaired at time of screen
2G4GR5ER 7C9 [REDACTED] Unsold Bucket A	2/1/13 (50 miles) 1 Screen \$ Complete	2/1/13 (50 miles) BPIM Replaced Part not Requested (N5875)	TREAD2 ; Warranty: smoke coming from GCM.	2/1/13 TAC case (50 miles). Heard a pop and had smoke. P062F (ECM). Vehicle build date 9/21/11.	Repaired at time of screen

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Analysis of All TREAD Reports in Bucket C

VIN In use date	Warranty Claim for Screening	Warranty Claim for Repair	Severity of the Event (Vehicle and Circuit Board)	Warranty / TAC Case Information (Codes, etc)	Screening Assessment
1G11D5SR 3DF2 [REDACTED] Unsold Bucket C	2/12/13 (5 miles) 1 Screen \$ Failed	2/12/13 (5 miles) Only battery fan replaced	TREAD4 ; Warranty: Hybrid battery pack fan melted. Replaced fan and re-ran test. Passed. TAC: no thermal damage found.	2/14/13 TAC case (5 miles) Tech claims that the Pack fan was replaced due to POC32 as they were running the screen. There was no thermal damage to the harness or fan found. This contradicts the statement made of "melting" that was listed in the claim. Retest passed. Only the fan was replaced. Claim detail was inaccurate.	Repaired at time of screen
1G4GC5ER 1DF [REDACTED] In use date 2/14/13 Bucket C	11/16/12 (10 miles) 2 Screen \$ Fail	11/16/12 (10 miles) BPIM Replaced BPIM 582 NTF P1A6F	TREAD4 ; SES P1A6F during test. Harness for BPIM had melted and needed replacement. GMCH: No visible damage to the BPIM or PCBs.	12/3/12 TAC case (36 miles) SES P1A6F, grey harness that plugs into the GCM was brittle, will replace. The internal harness connector X4 that connects the SGCM was brittle, discolored and had a broken lock tab so they needed to replace the connector. The BECM wiring harness seemed to be thermally stressed at the eyelet connection. When informed that there is a shrink wrap seal at that connection he said it was melted but he may have been mistaken. No pictures available. The fuse block was replaced as well for an open fuse.	Repaired at time of screen
1G4GC5ER 5DF [REDACTED] 3/29/13 Bucket C	1/18/13 (9 miles) 2 Screen \$ Failed	1/18/13 (9 miles) BPIM 589 NTF P1A6F	TREAD4 ; Warranty: Smoking/ hot smell from pack during screen. TAC: pack started smoking and there was an odor from the trunk. The windows needed to be opened to clear smoke from the cabin. GMCH: No visible damage to the BPIM or PCBs. (pic)	1/29/13 TAC case (9 miles) smoking and hot smell from battery pack during screen. P1A6F present and repeated. QIS2 shows the following DTCs read on 2/4/13: P0A1B U0293 U1817 U1844 U1845 U1831 on the same date. The tech does not remember seeing any of these DTCs prior to making the repair. He is familiar with the normal odor that may occur when performing 12238 and considered what he saw to be excessive. These DTCs may have been induced during the repair but we are not sure.	Repaired at time of screen

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eAssist BPIM Cap Board Isolation Field Failure Rate Analysis

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What do we know about Cap board isolation failures in the field?

- Only bucket B has failures in the field (8 of 22,040 vehicles)
- Bucket A has 20,032 vehicles without a cap board isolation failure. This population has been in the field longer than Bucket B.
- Bucket C has 11,453 vehicles without a cap board isolation failure.
- 6 of 8 caught during screening by the dealer (customer incidents @ 175 and 946 miles)
- 1 of 8 failed after screening (customer incident @ 946 miles)
- 7 of 8 have severely damaged cap boards
- 1 of 8 has minor damage to the cap board (customer incident @ 175 miles)

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Analysis of Confirmed Cap Iso. Failures –Bucket B

VIN In Use Date	Warranty Claim for Screening	Warranty Claim for Repair	Severity of the Event (Vehicle and Circuit Board)	Warranty / TAC Case Information (Codes..)	Assessment
1G11D5RR9D F [REDACTED] Unsold Bkt B	10/24/12 (5 miles) 1 Screen \$ Completed	11/5/12 (5 miles) PP Replaced PP361 Cap Brd Iso	Buy back for damage, smell and soot (Spitzer). GMCH: Cap board severely damaged (pic)	Failed during screen, popping noise and smoke.	Repaired at time of screen
1G11F5RR3D F [REDACTED] Unsold Bkt B	11/15/12 (5 miles) 2 Screen \$ Complete	11/27/12 (5 miles) PP Replaced PP425 Cap Brd Iso	Warranty: Vehicle caught fire, replace burnt harnesses and rear trim (McMurray) GMCH: Cap board severely damaged (pic)	PEP car failed during screen	Repaired at time of screen
1G11D5RR7D F [REDACTED] 2/28/13 Bkt B	12/6/12 (25 miles) 2 Screen \$ Complete	12/13/12 (31 miles) PP Replaced PP437 Cap Brd Iso	Noise, smoke, and soot, during screening (York) GMCH: Cap board severely damaged (pic)	12/6/12 TAC U0293 U1817	Repaired at time of screen
1G11F5RR0D F [REDACTED] Unsold Bucket B	10/22/12 (3 miles) 1 Screen \$ Failed	None PP322 Cap Brd Iso	Removed from dealer inventory. Thermal event in battery pack overheat & caught fire (Moran) Cap board severely damaged (pic)	Caught during the screen. Vehicle was scrapped	Repaired at time of screen
1G11F5RR8D F [REDACTED] Unsold Bucket B	10/22/12 (91 miles) 1 Screen \$ Failed	10/22/12 (91 miles) PP Replaced PP365 Cap Brd Iso	Burn dust all over battery module and asm. GMCH: Cap board severely damaged (pic)	P1AF4 P1B0B	Repaired at time of screen
2G4GSSER8C 9 [REDACTED] Unsold Bucket B	11/1/12 (426 miles) 1 Screen \$ Failed	None PP405 Cap Brd Iso	Smell smoke during screening. Removed cover. Soot and odor inside pack. GMCH: Cap board severely damaged (pic)	11/1/12 TAC @ 426 miles	Repaired at time of screen
1G11D5RRXD F [REDACTED] 11/9/12 Bkt B	12/18/12 (946 miles) 1 Screen \$	Buy back Cap Brd Iso No PP# yet	Extensive damage to the interior and trunk compartment of the vehicle	(South Carolina)	Failed after the screen
1G4GC5ER0C F [REDACTED] 7/21/12 Bkt B	Not part of sub Vehicle Bld 5/30/12	7/23/12 (175 miles) BPIM Replaced BPIM279 Cap Brd Iso	SES. GMCH: Cap board minor damage (pic)	P1B0B P1AF0	Not Included in Service Update

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{ * }

Back Up















Bucket D Information

- As of 5/13/13 there have been:
- 5796 Bucket D vehicles produced in North America
- 2230 of these have been sold
- 2 of these have had BPIMs replaced in the field.
- Both have been tested by GMCH and determined to be NTF (no trouble found)
- Both are unrelated to the isolation issue.

{ ** } Indicates Cost Information Redacted

Chevrolet Malibu Eco, Buick Regal eAssist, Buick LaCrosse - eAssist System



17,386 Vehicles

Cost Estimate: { ** }

N-12xxxx

Condition:

Certain 2012-2013 model year vehicles with the eAssist system were built with a Battery Power Inverter Module (BPIM)¹ that may not function properly.

Suspect Population:

Suspect VIN list is based on BPIM build dates of two suspect lots, BPIM PCM is not directly traceable to VIN. There are 10,741 PCBs in the two suspect lots.

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. Evidence of thermal events within the metal-encased BPIM have also been observed in field returned parts.

Technical Root Cause:

Shorting between layers of the multi-layer circuit board. Shorting of a toroidal inductor winding to a PCB.

Responsibility: Supplier (GMCH)

Frequency: 23.3 IPTV @ 90 days

Potential Field Action Category: Recall / Service Update (unsold only)

¹ – Known as Generator Control Module in Service Parts List

Chevrolet Malibu Eco, Buick Regal eAssist, Buick LaCrosse - eAssist System

Potential Field Remedy:

Replace Generator Control Module with service part of same part number with Julian date code > 2180 (June 28, 2012).

Discovery:

The issue was discovered from analysis of warranty parts returned.

Current Status:

Design change in the BPIM has been implemented, first vehicle builds on Aug 14. Vehicle screening test being developed for possible use on assembly plant held vehicles and unsold dealer stock.

Immediate Improvement /Containment:

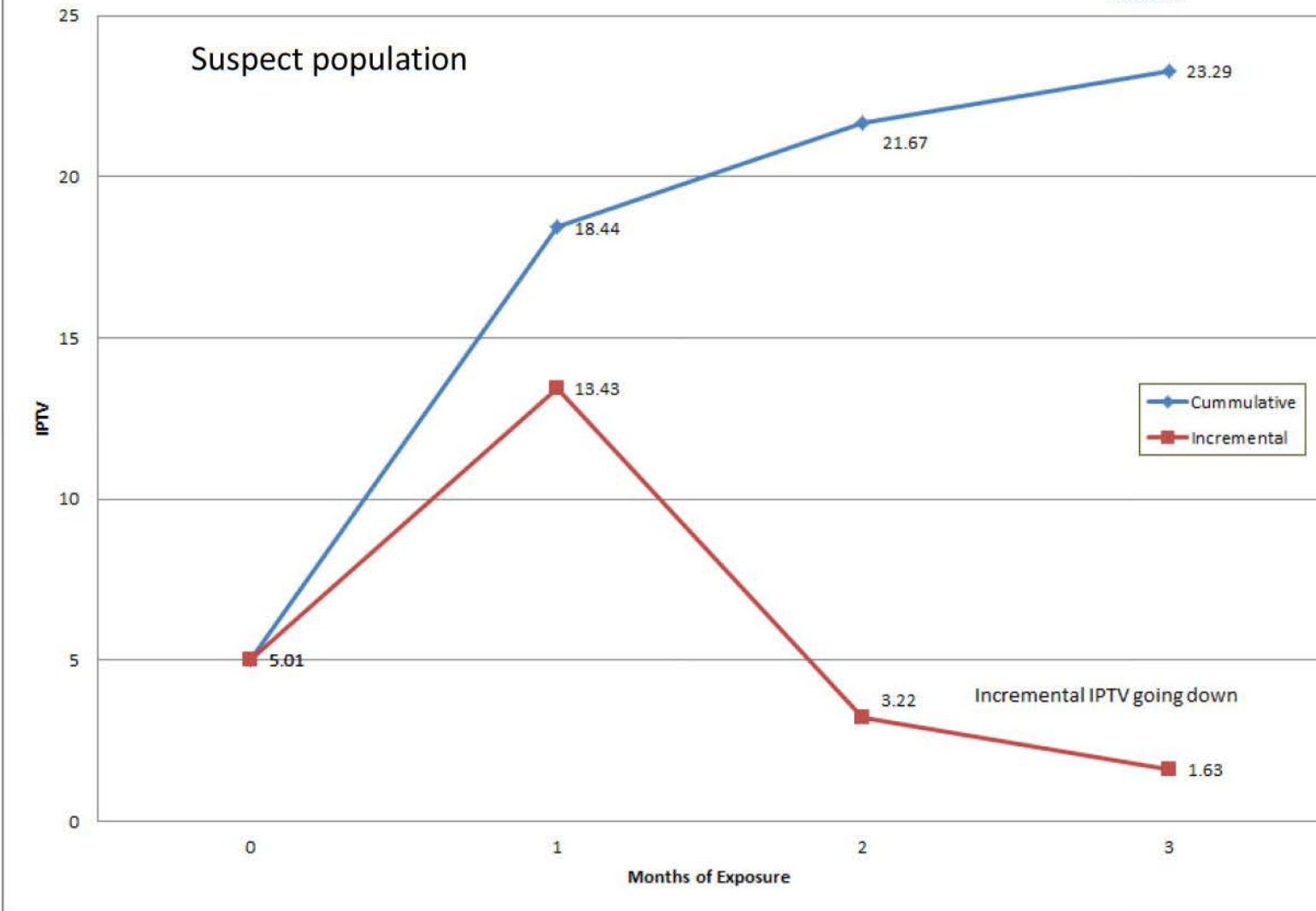
Upon discovery of the issue, a build stop order was issued. TWO/EWOs were developed to revised the BPIM design by adding an additional pre-preg layer between copper layers 1L, 2L and 7L,8L. Supplier sorting of toroid inductors implemented with go/no-go gage.

Systemic Root Cause:

TBD

2012/2013 Select Lacrosse, Malibu, Regal

N5875
N5866



Warranty Comment Summary

N5875 - Generator Control Module Replacement

N5866 - Generator Control and Battery Module Replacement and Shipping Preparation

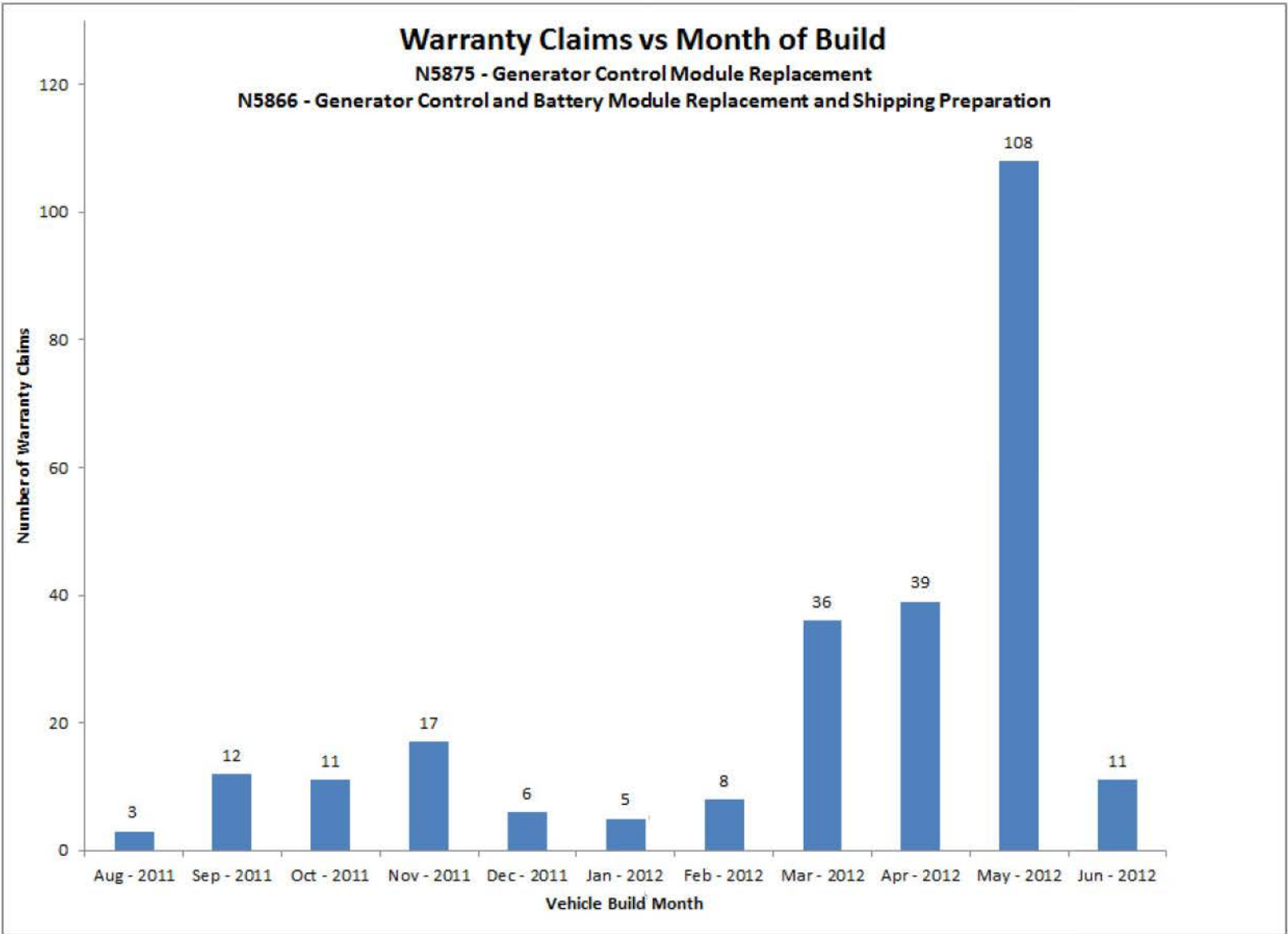
Warning Light or Message	STALL/NO START									
	LaCrosse			Regal			Malibu			Total
	Yes	No	Total	Yes	No	Total	Yes	No	Total	
Yes	10	71	81	3	13	16	8	93	101	198
No	26	2	28	2	0	2	16	12	28	58
Total	36	73	109	5	13	18	24	105	129	256
% Stall/No Start	33%			28%			19%			25%

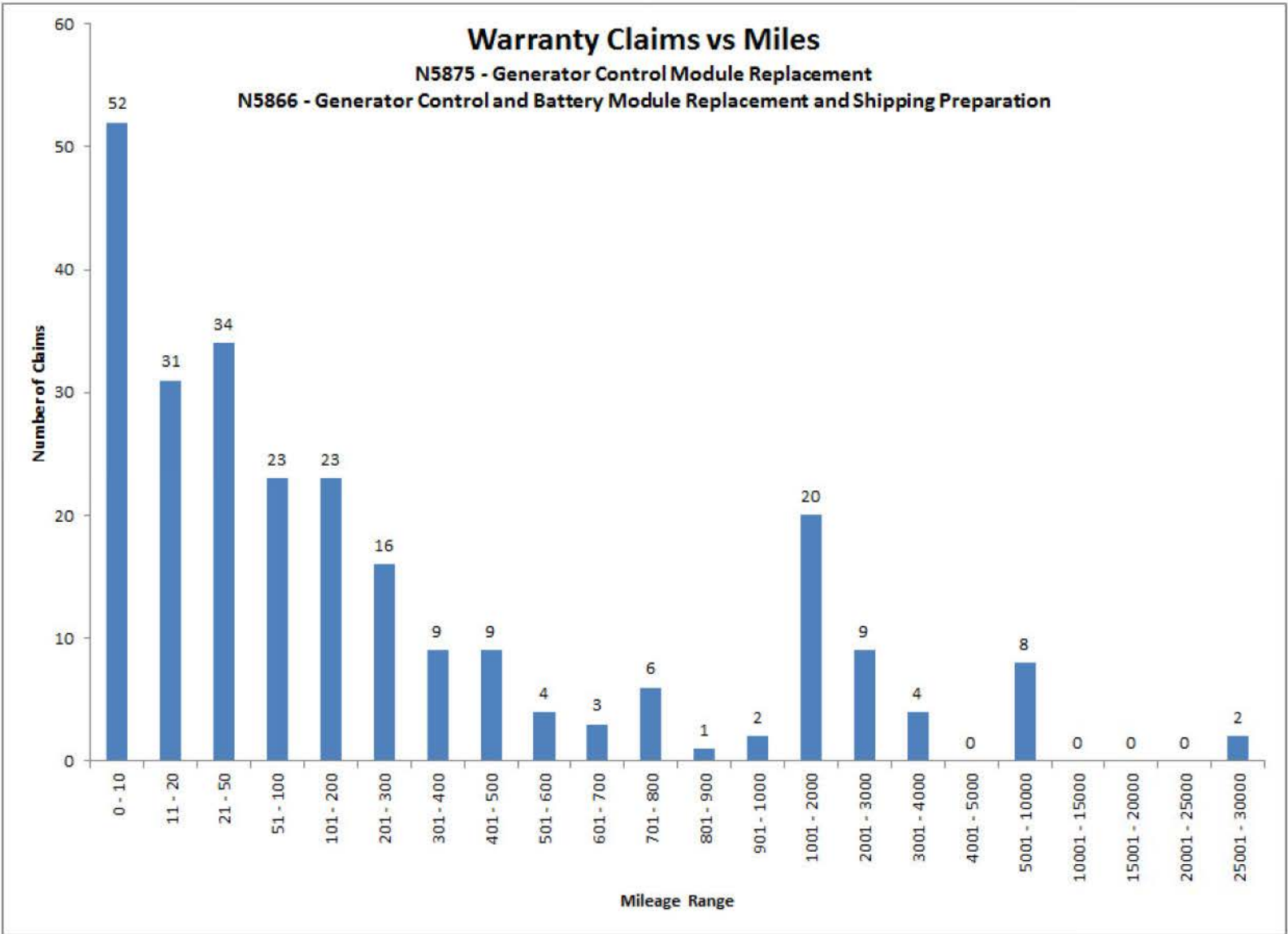
Notes: Eight customers report a noise prior to failure, and three report a burning smell.

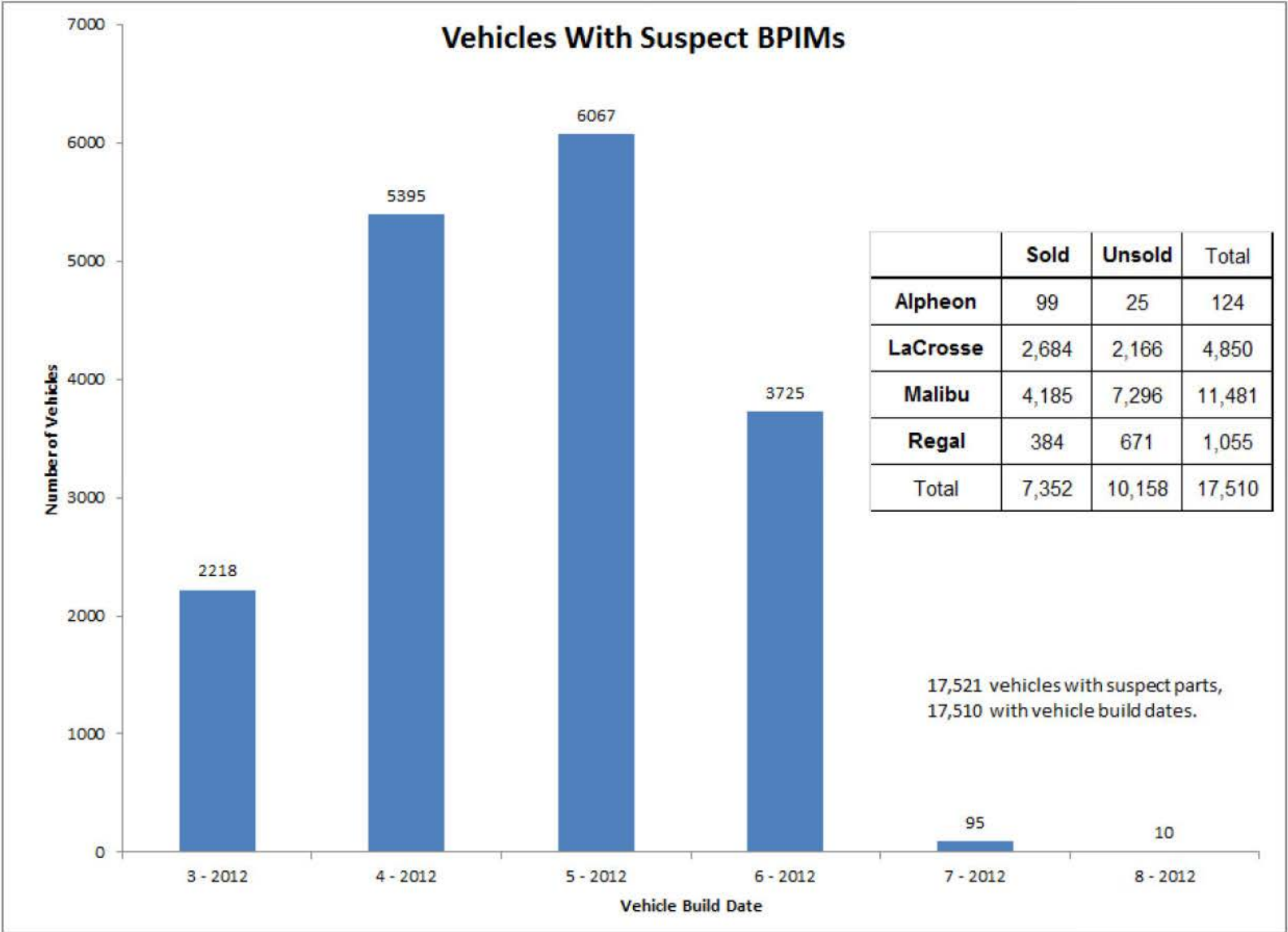
Notes: Stall counts based on comments or towing claims.

Notes: Data as of Aug 14, 2012

Warranty Comment Summary.xlsx









NHTSA Campaign No.	Model Years	Models	Description	Warning	Rate (IPTV)	Field Action
N120032	2012	LaCrosse	Loss of 12v power generation due to separation of serpentine belt	Yes	489 – 929 @ 1 Yr	Customer Sat
N120013	2012	LaCrosse, Regal	Loss of 12v power generation due to short to ground in BAS Power Inverter Module (BPIM)	Yes	111	Service Update
09V155000	2010	Camaro	Battery cable short, stall	No	43	Safety Recall
09V154000	2009	Canyon, Colorado, Escalade EXT, Yukon XL, Avalanche, Suburban, Escalade ESV, Yukon, Tahoe, Escalade	Fuel MRA, stall	Maybe	40.1 @ 3 yr	Safety Recall
N100054		GMT 360	GMT360 Fuel Level Sensor, High rate, much warning, high repair rate, NHTSA agree non-safety	Yes	12.4 @ 3 yr	NHTSA agree - non-safety Special Coverage
N-090102	2008-9	C/K Hybrid	Battery may read incorrect SOC. Potential engine shutdown with restart	Yes	8 @ 14 MIS	Emission Recall
N100316	2010-2011	Regal/LaCrosse LAF stall	Stall. Associated with decel fuel cutoff in some cases, transition between torque and speed control modes in other cases.	No	7.5 @ 3 yr	Service Update
N100310	2010-2011	Malibu/LY7	Stall. Associated with decel fuel cutoff, POPD diagnostic and early release of torque converter clutch.	No	5.3 - 13.5 @ 3 yr	Service Update
07V519000	2001	Saturn L Series	Timing chain failure, stall	No	3.14	Safety Recall
04V376000	2005	Sierra, Silverado, Yukon XL, Suburban	Fuel rail joint leak, stall / fire	No	2.7	Safety Recall
05V155000	2000, 2001	Suburban, Yukon XL	Fuel MRA, stall / fire	No	0.05 (stall)	Safety Recall
99V239000	1999	Firebird, Camaro	Clutch master cylinder, Unintentional movement, stalls or other	No	Unknown (69 veh involved)	Safety Recall

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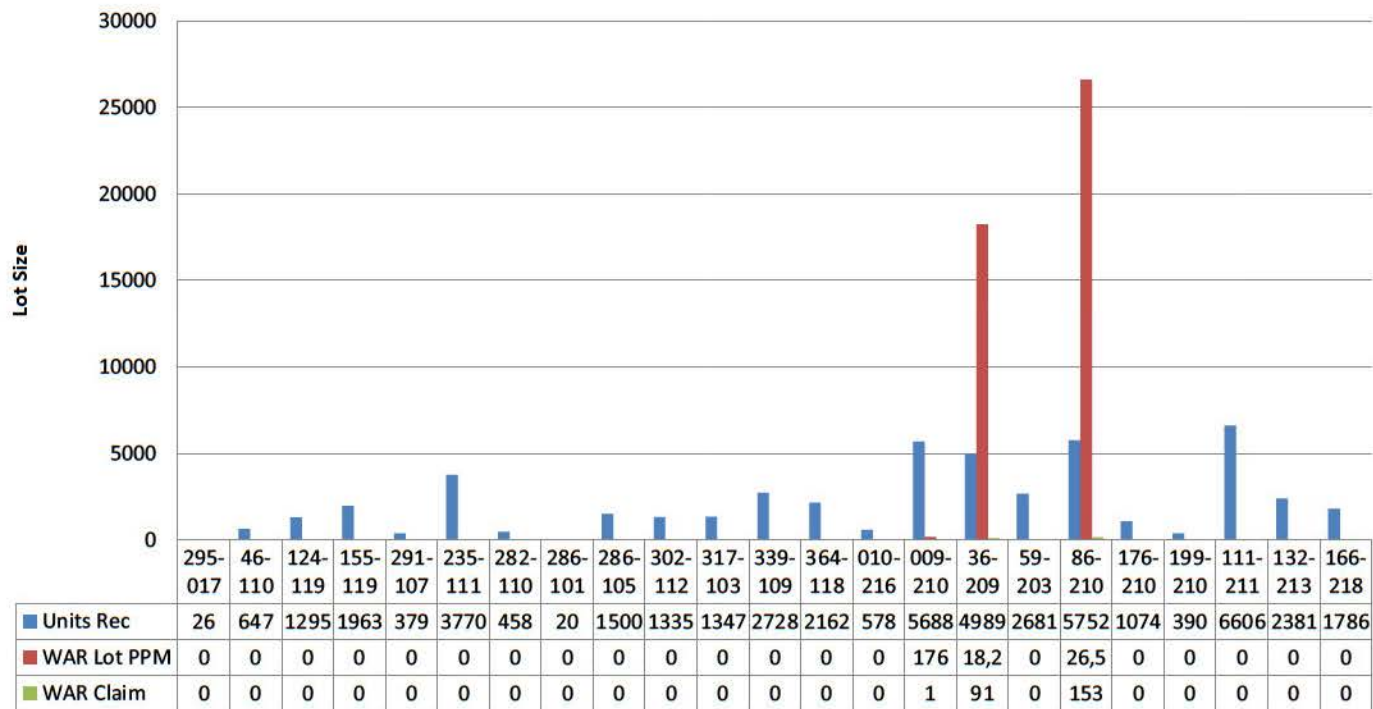




Backup

Revised with additional TAC cases provided 8-13-12

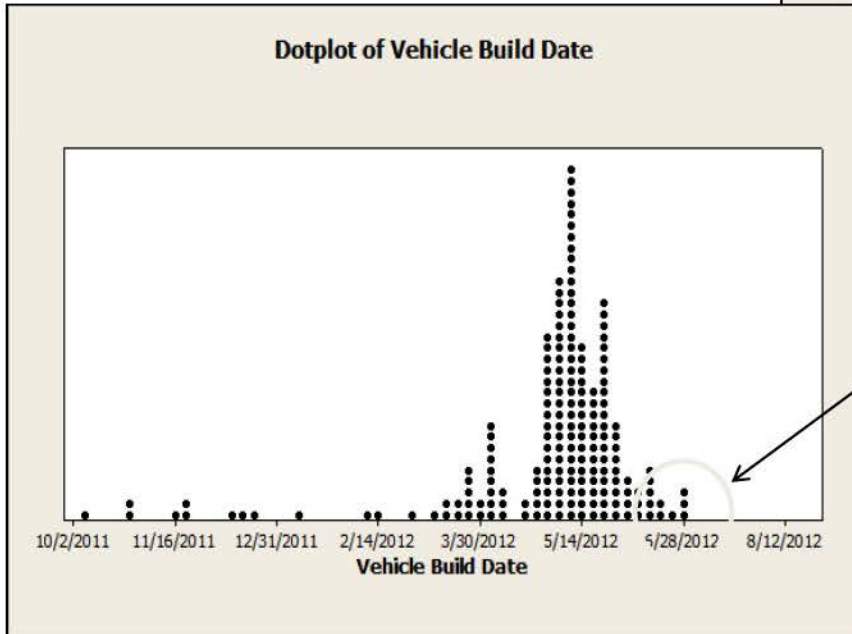
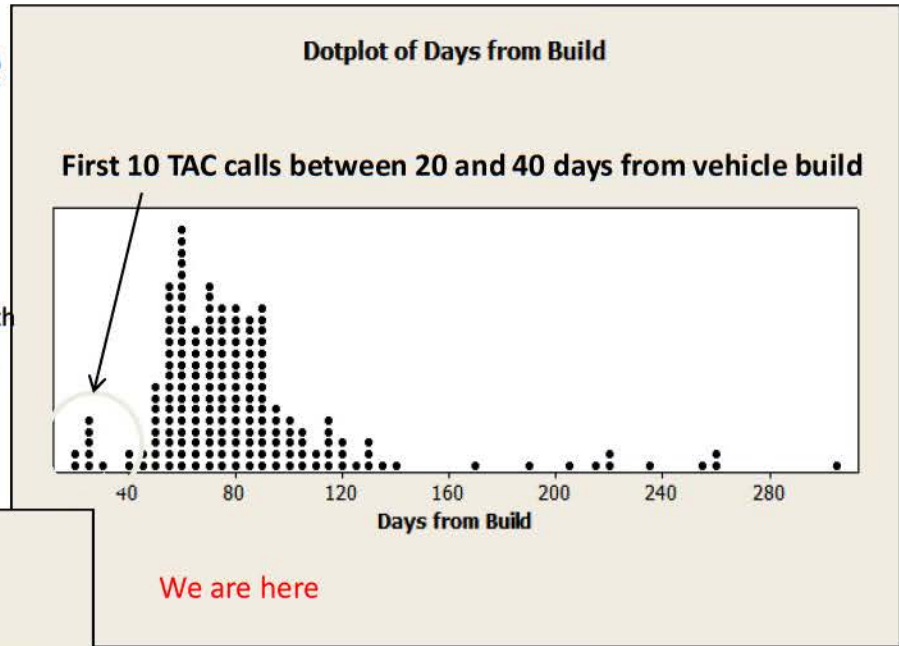
Warranty Returns by Nanya Lot Code all LV and HV Isolation Faults and P1BOB TAC cases



TAC Case vs Build Date

Data as of August 10th

1. Assume first non-suspect parts in cars July 16 (Monday after shutdown)
2. 25 days between July 16) and August 10th
3. If no change in distributions, expect TAC cases to begin by 20 days after July 16.



End of March- May suspect batches – June 15
Last TAC case build date June 29

Following 7 slides are from:

eAssist BPIM/APM Warranty Review

August 7, 2012

Prepared by:
Stephen Farris (BPIM DRE)
Reena Datta (APM DRE)

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Chevrolet Malibu Eco, Buick Regal eAssist, Buick LaCrosse - eAssist System



17,386 Vehicles

Cost Estimate: \$ { ** }

N-12xxxx

Condition:

Certain 2012-2013 model year vehicles with the eAssist system were built with a Battery Power Inverter Module (BPIM)¹ that may not function properly.

Suspect Population:

Suspect VIN list is based on BPIM build dates of two suspect lots, BPIM PCM is not directly traceable to VIN. There are 10,741 PCBs in the two suspect lots.

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. Evidence of thermal events within the metal-encased BPIM have also been observed in field returned parts.

Technical Root Cause:

Shorting between layers of the multi-layer circuit board. Shorting of a toroidal inductor winding to a PCB.

Responsibility: Supplier (GMCH)

Frequency: 23.3 IPTV @ 90 days

Potential Field Action Category: Recall / Service Update (unsold only)

1 – Known as Generator Control Module in Service Parts List

Chevrolet Malibu Eco, Buick Regal eAssist, Buick LaCrosse - eAssist System

Potential Field Remedy:

Replace Generator Control Module with service part of same part number with Julian date code > 2180 (June 28, 2012).

Discovery:

The issue was discovered from analysis of warranty parts returned.

Current Status:

Design change in the BPIM has been implemented, first vehicle builds on Aug 14. Vehicle screening test being developed for possible use on assembly plant held vehicles and unsold dealer stock.

Immediate Improvement /Containment:

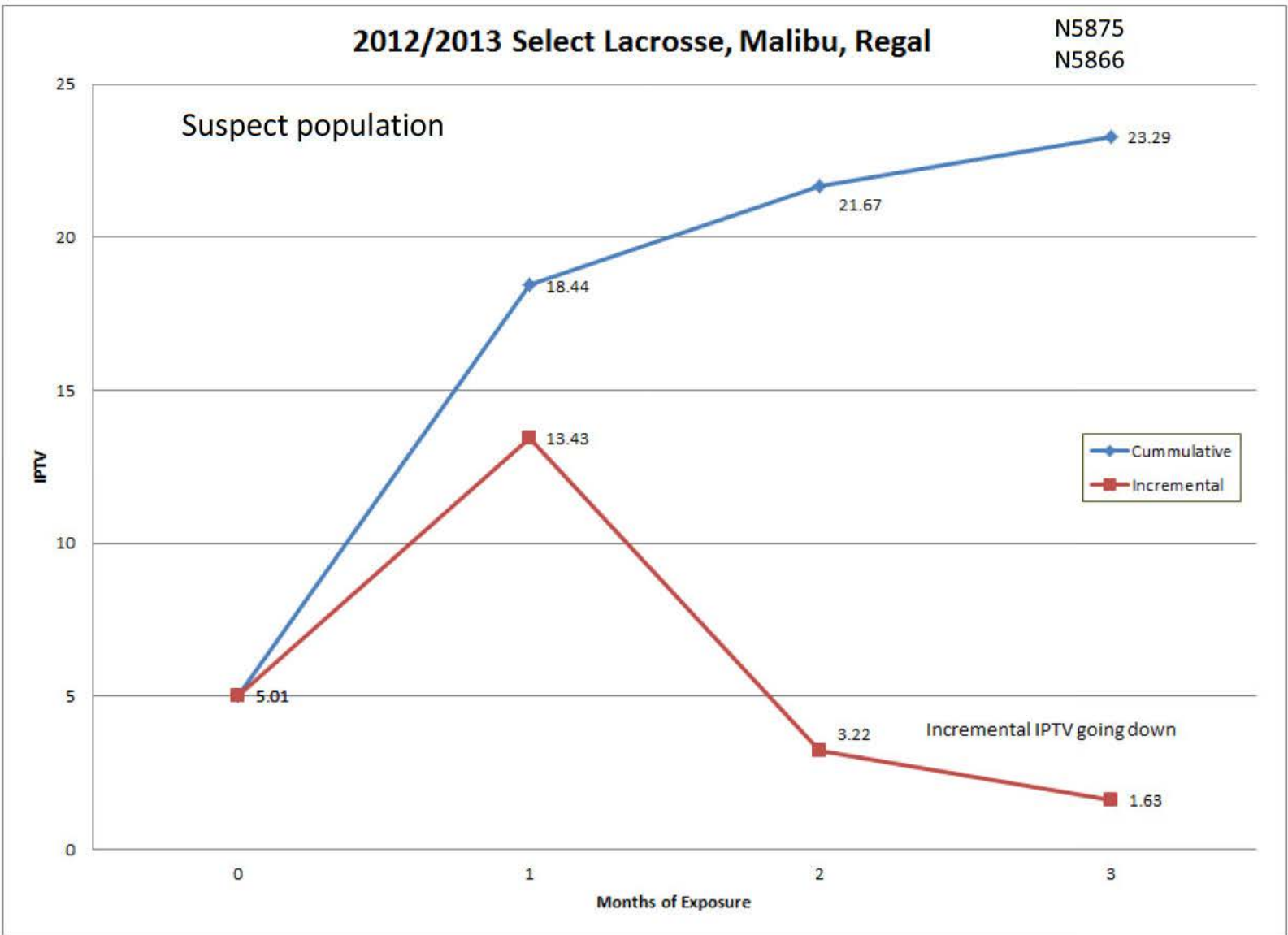
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Systemic Root Cause:

TBD

2012/2013 Select Lacrosse, Malibu, Regal

N5875
N5866



Warranty Comment Summary

N5875 - Generator Control Module Replacement

N5866 - Generator Control and Battery Module Replacement and Shipping Preparation

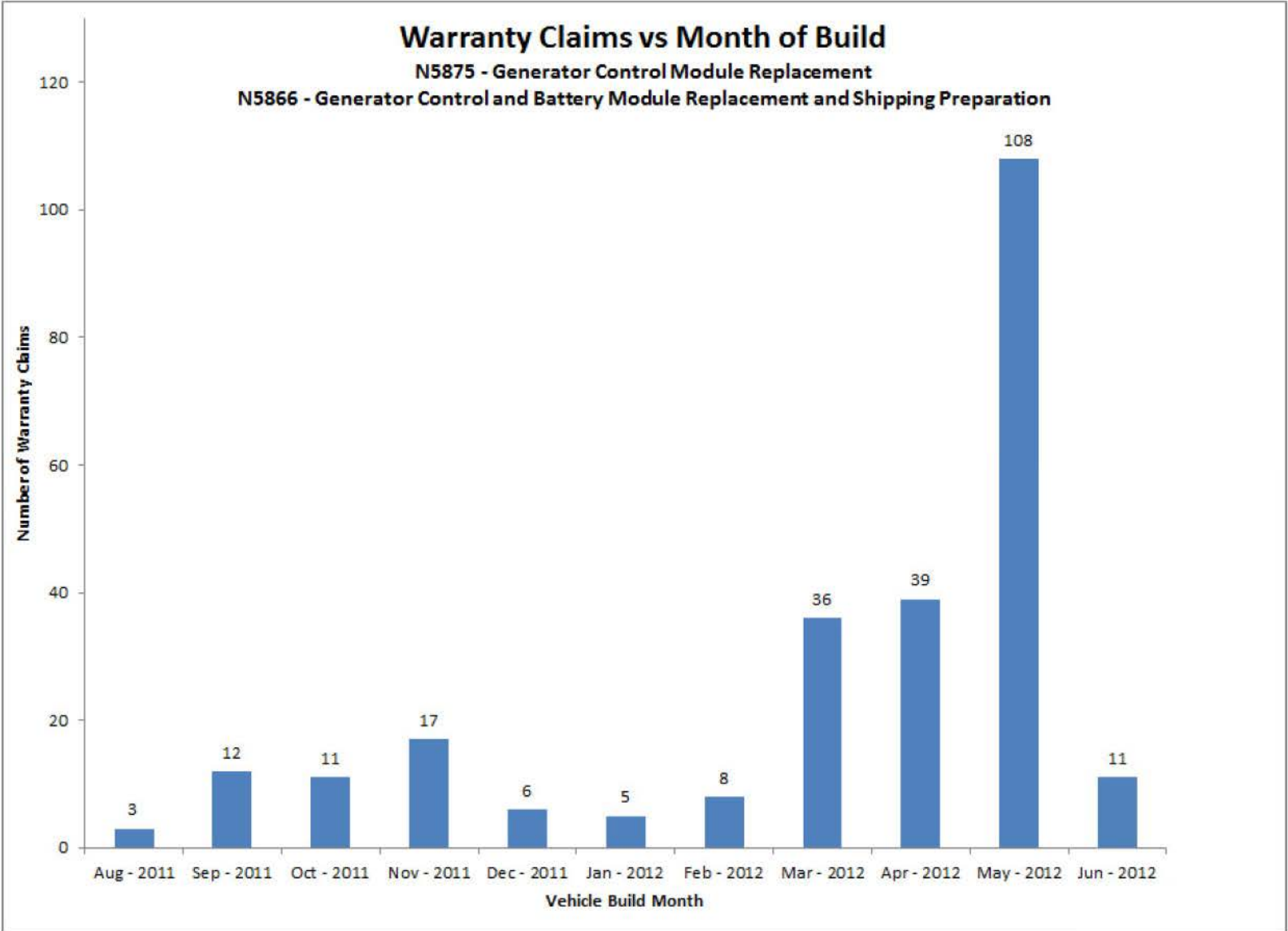
Warning Light or Message	STALL/NO START										
	LaCrosse			Regal			Malibu				
	Yes	No	Total	Yes	No	Total	Yes	No	Total		
Yes	10	71	81	3	13	16	8	93	101	198	
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% Stall/No Start	33%			28%			19%			25%	

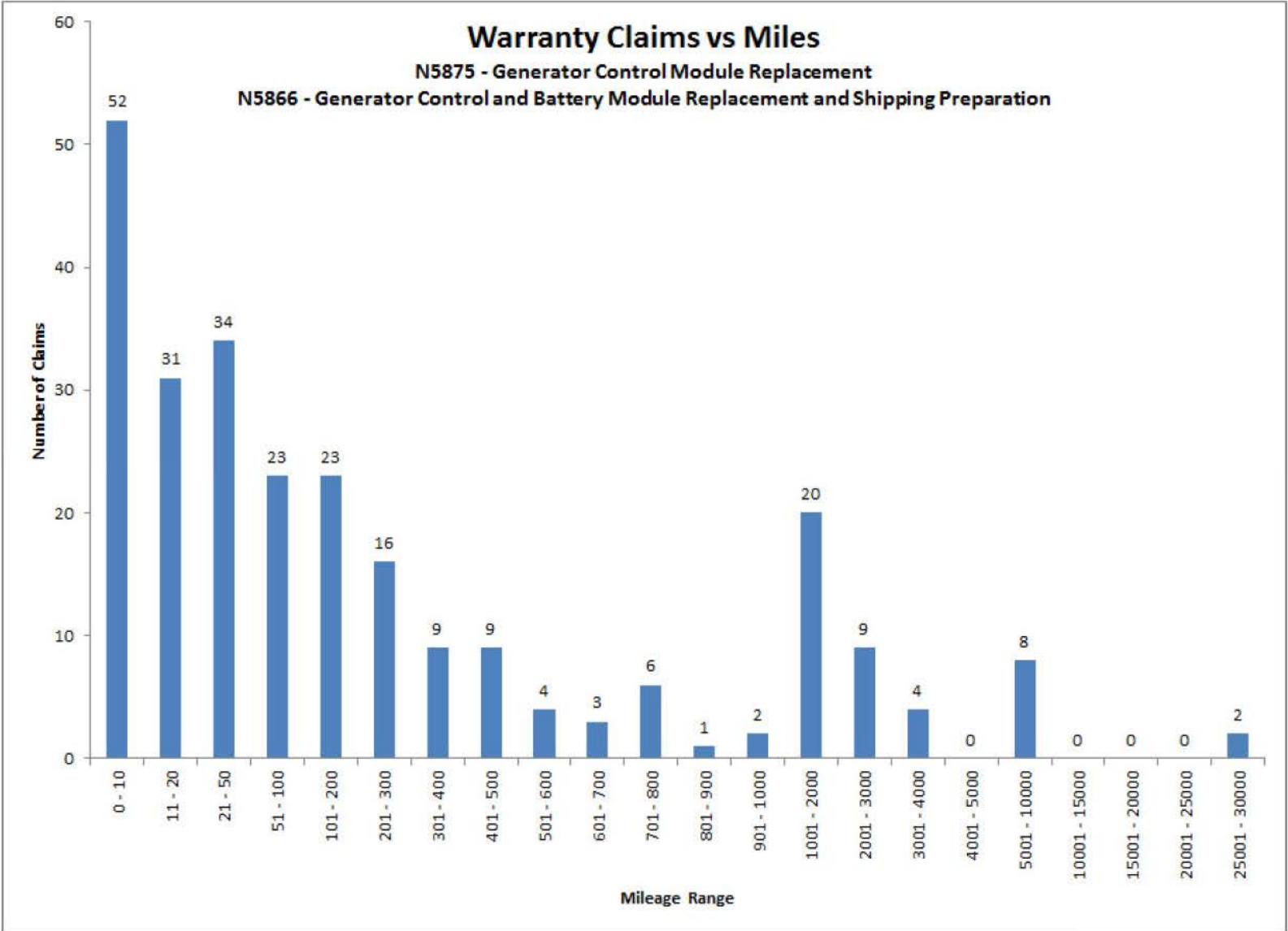
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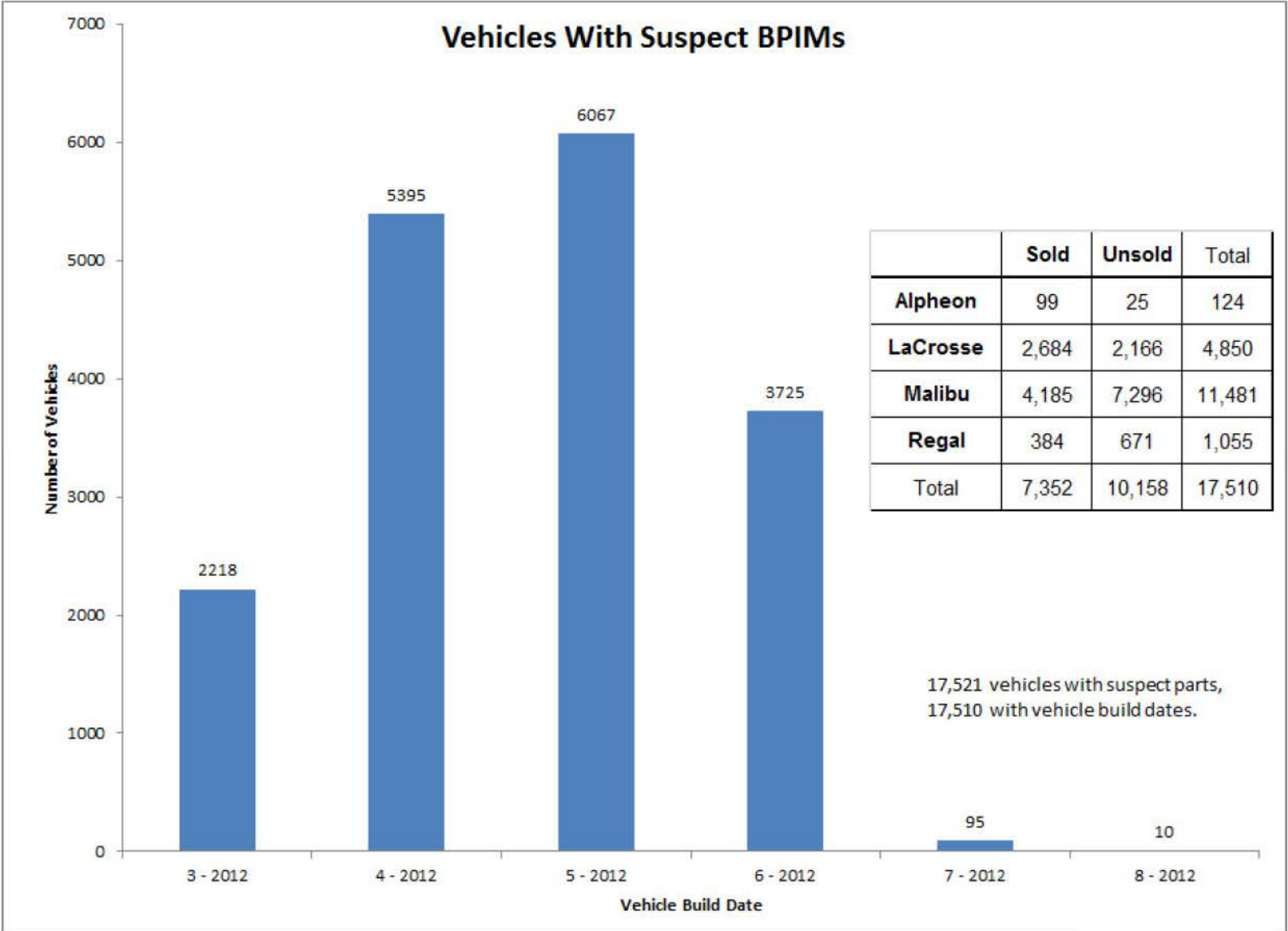
Notes: Stall counts based on comments or towing claims.

Notes: Data as of Aug 14, 2012

Warranty Comment Summary.xlsx







{ * }

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C:\Data\Excel\Engine Stall Recall History.xlsx















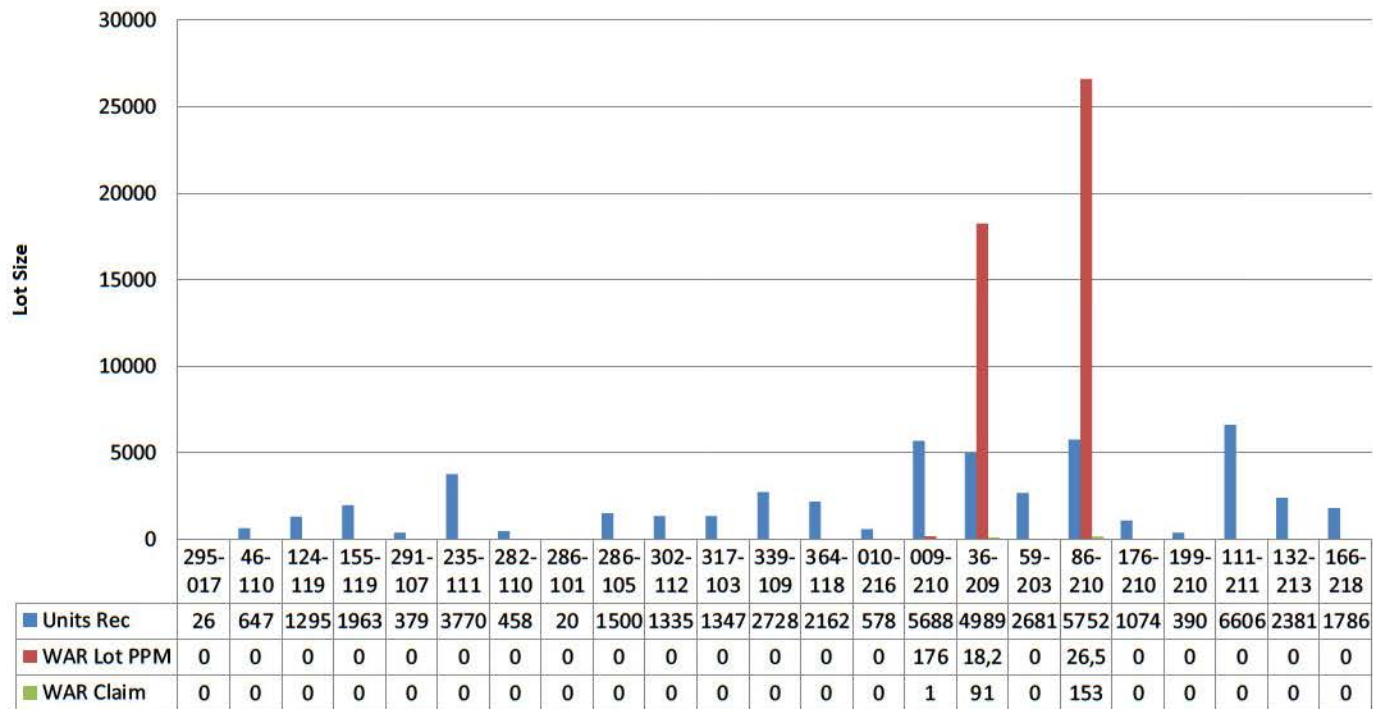




Backup

Revised with additional TAC cases provided 8-13-12

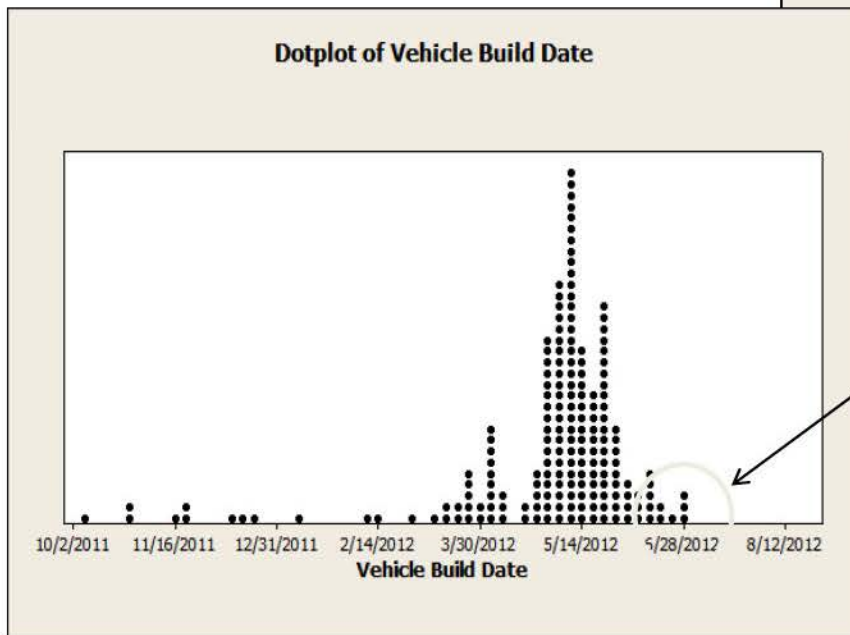
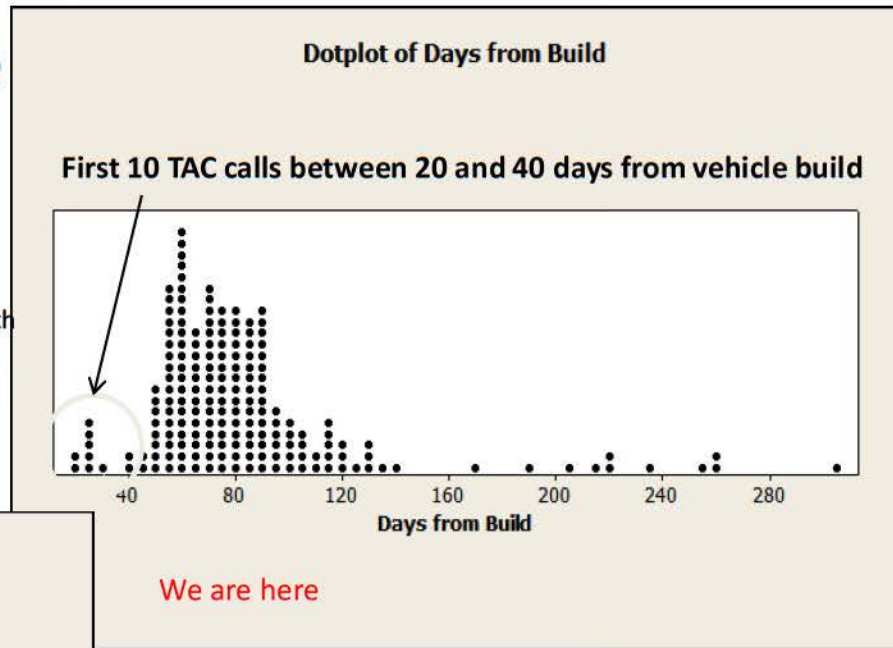
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August 7, 2012

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{ * }









2012 – 2013 Malibu, Regal, LaCrosse – eAssist – Cap Board



52,458 Vehicles (or less if mileage / days in use limits are used)

U.S. – 51,626 Canada – 832

N-12xxxx

Condition:

Certain eAssist vehicles were built with a generator control module (aka BPIM) that may not function properly. A shorting between layers of the multi-layer “cap circuit board”, similar to the condition on the “power circuit board” may cause the loss of battery charge 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 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 a new “cap circuit board” in Jan, 2013 are suspect.

Technical Root Cause:

Shorting between layers of the multi-layer “cap circuit board”

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2012 – 2013 Malibu, Regal, LaCrosse – eAssist – Cap Board



52,458 Vehicles (or less if mileage / days in use limits are used)

U.S. – 51,626 Canada – 832

N-12xxxx

Responsibility: Supplier (GMCH)

Frequency:

There are two confirmed “cap circuit board” field reports.

- One at dealer that was investigated at MPG ([see photos](#)).
- Other from a normal warranty return
 - No external evidence and was replaced for a dash light and DTC.
 - GMCH found small burn spot on the cap board

Warranty data as of Nov 13, 2012 for Service Update Labor Op V2675 yields 2,421 claims, none of which cite any indications of smoke, fire, flame, burn, soot, smell, or melt. Of these claims, it is estimated 90% passed the screening.

Potential Field Action Category: Safety or Customer Satisfaction Recall

Potential Field Remedy:

Screen all vehicles similar to Service Update 120238a.

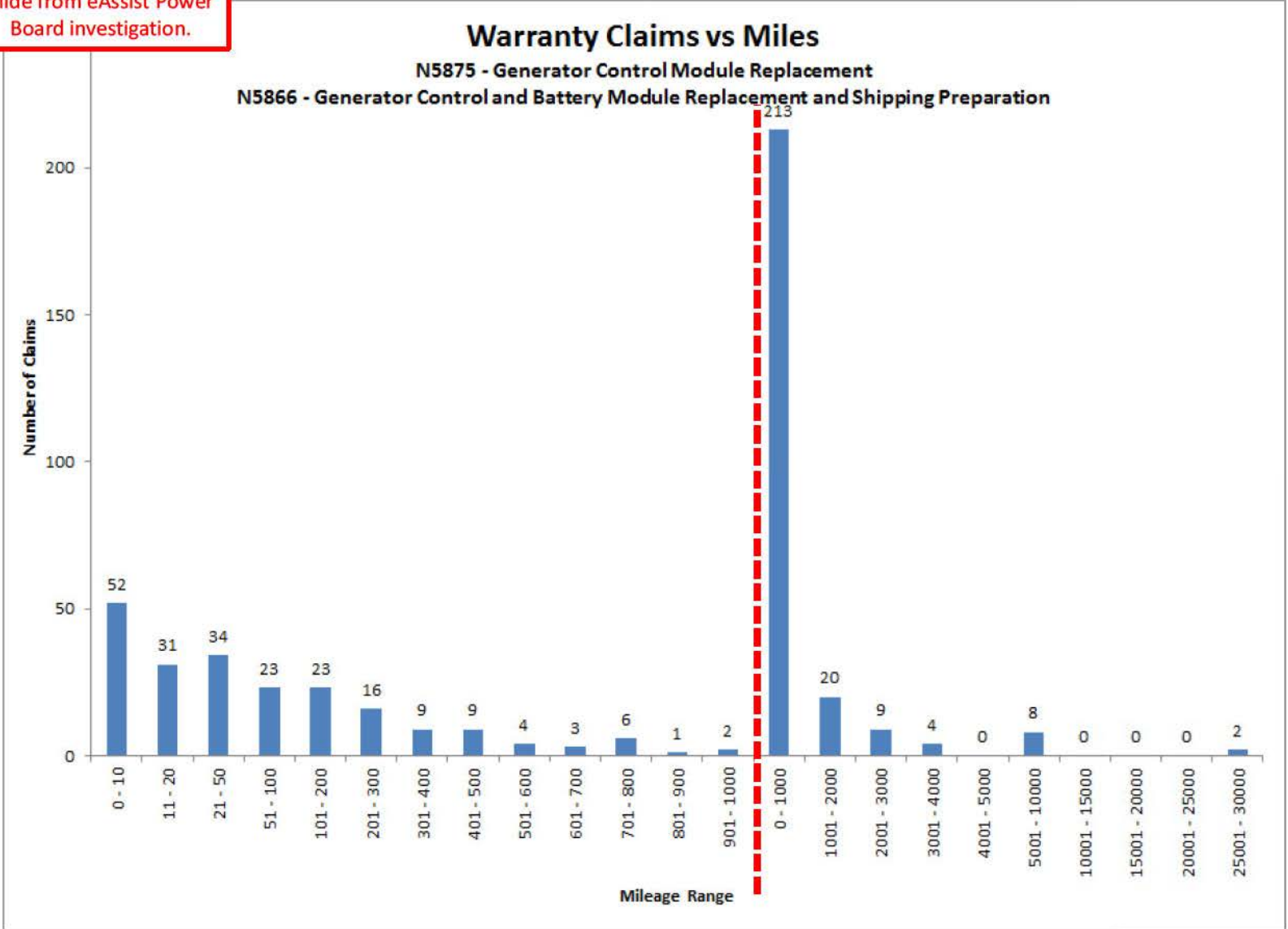
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Backup

Slide from eAssist Power Board investigation.



Return

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Slide from eAssist Power Board investigation.

Warranty Comment Summary

N5875 - Generator Control Module Replacement

N5866 - Generator Control and Battery Module Replacement and Shipping Preparation

Warning Light or Message	STALL/NO START									
	LaCrosse			Regal			Malibu			Total
	Yes	No	Total	Yes	No	Total	Yes	No	Total	
Yes	10	71	81	3	13	16	8	93	101	198
No	26	2	28	2	0	2	16	12	28	58
Total	36	73	109	5	13	18	24	105	129	256
% Stall/No Start	33%			28%			19%			25%
Total Stall	11			2			11			
Stall While Driving	5			1			7			

Notes: Eight customers report a noise prior to failure, and three report a burning smell.

Notes: Stall counts based on comments or towing claims.

Notes: Data as of Aug 14, 2012

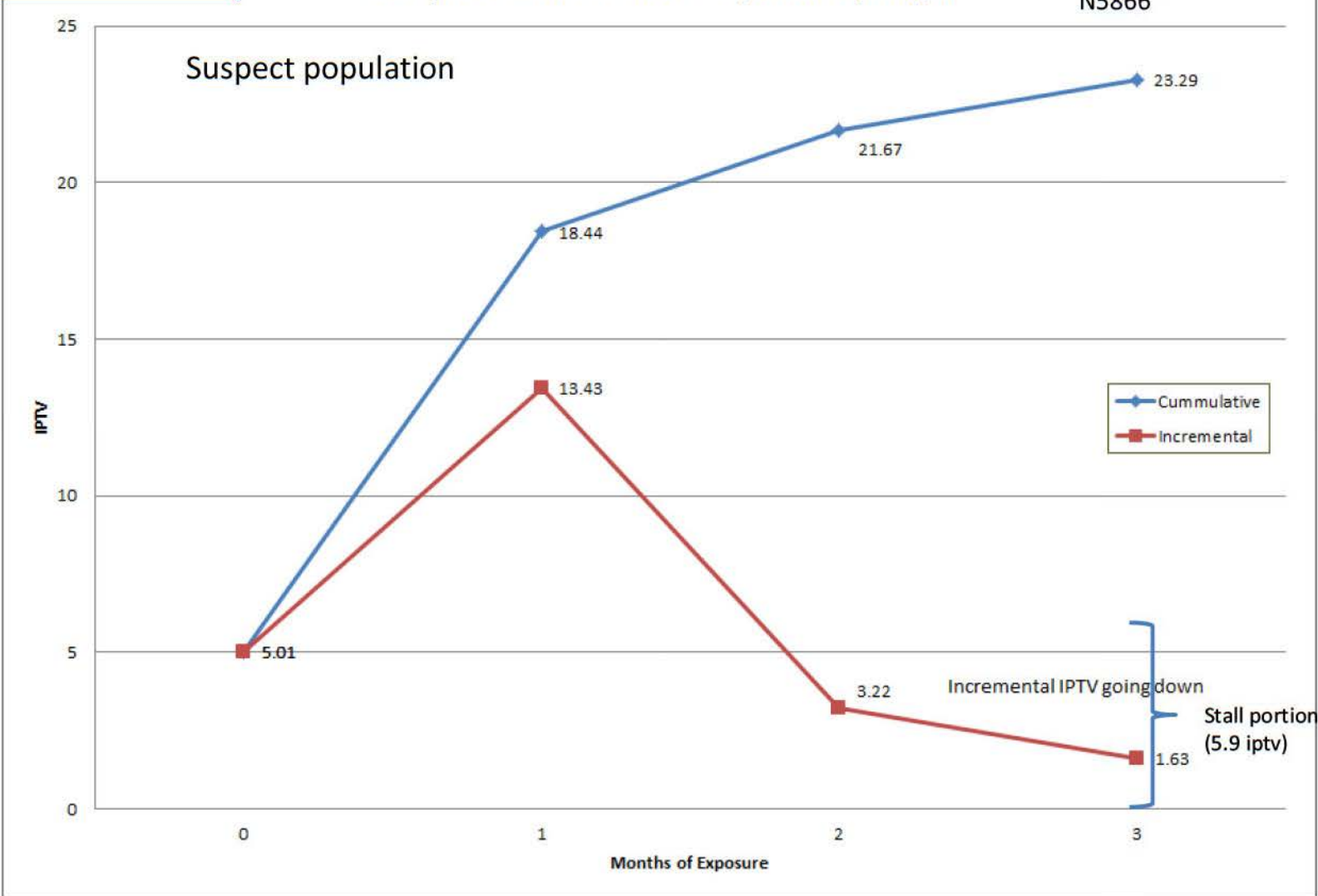
Warranty C

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Slide from eAssist Power Board investigation.

2012/2013 Select Lacrosse, Malibu, Regal

N5875
N5866



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VEHICLE 2013 CHEV. MALIBU
VIN No. 1G11F5RRODF118790
PHOTOGRAPHER RON ORLANDO



Return

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2012 – 2013 Malibu, Regal, LaCrosse – eAssist – Cap Board



52,458 Vehicles (or less if mileage / days in use limits are used)

U.S. – 51,626 Canada – 832

N-12xxxx

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2012 – 2013 Malibu, Regal, LaCrosse – eAssist – Cap Board



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U.S. – 51,626 Canada – 832

N-12xxxx

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- Other from a normal warranty return
 - No external evidence and was replaced for a dash light and DTC.
 - GMCH found small burn spot on the cap board

Warranty data as of Nov 7, 2012 for Service Update Labor Op V2675 yields 2,215 claims, none of which cite any indications of smoke, fire, flame, burn, soot, smell, or melt.

Potential Field Action Category: Safety or Customer Satisfaction Recall

Potential Field Remedy:

Screen all vehicles similar to Service Update 120238a.

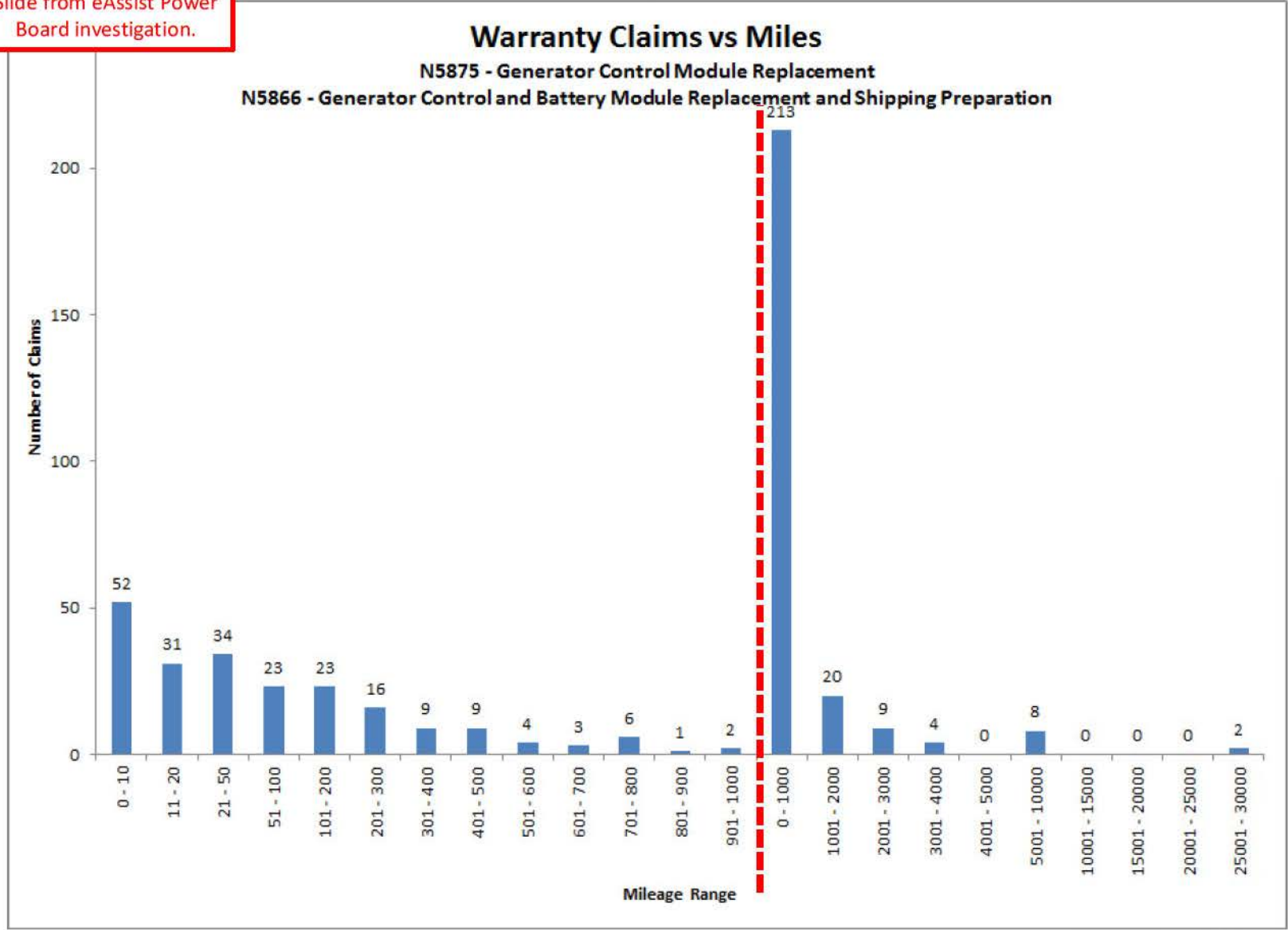
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Backup

Slide from eAssist Power Board investigation.



Return

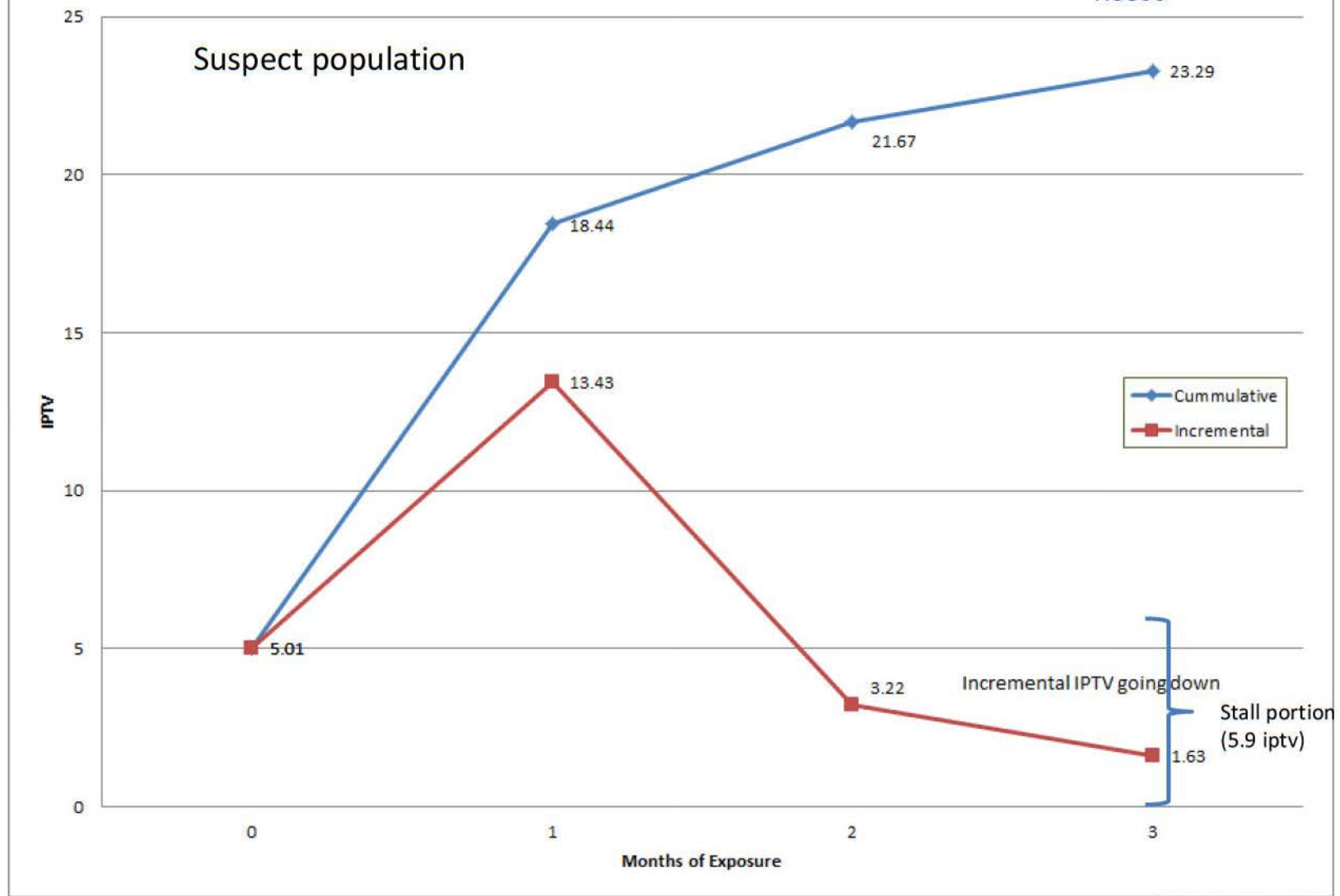
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Slide from eAssist Power Board investigation.

2012/2013 Select Lacrosse, Malibu, Regal

N5875
N5866



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VEHICLE 2013 CHEV. MALIBU
VIN No. 1G11FSRROD8
PHOTOGRAPHER RON ORLANDO



Return

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