

Ford C-Max Flat Towing Brake Lock-up update May 2018

By Mike Angles / mangles@pacbell.net

Written for current and future Ford C-Max toad owners, as a collective update for avoiding brake lockups.

The C-Max is one of a handful of automatic transmission equipped flat towable cars on the market. It is available as a Hybrid or a Plug-in Hybrid Electric Vehicles (PHEV). As a Hybrid/PHEV, it is equipped with an electric vacuum pump that provides braking assistance when the internal combustion engine (ICE) is not running. As a side note, it also is equipped with electric power steering.

The C-Max has an “Active Braking” system. This differs from traditional “Vacuum Braking” using engine produced vacuum. Vacuum based systems were commonly called “power assistance braking” in older cars.

The C-Max uses an electric pump to produce vacuum for its active braking system while the ICE is not running when operating from its Hybrid battery or in PHEV mode.

Flat Towing

When towing four-down (all wheels on the road) behind an RV, we are legally required to have supplemental braking on the towed vehicle (toad). Most activate the toad’s brakes by pushing or pulling the brake pedal.

Sophisticated braking systems from the likes of Roadmaster, RViBrake and SMI are the most popular. Whereas ReadyBrake markets a simple inertia braking systems with an integrated surge brake that activates the C-Max brake pedal via a physical cable.

A discussion of the various braking systems attributes is beyond the scope of this paper, other than to say a small group of C-Max owners have studied their operation as we seek to understand and resolve our towing issues with the toad brake manufacturers.

Each of the noted systems depresses the C-Max brake pedal in some manner to facilitate stopping the toad. The Key issue and fundamental problem is that the C-Max has an “Active” braking system that has produced ***unpredictable*** braking, resulting in brake or wheel lock-ups and some reported cases of front end suspension shakes referred to as a “Death Wobble”.

One would expect towing the C-Max with the ignition off would disable Active Braking, but this is not always the case, and this is the problem. We have documented videos with unexpected electric vacuum pump activation. I say “unexpected” since we have observed a variance amongst our C-Max Hybrids and Energi cars manufactured from 2013 to the present. In my 2014 C-Max Energi I have recorded vacuum pump activation lasting fractions of a second with the ignition off, and in Joel P’s car we encountered longer lasting activations towing with the ignition in the accessory position per Ford’s outdated RV Flat Towing procedures.

Why the variances? First off, Ford created confusion with their original procedures calling for ignition accessory mode to be on while flat towing. I am not sure when or why Ford changed this procedure to towing in the off mode. And it appears the steps for putting the car in accessory mode for the duration of the towing time can be problematic.

In trying to get clarification and communicate the brake lockup issue to Ford Headquarters, they refused to talk with us. And their dealer network has been unable to resolve the problems and/or address the problem with Ford management.

We know that the electric vacuum pump activates, creating vacuum that results in random brake lock-ups. Because of this unsafe braking action, we concluded we must tow with the electric vacuum pump disabled. Doing so allows the toad supplemental braking system to operate in a consistent manner once calibrated to the toad.

Disabling the electric vacuum pump can be accomplished by removing Fuse #9, a 40 amp fuse, from the electric vacuum pump circuit.

Fuse #9 is located in the engine compartment Battery Junction Fuse Box. It provides battery voltage to a Vacuum Pump Cut-Out Relay (R7), that, when energized, passes power to the Vacuum Pump Relay (R10), the vacuum pump and to the Anti-Lock Brake System (ABS) Vacuum Pump Monitor.

Removing Fuse #9 opens the circuit used to energize the electric vacuum pump. Additionally, one can monitor the vacuum pump activity with a test light plugged in parallel with Fuse 22.

So, what are the options for removing Fuse #9?

1. Pull Fuse #9 after hitching the toad to the RV.
2. Incorporate a high amperage switch under the hood to facilitate this disconnect.
3. Install an under the hood ready-made fuse by-pass kit.
4. Install a driver's area mounted switch fuse by-pass kit such as RoadMaster 's Fusemaster JK76517.

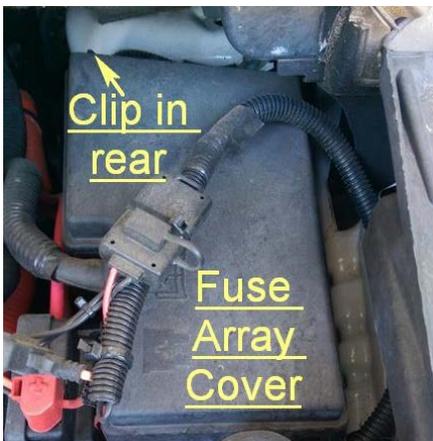
The following sections provide details for each option. These are followed with supplemental C-Max information.

Note - Removal of Fuse #9 disables the electric vacuum pump, an action that should be limited to periods of flat towing if you encounter *unpredictable* brake lock-up situations.

Pull Fuse #9 after hitching the toad to the RV.

Fuse #9 is a 40 amp fuse that protects and delivers 12 volt DC power to the electric vacuum pump in the C-Max Hybrid and Energi. It is located in the front engine compartment's main fuse bank. The fuse bank is on the driver's side, protected by a black plastic cover with one hidden latch/clip at the rear side of the cover on the left, 1 inch below the top edge.

To remove the cover:



1. Reach to the rear left back-side (below the left edge) and you will feel the clip, which you cannot see. With your fingertips pull upward slowly in the center of the clip. The clip is about 1" wide, side-to-side. You will feel the clip lift up as it unlatches the cover.
2. Continue to lift the rear cover a few inches to clear the back of the fuse array base. As you do so the front will rotate freeing the front clips so that you can slip the cover forward an inch or so.
3. Then you just have to work the cover up and out of the way.

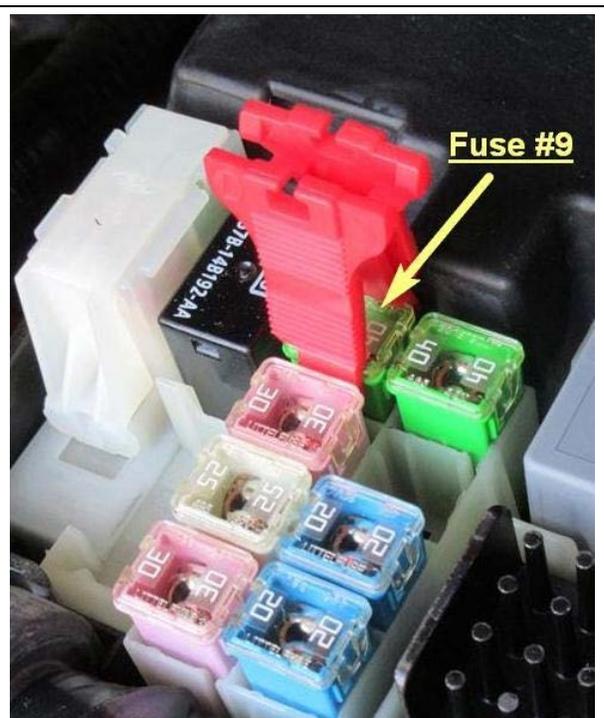
The photo on the left shows the main fuse bank cover as viewed while standing in front of the driver's side headlight looking towards the steering wheel. This photo also shows a [Hopkins 39332 BrakeBuddy Towed Vehicle Battery Maintainer](#) and wiring running across the top of the fuse bank cover. The BrakeBuddy charges the C-Max battery from the RV while flat towing to prevent a dead C-Max battery.

The following two photos show the fuse bank cover clips:

<p>Rear Clip: First locate the rear left corner clip as seen in a mirror. Lift this flat piece of plastic with your fingertips to release the cover catch. Very little pressure is needed to release the clip.</p>	<p>Front clips: The front has two clips, one on the left and one on the right that release as you lift the rear of the cover. Next you will work the cover out of the way to expose the fuse bank.</p>
	

<p>A fuse layout and red fuse puller is located on the inside of the cover. The fuse puller works somewhat with ample fingertip pressure. In my car I have marked the Fuse #9 location on the inside cover layout with a white marker. The fuse cover layout is offset 90 degrees from the fuse bank.</p>	<p>C-Max owner's manual fuse layout aligned with the fuse bank orientation. Fuse #9 is highlighted in yellow and should not be confused with relay #9 (R9).</p>
	

Removing the fuse takes some finesse. I found small needle-nose pliers work best. Alternatively, the red Ford fuse puller will work by pressing firmly after sliding it onto the fuse as shown below.



Incorporate a High Amperage switch solution or factory made kit under the hood to facilitate this disconnect

This solution was installed by a [ReadyBrake](#) installer for Chris P. It is a NSA RV Products “de-Fuser”. \$65.95 on the [ReadyBrake](#) web store and a little less at [RVupgrades.com](#)

In researching such a solution, I found 12 VDC rated 50 amp switches on Amazon with long switch paddles. However, in looking at this ReadyBrake solution, I was impressed by the use of a low profile rocker switch and the small size that allowed the installer to place it within the fuse cover.



This appears to be a simple solution in which using a good switch and water leakage protection are important.

We have learned the C-Max electric vacuum pump is protected by a 40 amp fuse. In my opinion, I would **NOT** use a by-pass solution with a smaller amperage rating as wiring, or the switch that is normally in the closed mode for non-flat towing could fail.

RoadMaster markets various “[Fusemaster](#)” by-pass solutions, as do a few other firms such as [NSA/ReadyBrute](#) and [RV-partsplus.com](#).

Here is some additional information:

- RoadMaster under the hood heavy-duty [76513](#) switch
- RV-Partsplus.com [De-Fuser application guide](#).

Install a driver’s area mounted switch fuse by-pass kit such as the RoadMaster Fusemaster JK76517.

The following photos provided by Joel P. show the RoadMaster JK76517 installed on his Energi. The RoadMaster kit provides a small switch in the driver’s area for easy use. This switch controls an engine compartment located heavy duty latching relay housed in a heat sink. Note that the switch that comes

with this kit does not click to each position, but is a momentary rocker switch without any indicator light to show that it is in towing or non-towing state. That is an enhancement that would improve this installation.

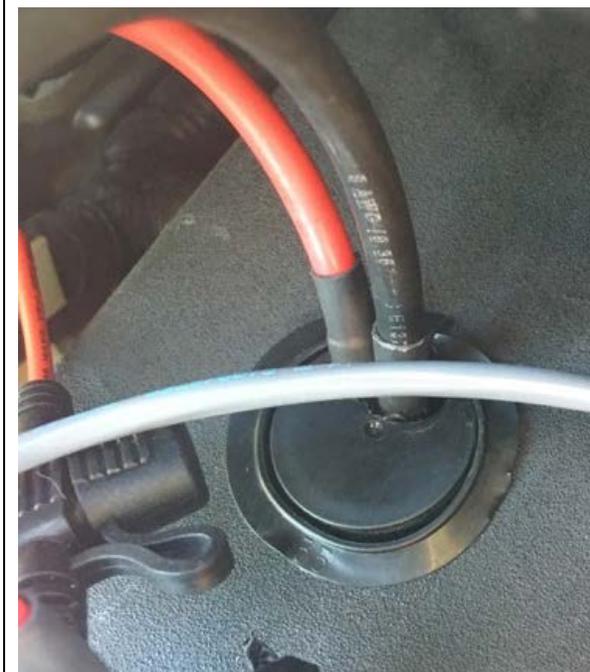
RoadMaster JK76517 kit with instructions.
Available from eTrailer.com or RoadMaster.



Heat sink mounted relay installed on the fuse cover. Note heavy gauge wiring and fuse. High amperage stays under the hood. Small gauge wiring is for remote switch in driver's area.



Close-up photo showing wiring penetration in the fuse box cover from the RoadMaster relay to Fuse #9 socket under the fuse cover.



Driver's compartment switch mounted in the side of center console between the driver's seat and gas pedal.



Always Flat Tow with the Ignition Off!

I drive a 2014 Energi that I purchased new on Halloween Day, 2014. The owner's manual flat towing procedures ended with place the **"ignition in the accessory mode."** These instructions also applied to the 2013 model year.

Sometime during 2014 Ford released SB-10058109-4254 applicable to 2013 and 2014 model year cars built on or before 7/22/2014. This service bulletin is described as "Discharged 12-Volt Battery or Service Advancetrac Cluster Message After Four Wheel Flat Towing Behind RV..."

The service bulletin included an updated flat towing procedures ending with place the "ignition in the off mode."

I later learned the service bulletin addressed an expensive 12 volt battery warranty replacement issue for Ford. I suspect the batteries were damaged by the electric vacuum pump after repeated flat towing.

Furthermore, I believe this service bulletin continues to create confusion because preowned C-Max's are purchased for flat towing by unaware buyers. Not only may the new owners not know of the service bulletin, they may not know if the car has been updated, regardless of towing procedures they may possess.

In late April 2018 I received an urgent call from a 2013 C-Max owner advising his brakes were surging while towing even with a Fuse #9 by-pass switch disabling the electric vacuum pump. In our conversion we concluded the ignition should be off. He had followed the owners' manual procedure, towing with the accessory mode enabled. Sometime later he called advising towing with the ignition off corrected the issue.

Supplemental Information:

Driving with Fuse #9 Removed

No vehicle should ever be driven with compromised safety systems. The Fuse #9 by-pass should only be enabled while hitched to a tow vehicle for flat towing.

I have test driven my Energi with Fuse #9 removed. When doing so, the car operated only with the internal combustion engine (ICE). That is, one cannot drive the C-Max on electrics as a Plug-in Hybrid Electric Vehicle (PHEV) which I assume also applies to the Hybrid model. Limp mode was not noted, but the car was not tested at highway speeds.

In testing my car with Fuse #9 removed, the engine starts immediately upon "starting" the car whereas I normally will have just PHEV in Run mode. Forward and reverse travel was tested and braking felt normal.

The dashboard "engine service alert" and other brake system notifications were displayed as shown in the following pictures. DTCs P1A1B and P258B were observed on a ScanGauge. Both DTCs were cleared automatically after reinstating Fuse #9, and 3 or 4 car restarts.

P1A1B - Per the Ford OBD manual: **Brake System Control Module** - Forced Engine Running by request of Brake System Control Module due to regenerative braking system fault.

P258B – Per the Ford OBD manual: **Brake Vacuum Pump General Electrical Failure** - Vacuum pump control circuits are used to activate and control the electric vacuum pump to provide the required amount of vacuum to the ACU. Diagnostics on these control circuits include general electrical faults such as short to ground or open circuit (general electrical fault).



Ford Is Not On Board

Yeah, I called Ford. First the local dealer, then the Ford customer support center, and lastly the CEO's office. In pursuing this issue with Ford, I received a call back telling me of the need for C-Max owners to report this problem to Customer Service at 800-392-3673, as Ford has no such reports. If you call Ford or seek service, tell them you demand an escalation case number. I have learned that Ford does not like an escalation as it entails additional paperwork.

Additionally, if you encounter uncontrollable flat towing brake-lockup, I recommend you report this issue to the National Highway Traffic Safety Administration at <https://www-odi.nhtsa.dot.gov/VehicleComplaint/>

Reporting this to the NHTSA may help others and perhaps gain Ford's attention. Also be aware Ford will blame the add-on brake unit, which could be correct if it is incorrectly calibrated.

Reference docs

The following additional information may help C-Max owners understand their braking systems.

-[ABS and Stability Control Operation extract](#) from the 2014 service manual.

-[Ford 2017 My OBD System Operation Summary for Plug-In and Hybrid Vehicles](#)

-[2014 C-Max fuse extract from the car manual](#)

-[2014 Energi/Hybrid Brake System wiring extract](#)

-[Ford service bulletin](#) addressing 12-volt battery discharge or Advancetrac error message after flat towing. This document also contains the current Ford flat tow recommendations. (SB-10058109-4254 / TSB 14-0173).

About Our Driving Tests

Joel P. and I conducted flat towing tests on multiple occasions on dry surface roads in San Jose, Ca.

Joel's C-Max Energi is equipped with a new RViBrake3 with the latest firmware. Tests were conducted using the RViBrake's various Active and Vacuum Brake settings with the ignition on, off and in accessory mode. Video and still photos were taken to analyze braking events. Inclusive in our tests was a LED indicator to show electric vacuum pump activation. It was wired in parallel to Fuse #22.

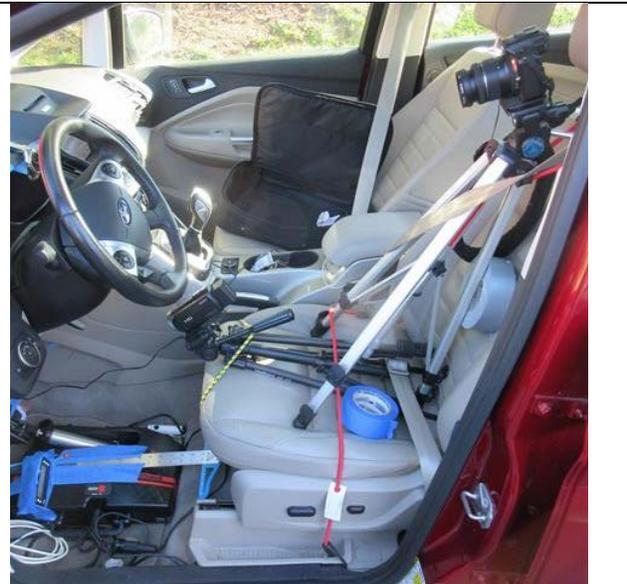
While flat towing, the LED showed normal vacuum pump activation with the ignition on and sometimes with accessory mode on. Furthermore, I observed the LED flashed on for milliseconds in my car while towing with the ignition off.

Note to self – Always tow the C-Max with the ignition off.

And verify the odometer did not increment after towing to confirm the ignition remained off.

Braking tests were performed over a range of RViBrake settings. On the lightest settings, no toad braking was noted in the videos and the electric vacuum pump did not activate.

The higher RViBrake settings removed considerable tire material. The RViBrake brake unit's plunger speed and travel distance varies with the settings selected. For example, using the 5 PSI setting with Active Brake mode resulted in no noticeable toad braking with slow limited plunger travel. Whereas the 20 PSI setting was too forceful if the C-Max electric vacuum pump was enabled. The same can be said for the RViBrake Vacuum Mode tests. In one test we achieved a front wheel "Death Wobble" that required a full stop to halt the severe shaking that displaced our cameras and associated test gear. Here's a short YouTube video of someone else's [Death Wobble](#).

<p>Joel's car all set to rock and stop with two video cameras.</p>	<p>All set with the RViBrake3, a ScanGauge, ruler for brake pedal travel measurements, a non-atomic timing clock and an LED to show the C-Max vacuum pump activations.</p>
	

The RV dashboard testbed. An RViBrake Command Center Tablet on the left, and other stuff we recorded during testing for analysis.



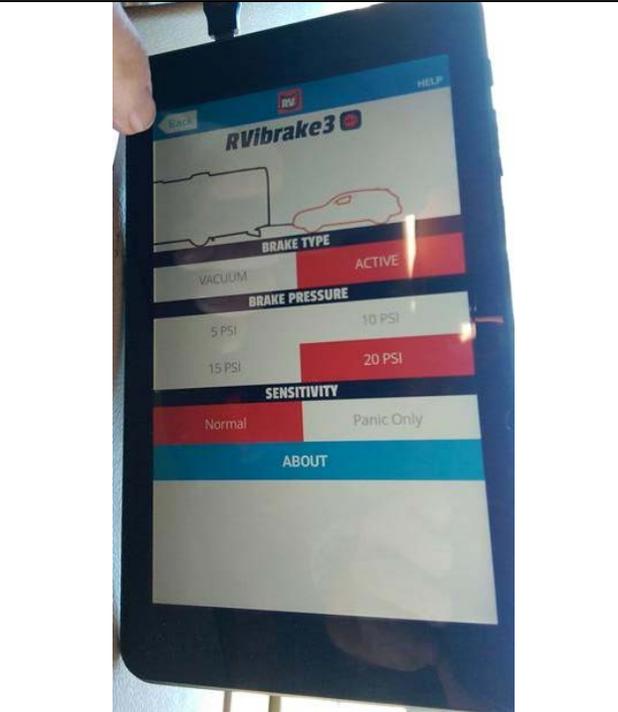
LED indicator testing in my C-Max before a towing test. The LED shows electric vacuum pump activation.



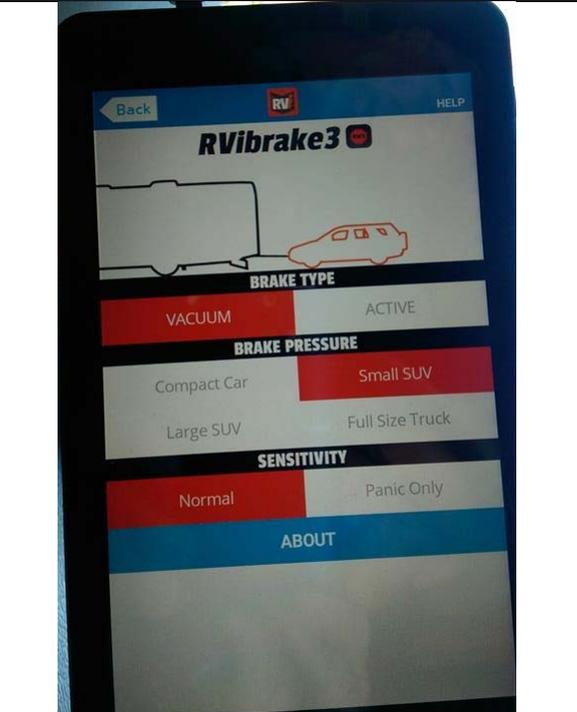
When I started writing this paper, Joel was refining his preferred settings. He recently completed a 300 mile round trip area using the 15 PSI Active Mode setting with a Fusemaster JK76517 disabling the C-Max vacuum pump. Joel felt this setting resulted in toad under-braking and has since selected 20 PSI Active Mode as his preferred setting with the C-Max electric vacuum pump disabled.

One of the nice RViBrake3 features is the ability to adjust toad brake settings from the Command Center Tablet in the RV while motoring down the road. So, if he finds the 20 PSI Active Mode inadequate, he can change to a more forceful Compact Car or Small SUV Vacuum Mode configuration at the push of a few buttons.

RViBrake Command Center Tablet in Active Mode braking at 20 PSI.



RViBrake Command Center Tablet in Vacuum Mode braking for a Small SUV.



The RViBrake Tablet allows one to perform a toad brake test by pressing the blue command button.



The RViBrake Tablet shows the amount of toad braking force applied.



Odometer Mileage

Some 2013 C-Max's odometers incremented while flat towing. I don't recall the ignition position, but the owners were unhappy as the added mileage reduced their warranty period. This situation may also apply to 2014 models until Service Bulletin 10058109-4254 is applied.

I do not know if the Service Bulletin corrected bad firmware or if the updated towing instructions (tow with ignition off) solved this issue. But what I can tell you is to watch your odometer. If it adds mileage while flat towing, your ignition is either not off or something is wrong. As a matter of habit I write down or take a photo of my odometer each day before we leave camp.

And I learned that even with the ignition off and no incremental odometer mileage, at the end of a day of towing, the Energi's "big battery" display showed a full charge (I believe from regen braking) and the display showed a PHEV mileage range exceeding Ford's 22+/- miles specifications. That is, the maximum range for PHEV travel is about 22 miles with a fully charged PHEV battery. Yet my C-Max erroneously would display a higher range, up to 38 miles.

Below is a photo showing 32 PHEV mile range on the left. And my ScanGauge shows the PHEV (big battery) with a 98.6% State of Charge (SoC).



I once spoke to our local Santa Clara Ford dealer about this. He felt the PHEV computer was tracking the flat towing mileage as if the car was driven on electrics and incorporating each day of flat towing into its counters increasing the average value of the PHEV display. And this was while flat towing with the

ignition off and no additional odometer mileage noted. What this told me, even if he was wrong, was the car is award of movement, even when the ignition is off.

Other Service Bulletins

It seems like C-Max service bulletins come and go. That is, I may find them while searching the web, and later they are just gone. So I started copying those relating to brakes and electrical. Unfortunately, I am unable to locate all that I once had. Below are the first couple of paragraphs for a few you should be aware of. You may also be able to obtain others from your Ford dealer.

Additionally, there are some web sites that follow car problems. I have found the carproblemzoo.com web site informative for owner complaints.

SB-10058088-3257, aka SB10058266-6444



Michael A. Berardi
Director
Service Engineering Operations
Ford Customer Service Division

Ford Motor Company
P. O. Box 1904
Dearborn, Michigan 48121

July 20, 2015

TO: All U.S. Ford and Lincoln Dealers

SUBJECT: **Customer Satisfaction Program 15B04 - Supplement #1**
Certain 2013 and 2014 Model Year C-MAX Hybrid Electric Vehicles (HEV)
12 Volt Battery Test and Module Software Update

REF: **Customer Satisfaction Program 15B04**
May 18, 2015

New! REASON FOR THIS SUPPLEMENT

This program is being supplemented to include the offering of a refund for owner-paid repairs covered by this program if the repair was performed before the date of the Owner Notification Letter. This refund offer expires January 31, 2016. Please review Attachment I for details.

PROGRAM TERMS

This program will be in effect through May 31, 2016. There is no mileage limit for this program.

AFFECTED VEHICLES

Certain 2013 and 2014 model year C-MAX Hybrid Electric Vehicles (HEV) built at the Michigan Assembly Plant from Job #1 through Job Last (Energi plug-in hybrid vehicles are not included). Affected vehicles are identified in OASIS. In addition, for a list of vehicles assigned to your dealership, visit <https://web.fsavinlists.dealerconnection.com>. This information will be available on May 18, 2015.

REASON FOR THIS PROGRAM

In some of the affected vehicles, certain electronic control modules may not time out/power down correctly when the vehicle is not in use, keeping the onboard module communication network active. This may cause the 12 volt battery to discharge after being parked overnight or for a short period of time, resulting in a no start condition.

HYBRID AND ENERGI – DISCHARGED 12 VOLT BATTERY	TSB 14-0155
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SB-10056697-7185

FORD:
2013-2014 C-MAX

This article supersedes TSB 13-7-10 to update the model years, Title, Issue Statement and Service Procedure.

ISSUE
Some 2013-2014 C-MAX Hybrid and Energi vehicles may experience a concern with a discharged 12 volt battery.

ACTION
Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

1. Disconnect the 12-volt battery. Refer to Workshop Manual (WSM), Section 414-01.
2. Connect the Rotunda Midtronics GR1-190 or GRX-3590 Diagnostic Battery Charger to the vehicle's battery terminal posts only. Battery cables must be removed and no other connections, such as body ground, can be in the circuit during testing.
 - a. Select diagnostic fast charge.
 - b. On GR1-190 only - select above 400 km (250 miles) or below 400 km (250 miles) based on vehicle mileage.
 - c. Select battery type Lead Acid.
 - d. Enter cold cranking amp (CCA) rating of 390 CCA.
3. Did the battery pass the load test?
 - a. Yes - allow battery to fully charge. After charging is complete, reconnect the 12-volt battery. Refer to WSM, Section 414-01. Proceed to Step 4.
 - b. No - record the failure code. Replace the battery. Refer to WSM, Section 414-01. Make sure the 12-volt battery is fully charged. Using Integrated Diagnostic System (IDS) service tool, perform the battery monitoring system (BMS). Reset after the new battery is connected. Proceed to Step 4.
4. Reprogram the powertrain control module (PCM), DC/DC converter (DCDC), instrument panel cluster (IPC), gateway module (GWM) and, if equipped with the 4.2-inch display, the front control / display interface module (FCDIM) using IDS release 91.05 or higher. Make sure you are connected to the internet when entering module programming to guarantee you will receive the latest updates. Calibration files may also be obtained at www.motorcraftservice.com.

DISCHARGED 12-VOLT BATTERY OR SERVICE ADVANCETRAC CLUSTER MESSAGE AFTER FOUR WHEEL FLAT TOWING BEHIND RV - BUILT ON OR BEFORE 7/22/2014	TSB 14-0173
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FORD:
2013-2014 C-MAX

ISSUE
Some 2013-2014 C-MAX Hybrid or Energi vehicles built on or before 7/22/2014 may exhibit a discharged 12-Volt battery or a Service AdvanceTrac cluster message after four wheel flat towing behind a recreational vehicle (RV).

ACTION
Follow the Service Procedures steps to correct the condition.

SERVICE PROCEDURE

1. If the vehicle is a 2013 C-MAX Hybrid or Energi, reprogram the powertrain control module (PCM) and the instrument panel cluster (IPC) to the latest calibration using IDS release 91.05 and higher. Make sure you are connected to the internet when entering module programming to obtain the latest updates. Calibration files may also be obtained at www.motorcraftservice.com. Proceed to Step 3.
2. If the vehicle is a 2014 C-MAX Hybrid or Energi vehicle built on or before 7/22/2014 reprogram the PCM to the latest calibration using IDS release 91.05 and higher. Make sure you are connected to the internet when entering module programming to obtain the latest updates. Calibration files may also be obtained at www.motorcraftservice.com. Proceed to Step 3.
3. Print the customer towing instructions attached to the end of this article and provide it to the customer. Make sure the customer is aware they can ignore the SHIFT TO PARK or TRANSMISSION NOT IN PARK messages during recreational towing that will appear in the instrument cluster when the transmission is in the N position and the ignition is in the off position.

SB-10055363-3773

44440 2013-2014 C-MAX Hybrid/Energi vehicles - Pull During Braking

2013-2014 C-MAX Hybrid/Energi vehicles may exhibit a slight drift to the left during low speed regenerative braking. Inspect and inflate tires to correct cold pressure as listed on placard. Inspect the tires for abnormal wear or damage per Workshop Manual, Section 204-00. If condition still exists, it may be further minimized by reducing camber on the left front wheel and increasing camber on the right front wheel. Do not exceed the maximum left to right camber split of - 0.3 degrees or published camber specification limits. Refer to the Workshop Manual, Section 204-00 for camber adjustment procedures and published Service Labor Time Standards.

SB-10055057-1985

SB-10055057-1985

2013 C-Max, 2013-2014 Escape And Focus - Body Control Module Ground, DTC U3008:13

Some 2013 C-Max, 2013-2014 Focus vehicles built on or before 7/10/2013, 2013-2014 Escape vehicles built on or before 9/23/2013 may exhibit DTC U3008:13 in Body Control Module (BCM). If DTC present, a BCM ground issue exists and must be given priority over other DTCs-symptoms. A poor ground can cause low voltage to BCM, which could cause erratic, intermittent operation of several electrical components. Check ground circuits G107, G301 on Focus and C-Max, G103 and G200 on Escape. To verify integrity of ground circuits, use a suitable bulb to place load on circuits, measure voltage drop. With load present, manipulate wiring harness to check for intermittent fault. Repair circuit that drops greater than 0.3 volts and re-test. Check pin fit in all BCM connectors with a flex probe. BCM replacement will result in repeat repair if ground issue is left unresolved.