

Thursday, December 18th was a big day for me. Mission Accomplished. For those of you paying an installer to prep your toad with a baseplate and install an SMI Air Force One, I say it is money well spent. And wages well earned. I know because I just finished this "Do it yourself" project, installing the SMI and a Roadmaster base plate on a Ford CMax Energi, for towing behind our 2014 Tiffin Phaeton. For those that don't know, the CMax Energi is a flat towable (4-down) plug-in Hybrid car with a battery range of 20 miles and a 560-mile range per tank fill. (http://en.wikipedia.org/wiki/Plug-in_hybrid)

Project summary:

There was no part of this installation that was easy, because the CMax is a very compact car. While there were postings on the web (including YouTube videos) for SMI Air Force One installations, there are almost none for the CMax Energi. However, etrailer.com – whose prices, service, and customer reviews are outstanding -- has very useful videos; and the detailed SMI and Roadmaster instruction manuals were very helpful. The SMI kit also comes with a video CD with specific diesel pusher installations instructions.

This is NOT a weekend DIY project, or one to do while on the road. I spent about two weeks working afternoons in the comfort of my garage while it rained. Some days I did not work at all while I awaited parts. Would I do this project again? Yes, because it gave me the knowledge to make repairs if necessary. Could it have been easier? Yes. A car lift would have been a blessing; being 20 years younger would also help. I could have made things easier on myself if I hadn't chosen to solder many of the electrical connections.



When I finished this project, we drove our Phaeton and toad over to a nearby church parking lot to check tight-cornering clearances and hitch heights. We started off with the DW sitting in the CMax to observe braking (does it work, is it too much) and whether the steering wheel turned as we went around corners. Simple things - like did we smoke the tires, did she get jerked back and forth, etc? For DW it was like being in a google self-driving car, which are typical in our area.

My thanks to all those that shared their experiences, good and bad on YouTube, etrailer.com, the Ford CMax forum, IRV2.com and the Tiffin RV Network. I am forever grateful. A copy of this project paper, with updates, if any, can be found on my web site at <http://www.mangles.net/fun/projects/Phaeton/MyCMaxToadBrakes.pdf>

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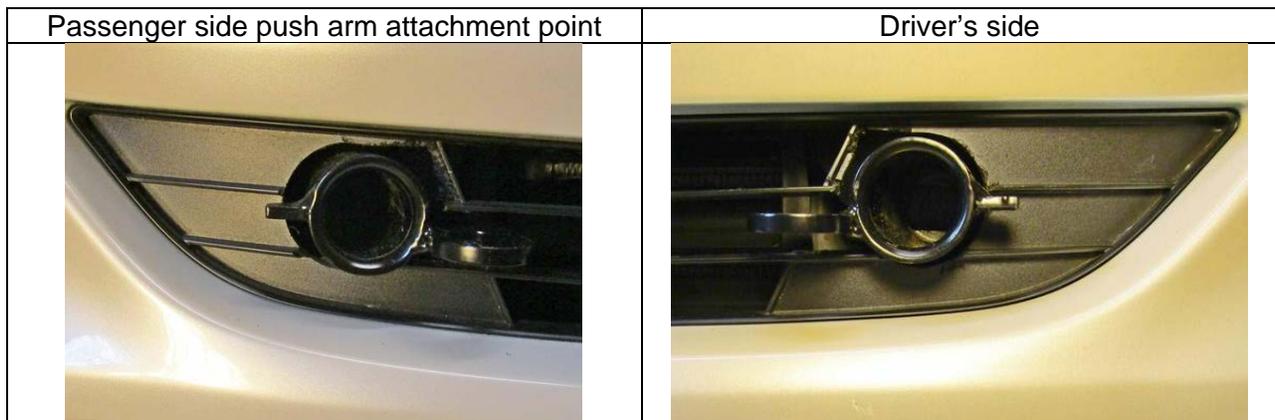
My collection of parts for this project included:

- 2014 Tiffin Phaeton RV
- 2014 Ford CMax Energi
- Blue Ox BX8869 tail light kit
- Roadmaster 524432-1 baseplate
- Roadmaster 522 Falcon All-Terrain tow bar
- Roadmaster RM-048-2, 2" drop down receiver adapter (on backorder)
- SMI Air Force One, SM99202 air braking system
- 7-pin molded wire whip, 8' long
- 6-pin Pollak socket
- Napa BE13250 air brake stoplight switch
- BrakeBuddy 39332 Towed Vehicle Battery Maintainer
- Miscellaneous extra stuff including ¼" 90° and tee air fittings, aluminum angle bar, hookup wire, shrink tubing, wire loom, wiring terminals, etc.

Roadmaster Baseplate:

The Roadmaster baseplate installation was straightforward once the CMax's front end was removed. (Just FYI, taking apart a new car that has less than 200 miles on the odometer is somewhat uncomfortable.) I found Roadmaster's installation instructions very complete with step-by-step narrative and pictures. One place I deviated was in cutting the holes for the round push arm attachment points. Roadmaster recommends cutting a rather square opening in the fascia to facilitate sliding the front grill assembly back into place, but I used a hole-saw to create round openings to better match the contour of the attachment points. Also, I didn't use metal screwdrivers to force things apart as suggested for fear of scratching the paint. Instead, I recommend nylon/poly pry tools such as the ACI 87901 Door Trim Removal Tools available from Amazon for removing trim, fascia, fender fasteners, etc. They are inexpensive and well worth the minor investment.

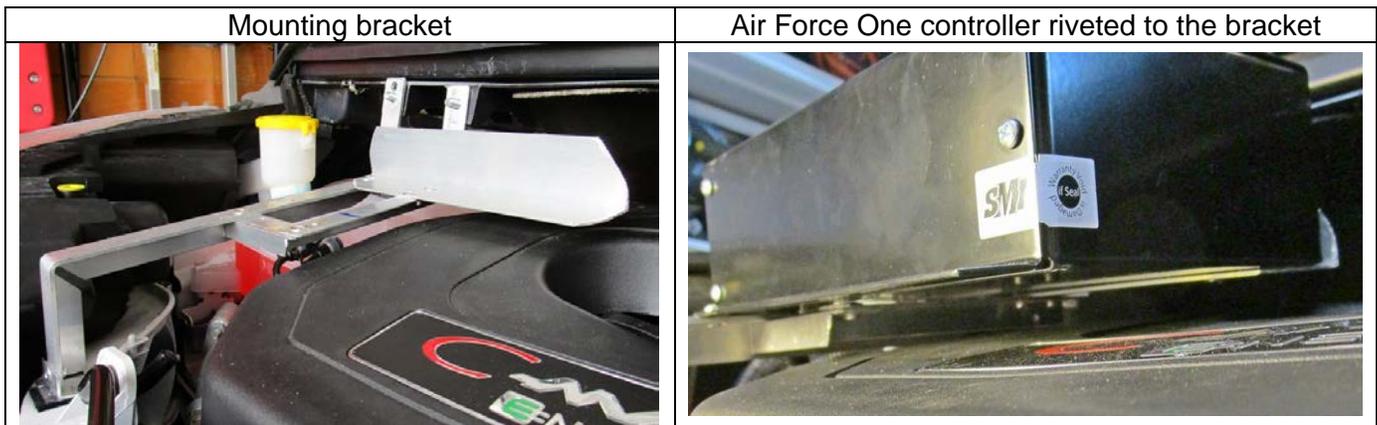
In case you are wondering why I chose Roadmaster vs Blue Ox, my choice came down to esthetics. I liked the looks of the Roadmaster including the attachment location penetrations. It was also the Roadmaster staff that recommended etrailer.com.



SMI's Air Force One air brake system:

SMI's instructions are very good, providing step-by-step instructions for a DIY installation that impacts vehicle braking systems – rather important stuff. Perhaps the most concerning is cutting the air lines on a new RV. This is also where I encountered the biggest surprise. Even though I had drained the air holding tanks, the main 5/8" line blew when I cut it. To say this was a shock is an understatement; but no soiled undies. As a side note, I strongly recommend a good plastic tubing cutter that will cut square edges quickly. I found the Conbraco Industries 69PTKC001 Apollo Tubing Cutter from Amazon effective for this project. See web links on the last pages of this project paper.

Mounting the SMI controller box was a challenge in an engine compartment so stuffed that Ford placed common under-the-hood components into the front fender wells below the headlights. I spent at least two days creating a custom support bracket, which supported the SMI box on the passenger side of the engine compartment, adjacent to the firewall penetration point via the main wiring harness rubber grommet. This location allowed for the SMI air brake line to enter the passenger compartment behind the glove box. There is only ½" of space below and above the SMI controller box, between the hood and engine air cleaner assembly.



Everything in place. The unconnected white-tipped vacuum assist line is not needed for the CMax, according to SMI tech support. An air brake stoplight switch is connected to the controller's outgoing airline.



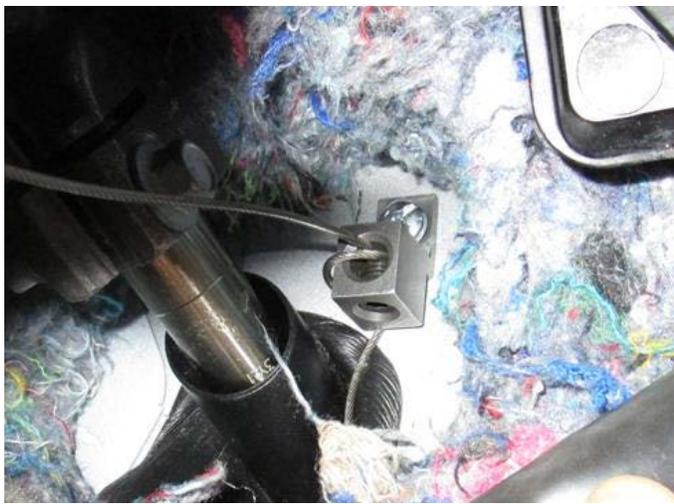
I had to remove the engine cover/air filter assembly to gain access to the firewall in the engine compartment. Getting the ¼" airline into the passenger cabin from there was fun due to the limited space and my rather short reach; nothing is as direct and easy as it used to be on my old CJ2A with its ample firewall penetrations. Once the airline was fed into the passenger compartment, it was easy to route it along the steel cabin stiffener support to the driver's side, where it aligned almost perfectly with the Air Force One air cylinder connector mounted on the brake pedal.

Firewall area under the dashboard. The 1/4" airline from the SMI controller is protected by the black wire loom. I made a large loop to avoid airline kinks and to provide slack for adjustments if needed. The steel cabin stiffener support is at the bottom of the photo.



Proper placement of the air cylinder on the brake pedal required a few calls to SMI technical support. They were helpful and easy to reach. When I had to secure the floor anchor, I was nervous about blindly drilling into the firewall near the steering linkage; this location is not viewable from under the car, so I could not determine what was on the underside when drilling from the inside. So I went very slowly using small drill bits and a bright flashlight. There is a black material on the other side which could be firewall or wiring insulation. With a little probing I concluded it was firewall insulation (I hope).

Floor anchor



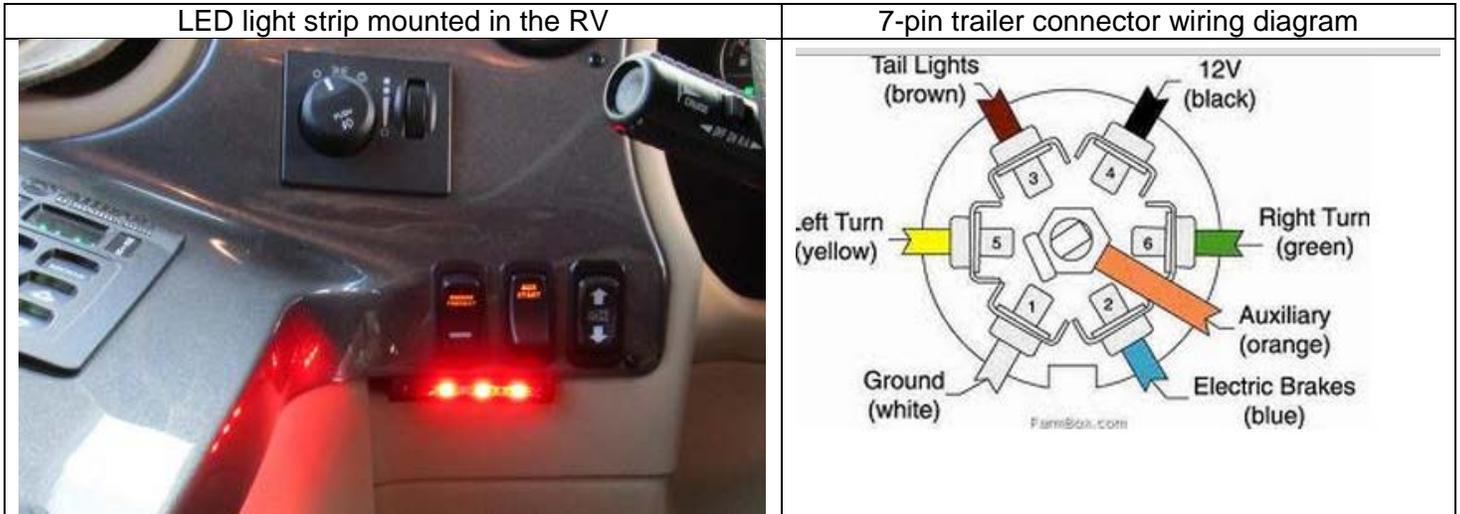
Air cylinder connected and ready to work.



Braking Indicator:

I found discussions in RV forums for wireless and wired braking indicators, which inform the RV driver when the toad brakes are applied. The indicator can alert the driver to a problem situation when toad tires or brakes could be damaged due to faulty application of toad brakes, or a toad braking system failure. SMI uses a simple and very bright LED light strip. The Air Force One instructions call for tapping into the toad's brake light switch and placing the LED strip in the front windshield where it can be seen in the RV's rearview camera.

However, SMI also presents alternative locations, including the RV driver's area, so I chose to install the LED strip in the cab near the headlight switch. Since the CMax brake light switch is a dead switch when the ignition is off, I also installed a NAPA BE13250 air brake stoplight switch at the Air Force One controller box under the hood. Next, I appropriated the unused trailer brake wire, pin 2, to feed signal power to the LED strip from the air brake stoplight switch via the RV to toad connector harness. Now I can easily see the toad's brake system status while driving.



Dead battery concerns:



My web research indicated a battery discharge problem for the CMax; the battery charge can be insufficient to start the car after a full day of towing. My solution was to provide a battery charge line from the RV. Since most tow vehicles with a 7-pin connector are wired with +12 vdc on pin 4 (see above), it was a simple matter to extend this charge line to the CMax jumper post under the hood via a BrakeBuddy Towed Vehicle Battery Maintainer. This addition required an extension line from the CMax 6-pin receptacle to the BrakeBuddy with its internal 20 amp fuse, then to the CMax's jumper post. The CMax battery is located in the rear of the car, so Ford placed a jumper post under the hood (smart decision).

This photo to the left shows the jumper post with the red (+) cover removed. Directly behind the copper jumper post is the inline 20 amp fuse line that feeds the breakaway switch. Behind that fuse is the BrakeBuddy with its yellow 20 amp internal fuse uncovered.

Toad tail lights:

Since our CMax is a new car, I chose not to cut the factory wiring to install diodes, but rather to install another tail light pigtail in each tail light enclosure. I wanted to use LED tail lights, but online reviews indicated reliability issues; so I chose an incandescent bulb kit. The Blue Ox BX8869 tail light kit contains all the parts I needed and it received high rankings on the web. The pigtail installation was easy because the CMax tail light enclosures are spacious. The hard part was running the wires. Since there was no access to the rocker panel cableways or adequate routes within the CMax frame, I followed existing wiring and fuel line paths on the underside of the passenger side. This was a PITA because I lacked a lift rack to facilitate access. All and all, it took about one hour to install the lights and another 3 or 4 hours to run the wiring in a protective route. I used wire loom and tie wraps to secure and protect the taillight wiring. I soldered all the connections, and added easy connect/disconnect terminals at each of the new taillights to facilitate removing the fixtures if needed.

Fascia preparation before reinstallation:

I had to remove the front fascia (grille and bumper assembly) to install the Roadmaster baseplate. While the fascia was off the car, I thought I was being smart in drilling and mounting the breakaway switch on the fascia before reinstalling it; putting the CMax fascia on is easy compared to taking it off again. Unfortunately I did not pre-mount the Air Force One air connector when I had more space for tools with access to the backside. So the air connector installation was more laborious than it needed to be. How hard can two screws be to install?

Wiring:

Designing the wiring path(s) from the Roadmaster baseplate mounted 6-pin receptacle was made more difficult than need be, partly because at the time when the front fascia was off, I did not know I had a dead brake-light switch and I was unsure where the Air Force One controller would fit. To improve my options, I installed a wire loom with four wires each on both sides of the radiator before I reinstalled the front fascia. Each set of wires extended up from the 6-pin receptacle to the top of the radiator with three feet of excess wiring. Later, I used one of the wires on the passenger side to pull the ¼” airline and a replacement wire into place. Note to self: determine all your potential wiring needs and pathways before you reinstall the front end of the car.

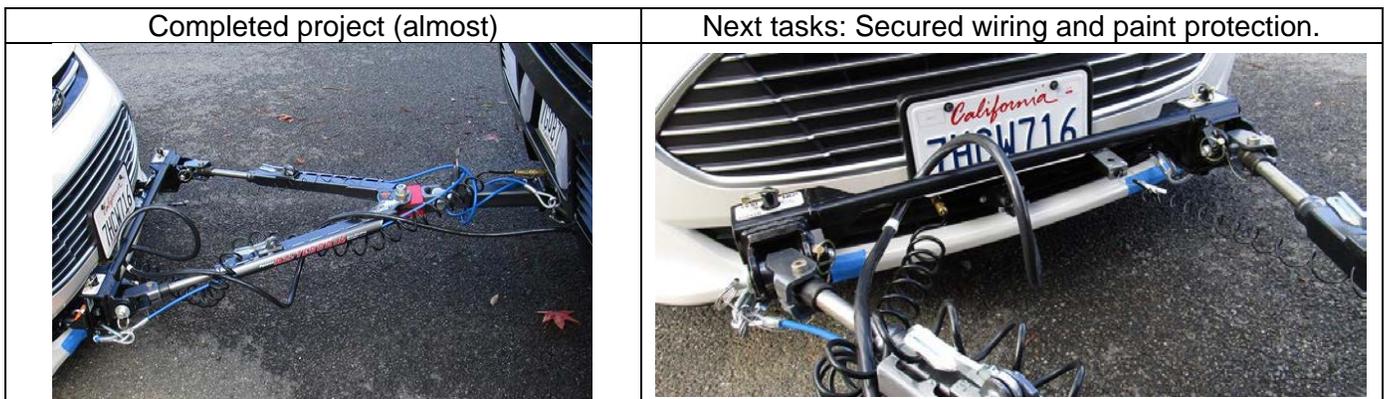
I custom fitted an RV/trailer 7-pin molded wiring whip with a 6-pin plug for the toad. Etrailer.com has many choices, from custom kits to factory wired. Common connectors are also available from Amazon.

Wrapping it up:

Once I connected the car and its tow bar to the RV hitch, I saw that there was an unacceptable height difference. From the Roadmaster documentation I concluded that I needed a 2” drop-down receiver adapter, which I have ordered. I chose the 400 pound tongue weight option for the receiver adapter since the 100 pound option seemed too light-duty.

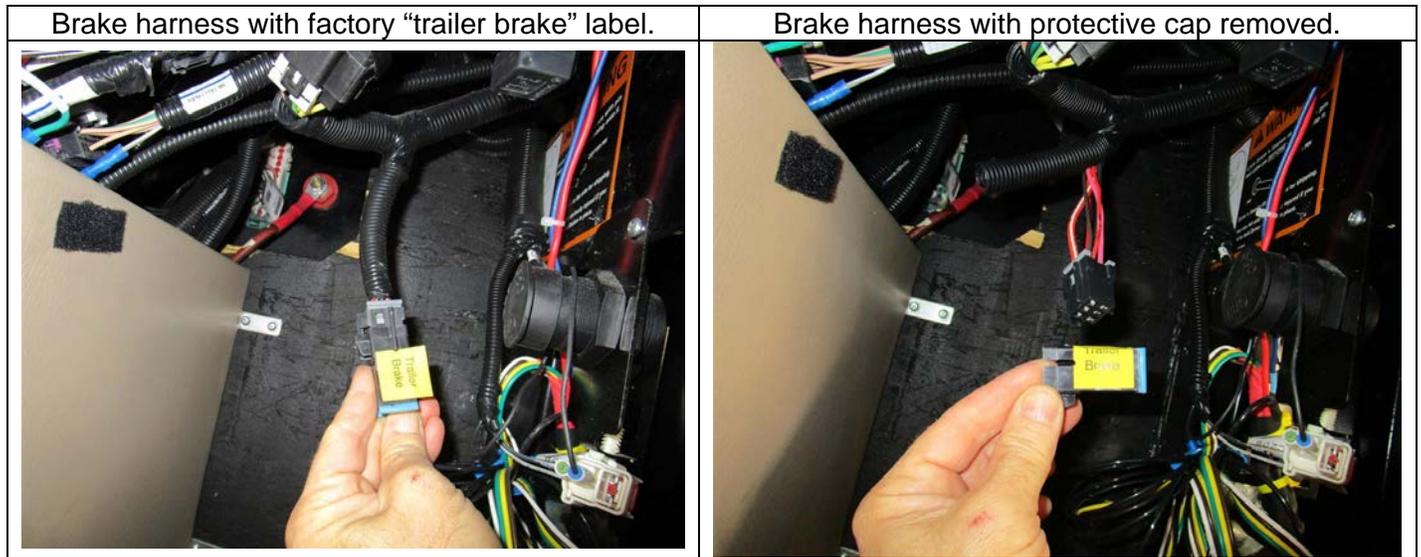


There are a few things I’d like to improve; I’m still not happy with the unsecured wiring path between the RV and toad. And the baseplate safety cables may scratch the toad’s paint finish; for the present I am using blue painters’ tape to protect the toad paint.



A final bit of information:

While doing this project a Tiffin RV Network forum discussion took place concerning the unused electric brake harness. Using the RV trailer brake signal wire seems like a common solution for the toad brake status indicator. Additionally, the biggest challenge discussed is the wire harness location. I have been told the harness and its location are common with the Freightliner chassis; located above the brake pedal and/or to the left of the steering column, adjacent to the left kick panel. In my RV this is where I found it with a labeled protective cap on the end of the wiring harness as the following photos show.



This photo shows the unused electric brake wiring harness after I used Scotch wiring taps for connecting the SMI LED light strip. The red wire with a white strip is the hot lead from the toad mounted air brake light switch and the dark gray wire provides a ground connection. Scotch clip-on taps were used in case I later need to use this harness with an electric brake controller.



Useful web links for this project:

I have not included IRV2.com or Tiffin RV network links as they are membership web sites.

Education for project planning:

YouTube videos are plentiful. On the YouTube web site enter the product name and your toad model. Most of the etrailer videos are on YouTube.

Links to the etrailer videos and manufacture's installation instructions are also available on the etrailer product web pages. For the CMax they are:

<http://www.etrailer.com/Tow-Bars/Roadmaster/RM-522.html>

<http://www.etrailer.com/Tow-Bar-Braking-Systems/Ford/C-Max/2014/SM99202.html?vehicleid=20141392369>

<http://www.etrailer.com/p-BX8869.html>

<http://www.etrailer.com/Base-Plates/Ford/C-Max/2014/524432-1.html?vehicleid=20141292180>

SMI Air Force One

<http://www.smibrake.com/air-force-one.html>

Overview:

<https://www.youtube.com/watch?v=chThaftiJ9g>

Installation:

<https://www.youtube.com/watch?v=xLFu9ldYXCI>

Roadmaster web site

<http://roadmasterinc.com/index.php>

CMax baseplate installation video

https://www.youtube.com/watch?v=oE_zpWwnUxA

Blue Ox web site

<http://blueox.com/>

Purchases:

Typical etrailer and Amazon items

SMI Air Force One brake system

<http://www.etrailer.com/Tow-Bar-Braking-Systems/Ford/C-Max/2014/SM99202.html?vehicleid=20141392369>

Roadmaster 55 All Terrain Tow Bar

<http://www.etrailer.com/Tow-Bars/Roadmaster/RM-522.html>

http://www.amazon.com/gp/product/B000F50CQM/ref=oh_aui_detailpage_o09_s00?ie=UTF8&psc=1#customerReviews

Roadmaster CMax baseplate

<http://www.etrailer.com/Base-Plates/Ford/C-Max/2014/524432-1.html?vehicleid=20141292180>

Blue Ox BX8869 tail light kit

<http://www.etrailer.com/p-BX8869.html>

http://www.amazon.com/dp/B003VAUQ2I/ref=sr_ph?ie=UTF8&qid=1419181969&sr=1&keywords=bx8869

BrakeBuddy

<http://www.brakebuddy.com/Products/Accessories/Towed-Vehicle-Battery-Maintainer>

http://www.amazon.com/gp/product/B004RCXB8A/ref=oh_aui_detailpage_o08_s00?ie=UTF8&psc=1

7-pin molded wiring harness

<http://www.etrailer.com/Wiring/Hopkins/H20046.html>

http://www.amazon.com/Hopkins-20146-Blade-Molded-Trailer/dp/B0007LL0CO/ref=pd_sim_sbs_auto_2?ie=UTF8&refRID=0K6X5JMPFGTKCHBHYXMM

6-pin trailer plug and receptacle used on the toad

<http://www.etrailer.com/Wiring/Pollak/PK11604.html>

<http://www.etrailer.com/p-PK12720.html>

Air brake switch:

Napa, MBI BE13250 air brake switch

<http://www.napaonline.com/Catalog/Result.aspx?Ntt%3dBE13250%26Ntk%3dKeyword%26Nty%3d1%26Dn%3d0%26D%3dBE13250%26Dk%3d1%26Dp%3d3%26N%3d0>

An alternative is the SMI air brake switch kit available from etrailer.com

<http://www.etrailer.com/Tow-Bar-Braking-Systems/SMI/SM99629.html>

Misc purchases:

Conbraco tubing cutter

http://www.amazon.com/gp/product/B0054YDY0A/ref=oh_aui_detailpage_o04_s00?ie=UTF8&psc=1

ACI poly/nylon door trim removal tools

https://www.amazon.com/gp/css/order-history/ref=oh_aui_pagination_1_2?ie=UTF8&orderFilter=months-6&search=&startIndex=10

Non-DOT rated 1/4" tubing elbows

http://www.amazon.com/gp/product/B009PT3SFQ/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1

Non-DOT rated tee with 1/4" tubing and 1/4" NPT female for direct connection to Napa air brake switch

http://www.amazon.com/gp/product/B009PT2D2A/ref=oh_aui_detailpage_o00_s01?ie=UTF8&psc=1

DOT rated air brake couplers:

While I did not write about them, I purchased DOT rated couplers for my coach airlines in case I made a mistake and/or if I needed to remove the SMI tee fittings. Additionally, carrying such couplers in one's RV is a good idea for roadside repairs.

Royal Brass / Parker Store in San Jose, ca.

<http://rbisj.com/>