

The Hitch in Trailer Wiring.

When working on a trailer, the electrical interface between the trailer and the tow vehicle can present special issues that must be understood and dealt with in order to prevent problems

- The 7-Pin connector can not handle the current used in alternator charging
- The 7-Pin connector connects several critical safety signals that must continue to operate.
 - Electric brake controls
 - Brake lights
 - Running lights
 - Reverse lights

If the user is not careful, they can create situations where these functions do not work and/or create a fire hazard.

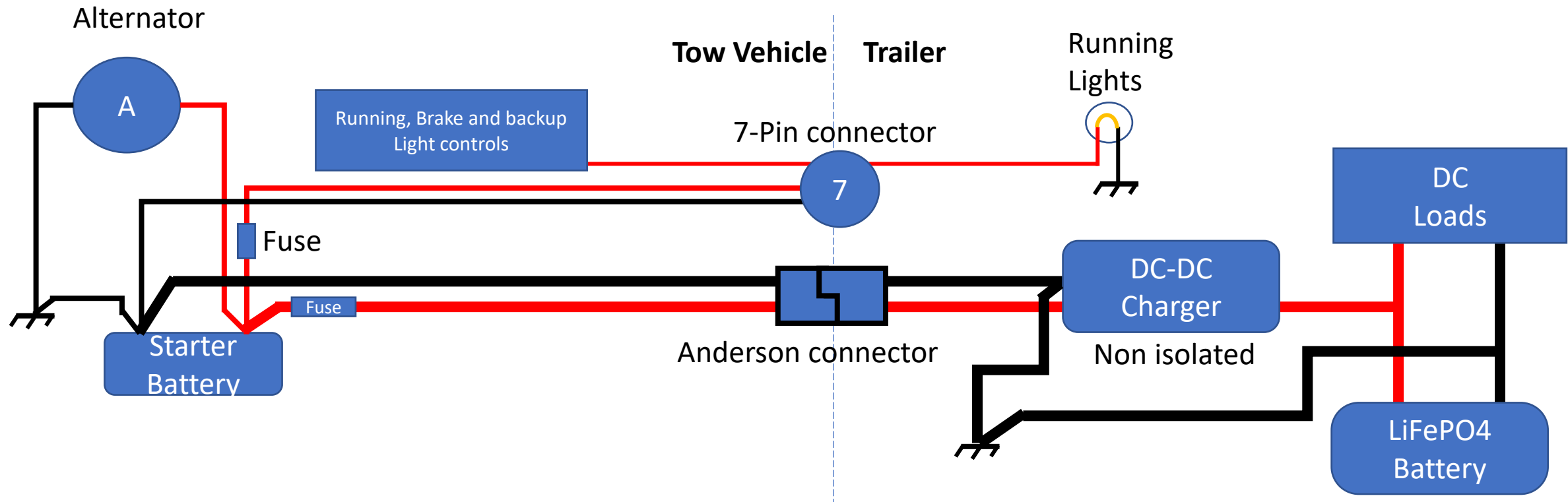
Appendix A & B of this paper show the typical wiring and the common pinouts of the 7-pin connector. However, this paper does not attempt to describe how to wire the 7-pin connector. Instead, it discusses issues around the 7-pin connector that trailer electrical upgrades may run into and how to avoid them.

Proper connection for alternator charging.

- 1) Since the 7-Pin connector can not handle the current for alternator charging, many people will use an Anderson connector and large wires instead of the Ground and +12V of the 7-Pin connector.

Problem: If Anderson Connector is not hooked up, the running, brake and backup lights won't work due to loss of chassis connection. If the user is OK with this risk, then things should be fine for them. However, since the electrical brakes and the various lights are important (critical?) safety items, I am not very comfortable with this solution

Problem 2: All tow vehicles used for the trailer must have the Anderson connector.

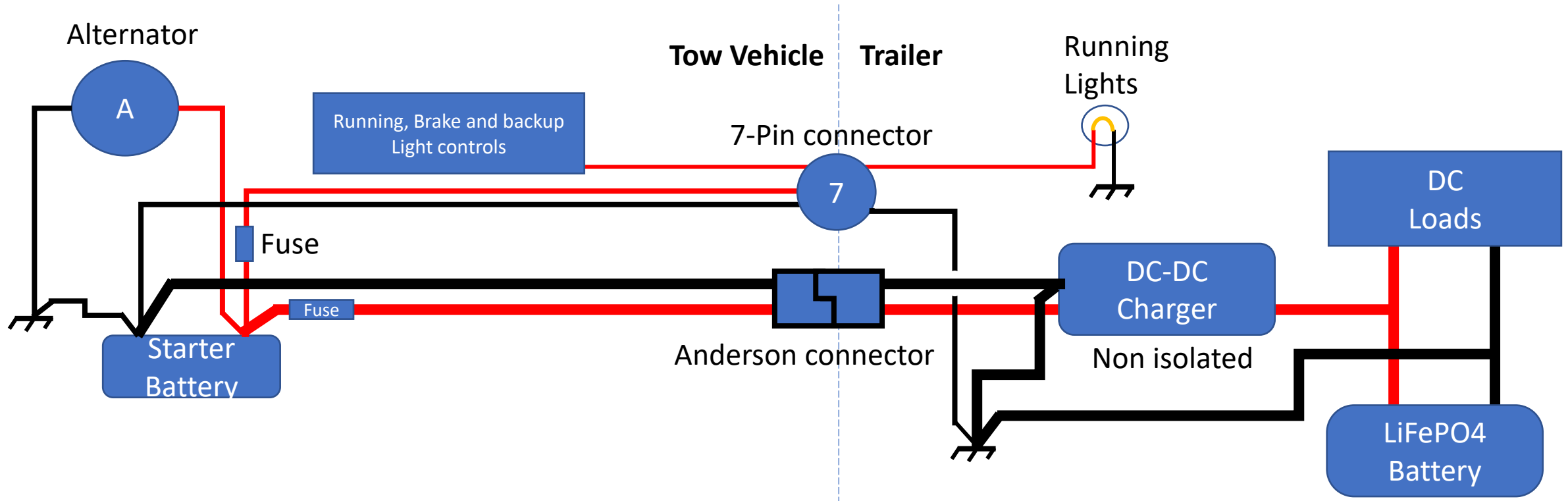


Proper connection for alternator charging.

2) One might suggest leaving the negative connected through the seven pin connector. This will keep the safety devices working even if the Anderson connector is unplugged.

Problem: If there is a bad connection anywhere along the large negative wire through the Anderson Connector, a large negative current could go through the 7-Pin connector and burn it and/or the associated small wires. In addition to possibly disabling the lights and brakes, this is a fire hazard.

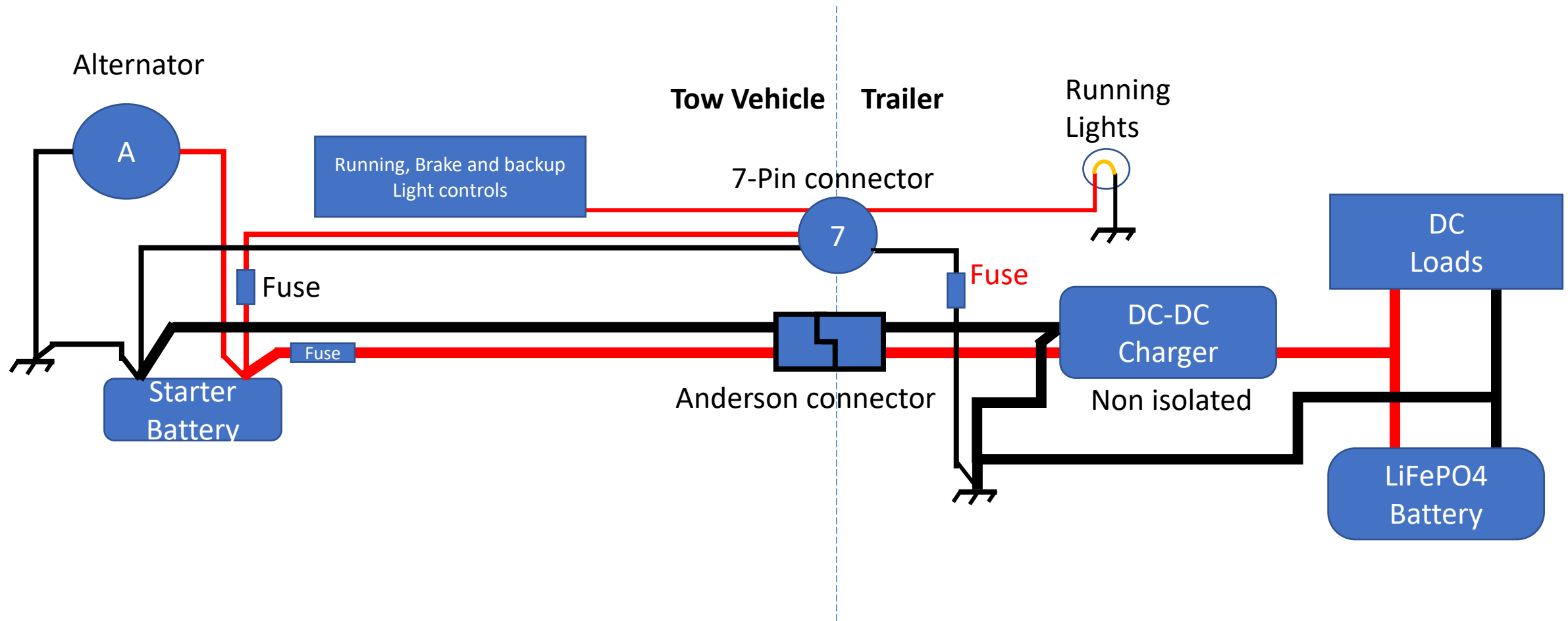
Note: Keep in mind that the Anderson connector is exposed to the elements and moving around a lot as the vehicle moves. This increases the probability of a problem with the connection.



Proper connection for alternator charging.

- 3) The 7-Pin connector could be protected with a fuse on the negative. This would keep the 7-Pin connector and wires from burning.

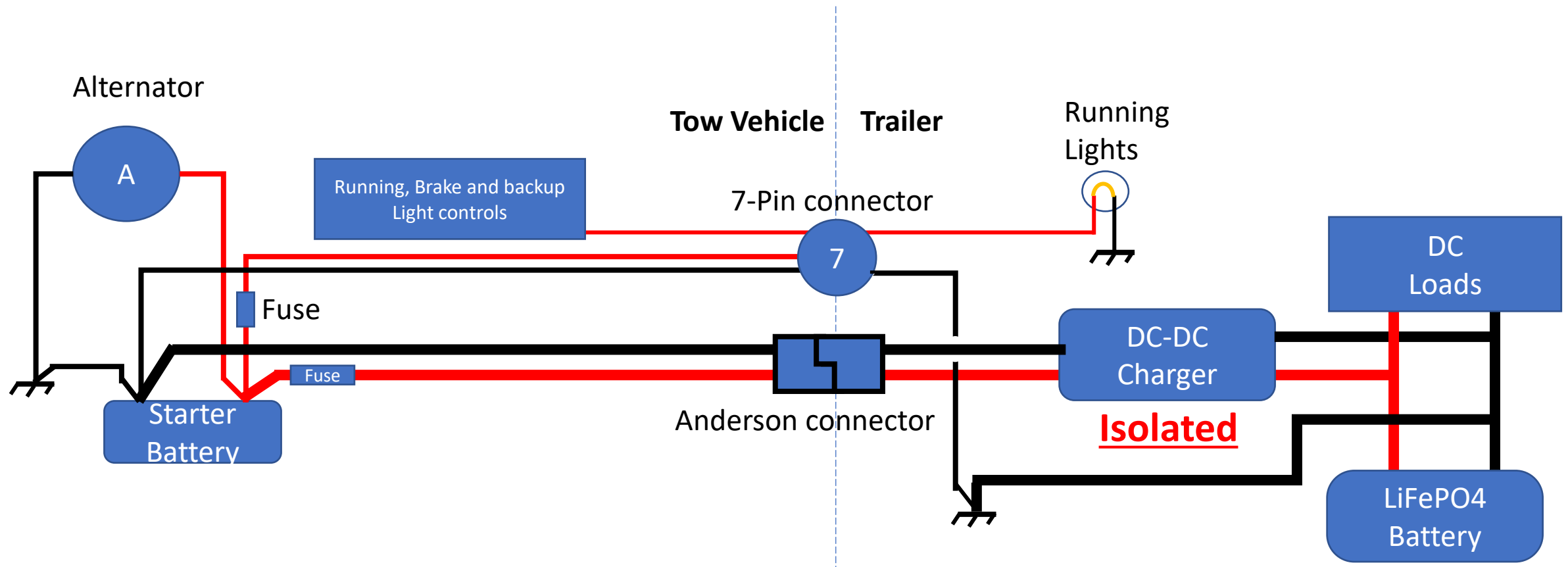
Problem: If the fuse blows, the trailer might lose the brakes and the various lights. It would prevent a fire, but is this really that much safer?



Proper connection for alternator charging.

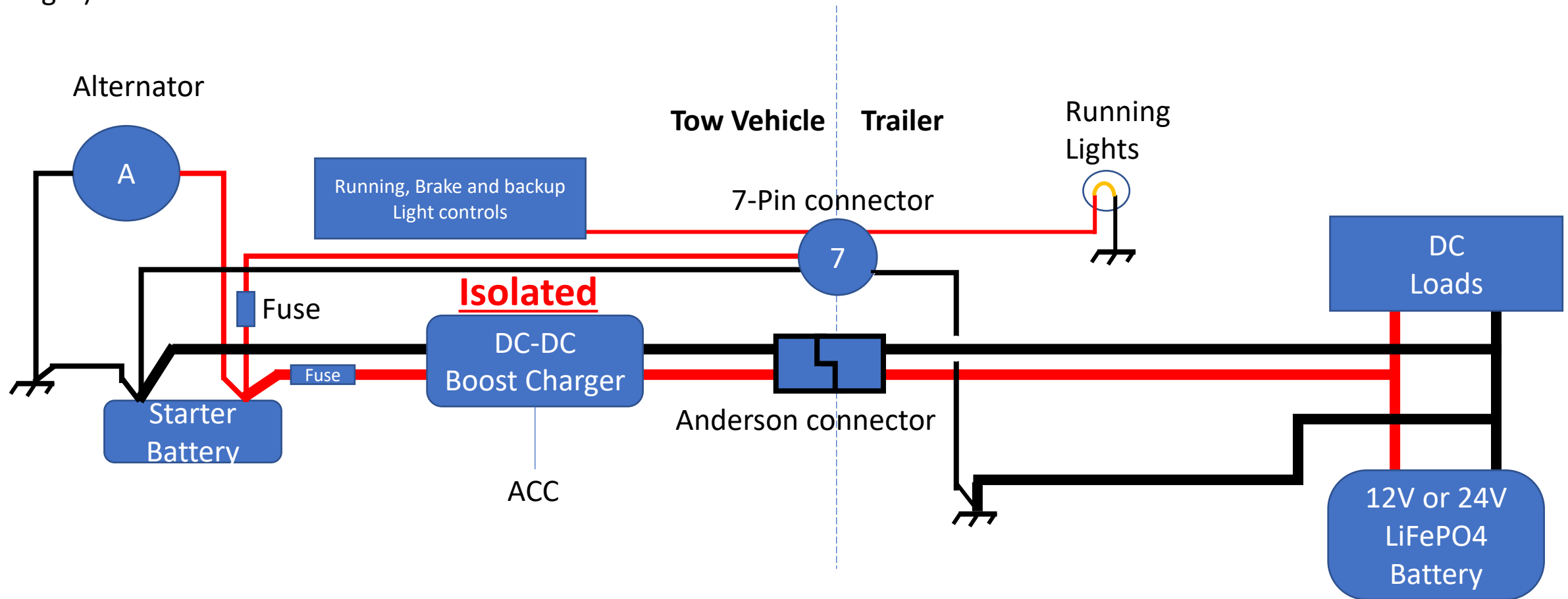
4) Use an isolated DC-DC charger.

This works without significant issues and is my recommendation....but isolated chargers can be expensive.



Bonus recommendation:

If you are using a Boost Charger to drive a 24 or 48V system, put the converter in the tow vehicle as close to the alternator as possible. This makes the high voltage, lower current part of the circuit the longer run. Therefore, there will be less voltage drop. Furthermore, the tow vehicle ACC signal is available to turn the boost charger on and off. (This alone is a good reason for putting the DC-DC charger in the Tow Vehicle, even if it is not a boost charger)



Special consideration for the brake-away brake switch.

An electrical brake-away switch is designed to apply the trailer brakes if the trailer brakes away from the tow vehicle. It is critical that any modifications to the trailer electrical system does not disable this functionality.

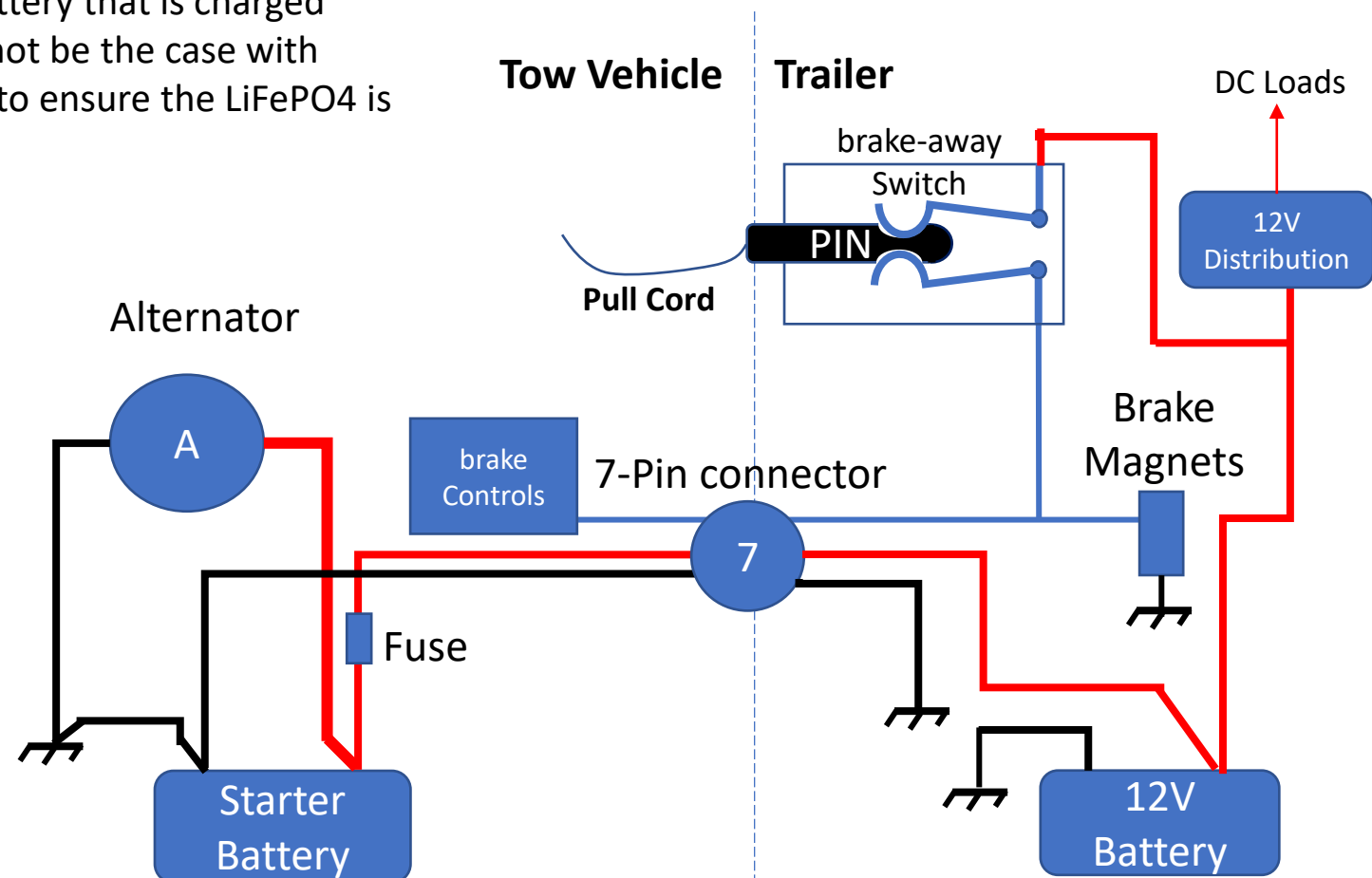
As seen in this diagram, if the trailer brakes away. The pin in the brake away switch will pull out and 12V will be applied to the magnet at the brakes, this will cause the brake pads to engage the drums and stop the trailer. If the trailer battery, is being replaced by a 12V LiFePO4, this system will continue to work as long as the lifepo4 is properly charged.

Note however that most trailers have a 12v lead acid battery that is charged by the 12V through the 7-Pin connector. This will may not be the case with LiFePO4 upgrades. Therefor it is important for the user to ensure the LiFePO4 is charged before traveling.

Furthermore, the brake-away switch should not be behind a switch that turns off DC loads. If the switch is left off while traveling it leaves the brakes disabled

Note: Many locals require the brake-away brake on all but the smallest trailers. Even if the trailer does not have a tow vehicle-controlled brake system, it may still have an electrical brake-away brake system.

The following pages discuss ways of providing the 12V to the brake-away switch when the house battery is converted to 12V or 48V

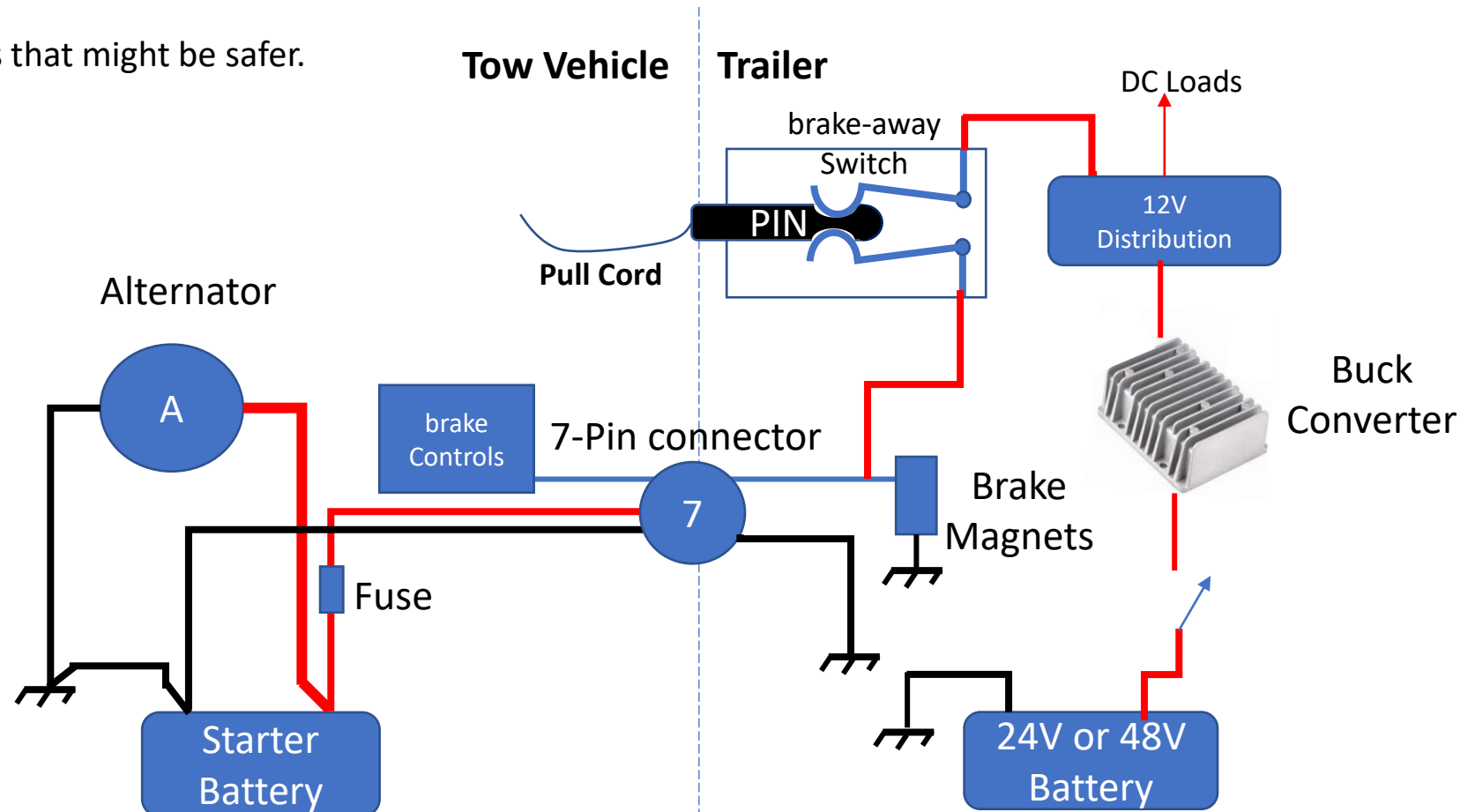


Special consideration of the brake-away switch if the house battery is **24V or 48V**

If the LiFePO 4 upgrade changes the house battery to 24 or 48V, special accommodations must be made to prove 12V to the brake-away switch.

Most of the time there will be a buck converter to power 12V loads, but there is also usually a switch that allows the converter to be turned off to eliminate the idle draw of the converter. If this switch is off while traveling, it could be dangerous, so this is not recommended.

The following pages show a few alternatives that might be safer.

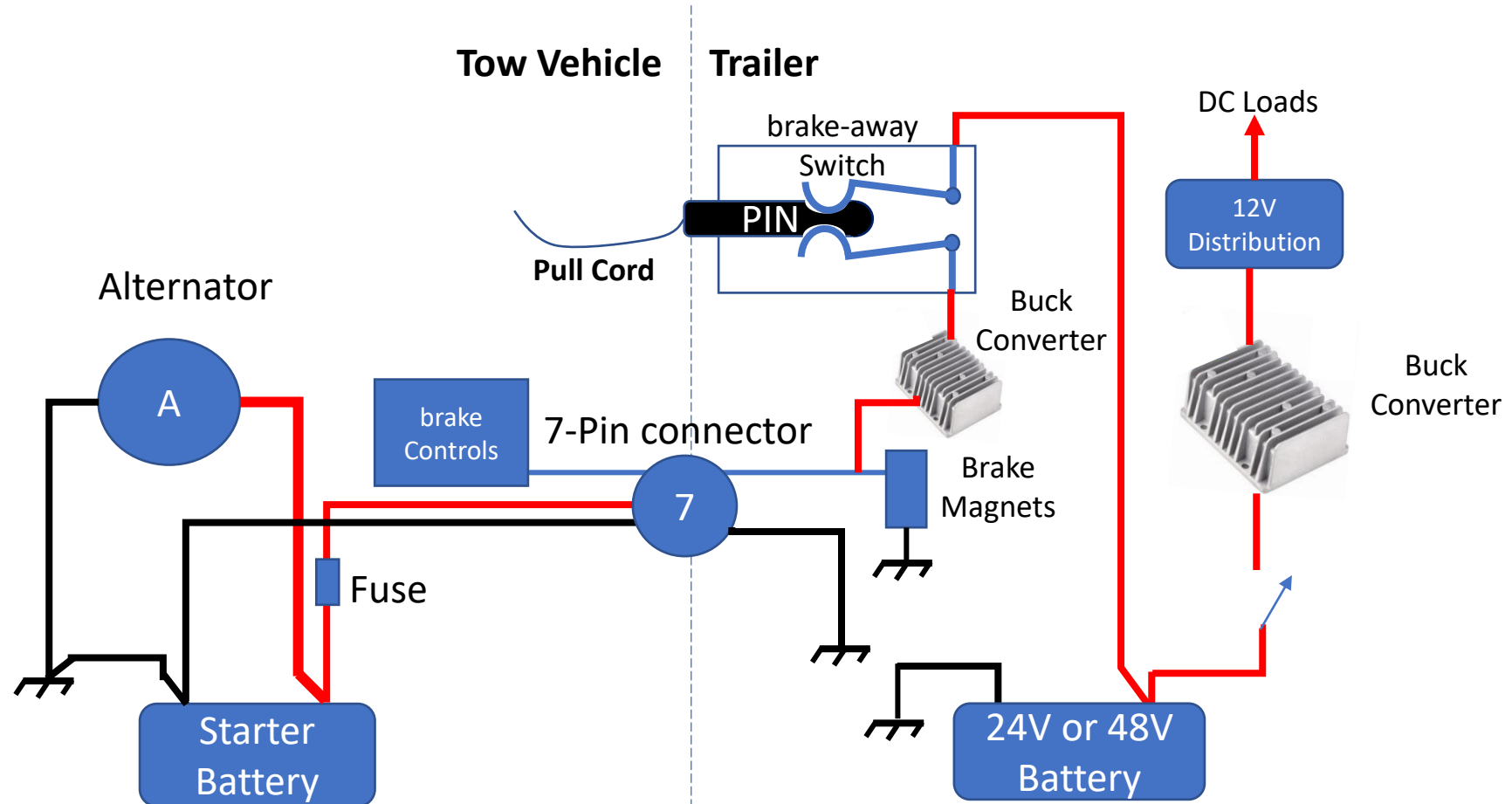


Special consideration of the brake-away switch if the house battery is 24V or 48V: Dedicated Buck Converter.

One possible solution for 24/48V systems is to have a dedicated buck converter that only engages when the brake-away switch closes. A small buck converter can usually be found for less than \$50.

Note: This is probably fine for 24V systems but can the switch work reliably at 48V (Probably.....but I don't know)

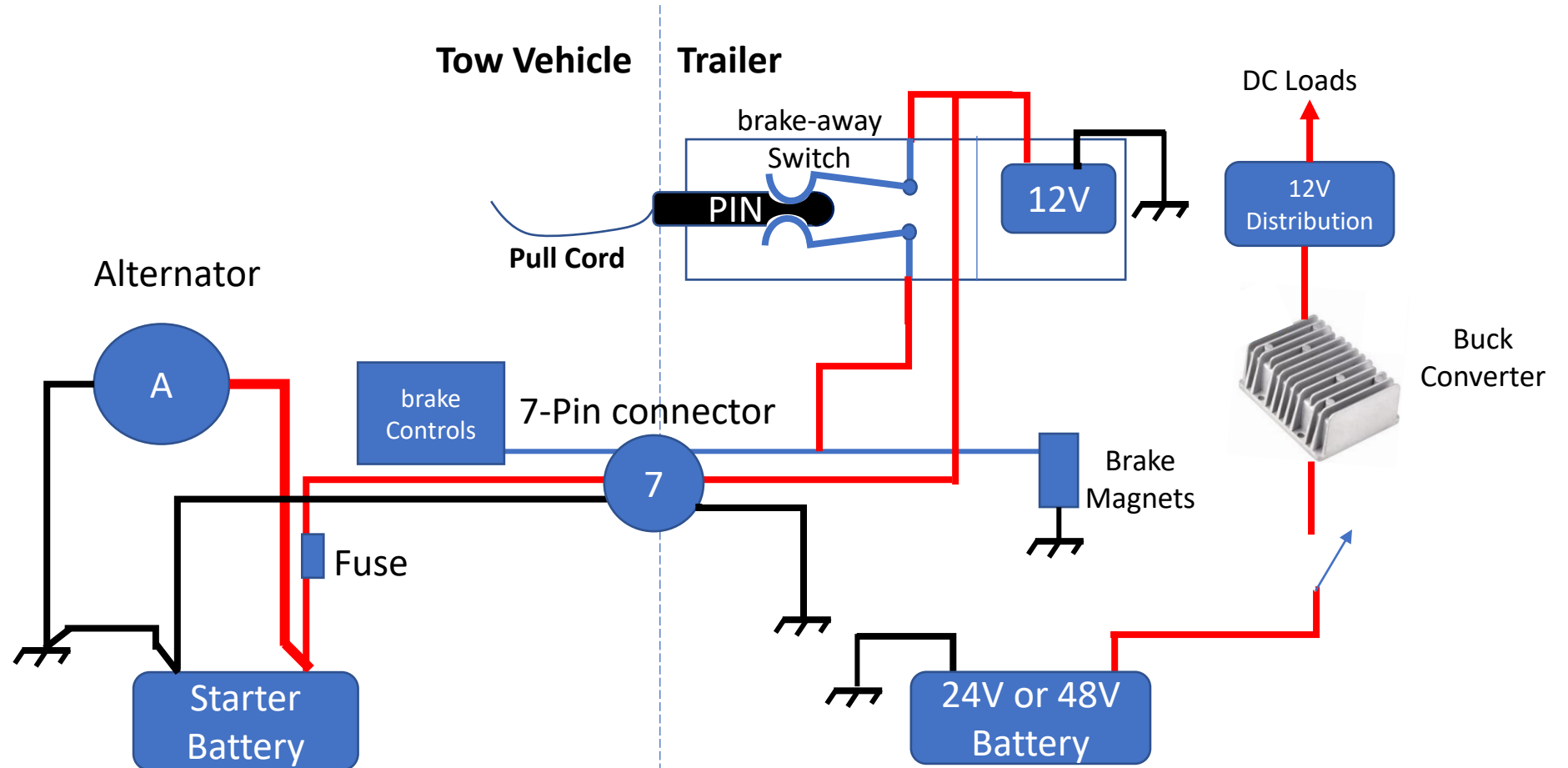
Note: The brake magnets typically draw ~3A each. That means a two-axel trailer will have 4 magnets and draw ~12A



Special consideration of the brake-away switch if the house battery is 24V or 48V: Self Contained brake switch

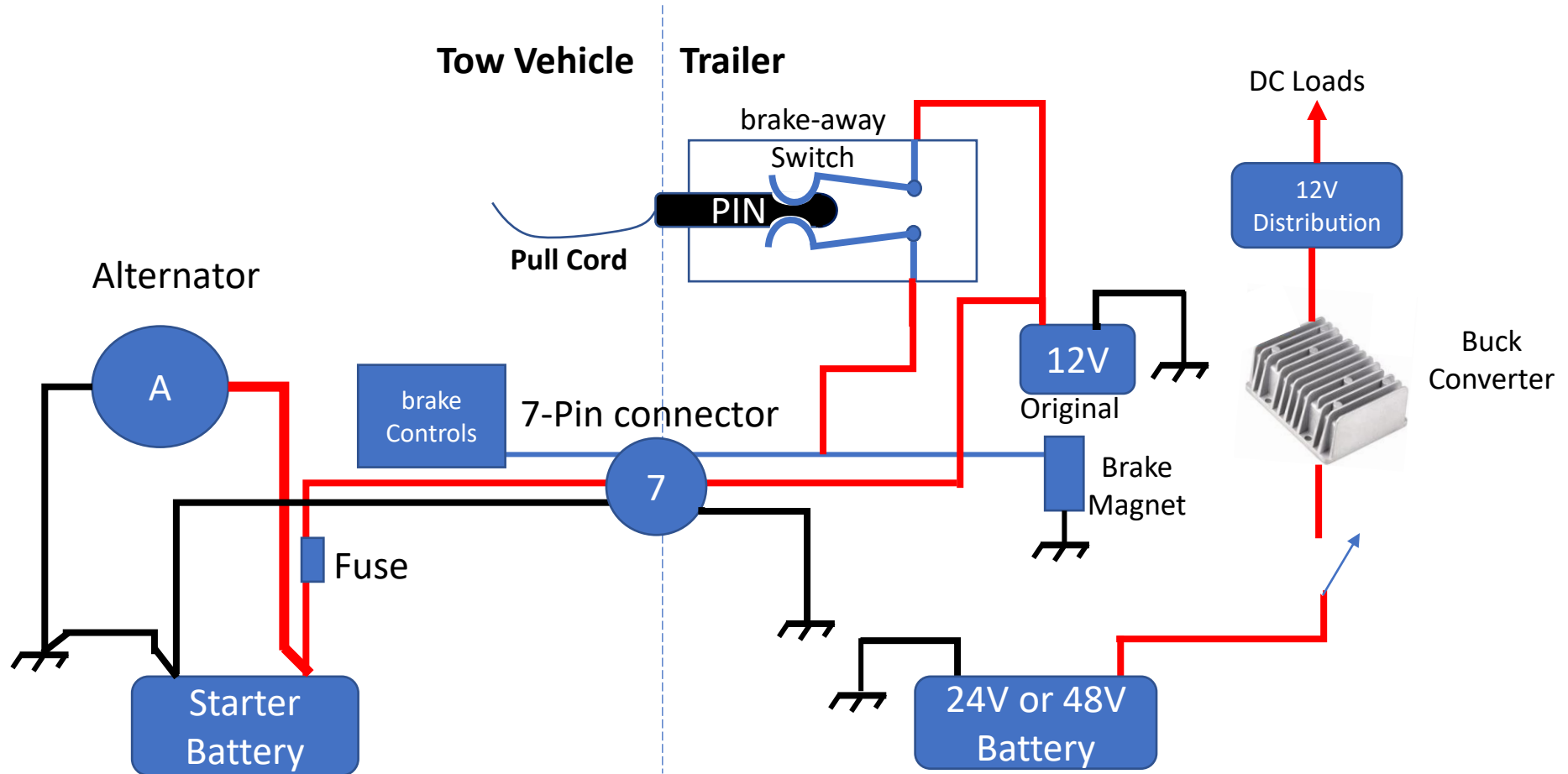
Since not all trailers have batteries but are still required to have brake-away brakes, there are brake-away brake systems that have their own battery that is charged via the 7-Pin connector. These are available for \$100 or less.

This may be my favorite solution because it is so independent of the rest of the trailer system.

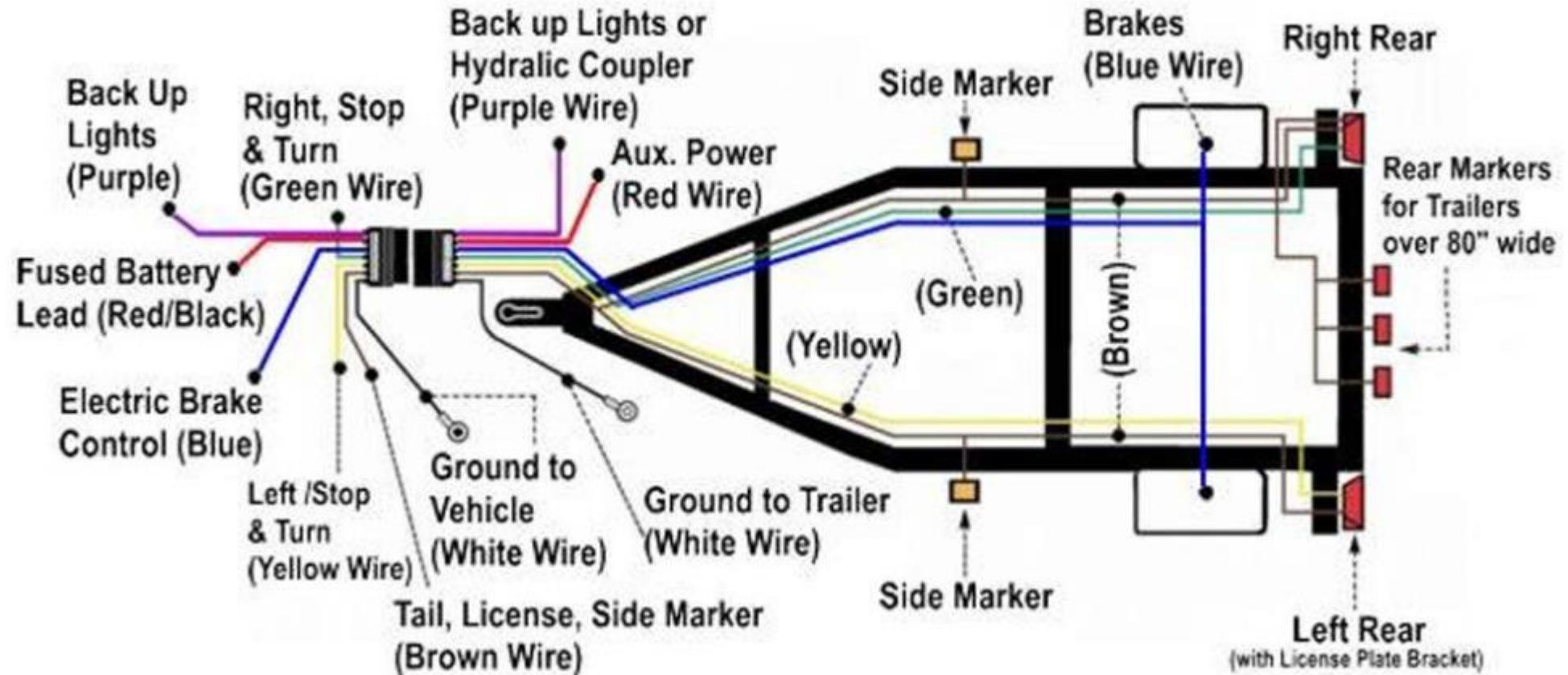


Special consideration of the brake-away switch if the house battery is **24V or 48V**: Leave the original 12V battery

One final solution is to leave the original 12V battery in place just for powering the brake. (Not many people will be happy with this solution)



Appendix A - Typical trailer wiring from the 7 pin connector



This image is copied from <https://www.etrailer.com/faq-wiring.aspx>

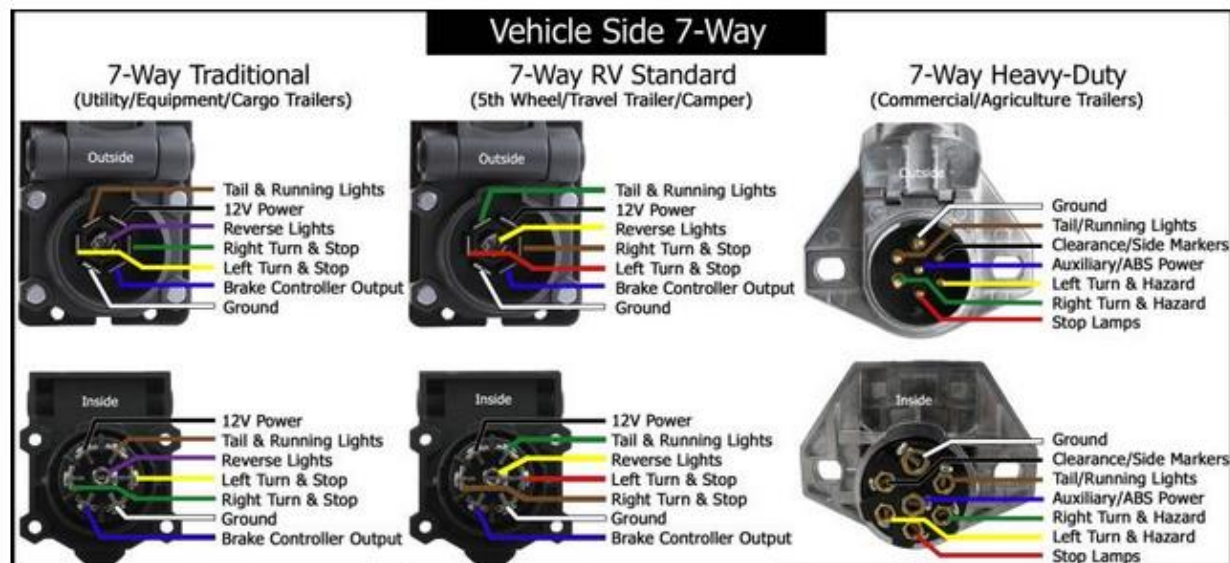
This page has a lot of good information about trailer connectors and wiring layout.

Appendix B - NOT ALL 7 Pin Connectors are wired the same.

If you are working around the 7-pin connector, do not assume a particular layout or color code. The image to the right shows the 3 most common layouts and where they are typically used. However, you can not assume a particular layout based on the type of trailer. The layout must be checked on each and every trailer.

The image to the left is copied from
<https://www.etrailer.com/faq-wiring.aspx>

This page has a lot of good information about trailer connectors and wiring layout.



Note: To ensure that your trailer connector is wired properly, we recommend using a circuit tester to match pins by function. Because wire colors can vary, they are not as reliable for determining functions. And improperly connected wiring can cause damage to electric components.