Trailer Wiring & LED Conversion For Glider Pilots

This document may have been updated
Be sure to download the latest version!

Issue Date: September 28, 2023

PLEASE NOTE

This presentation may have been updated with new information, changes, and corrections.

Be sure to visit my presentation web site and download the latest version of this document.

It could make an important difference to your work!

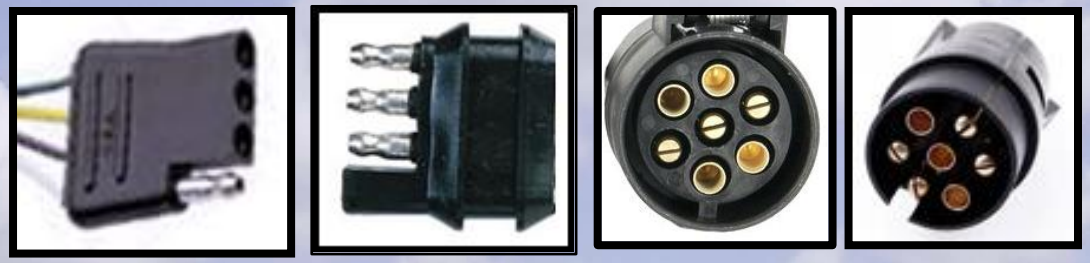
http://aviation.derosaweb.net/presentations

Thank you, John (OHM Ω)

Trailer Wiring 101

Trailer Wiring General Information

- Reference Links
- Wiring Diagrams - US and European
- Connectors
- Functions
- Pinouts
- Tables
- Separation of turn signal and brake wiring



Trailer Connector References

Trailer connectors in North America
https://en.wikipedia.org/wiki/Trailer_connectors_in_North_America

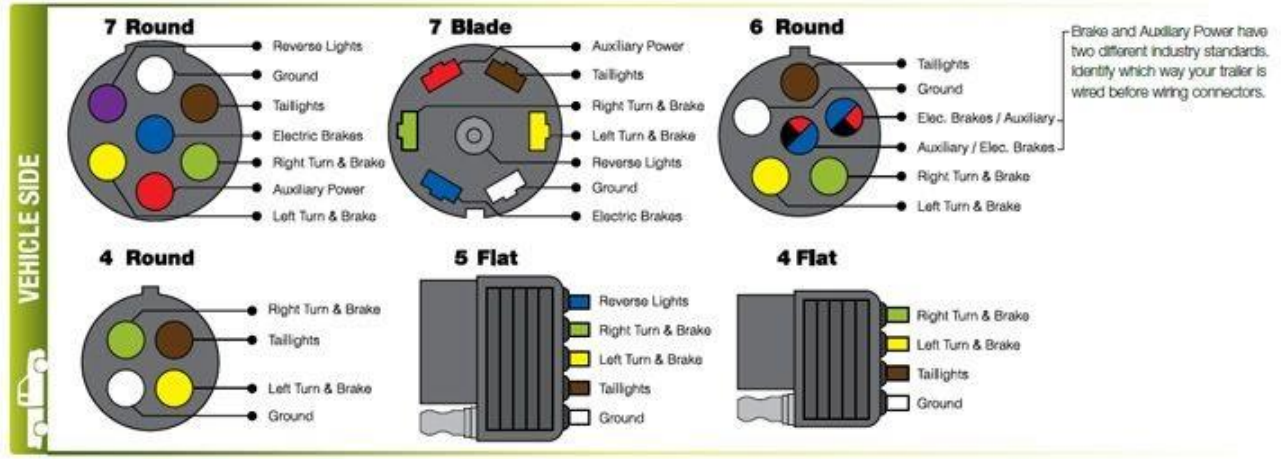
Trailer connectors in Europe
https://en.wikipedia.org/wiki/Trailer_connectors_in_Europe

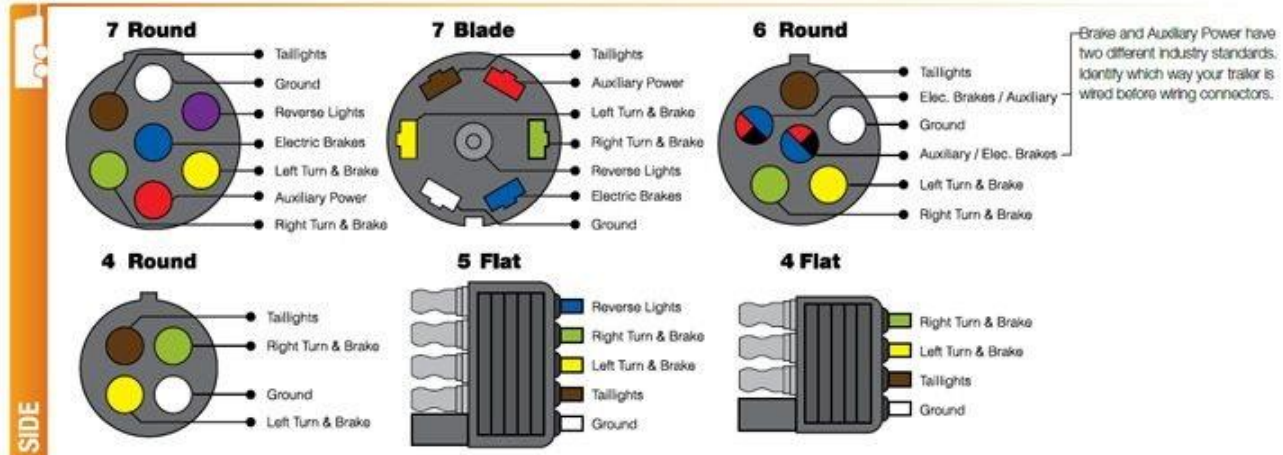
Trailer connectors in Australia
https://en.wikipedia.org/wiki/Trailer_connectors_in_Australia

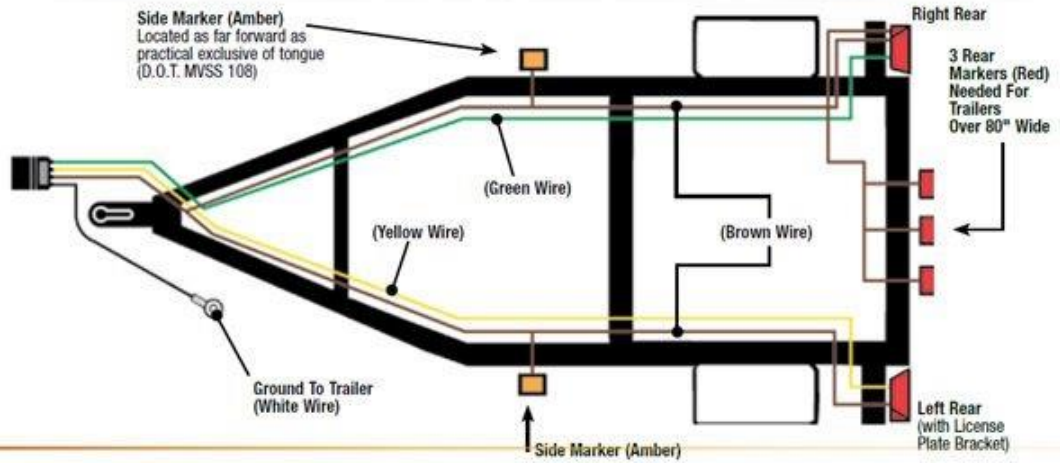
ISO standards for trailer connectors
https://en.wikipedia.org/wiki/ISO_standards_for_trailer_connectors

Source for Trailer Information and Parts
http://etrailer.com

US Trailer Wiring Color Codes







US Trailer Wiring Color Codes

Trailer Wiring Color Code								
Connector				Function	Color	Suggested Minimum Wire Gauge		Where To Attach - Vehicle Side	Where To Attach - Trailer Side
						4 Way & 5 Way	6 Way & 7 Way		
7 Way	6 Way	5 Way	4 Way	Right Turn	Green	18	16	Right turn of vehicle's wiring harness	Trailer's right turn signal
				Left Turn	Yellow	18	16	Left turn of vehicle's wiring harness	Trailer's left turn signal
				Ground	White	16	12	Vehicle ground point - metal, uncoated, rustproof	Vehicle ground point - metal, uncoated, rustproof
				Tail / Marker	Brown	18	16	Taillight of vehicle's wiring harness	Trailer's taillights
				Brake	Blue	18	12	Electric brake control, power for brakes	Break away switch
				Battery	Red (or Black)		12	Fuse block or FUSED battery Lead	Break away kit, interior lights and battery charger.
				Back Up	Purple		16	Back up circuit of vehicle's wiring harness	Back up lights (if available) / Hydraulic coupler.
This chart is a typical guide, wire colors may vary based on manufacturers. Use a circuit tester to verify connections.									

US Common Trailer 4-Flat Wiring

Trailer wiring and harness plugs are available in a variety of sizes and configurations. The most common and basic of designs is the color coded **4-wire** system. The "Flat-4" harness plug is found on almost all boat trailers and many smaller utility trailers that do not have electric brakes.

Very Common

"4-Flat" Cable

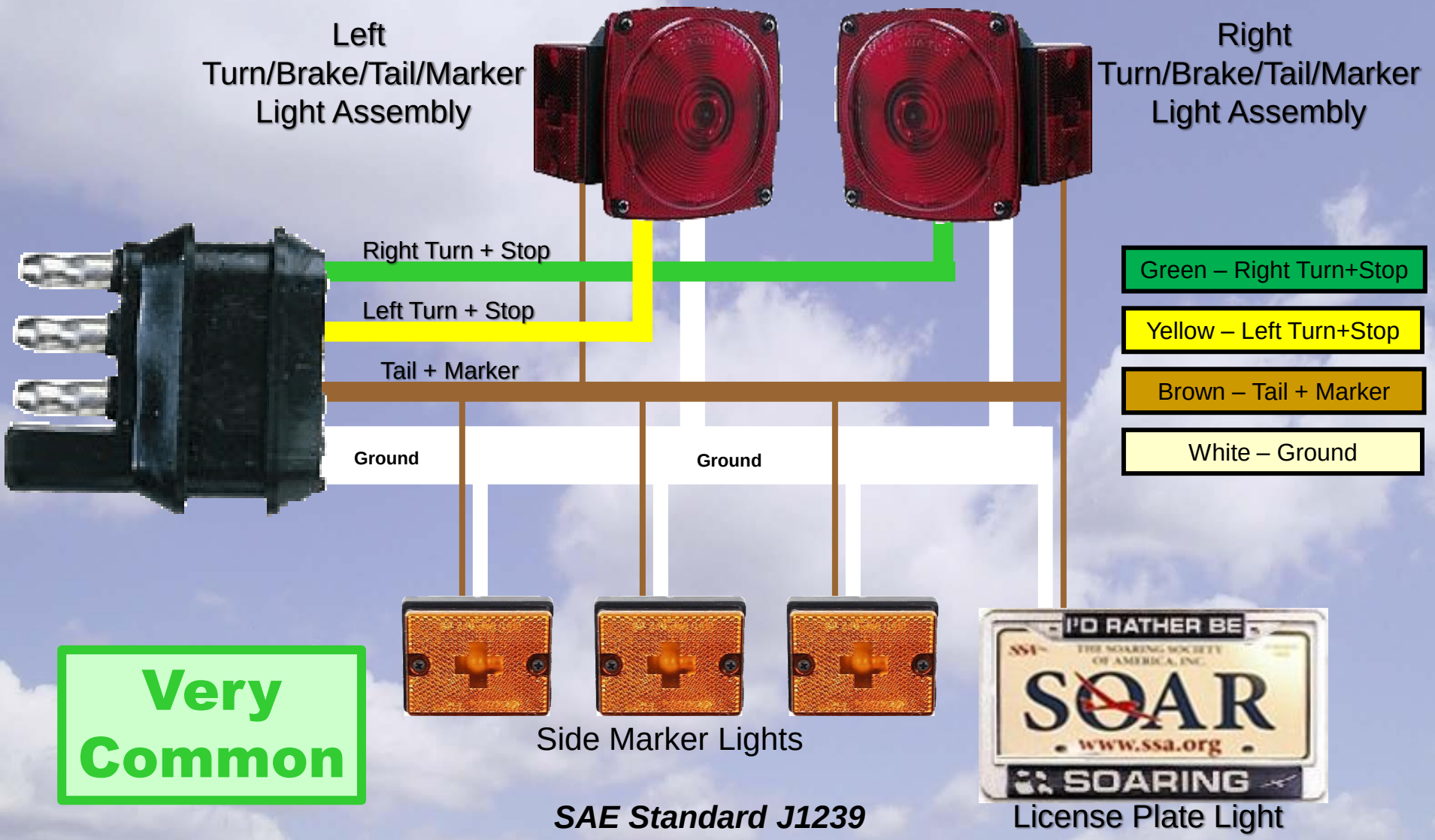
"4-Flat" or "Flat-4" Wiring

Green – Right Turn+Stop
Yellow – Left Turn+Stop
Brown – Tail+Markers
White - Ground

Vehicle	Trailer

SAE Standard J1239

US Common Trailer 4-Flat Wiring



US Common Trailer 7-Round Wiring

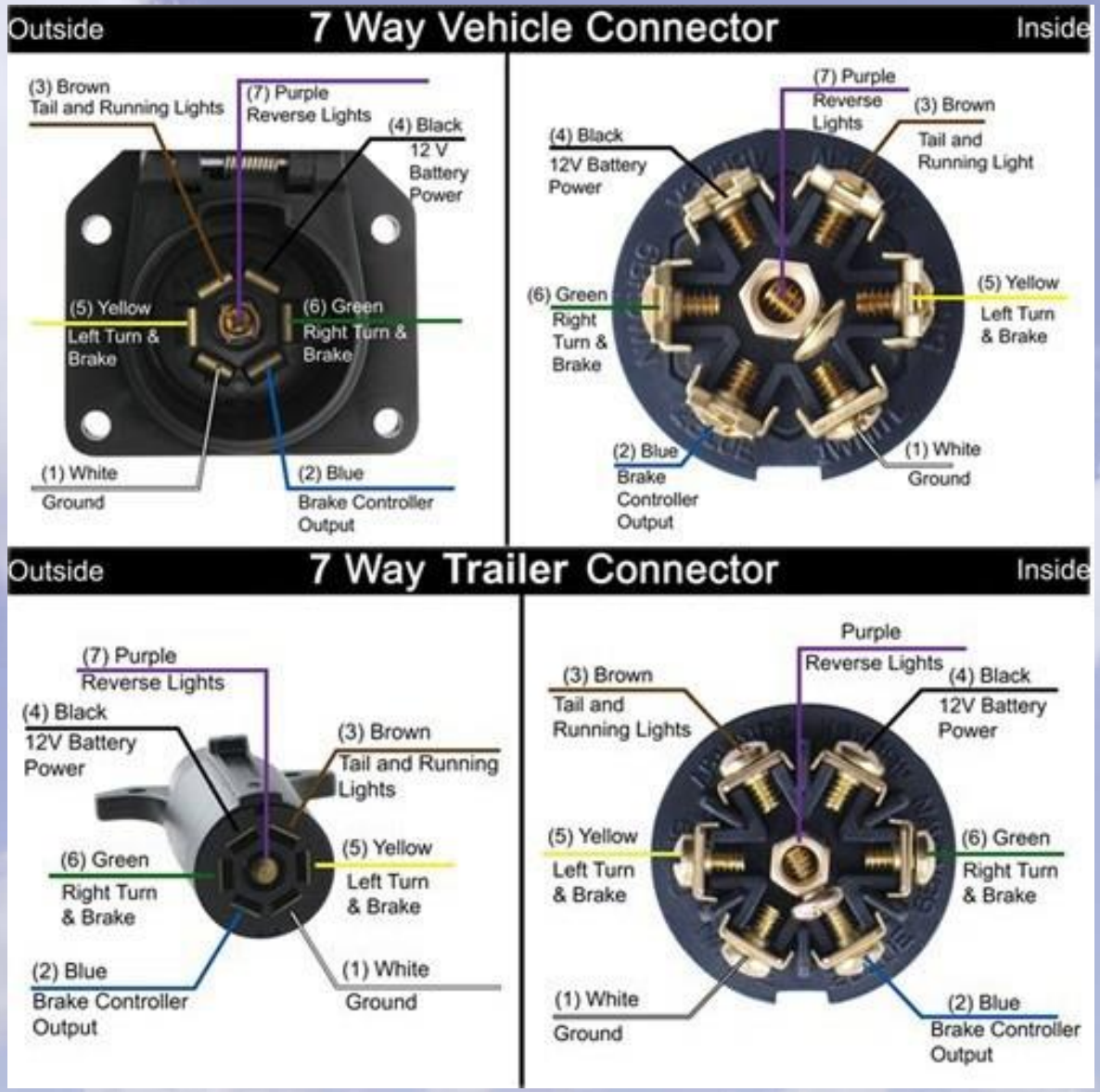
COMMON SYSTEM

One step up from the 4-Flat system is the commonly found 7-Way **Flat** pin connector found on many US vehicles with factory installed trailer wiring.

The two main changes are the addition of a connection for a backup (reverse) light and for an electric brake system.

Quite Common On New Vehicle Factory Installations

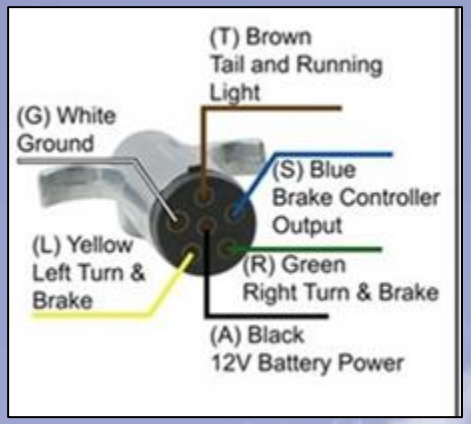
SAE Standard J2863



Source: http://etrailer.com

US Trailer Wiring - RARE

RARE



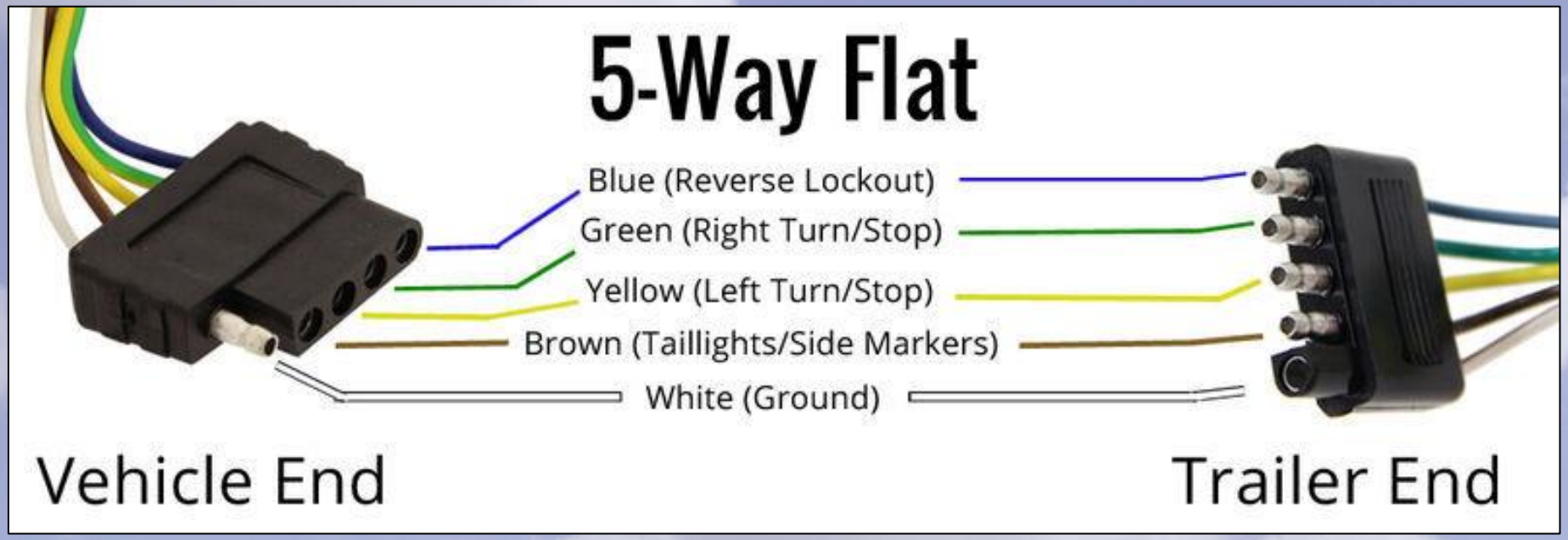
The following United States trailer wiring systems are rather uncommon

These are Included here for reference only

US Trailer Wiring - 5-Way Flat

This 5-Way system is rather uncommon. Included here for reference only.

RARE



Source: http://etrailer.com

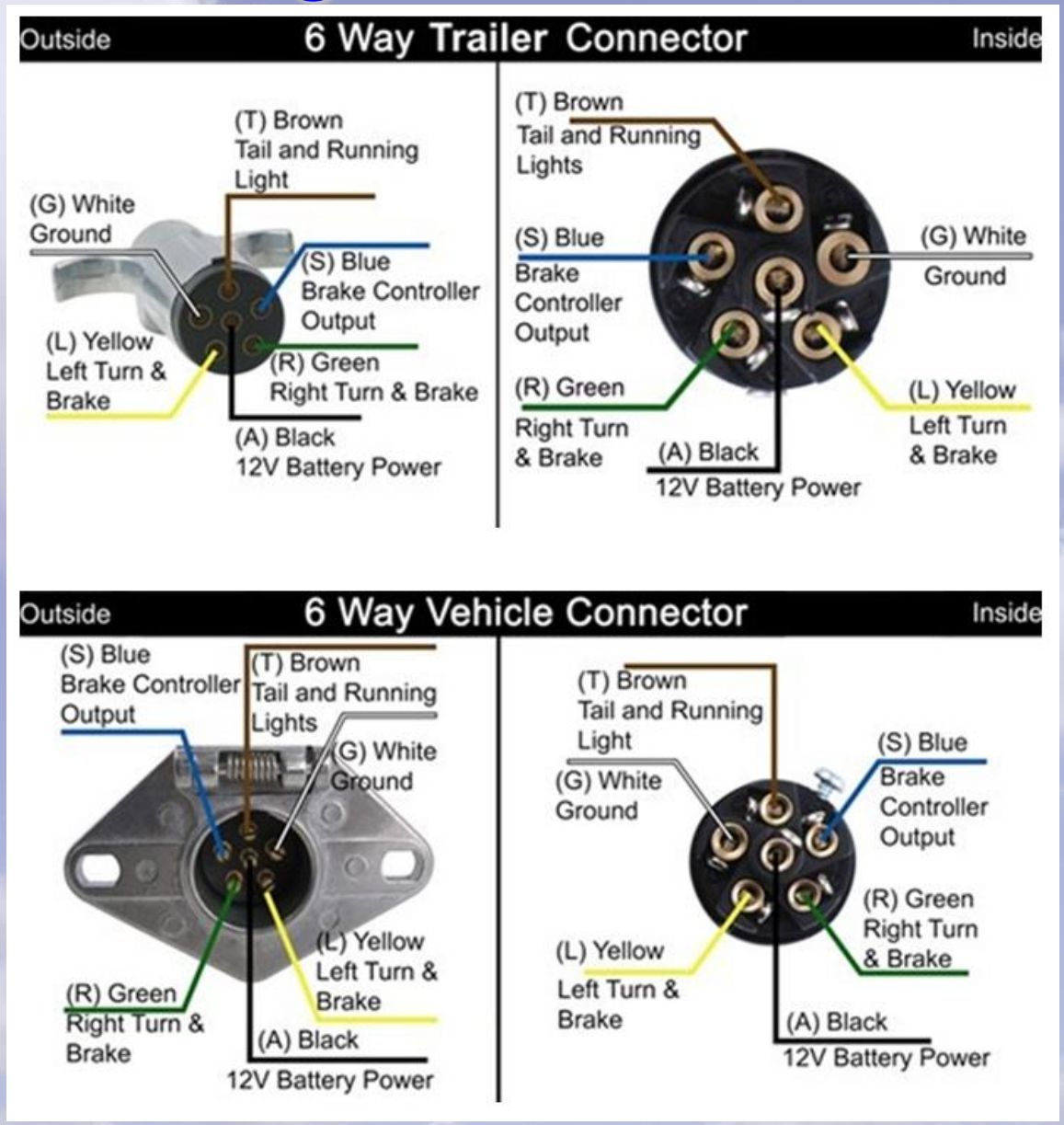
SAE Standard J1128

US Trailer Wiring – Round 6-Way

This 6-Way system is rather uncommon. Included here for reference only.

RARE

Source: http://etrailer.com



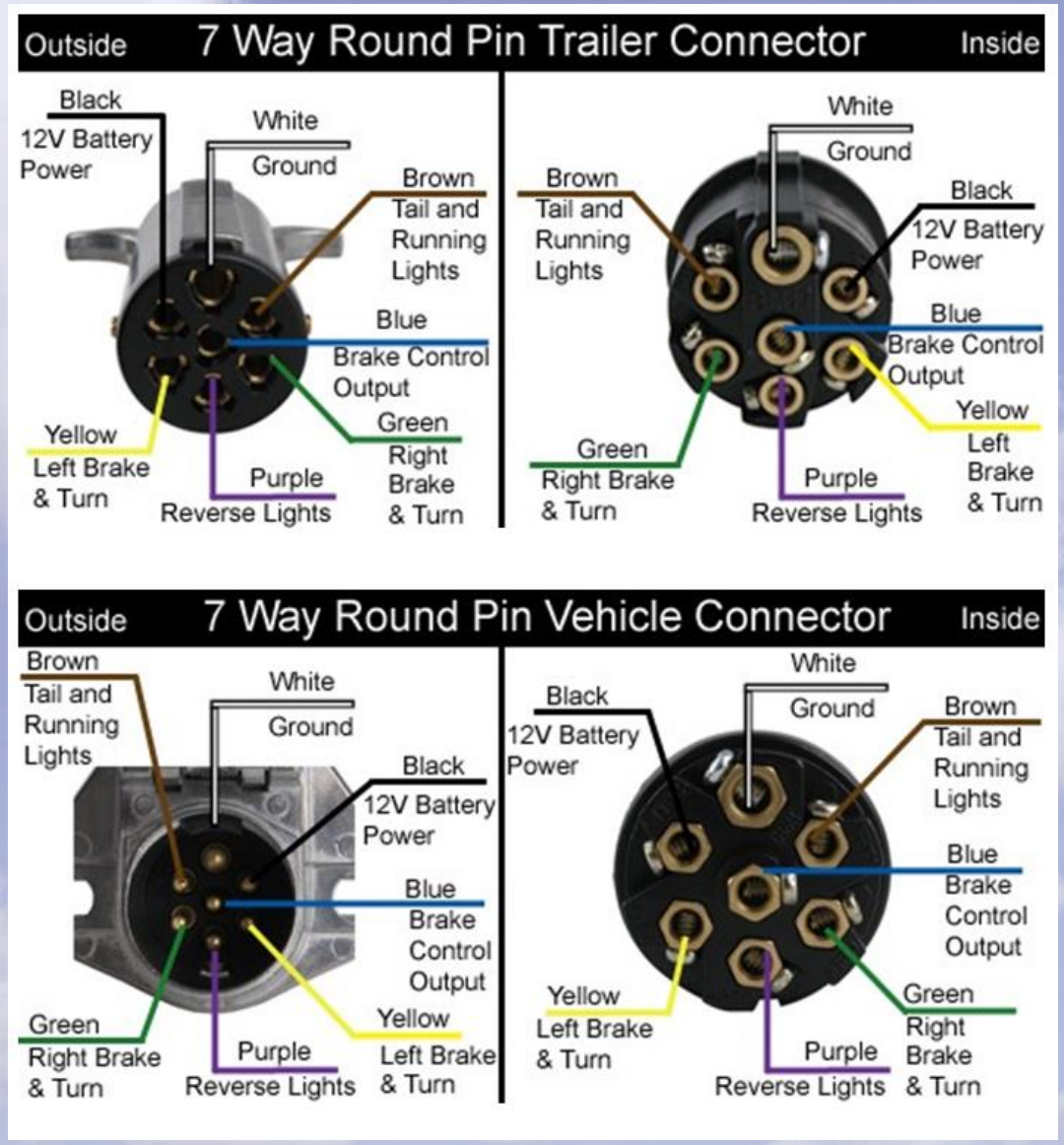
US Trailer 7-Round Wiring

This 7-Way system is rather uncommon. Included here for reference only.

RARE

Source: http://etrailer.com

SAE J2863
SAE J560



US Common Trailer 7-Round Wiring

Converters are readily available to change a 7-Pin Round connector to/from a 4-Flat connector

General Trailer Wiring Hints & Tips

- Use good quality lights, wires, and fixtures
  - LED lights are more expensive but are a more trouble free choice
- Crimp terminals on all connections
  - No wire nuts!
- Good Ground Connections
  - Remove all rust and paint
- Use Dielectric Grease to prevent corrosion
  - Dow Corning #4 or Permatex
  - On bulbs & sockets & Connectors
  - On pins of vehicle and trailer connectors

- To prevent corrosion use covers on both vehicle and trailer connectors when not in use. Fill with dielectric grease.
- Run wires inside of vehicle, trailer, frame, or tubing as much as possible to provide better physical protection.
- Know where your vehicle fuse box is located. Carry spares.
- Carry spare bulbs (LED or incandescent)
- A voltmeter can come in very handy when troubleshooting.
- Good reference site with trailer supplies: http://www.etrailer.com

Cobra Trailer Wiring

- European Trailer Wiring Diagrams
- Conversion to US 4-Flat
- Separation of turn signal and brake signals
- US to Euro adapter wiring

Source: ***https://en.wikipedia.org/wiki/ISO_standards_for_trailer_connectors***

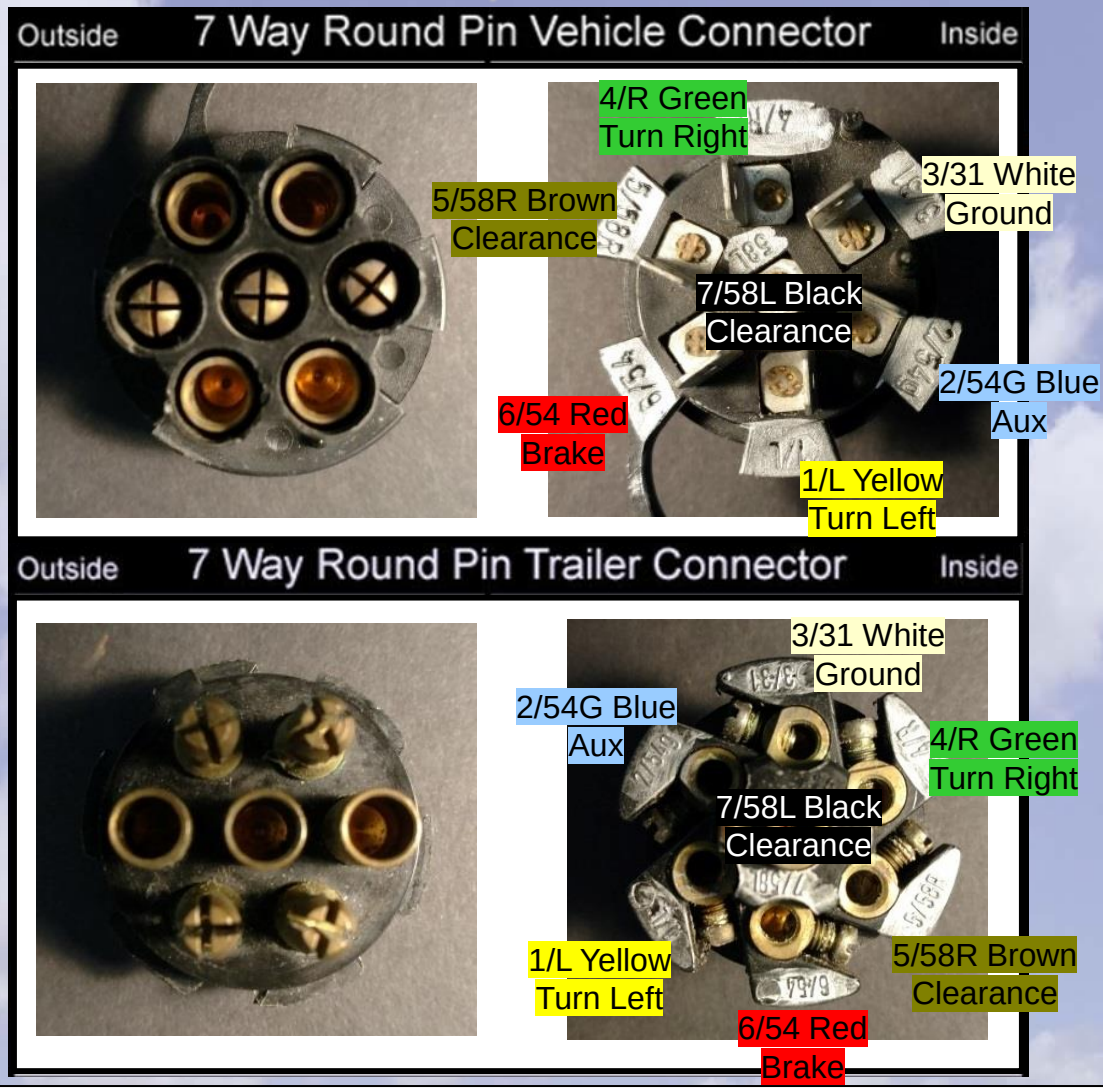
Euro Trailer Wiring - 7-Way N-Type (ISO DIN 1724)

The 7-Way (round pin) trailer connector (ISO DIN 1724) is found on many European made trailers, in particular the **Cobra** trailer line. Each pin has a number associated with it - see the labels at right and the chart on the next slide.

It is primarily distinguished from the US 4-Flat connector by the separation of wiring for stop and turn lamps. There is no designated backup or electric brake wiring.

When an European trailer is delivered to the US, the Euro connector is often replaced with a common US 4-Flat connector using the conversion detailed in the following slides.

The Blue Aux terminal (2/54G) is not used on Cobra trailers



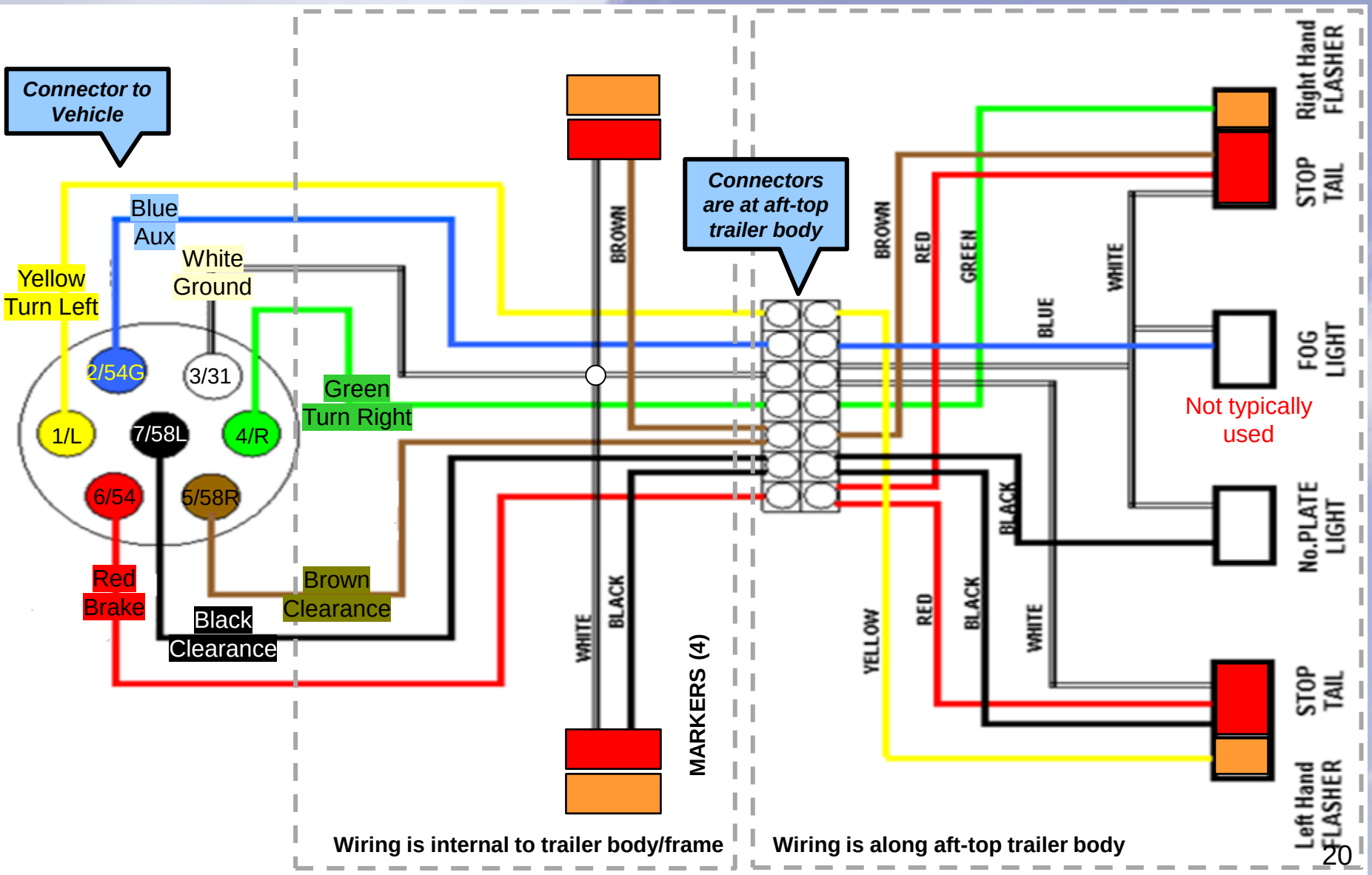
Euro Connector Source: http://www.tauntontrailers.co.uk/trailer-electrics-30-c.asp

Euro Trailer Wiring - 7-Way N-Type (ISO DIN 1724)

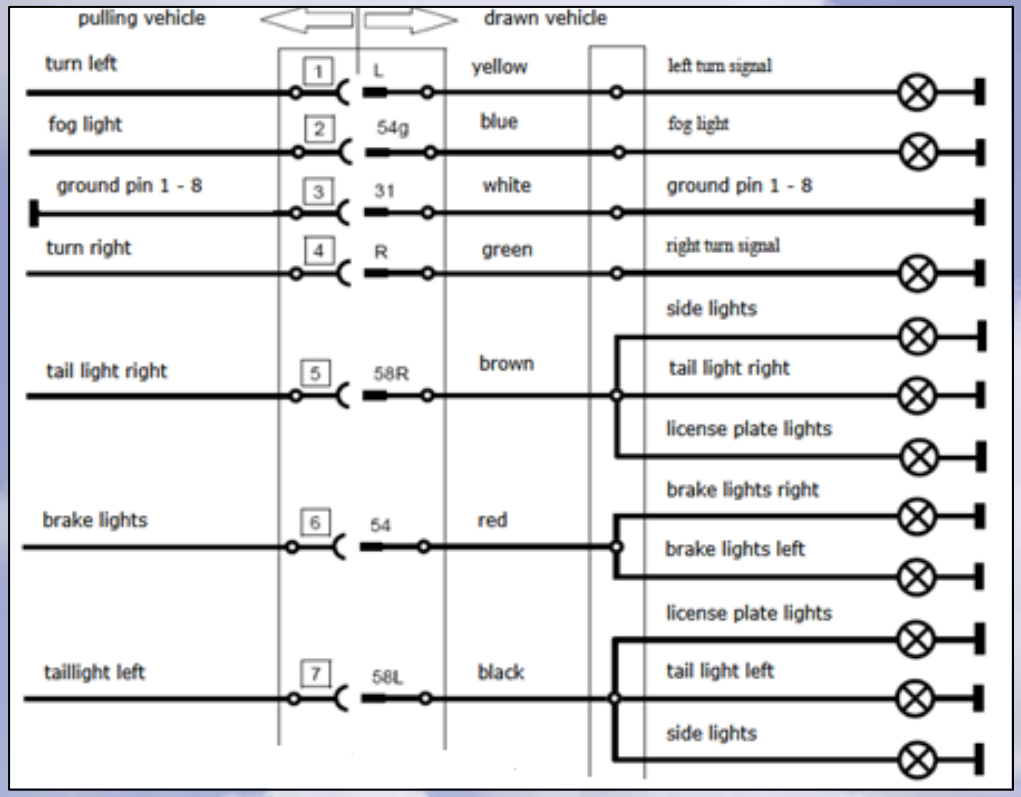
Pin No.	Pin Label	Wire Color	Function
1	1/L	Yellow	Left Hand Turn Light
2	2/54G	Blue	Auxiliary Not typically used
3	3/31	White	Running, Clearance, Tail, License
4	4/R	Green	Right Hand Turn Light
5	5/58R	Brown	Right Hand Running Light
6	6/54	Red	Brake Lights (Left/Right)
7	7/58L	Black	Left Hand Running Light

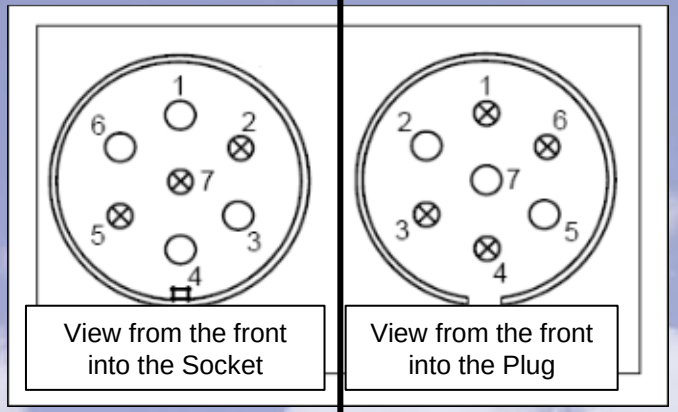
Source: http://www.tauntontrailers.co.uk/trailer-electrics-30-c.asp

Cobra Trailer Wiring
European 7-Way N-Type Schematic



Cobra Trailer Wiring
European 7-Way N-Type (ISO DIN 1724)





Vehicle Socket

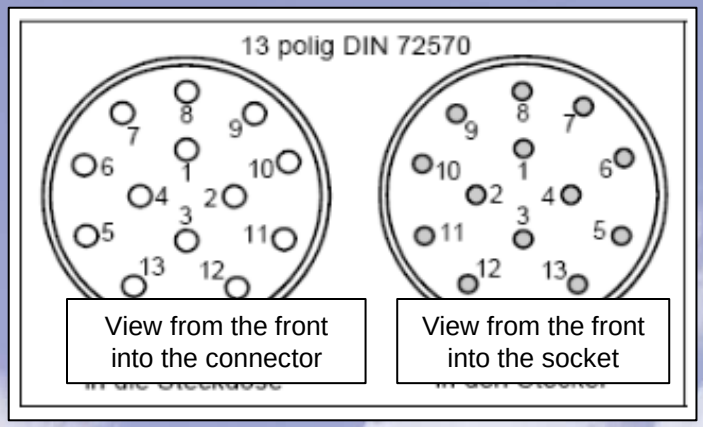
Trailer Plug

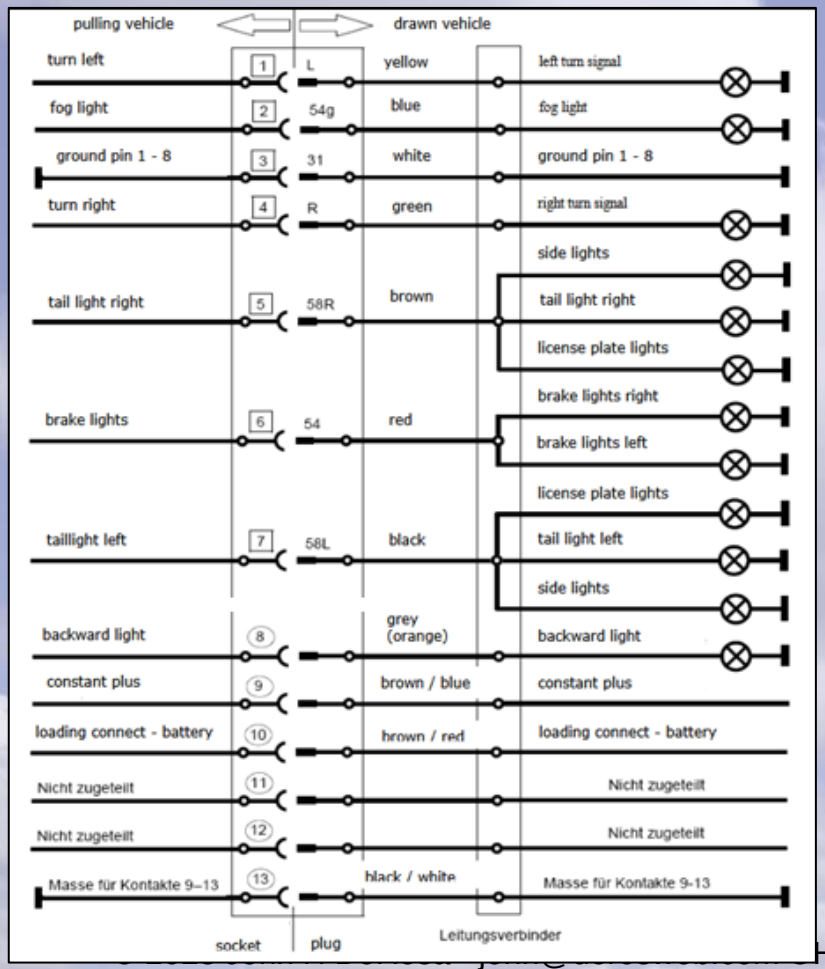
Source: https://www.cobratrailer.com ➔ Manuals

Cobra Trailer Wiring
European 13-Way (ISO DIN 72570)

This European system is rather uncommon. Included here for reference only

RARE





Plug

Socket

Source
https://www.cobratrailer.com ➔ Manuals

Spindelberger Cobra Trailer Wiring Conversion to US Vehicle

Trailer Connector Adapter
US Vehicle 4-Flat to a European 7-PinTrailer

US Vehicle with
4-Flat Connector
(SAE J1239)

European
Standard Connector
7-Way N-Type
(ISO DIN 1724)

US Vehicle

European Trailer

https://www.amazon.com/Oyviny-Converter-European-Connector-Waterproof/dp/B08N698D5C

Trailer Connector Adapter
US Vehicle 7-Pin to a European 7-pin Trailer

US Vehicle

European Trailer

https://www.amazon.com/CARROFIX-Trailer-Converter-Vehicle-European/dp/B08246SC8P

Trailer Connector Adapter
US Vehicle 7-Pin to a 13-Pin European Trailer

US Vehicle

European Trailer

https://www.amazon.com/CARROFIX-Vehicle-Connector-European-Converter/dp/B08D37BYDP

Trailer Connector Adapter
European Vehicle to a US Trailer

RARE

Not Commonly Useful in the US

US Trailer with
4-Flat Connector
(SAE J1239)

European
Standard Connector
7-Way N-Type
(ISO DIN 1724)

European Vehicle

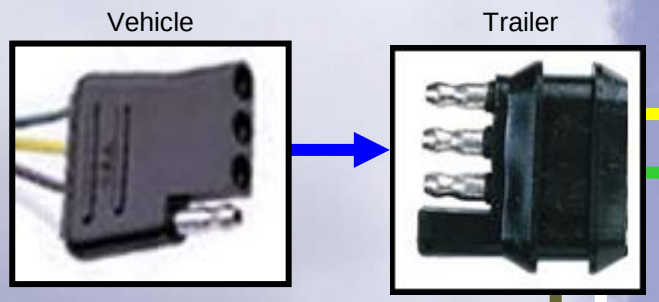
US Trailer

Source: https://www.etrailer.com/Wiring/Tow-Ready/118710.html

European Cobra Trailer Conversion to 4-Flat

Simple Converter 4-Flat (vehicle) – Step 1
To European 7-Pin Connector N-Type (trailer)

US Vehicle 4-Flat Connector

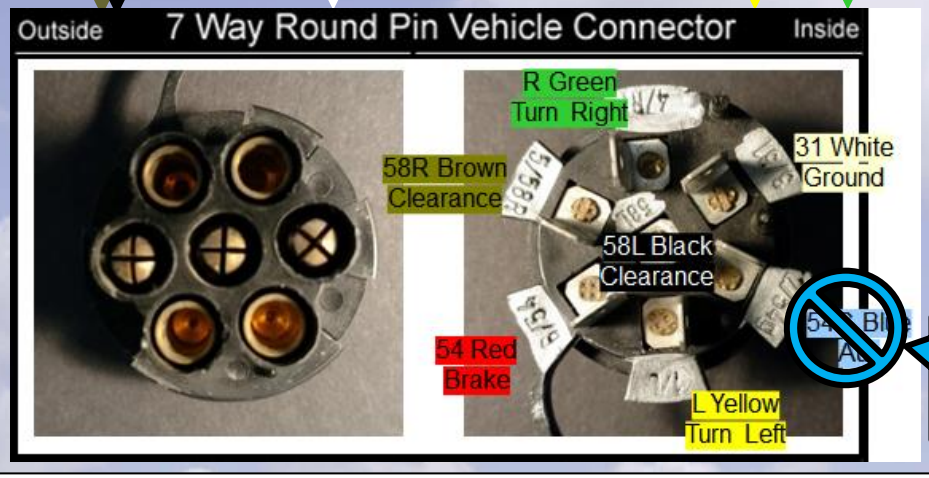


REQUIRED!
Conversion of Light Fixture!
See next slide

Function	Euro Color	Euro Pin	4-Flat Color
Clearance Lights	Brown & Black	5/58R & 7/58L	Brown
Ground	White	3/31	White

Function	4-Flat Color	Euro Color	Euro Pin
Left Turn/Brake	Yellow	Yellow	1/L
Right Turn/Brake	Green	Green	4/R

European Standard Connector 7-Way N-Type (ISO DIN 1724)



Cobra 7-Pin Connector N-Type
Existing Trailer Connector

Note: Blue terminal is not used. (Pin 2/54G Aux)

Euro Connector Source: http://www.tauntontrailers.co.uk/trailer-electrics-30-c.asp

.derosaweb.net/presentations

Euro (Cobra) Trailer Wiring

Simple Conversion to 4-Flat – **Step 2**

(Courtesy of Wings & Wheels)

"All should be well, except you will notice that the signal and brake lights are amber instead of red.

Go turn off the lights, get your Phillips head screwdriver and needle nose pliers, go to the rear of the trailer. The rear light lenses are held on by two Phillips head screws each. Remove the screws, and remove the lenses. You will notice that the wires are connected to the light bulb sockets with spade connectors.

Carefully reach in with your needle nose pliers, and pull the two (2) spade connectors off the two (2) light sockets (one on each socket, top and bottom), and reverse them, That is, the spade connector which came off the top light socket (amber light, yellow and green wires), must now be attached to the lower light socket (red light).

The wires from the lower light socket (red) might be too short to attach to the top socket, but no matter, as it won't be used. You can wrap that (unattached) red wire spade connector with electrical tape, or just push it back somewhere, it won't matter, as that one is powered by the red wire, which was not hooked up at the 4-flat plug.

Now, do the same thing on the other side."

Source: http://wingsandwheels.com/manuals.html

Euro (Cobra) Trailer Wiring

Simple Conversion to 4-Flat – **Step 2**

(Courtesy of Spindelberger)

1. ***Open the tail light lenses with the screw driver***
2. ***Disconnect the left hand and right hand flat plug (red wire) of the light bulb in the center of the lights***
3. ***Disconnect the wires of the light bulbs in top of the lights (left hand yellow, right hand green)and plug this wires on the lightbulbs in the center of the lights.***
4. ***Close the tail light lenses.***
5. ***Now open the trailer side 7-pin connector (in front of the trailer) by turning the plastic nutover the cable by hand anti-clock-wise. Push the little hook on the side of the plugoutwards. Then the plug will open like a book.***
6. ***Disconnect the brown and the black wires, cut off the plugs and remove insulation.***
7. ***Give both wires together and press a new flat plug on. Connect these two wires to number7/58R. Close the trailer plug in the opposite way as described before. Make sure that the nose of the plastic part that holds the pins rests in the right slot of the outer shell. The plug must close slightly***
8. ***In the front box of your trailer there is a car side 7-pin connector and some flat plugs. Connect both, the car side and the trailer side plugs together.***
9. ***Take your US 4-pin trailer connector and press a flat plug on each wire.***
10. ***Connect this wires with the pins on the rear side of the car side 7-pin connector in the way described below.***

Source: https://www.cobratrailer.com ➔ Manuals

Euro (Cobra) Trailer Wiring

Complex Converter to 4-Flat

Device Provides Separate Turn Signal Function from Brake Function

Vehicle 4-Flat Wiring	Trailer Wiring	To Trailer Lights
Green	Right Brake/Turn	Right Turn (amber)
White	Ground	Brake (red)
Yellow	Left Brake/Turn	Left Turn (amber)
Brown	Marker	Marker
		Ground

Curt Model C56196

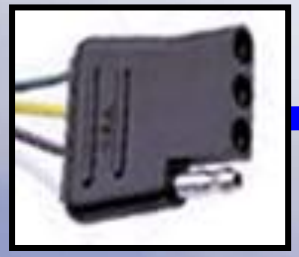
Source: http://www.etrailer.com/Accessories-and-Parts/Curt/C56196.html

Complex Converter to 4-Flat (vehicle) to European 7-Pin Connector N-Type (trailer)

NO Conversion of Light Fixture is Required!

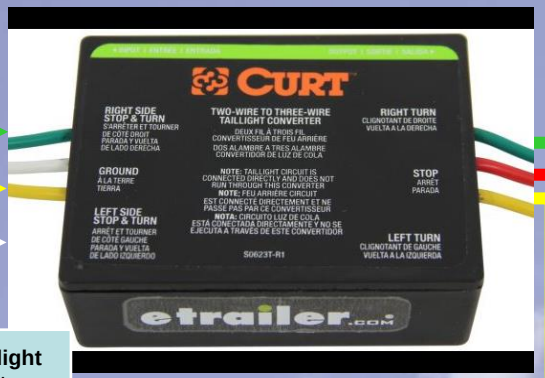
US Vehicle 4-Flat Connector

Vehicle



Trailer

Source: http://etrailer.com Curt Taillight Converter #C56196



Green (Right Turn + Brakes)

Yellow (Left Turn + Brakes)

White (Ground)

Function	Euro Color	Euro Pin	4-Flat Color
Clearance Lights	Brown & Black	5/58R & 7/58L	Brown
Ground	White	3/31	White

Brown

White

Function	Euro Color	Euro Pin	Curt Taillight Converter
Left Turn	Yellow	1/L	Yellow
Brake	Red	6/54	Red
Right Turn	Green	4/R	Green

Yellow (Left Turn)

Red (Brake)

Green (Right Turn)

Brown +Black

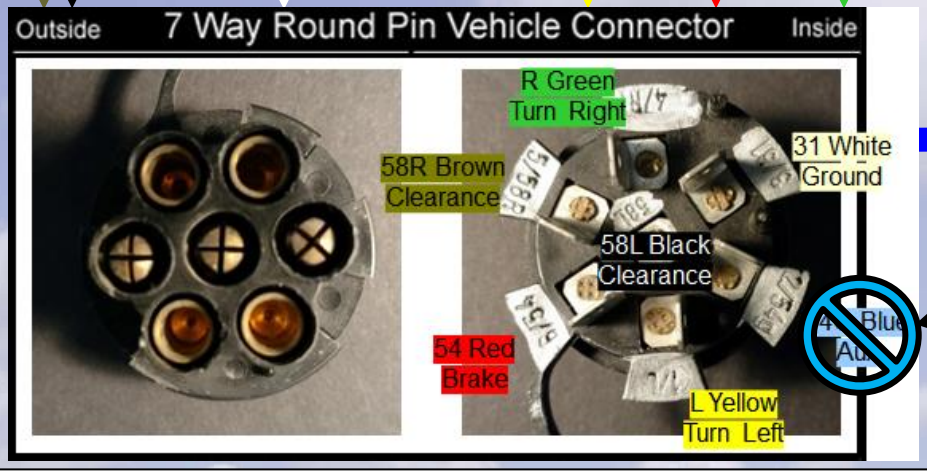
White

Yellow

Red

Green

European Standard Connector 7-Way N-Type (ISO DIN 1724)



European 7-Pin Connectors N-Type

Vehicle

Trailer

Note: Blue terminal is not used. (Pin 2/54G - Aux)

Euro Connector Source: http://www.tauntontrailers.co.uk/trailer-electrics-30-c.asp

.derosaweb.net/presentations

What to Do for a Unique Trailer

What can you do if your “glider” trailer has faulty or confusing wiring and determine what goes where?

You will need a multimeter/ohmmeter/continuity-checker and know how to use it

1. ***Disconnect the trailer’s connector from the tow vehicle.***
2. ***Open every trailer’s light fixture and remove all the incandescent light bulbs from each fixture. NOTE: this procedure may not work for LED bulbs.***
3. ***Set the multimeter to its continuity setting.***
4. ***Test each bulb with the multimeter’s continuity function.***
5. ***Select one of the fixtures and replace a bulb into it.***
6. ***Move to the trailer’s front where the vehicle connector is located or that stripped wires are found.***
7. ***Attach one probe to one pin/wire of the trailer’s connector and the other probe to another pin/wire.***
8. ***If the multimeter indicates ZERO continuity (an open) then those two pins are not connected to the bulb’s terminals. Move to two other pins until some continuity is found*.***
9. ***Update a diagram of which bulb+fixture (brake, turn, reverse, running), and which pins/wires, that you found continuity.***
10. ***Remove the bulb from the fixture being tested.***
11. ***Repeat steps 5-11 until all bulbs+fixtures have been tested.***
12. ***You should find that every light fixture connects to the same pin/wire. This is the “ground” or “common” pin/wire.***
13. ***If you cannot find continuity for a particular bulb+fixture then there is a broken wire, broken fixture, broken connector, and/or a defective bulb.***
14. ***Use the resources within this document to determine how to connect each of the trailer’s wires/pins to your vehicle.***

* Some bulbs have two filaments (brake+turn) and you may find three pins that provide a continuity reading. You will seldom get a 100% continuity reading (a short) due to the bulb’s filament being in the circuit.

Cobra Trailer Wiring Incandescent Lights & LED Conversion

Cobra Trailer Incandescent Standard Bulbs

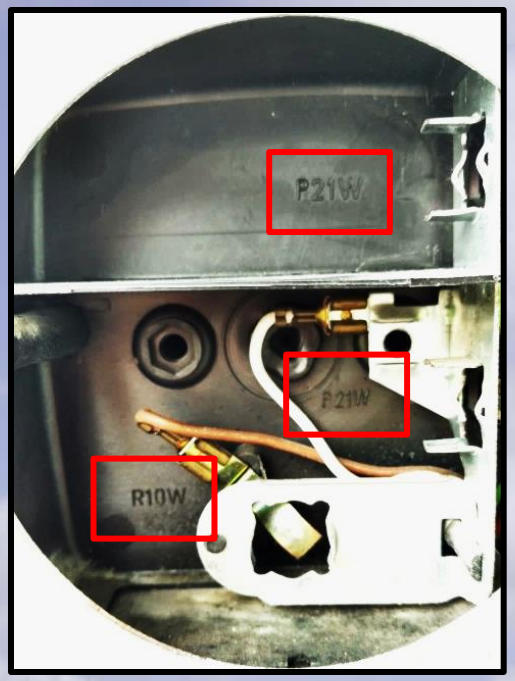
- **Tail Bulb – Turn/Brake (top/middle)– P21W (or 1156 G18 BA15S)**
- **Tail Bulb – Running (bottom) – R10W or (67 12821 R5W BA15S)**
- **Marker Side Bulb – T4W or (T11 BA9S 5050 3886X H6W 363)**

Tail Light Fixture Bulb Markings

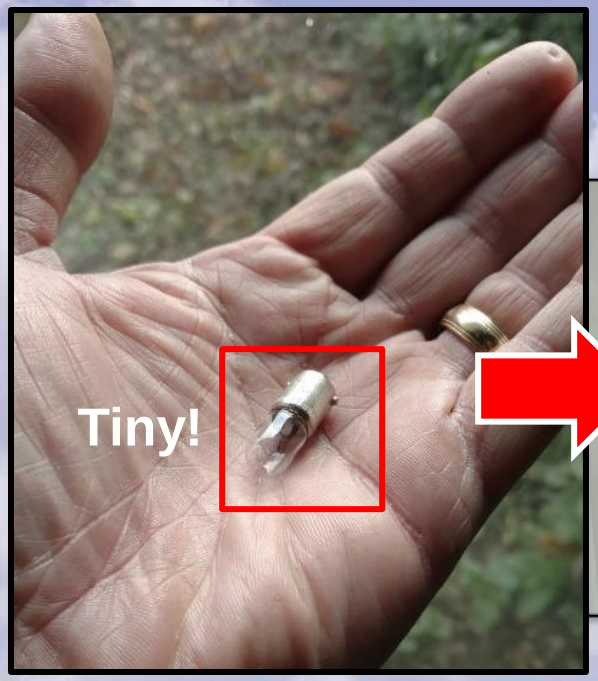
Turn P21W

Brake P21W

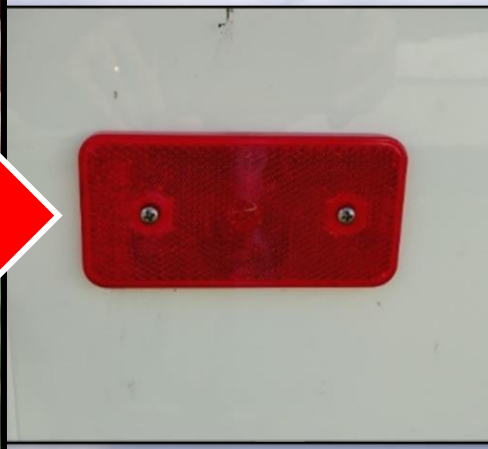
Running R10W



Side Marker Bulb

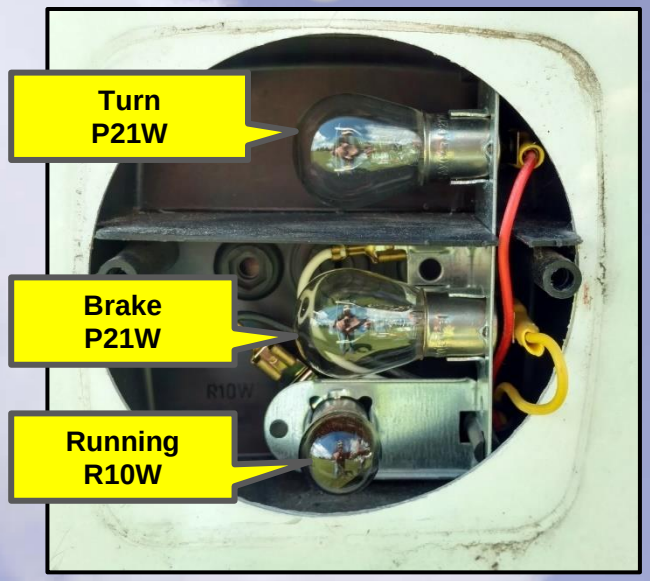


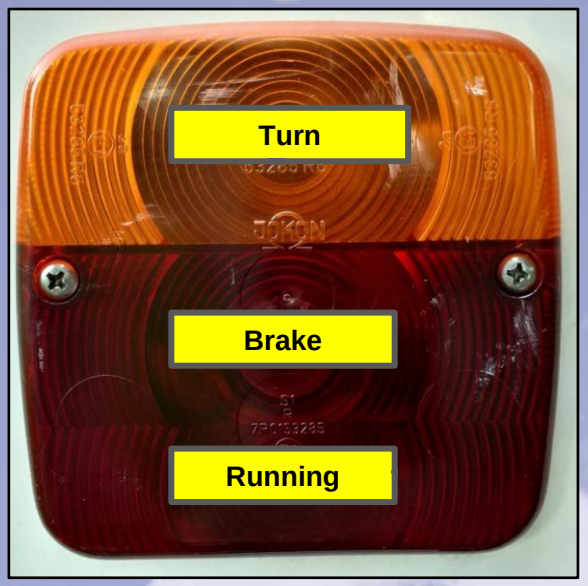
Marker T4W



Cobra Trailer Lights – Aft Lights

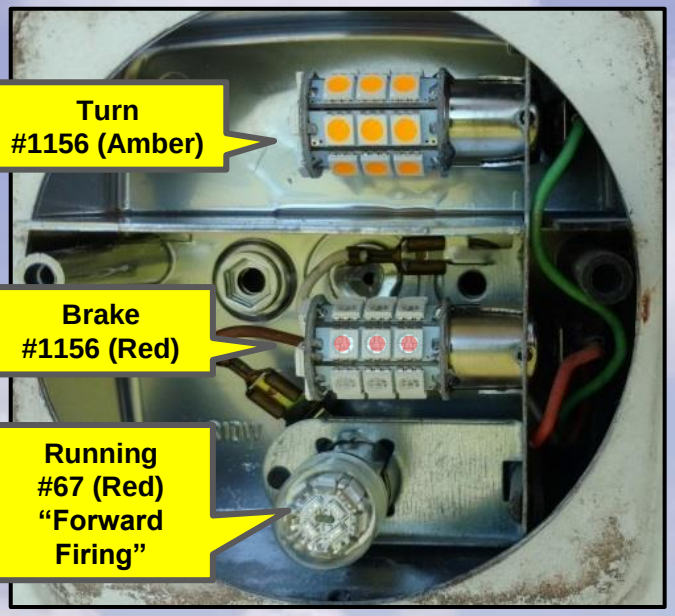
Original Incandescent Bulbs ➔





Note: LED lights may fool some vehicles into giving an alert that a lamp has burned out.

Replacement LED Bulbs ➔



Source:
http://www.superbrightleds.com

Cobra Trailer Lights – LED Conversion

LED Advantages

- Brighter
- Longer lasting
- Lower current
- Quicker turn on
- Plug and Play

Cobra Trailer Aft Fixture Red/Amber LED Colors

Using more commonly available white LED bulbs will "wash out" the amber/red lens colors.

Better to use red or amber LED bulbs depending on the light fixture's lens color.

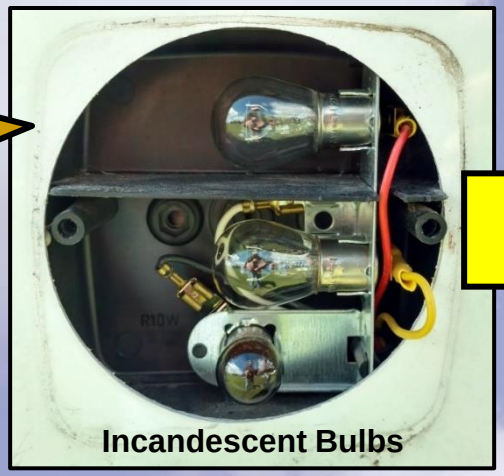
Amber Lens ➔ Amber Bulb

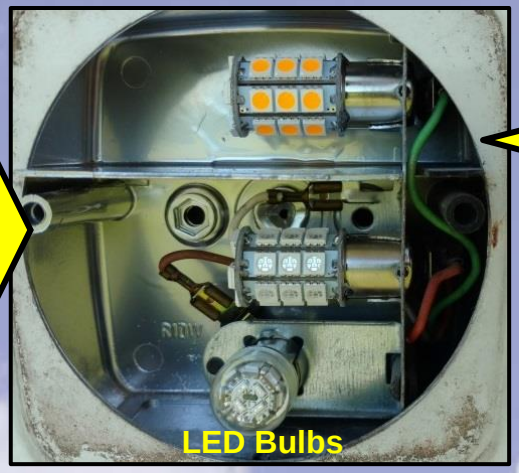
Red Lens ➔ Red Bulb

Source: http://superbrightleds.com

Enhancing the Brightness of Cobra Trailer Aft Light Fixtures

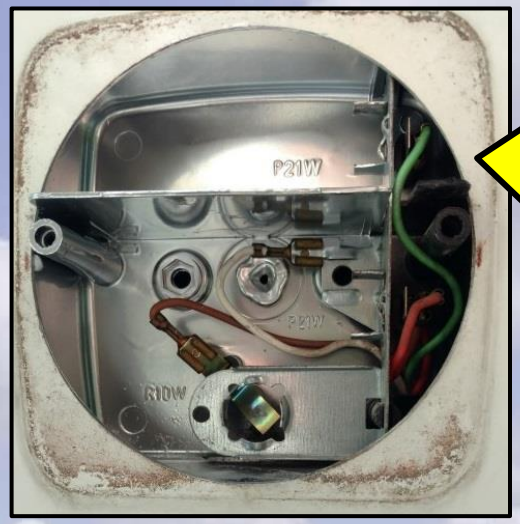
The interior of the aft fixtures are black plastic and almost totally non-reflective





Brighter results after spraying the interior with more reflective paint

Painted with Rust-oleum "Metallic Finish Chrome"(#7718830)



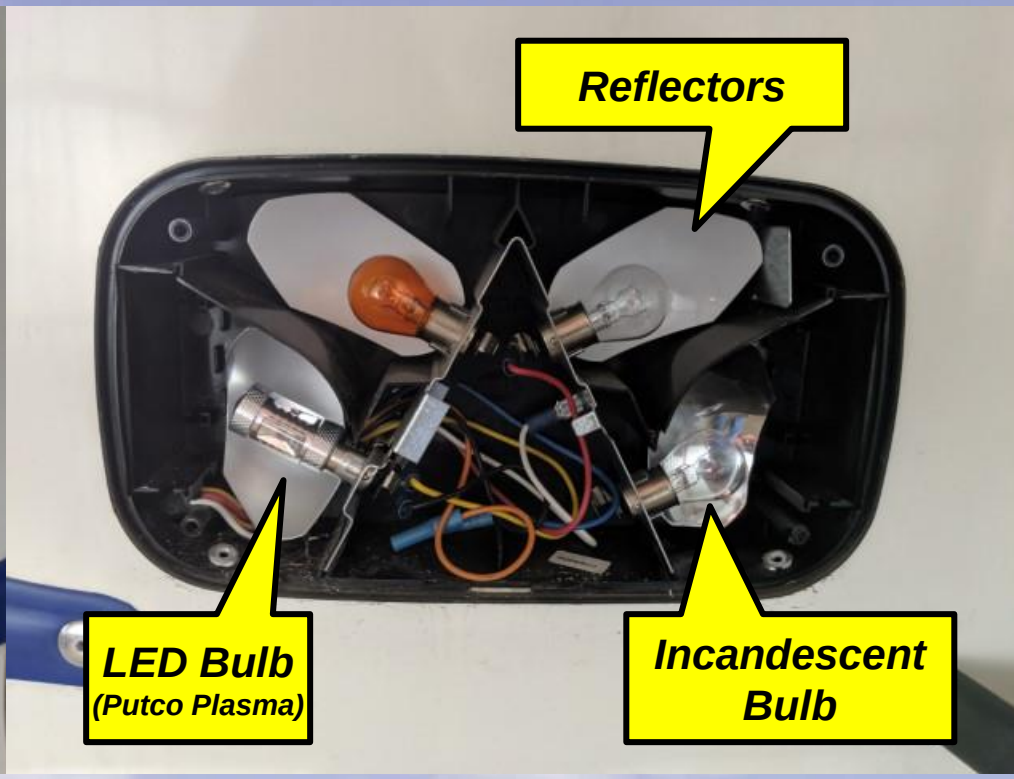
Coat the inside of the fixture with something reflective to enhance lamp "brightness".

Suggestions

- "Chrome" spray paint
- "Mirror" spray paint
- Gloss white spray paint
- Aluminum foil tape (used to seal air ducts)

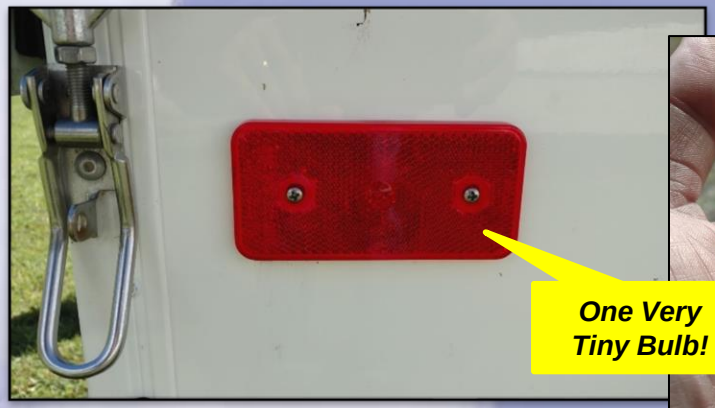
Newer Cobra Trailer Light Fixture

- **Note the built-in bulb reflectors**
- **Unsure about bulb types – assumed to be #1156**



Cobra Trailer Lights
Marker/Side/Clearance Lights

Original Incandescent Fixture ➔



Replacement 21 LED Fixture ➔

Covers the original fixture's holes

Source: eBay

Note: All marker light wiring is run internal to the frame of the Cobra trailer.

Cobra Trailer Center High Mount Stop Lamp

“CHMSL” Brake Light

Required safety equipment on all US vehicles manufactured after 1991 is a “Center High Mount Stop Lamp” (CHMSL) brake light. This can easily be added to a glider trailer by mounting a single sealed LED fixture high up on the tail fin of for maximum visibility.

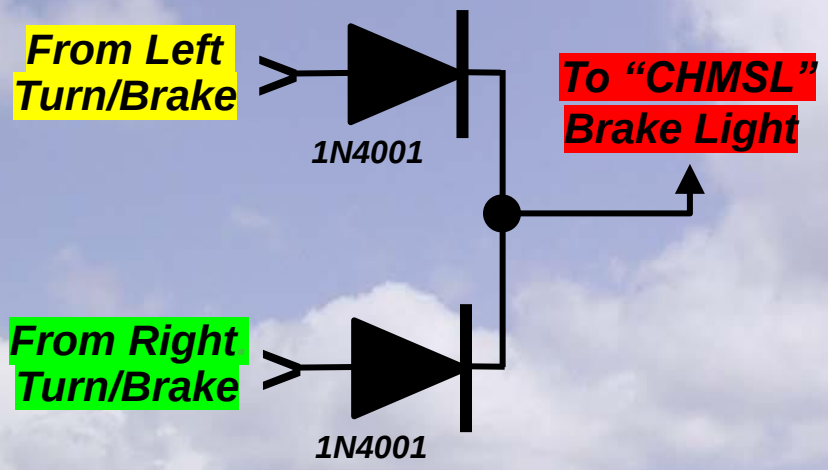
“CHMSL” Trailer Lights

LED Motorcycle Tail Brake/Turn Light Assembly

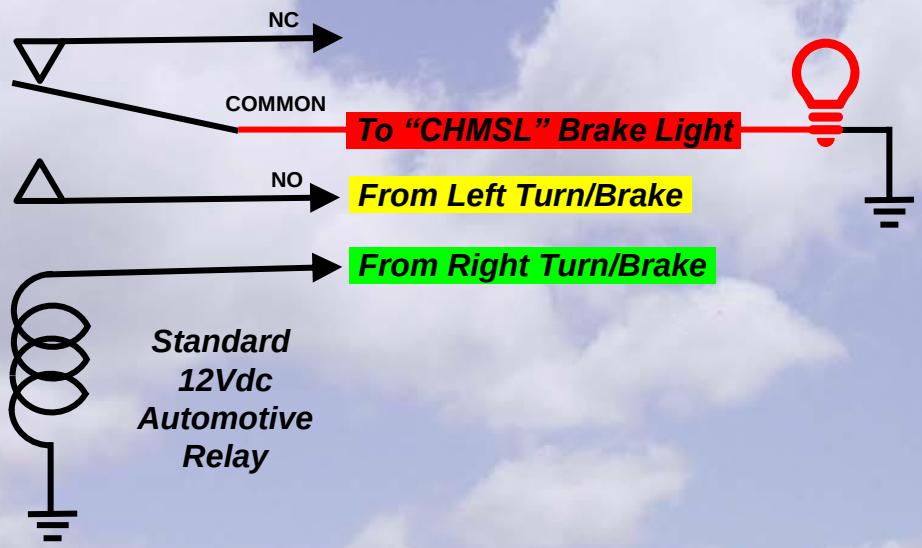
Cobra Trailer Lights
"CHMSL" Light Isolation Wiring

In a commonly used 4-Flat or 7-Round US trailer wiring system the left and right turn signal bulbs are also used for brake lights. A "Center High Mount Stop Light" (CHMSL) can be made to illuminate when the brakes are applied by using either method shown below. The left and right turn signal wires will be isolated from one another in the circuit diagrams below.

Method 1 - Diodes



Method 2 – Relay*



* Note that the "CHMSL" brake light will flash if either turn signal is on.

Cobra Trailer Wiring Miscellaneous Information

LED Trailer Lights

Hyperflashing & False Bulb Out Warning

There is one known issue that you need to be aware of with the conversion from incandescent bulbs to LED bulbs. This is known as "Hyperflashing" and false bulb out warning.

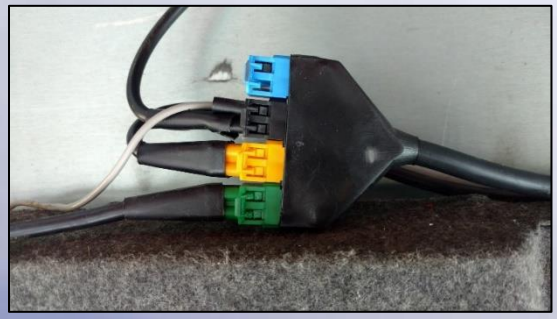
Hyperflashing is when the LED turn signals blink faster after replacing incandescent with LED. The vehicle's flasher mechanism design assumes the slow response of an incandescent bulb and applies a short pulse of power to it. This short pulse makes the LED bulb to flash very quickly. This issue greatly depends on the age of your tow vehicle.

False bulb out happens because LED bulbs draw such little current as compared to incandescent bulbs that the tow vehicle's turn signal relay reacts as if the (LED) bulbs are "burned out". There are two possible solutions to this issue;

1) **Install a new LED flasher relay shown at left (simple)**
2) **Install resistors shown at right across every LED bulb to fool the existing flasher relay (can be difficult).**

Details about this issue along with solutions can be found at;
https://www.superbrightleds.com/blog/led-turn-signals-blinking-too-fast-hyperflashing/275/
https://www.etrailer.com/question-541333.html

Cobra Trailer Lights – Aft Wiring Block

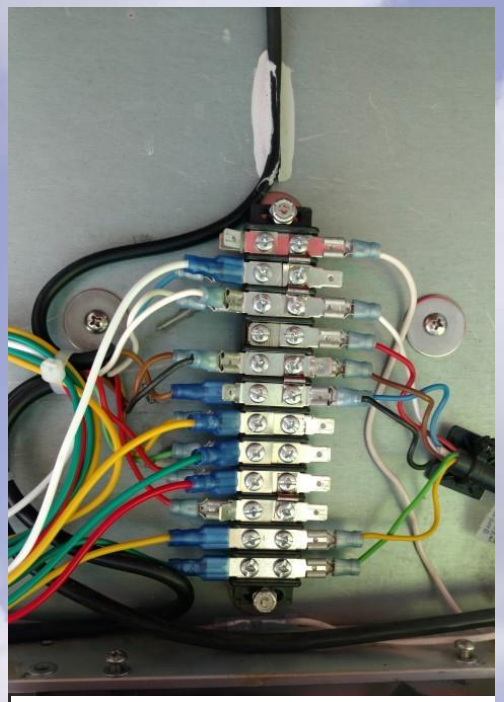


← Original Cobra Aft Wiring Block

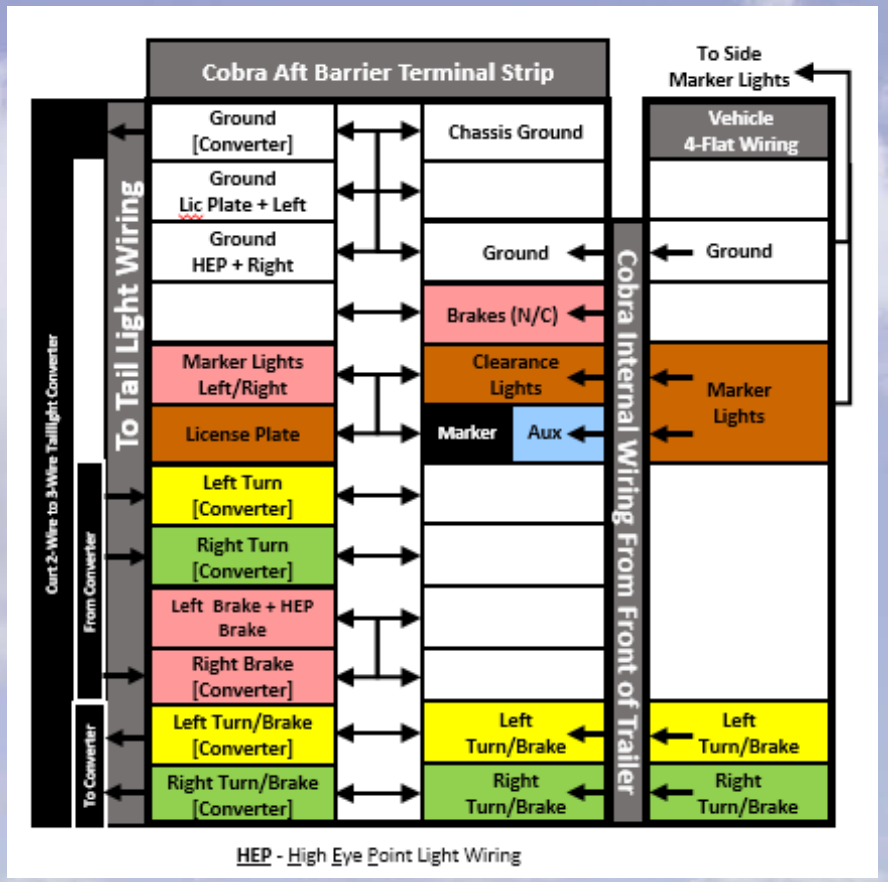
Typically hidden behind an aluminum panel riveted to the frame just above the aft lock mechanism. While this makes for quick work in the factory, it isn't easy to modify.

Alternative Aft Wiring Block →

This barrier block arrangement with "Faston" push-on connections replaces the Cobra aft wiring block and allows easy access, and changes, to all trailer wiring and lights.



Barrier strips, quick connectors,
and quick terminals
Source: www.waytekwire.com



Trailer Connector References

Trailer connectors in North America
https://en.wikipedia.org/wiki/Trailer_connectors_in_North_America

Trailer connectors in Europe
https://en.wikipedia.org/wiki/Trailer_connectors_in_Europe

Trailer connectors in Australia
https://en.wikipedia.org/wiki/Trailer_connectors_in_Australia

ISO standards for trailer connectors
https://en.wikipedia.org/wiki/ISO_standards_for_trailer_connectors

Source for Trailer Information and Parts
http://etrailer.com

See My Other Presentations

- Glider Electrical Wiring
- Transceiver Troubleshooting
- Oxygen Systems
- Working with Glider Air Lines
- Trailer Chains
- Soaring Pilot Relief Systems
- Battery Testing
- Emergency Location Devices
- Survival Kits
- Spar Alignment Tool
- L'Hotellier Fittings
- Carbon Fiber Panels
- IGC Filename Decoding
- Blanik L-23 Strut Work
- Removing Painted Lettering
- Open Glider Network
- Instrument Knob Extensions
- Landing Gear Warning

http://aviation.derosaweb.net/presentations

Let me know of any comments!