

Shocking electrical trailer connections

We rely upon technical standards and design rules to specify the compatibility requirements between interconnected vehicles. At the connection points, brake air signals are transmitted, mechanical forces are transferred and electrical currents flow. Our vehicle-standards rules attempt to make the connections consistent and reliable. There can be many different acceptable practices and with many global manufacturers creating “Australian specific” permutations. The risk is that bending over backwards to accommodate a range of different connection types might lead to confusion or unreliability. At present there is much confusion about electrical trailer connector requirements. The specifications for electrical connections of lighting circuits are in Australian Design Rule (ADR) 42 – General Safety. The Antilock and Vehicle Stability Control circuit connections are in ADRs 35 & 38 – Braking Systems. New versions of these ADR rules have recently been approved. I want to review the connections requirements and discuss how to overcome some of the inconsistencies that exist. ADR 42/05 – General Safety was

Pin Number	AS 4735:2003 (Australia)	ISO 1185:2003 (Europe)	SAE J560 (USA)
	Heavy-duty Australian	Heavy-duty Europe	Heavy-duty USA
1	White - Return / Ground	White - Return / Ground	White - Return / Ground
2	Black - Side marker lights	Black - Rear position on right side	Black - Side marker lights
3	Yellow - Left turn	Yellow - Left turn	Yellow - Left turn
4	Red - Stop lights	Red - Stop lights	Red - Stop lights
5	Green - Right turn lights	Green - Right turn lights	Green - Right turn lights
6	Brown - Rear position	Brown - Rear position on left side	Brown - Rear position lights
7	Blue - reverse lights	Blue - Trailer brake control	Blue - Auxiliary circuit / ABS power

Table 1: The pin designations for the four lighting connectors that are allowed under ADR 42/05.

recently introduced. It is mandatory for new model approvals but not for existing vehicle models. It specifies four lighting connector options for heavy vehicles, three of which are heavy duty connectors. They are respectively specified in the following standards: ISO 1185:2003, SAE J560:2016 and AS 4735:2003. The mechanical design of these three connector types are notionally identical, as illustrated in Figure 1. They all have the large earth pin 1. Occasionally, lid features on one type will get in the way of easy connection with another type. The electrical pin allocations for the three heavy-duty connectors is shown in Table 1. Whilst the pin colours of the heavy-duty connectors are the same, the lighting functions on pins 2, 5, 6 and 7 can be different. In particular, the Australian standard requires a reverse-light circuit even though reverse lights are optional on heavy trailers. Of concern is that while the plug shape is the same for all three heavy-duty standards, the wiring is different. The main problem is with pin 7, which can be either Reverse or Auxiliary Power. There is no way to tell whether the

connector has a reverse wire or not by looking at the connector. While reverse lights are mandated on trucks, the reverse-light circuit is not mandated in the trailer connector. Note that voltage level, 12V or 24V is optional. Like almost everyone else in the Australian transport industry, you may be unaware that the new ADR 42/05 changes mean that the small round 7-pin connection is no longer allowed on newly approved vehicle models. This widely used medium-duty plug and socket type (known as ISO 1724 / AS 2513), was omitted from the specifications in the most recent ADR changes. ADR 42/05 is a running change to the ADR 42 – General Safety – rules. This means that ADR 42/05 is only mandated for new model approvals. Existing vehicle model approvals can continue to comply with ADR 42/04, which allows the medium-duty round seven pin connector (AS 2513) as well as the three heavy-duty connectors identified in Table 1 on heavy vehicles. A J560 (USA) heavy duty plug. Notice that the centre socket is marked ‘ABS’. This is not valid for Australia.

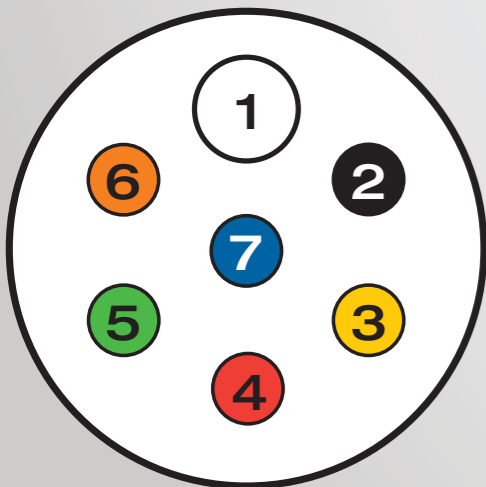
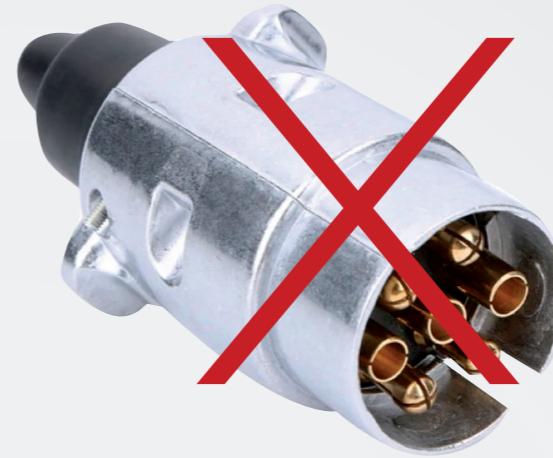


Figure 1: The pin arrangement for the lighting connector plug on the towing vehicle.



The medium-duty round type connector (AS 2513) is no longer acceptable on new model approvals. It can continue to be used on existing heavy vehicle models.

Here are some tips to overcome problems with lighting connectors:

- Vehicle manufacturers should publish the trailer connector pin allocations in the owners’ manual. If not, seek advice from the dealer or manufacturer.
- Connectors should be adequately protected against dust and water ingress. Both the plug and socket should be sealed at the back where the electrical cable comes into the terminals. A suitable IP rating is IP55 (protection against dust and pressure washing). Fully-moulded

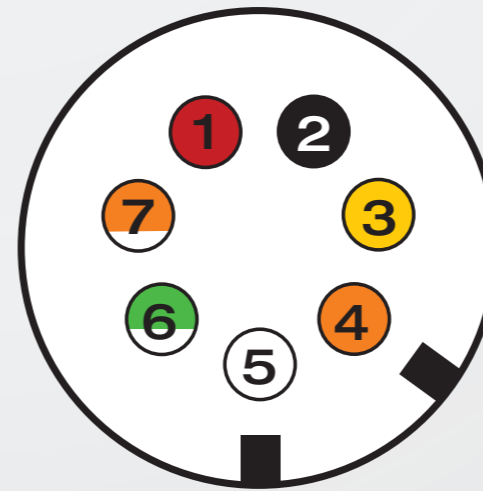


Figure 2: The pin arrangement for the ABS / VSC connector plug on the towing vehicle. The 24V keyway is at 6 o'clock and the 12V keyway is at 4 o'clock

plugs provide the ultimate solution in terms of dust and water ingress, as well as eliminating random connection changes which so often occur.

- If the connector is not being used, ensure the cover is firmly closed.

The electrical connector types for Antilock and Vehicle Stability Control (VSC) connections (commonly known as ABS or EBS) between a towing vehicle and a trailer are specified in ADRs 35 and 38 series of brake rules. Even though new rules 35/06 and 38/06 have been introduced, there was no change to the brake connector types. The technical standards are: ISO 7638-1:2003 (24 Volt) or ISO 7638-2:2003 (12 Volt). These are seven-pin connectors that have the same mechanical design except that the keyways are in different positions, so a 12V plug cannot be pushed into a 24V socket and vice-versa, as shown in Figure 2 below. These two standards have the same pin allocations (see Table 2 below). Note that ADR 38/05 mandates +24V for ABS and VSC on Road-Train semitrailers and dolly trailers, but not on B-double semitrailers. This requirement has been dropped from ADR 38/06, which is mandatory on all new vehicles from 1 January 2022.

Most Vehicle Stability Control systems used on Australian trailers are now ‘multi-volt’, which means they will operate on either 12V or 24V circuits. The mixture of 12V and 24V vehicles in Australia has produced a work-around solution with a ‘multi-volt plug’ with two keyways in the one plug, which is able to be inserted into either a 24V (ISO 7638-1) or 12V (ISO 7638-2) socket. Here are some tips to make reliable connections:

- If you must connect vehicles with opposing sockets (e.g. a 24V prime mover with a 12V trailer) always use a multi-volt plug (male) and never use a key-less socket (female).
- Always insert the plug into the socket

Pin Number	Function
1	Permanent +12V or +24V supply for control valves
2	+12V or +24V ignition-switched supply for electronics
3	Return/Ground for electronics
4	Return/Ground for control valves
5	Fault circuit. Fault active when voltage is low,
6	CAN High (communication)
7	Can Low (communication)

Table 2: The pin designations for the Antilock (ABS) or Vehicle Stability Control (VSC)

in a latch-aligned position, ensuring the pins align with their correct tube allocations.

- If you’re unsure, revert to your manufacturer for advice on VSC voltages and connecting instructions.
- If the truck has a brake connector and the trailer has brake socket, plug them in!

I am grateful to Erin Collins of TRAIL-LINK for helping me with the article.

Dr Peter Hart,
ARTSA



The ABS/VSC seven-pin braking connector.