



Couplings, turntables and d-values

Table 5.1 of Australian Standard AS/NZS 4968.1:2003 Design criteria and selection requirements for fifth wheel, kingpin and associated equipment. The attachment, which includes the turntable, must withstand a static longitudinal (pulling) force of $2.18 \times D$ -value and a static lateral (sideways) force of $0.75 \times D$ -value without breaking. Therefore, the strength of turntable in each of its three directions should be established by engineering calculations and/or static tests.

If the coupling mechanism carries an imposed vertical load, then the endurance testing must involve oscillating horizontal and vertical forces that are out of phase. This is the situation for pintle-hooks, ball couplings and pin couplings. These types of couplings are rated with a D-value (pulling strength) and V-value (load bearing strength). The forces that are applied during an endurance test are 60 per cent of the D-value (horizontal rating) and 60 per cent of the V-value (vertical rating). Often these types of couplings have dual ratings. The Dc-value pulling rating is applicable when the full vertical load at the V-value is applied. The D-value horizontal rating is applicable when there is minimal vertical load on the coupling mechanism. For example, the D-value is applicable to a pin coupling in front of a dog trailer with a hinged drawbar, as there is minimal vertical load on the coupling mechanism. However, if this coupling is used with a fixed drawbar, the Dc value is applicable because the coupling mechanism can experience a substantial vertical load. In this application the coupling should have a V-value. Incidentally, the "c" in Dc identifies this rating is for centre-axle (i.e. pig) trailers. The applicable technical standard for mechanical couplings that interconnect vehicles in combination is Australian

Design Rule 62/02, Mechanical Connections Between Vehicles. A mechanical coupling can be granted an approval called a Component Registration Number (CRN). Note that a coupling that has UN ECE approval status is also acceptable in Australia without the coupling having an Australian approval. Australia accepts couplings that are certified under UN Regulation 55/01 because the Australian rule ADR 62/02 is consistent with it. All couplings must have a manufacturers' rating plate attached nearby.

Turntables are used on semi-trailer trucks to get excellent articulation and they are an essential element of a dog trailer steering group. ADR 62/02 does not have any specific technical standards or requirements for a turntable. That is, a turntable is not a mechanical coupling and it cannot be issued an approval in the ADR system. So how is a turntable rated and tested?

If the endurance testing of a fifth wheel is done with a turntable underneath, which is sometime done, the strength of the fifth wheel is assumed to be proven in its own right and a CRN can be obtained for the fifth wheel alone and for the assembly of the fifth wheel and turntable. A CRN for the turntable cannot be obtained because it is not a mechanical coupling. There are problems with 'inherited' D-values for turntables. Firstly, the turntable mechanism - the ballrace - takes the imposed load. Therefore, it should have a V-value; but oscillating vertical load testing is not done for fifth wheels and by association, turntables. So a V-value cannot be determined. Secondly, ballrace endurance testing is always linked to a make and model of fifth wheel. The D-value cannot be transferred to some other fifth wheel that it was not tested under.

Suppliers of a turntable should determine the pulling force and imposed load ratings based upon strength calculations and practical experience. The ratings should be stated as: Maximum pulled load (which is the maximum ATM of the training equipment) and the maximum imposed load, which is the S-value. There is no provision in the ADR approval system for the 'swapping' of turntables under fifth wheels and claiming that the CRN number of the original assembly somehow applies to the new assembly. Therefore, suppliers of turntables should not advertise a turntable D-value. So the situation is:

1. A CRN can be obtained for a fifth wheel.
2. A CRN can be obtained for a fifth wheel mounted onto a turntable.
3. A CRN cannot be obtained for a turntable alone.
4. A CRN cannot be obtained for mounting angles or a baseplate alone.
5. If a CRN applies to the assembly of a fifth wheel onto a turntable, then the CRN does not apply to the combination of the turntable underneath some other fifth wheel.
6. Turntable manufacturers should state the static pulling, lateral and vertical load ratings; if the turntable is represented as being suitable for a stated D-value, then these ratings must be at least $2.18 \times D$; $0.75 \times D$ and S. Additionally the turntable must withstand an overturning moment $= 0.75m \times D$.
7. There must be a locking block on the semi-trailer skid plate to keep the fifth-wheel correctly orientated.

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FOR REFERENCE THE REQUIRED D-VALUE IS CALCULATED FOR THE PARTICULAR TYPE OF VEHICLE INVOLVED.

HERE ARE THE AUSTRALIAN FORMULAE

PRIME MOVER WITH ONE SEMITRAILER

MINIMUM FIFTH WHEEL D-VALUE = $5.9 \times \text{TOWING} \times \text{TRAILER ATM} / \text{GCM}$

B-DOUBLE PRIME MOVER

MINIMUM FIFTH WHEEL D-VALUE = $4.9 \times \text{TRAILER ATM} \times (\text{TOWING} + 0.08 \text{ TRAILER ATM}) / \text{GCM}$

RIGID TRUCK WITH DOG TRAILER

MINIMUM COUPLING D-VALUE = $9.806 \times \text{TRAILER ATM} \times \text{TOWING} / \text{GCM}$

RIGID TRUCK WITH CENTRE AXLE (PIG) TRAILER

MINIMUM COUPLING DC-VALUE = $9.806 \times \text{TRAILER GTM} \times \text{TOWING} / \text{GCM}$
MINIMUM COUPLING V-VALUE = $A \times \text{TRAILER GTM} \times X^2 / L^2$

TOWING - SUM OF THE AXLE WEIGHTS ON THE TOWING VEHICLE
- I.E. GVM FOR A TRUCK.

TRAILER ATM - SUM OF THE AGGREGATE TRAILER MASSES FOR ALL TRAILERS BEHIND THE COUPLING.

TRAILER GTM - AXLE GROUP RATING OF THE CENTRE-AXLE (PIG) TRAILER.

GCM - TOTAL WEIGHT OF THE COMBINATION VEHICLE.

L - DISTANCE BETWEEN THE COUPLING AND THE CENTRE OF THE AXLE GROUP ON THE CENTRE-AXLE (PIG) TRAILER.

X - LENGTH OF THE LOAD SPACE ON THE CENTRE-AXLE (PIG) TRAILER.

A - 1.8 FOR AN AIRBAG SUSPENSION OR 2.4 FOR A NON-AIRBAG SUSPENSION.