



## Vehicle Standards Guide (VSG-16)

### 50mm ball couplings

#### Purpose

This guide provides advice to heavy vehicle owners, operators and modifiers about the installation and use of 50mm ball couplings on heavy vehicles with a gross vehicle mass (GVM) of more than 5000kg.

#### Introduction

50 mm ball couplings are a common type of coupling used on heavy motor vehicles that tow trailers with an aggregate trailer mass (ATM) up to 3500kg. Under ADR62/., 50mm ball couplings intended for towing trailers with an ATM of up to 3,500kg must comply with the requirements of AS 4177.2, which sets requirements about design, construction, dimensions, strength and testing.

AS4177.2 is one of five parts of the AS 4177 series of standards, which covers all the components in the towing complex, including safety chains, trailer couplings, towbars and electrical connectors. The intent of the AS 4177 series of standards is to provide vehicle modifiers and operators with an approved series of components that if used, allow for towing of a trailer of up to 3,500kg ATM.

To ensure AS 4177 components are suitably rated, the standard assumes a maximum GVM of the towing motor vehicle of 5,000kg. This means that AS 4177 approved couplings can only be used on vehicle with a GVM not exceeding 5,000kg.

This GVM limitation is problematic for the heavy vehicle industry as 50mm ball couplings are widely used to tow light trailers.

#### Impact on motor vehicles with a GVM of 5000kg or less

AS4177 allows a compliant 50mm ball coupling to be used on a towing vehicle with a GVM of 5000kg or less to tow a trailer with an ATM of up to 3500kg. There is no impact on these types of vehicles.

#### Impact on motor vehicles with a GVM of more than 5000kg

The engineering behind towing is very complex and has to take into account a number of factors, with the biggest factor being dynamic loading (known as the D-value). The D-value of a coupling reflects the dynamic loading limits between a towing vehicle and a trailer and is dependent on the towing vehicle's GVM and the trailer's ATM.

#### Rating of a motor vehicle coupling

If an AS4177.2 compliant 50mm ball coupling is used on a vehicle with a GVM more than 5,000kg, the ATM rating of the trailer that can be towed decreases.

The NHVR has no objections with 50mm ball couplings being installed on motor vehicles with a GVM of more than 5000kg, provided that the necessary calculations are performed to determine the reduced capacity of the coupling.

To calculate the reduced capacity of the 50mm coupling limit, the following formula can be used:

$$50mm \text{ coupling limit} = \frac{GVM * 10,000,000}{4903 * GVM - 10,000,000}$$

#### Example

Where a AS4177.2 compliant 50mm ball coupling is being installed on a bus with a 6500kg GVM, the ATM limit of the trailer that can be towed is calculated as follows:

$$50mm \text{ coupling limit} = \frac{6500 * 10,000,000}{4903 * 6500 - 10,000,000}$$

$$50mm \text{ coupling limit} = 2972kg$$

A reference table of revised 50mm ball coupling ratings based on motor vehicle GVM is included at the end of this guide.

#### Rating of a trailer coupling

Just like for 50mm ball couplings, an increase in the GVM of the towing motor vehicle also reduces the rating of the 50mm ball receiver that is fitted to a trailer.

AS4177.3 trailer couplings can be rated by their manufacturer at three different ATM values and the formula that must be used to calculate the maximum permitted trailer mass (MPTM) are as follows:



750kg rated trailer coupling – D-Value = 6.4 kN

$$MPTM = \frac{GVM * 3,250,000}{4903 * GVM - 3,250,000}$$

2000kg rated trailer coupling – D-Value = 14 kN

$$MPTM = \frac{GVM * 7,000,000}{4903 * GVM - 7,000,000}$$

3500kg rated trailer coupling – D-Value = 20kN

$$MPTM = \frac{GVM * 10,000,000}{4903 * GVM - 10,000,000}$$

**Example**

Where a trailer has a AS4177.3 compliant 50mm ball receiver with an ATM rating of 2,000kg and it is being coupled to a truck with a 7000kg GVM, the MPTM is calculated as follows:

$$MPTM = \frac{7000 * 7,000,000}{4903 * 7000 - 7,000,000}$$

*MPTM = 1793kg*

A reference table of MPTM based on motor vehicle GVM is included at the end of this guide.

**Labelling requirements**

Where a AS4177.2 compliant 50mm ball coupling is installed on a vehicle with a GVM greater than 5000kg, or there is provision for one to be installed (i.e. certain types of tow bars used with interchangeable couplings, a typical example is a 50mm hitch receiver), a plate or label should be affixed near the coupling attachment to the towing vehicle, indicating the towing capacity limits, including the 50mm coupling limit and the MPTM. This information must be in lettering not less than 2.5mm high, embossed, indented, etched or engraved on a durable plate/label which is welded, riveted or otherwise permanently attached. An example of a plate/label is shown as Figure 1.

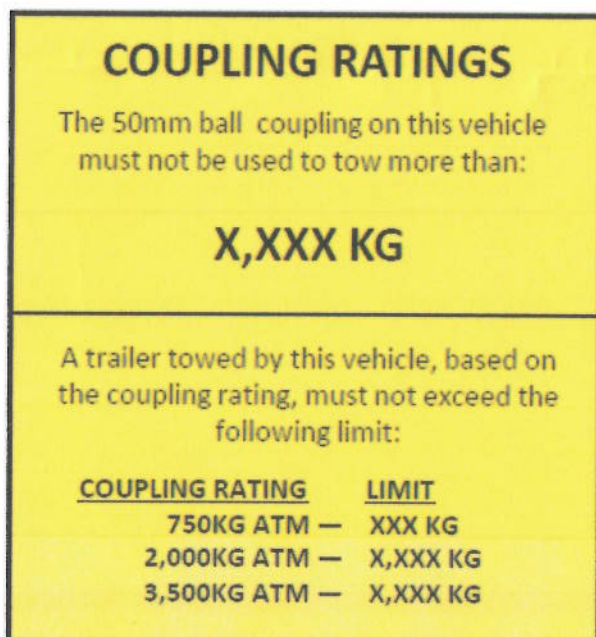


Figure 1. Example coupling limit plate/label

If a plate/label with the 50mm coupling limit and the MPTM is not fitted on vehicles with GVMs greater than 5000kg, the following limit and MPTM are to be assumed:

- 750kg trailer coupling – 675kg
- 2000kg trailer coupling – 1500kg
- 3500kg trailer coupling – 2100kg

Where a vehicle with a GVM more than 5000kg has previously been fitted a AS4177.2 compliant 50mm ball coupling, it is strongly recommended that the vehicle operator or a suitably qualified AVE determine the maximum towable mass and ensure the vehicle is appropriately labelled.

While the fitting of a label is only strongly recommended at this time, it will be made mandatory under the P1 modification code as part of the current revision of Vehicle Standards Bulletin 6 (VSB6). The revised VSB 6 is due to be implemented from 1 September 2017.

**Towing capacity limits**

Working out the tow limitations of a vehicle or combination is not just determined by the limit of the couplings. Instead the tow capacity of a combination is limited by the lowest rated towing related component. This includes:

- vehicle tow coupling
- vehicle tow bar
- vehicle gross combination mass (GCM)
- trailer tow coupling
- trailer drawbar

**Example**

The following vehicles are being used to form a combination:

Motor vehicle:

|               |                            |
|---------------|----------------------------|
| Tow bar       | 2,000kg                    |
| Ball coupling | 2,972kg (based on D-value) |
| GVM           | 6,500kg                    |
| GCM           | 9,500kg                    |

Trailer:

|         |                            |
|---------|----------------------------|
| MPTM    | 2,972kg (based on D-value) |
| Drawbar | 3,500kg                    |
| ATM     | 3,500kg                    |

As the towbar of the motor vehicle is the lowest rated component in the towing system, the motor vehicle may only tow up to 2,000kg.

In a fleet situation, a heavy vehicle may not have a dedicated driver who is aware of the towing limitations of the vehicle. To ensure any person who drives a vehicle is aware of the towing capacity limits, owners and operators may choose to provide information on or in the vehicle that outlines the limits. This could be in the form of a label in the vehicle cab or a towing capacity advice sheet provided to the driver.

## Combination Pintle Hooks

Combination pintle hooks are available where the hook incorporates a 50mm ball (see Figure 2). The 50mm ball may be a separate shank type tow ball that, when fitted, forms part of the hook, or the ball may be integrated into the casting of the hook.



Figure 2 - Example of Combination pintle hook with 50mm ball coupling

These types of coupling are required to have a D-value specified by the manufacturer. Where the D-value is clearly marked on the pintle hook, the following formula can be used to calculate the maximum towing capacity for the combination pintle hook:

$$GVM = \left( \frac{500000 * ATM * D}{(4903 * ATM - 500000 * D)} \right)$$

$$ATM = \left( \frac{500000 * GVM * D}{(4903 * GVM - 500000 * D)} \right)$$

If towing with a combination pintle hook using the 50mm ball component, and the trailer has an AS4177.3 rated coupling, the MPTM formula mentioned in the "Rating of a trailer coupling" section continues to apply to the trailer coupling.

The total towing limit in this case is calculated by determining the lowest rated component rating as illustrated in the "Towing capacity Limits" section.

## Complying with the national heavy vehicle safety standards

The operator of a heavy vehicle must ensure that their vehicle complies with the *Australian Design Rules (ADRs)* and *Heavy Vehicle (Vehicle Standards) National Regulation*. Using or permitting another person to use a defective heavy vehicle on a road is an offence.

A defective heavy vehicle is a vehicle that:

- does not comply with the heavy vehicle safety standards; or
- has a part that does not perform its intended function; or
- has deteriorated to an extent that it cannot be reasonably relied on to perform its intended function.

Penalties can include on-the-spot fines or prosecution. Formal warnings or a defect notice may also be issued. For more information see the *Heavy vehicle defects—Compliance and enforcement bulletin* at [www.nhvr.gov.au/ce-bulletins](http://www.nhvr.gov.au/ce-bulletins).

### About the NHVR

The NHVR has a dedicated Vehicle Standards team to help with modification applications and advise on any technical aspects.

#### For more information:

Email: [vehiclestandards@nhvr.gov.au](mailto:vehiclestandards@nhvr.gov.au)

Visit: [www.nhvr.gov.au/hvmodifications](http://www.nhvr.gov.au/hvmodifications)

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\*Standard 1300 call charges apply. Please check with your phone provider

Please note: While every attempt has been made to ensure the accuracy of the content of this Vehicle Standards Guide, it should not be relied upon as legal advice.



**Revised coupling ratings, based on towing motor vehicle GVM**

| Vehicle GVM<br>(kg) | 50mm tow ball<br>rating<br>(kg) | Trailer Coupling Rating<br>(kg) |              |              |
|---------------------|---------------------------------|---------------------------------|--------------|--------------|
|                     | 3500kg rated                    | 750kg rated                     | 2000kg rated | 3500kg rated |
| 5000                | 3500                            | 750                             | 2000         | 3500         |
| 5500                | 3241                            | 750                             | 1928         | 3241         |
| 6000                | 3089                            | 745                             | 1873         | 3089         |
| 6500                | 2972                            | 738                             | 1829         | 2972         |
| 7000                | 2878                            | 732                             | 1793         | 2878         |
| 7500                | 2801                            | 727                             | 1763         | 2801         |
| 8000                | 2737                            | 722                             | 1737         | 2737         |
| 8500                | 2683                            | 718                             | 1715         | 2683         |
| 9000                | 2637                            | 715                             | 1696         | 2637         |
| 9500                | 2597                            | 712                             | 1680         | 2597         |
| 10000               | 2562                            | 709                             | 1665         | 2562         |
| 10500               | 2531                            | 707                             | 1652         | 2531         |
| 11000               | 2503                            | 705                             | 1640         | 2503         |
| 11500               | 2479                            | 703                             | 1630         | 2479         |
| 12000               | 2457                            | 701                             | 1620         | 2457         |
| 12500               | 2437                            | 699                             | 1611         | 2437         |
| 13000               | 2419                            | 698                             | 1603         | 2419         |
| 13500               | 2402                            | 697                             | 1596         | 2402         |
| 14000               | 2387                            | 695                             | 1589         | 2387         |
| 14500               | 2373                            | 694                             | 1583         | 2373         |
| 15000               | 2360                            | 693                             | 1577         | 2360         |
| 15500               | 2348                            | 692                             | 1572         | 2348         |
| 16000               | 2337                            | 691                             | 1567         | 2337         |
| 16500               | 2327                            | 690                             | 1562         | 2327         |
| 17000               | 2317                            | 689                             | 1558         | 2317         |
| 17500               | 2308                            | 688                             | 1554         | 2308         |
| 18000               | 2300                            | 688                             | 1550         | 2300         |
| 18500               | 2292                            | 687                             | 1547         | 2292         |
| 19000               | 2284                            | 686                             | 1543         | 2284         |
| 19500               | 2277                            | 686                             | 1540         | 2277         |
| 20000               | 2271                            | 685                             | 1537         | 2271         |
| 20500               | 2264                            | 685                             | 1534         | 2264         |
| 21000               | 2258                            | 684                             | 1531         | 2258         |
| 21500               | 2253                            | 683                             | 1529         | 2253         |
| 22000               | 2247                            | 683                             | 1526         | 2247         |
| 22500               | 2242                            | 682                             | 1524         | 2242         |

COUPLING RATING-3500kg  
SPRING RATED FOR  
USE ON TRAILERS  
UP TO 2500kg ATM  
THIS PRODUCT COMPLIES  
WITH AS4177.3