Vehicle Standards Guide 16 (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

50mm 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.

AS 4177.2 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

AS 4177 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 AS 4177.2 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:

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

Example

Where an AS 4177.2 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:

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

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

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.

AS 4177.3 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 = 6.4kN

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

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

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

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

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

Example

Where a trailer has an AS 4177.3 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:

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

MPTM = 1793kg

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

Labelling requirements

For vehicles with a GVM greater than 5000kg being fitted with an AS 4177.2 compliant 50mm ball coupling it is mandatory under the Vehicle Standards Bulletin 6 (VSB6) P1 modification code to have a durable plate or label fitted indicating the towing capacity limits.

Note: Fitting a compliant coupling includes fitting a tow bar with interchangeable couplings, one of which is a 50mm ball. These are commonly known as 50mm receivers.

Where a vehicle with a GVM greater than 5000kg has previously been fitted with an AS 4177.2 compliant 50mm ball coupling, a coupling limit plate/label (refer to Figure 1) should be affixed near the coupling attachment to the towing vehicle, indicating the towing capacity limits, including the 50mm coupling limit and the MPTM.

Where the label is fitted, the 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.

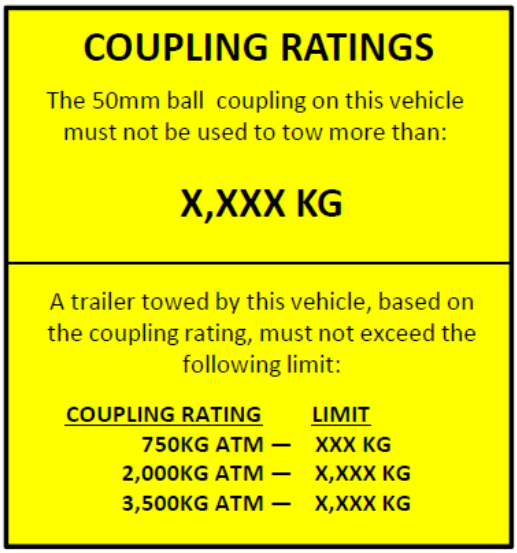

Figure 1: Example of coupling limit plate/label

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 with an AS 4177.2 compliant 50mm ball coupling, it is strongly recommended that the vehicle operator or a suitably qualified Approved Vehicle Examiner (AVE) determine the maximum towable mass and ensure the vehicle is appropriately labelled.

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, 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 AS 4177.3 rated coupling, the MPTM formula mentioned in the "Rating of a trailer coupling" section applies 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.

Operational limits

In operation, the mass values for GVM and ATM will be the actual masses of the towing vehicle instead of GVM and the actual trailer mass instead of ATM.

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. More information can be found at Heavy vehicle defects - https://www.nhvr.gov.au/hv-defects.

For more information:
Visit: www.nhvr.gov.au/vehiclestandards
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VSG-16 Revision history		
First Published	Sept 2017	
Revised	June 2024	Minor edits.

Revised coupling ratings, based on towing motor vehicle GVM

Vehicle GVM (kg)	50mm tow ball rating (kg)	Trailer Coupling Rating (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