

Vehicle Standards Guide 4 (VSG4) Inspection of Drawbar Eyes

The purpose of this guide is to provide information for inspectors, owners and operators of heavy vehicle combinations about the inspection of drawbar eye couplings and identifying some common issues that may lead to coupling failure.

Background

The inspection of a heavy vehicle and its components is a day to day part of operating a heavy vehicle and is also performed regularly by compliance and enforcement officers. Following feedback from operators and industry, the National Heavy Vehicle Regulator (NHVR) has developed this guide to provide specific guidance that may assist operators when inspecting drawbar eye type couplings.

This guide provides general advice about common signs that a drawbar eye coupling may need closer inspection or to be inspected by a suitably qualified person. Where there is any doubt about the installation or the condition of the eye, the manufacturers' specification should always be referenced.

To ensure the inspection of a drawbar eye is safe and thorough, the trailer should be inspected uncoupled from the towing vehicle, on a flat clean surface with the park brake applied (if applicable) and wheel chocks in place if needed. If a coupling cover has been used, it should be removed to allow all parts of the coupling to be inspected. Although this guide is specifically about drawbar eyes, all tow couplings should be regularly inspected and serviced.

Drawbar eyes used on heavy vehicles can be: 'Bolt-in', 'Weld on' or 'Bolt-on'.

Types of drawbar eyes

There are three types of drawbar eyes that are used on heavy vehicles, with each having different signs or indicators that need to be identified.



Figure 1: Bolt-in drawbar eye



Figure 2: Weld on drawbar eye



Figure 3: Bolt-on drawbar eye

Bolt-in Drawbar Eyes

General

A bolt-in drawbar eye typically consists of six main components. These are the Drawbar eye, the Mounting block, a Washer, Castellated nut and Split pin and an Eye bush (see figure 4).

Physical Movement of the Drawbar Eye

The castellated nut on the drawbar eye must be correctly tensioned, in accordance with the drawbar eye manufacturer's specifications. The tension of the castellated nut requires specialised equipment to test and cannot be easily checked in a basic visual or roadside inspection.

If the castellated nut is correctly tensioned, there should not be any vertical or horizontal movement of the drawbar eye in the mounting block. Movement could indicate internal wear in the block or the pin.

The torque specification for the castellated nut is usually high. If a check of the installation is to be conducted, it is recommended that the coupling is fully disassembled and worn or faulty parts replaced. Upon reassembly a torque wrench **must** be used.

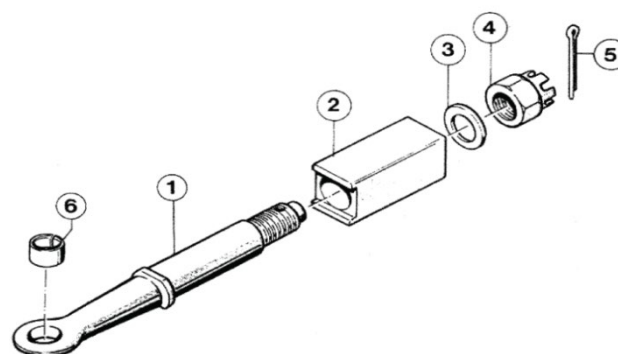


Figure 4: bolt in drawbar components

1. Drawbar eye
2. Mounting block
3. Washer
4. Castellated nut
5. Split pin
6. Eye bush

Wear on the drawbar eye locating flange faces

The drawbar eye has two machined flat surfaces (top and bottom) that locate the drawbar eye into the mounting block to ensure the drawbar eye is not able to rotate. If the castellated nut is not tensioned correctly there may be visible signs of wear on the machined flat surfaces on the drawbar eye and corresponding flat surfaces on the mounting block. Figures 5, 6 and 7 highlight some areas of potential wear on the flange faces including:

- a. signs of wear on locating flanges of the drawbar eye and mounting block
- b. wear on the edges of the drawbar eye and face of the mounting block
- c. wear on the edges of the drawbar eye and face of the mounting block
- d. gap between mounting block and drawbar eye

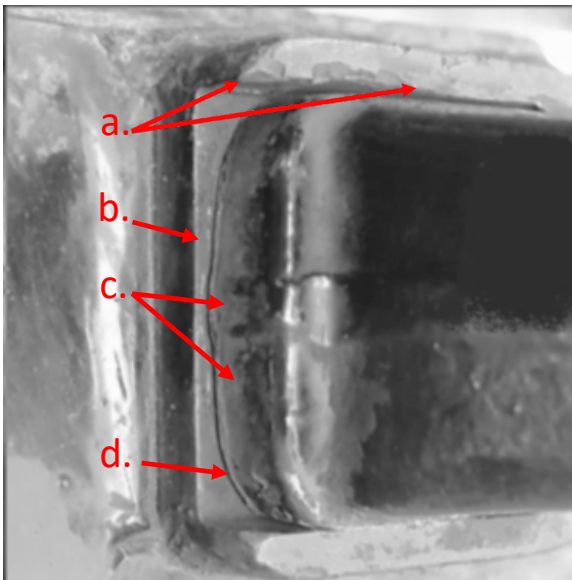


Figure 5: A loose drawbar eye with some wear

Figure 6 shows a drawbar eye with no wear or looseness. One indication that there is no movement of the drawbar eye in the mounting block is dirt around the drawbar eye .

- e. no wear evident on the flats of the drawbar eye or the mounting block.
- f. no signs of movement or wear around the drawbar eye and mounting block.

Note: Undisturbed paint around the drawbar eye indicates that there is no movement of the eye in the mounting block

- g. no movement or wear evident on the machined flats of the drawbar eye or the mounting block.
- h. No visible signs of movement or wear around the drawbar eye and mounting block.

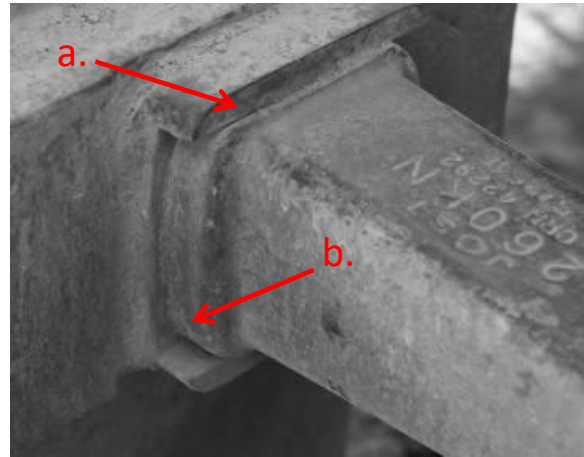


Figure 6: drawbar eye with no wear or looseness

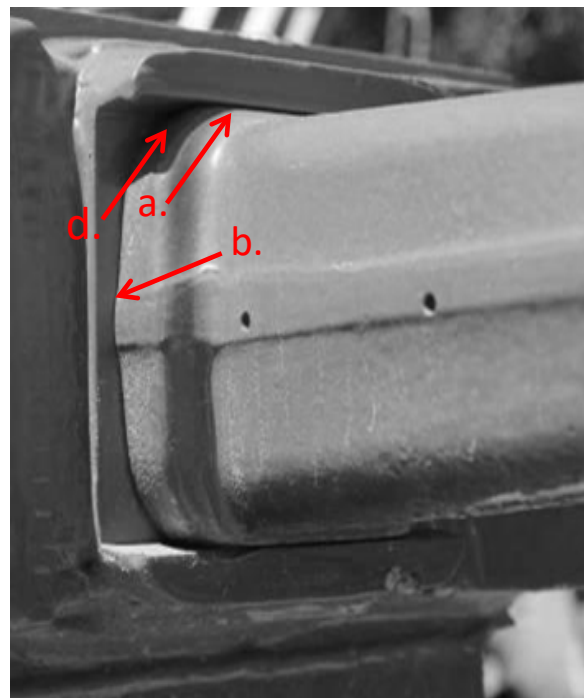


Figure 7: A drawbar eye with no visible wear or movement.

Polished face of the washer and signs of movement

If there is drawbar eye assembly is loose or insecure, the washer may be able to rotate on the drawbar eye shaft. If the washer does rotate, there may be signs of wear on the face of the washer where it contacts the castellated nut. This wear may be indicated by the washer appearing polished (shiny) or rusty. The shape of the washer may also have changed from being flat, to having a domed appearance. (See Figure 10)

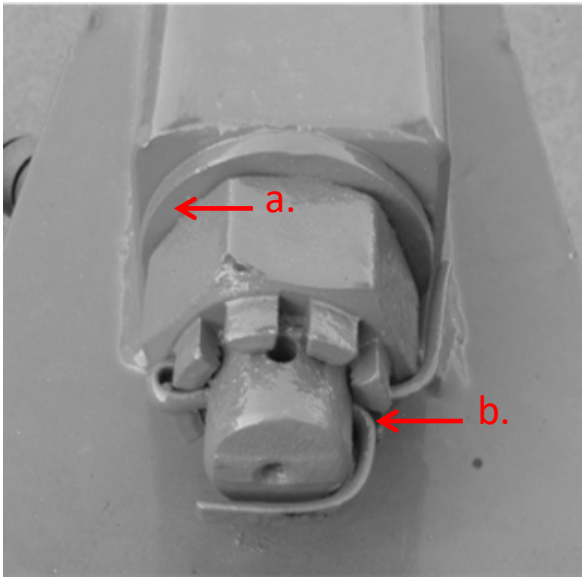


Figure 8: Correct bolt-in drawbar eye installation
 Figure 8 shows correct bolt-in eye installation.

- i. no visible signs of movement or polishing on the washer or mushrooming of the contact face of the nut and no rust residue between the washer and mounting block or washer and castellated nut.
- j. Correctly fitted split pin.

Note: The split pin provides a lock to prevent rotation of the nut. The split pin will not prevent the nut from pulling through when there is thread damage. A split pin is the only acceptable locking mechanism – refer to the manufacturer’s specifications if in doubt.

Internal Bore/Face Wear

A loose towing eye may be due to internal bore wear or wear on the face of the mounting block. A loose towing eye may also cause internal bore wear. When the towing eye is out, check for internal bore wear using a radial gauge. Replace when the wear exceeds the manufacturer’s specification.

Castellated nut loose or insecure (moved by hand)

The castellated nut should not be able to be moved by hand. Depending on how the load is placed on the drawbar eye, the nut may be insecure however not able to be moved by hand. In this case it may be possible to detect a gap between the front of the mounting block and the drawbar eye. (See item d in Figure 5)

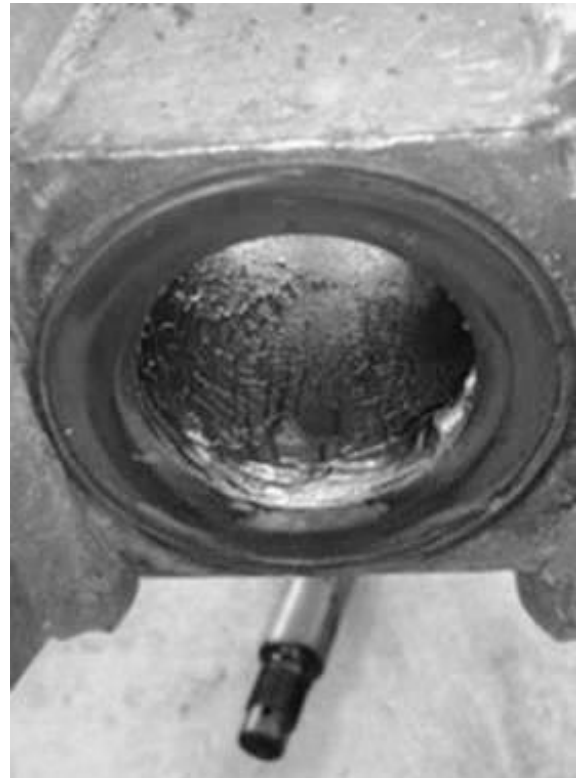


Figure 9: Wear in bore evidenced by grease pooling. Face wear into bore from washer movement.

Washer loose or insecure (moved by hand)

The washer should be securely clamped between the nut and the mounting block. If the washer can be rotated on the drawbar eye by hand, this is a good indicator that the castellated nut is not correctly tensioned and the drawbar eye is not secure. (See Figure 8)



Figure 10: Mushrooming of the washer due to face wear into the bore.

Mushroomed edges of the castellated nut

Movement of the drawbar eye in the mounting block may result in wear on the contact surface of the castellated nut. This movement may lead to the contact surface of the nut becoming mushroomed where it contacts the washer. (See Figure 10)

Rust residue around the front of the drawbar eye and mounting block

Movement of the drawbar eye in the mounting block may lead to a very fine brown/red rust residue appearing between the face of the mounting block and the drawbar eye. (See red arrows in Figure 5)

Rust residue around the rear of the drawbar eye, washer and mounting block

Movement of the drawbar eye in the mounting block may lead to a very fine brown/red rust residue appearing between the face of the mounting block and the washer and nut. (See Figure 10)

Gap between the front of the drawbar eye, the washer, castellated nut and mounting block and mounting block

A loose or insecure drawbar eye may lead to a gap being evident between the drawbar eye, washer, nut or the mounting block. This gap may occur at either end of the mounting block and detection may be dependent on the positioning of the load on the drawbar eye at the time of inspection. Careful attention should be paid to both ends of the drawbar eye. (Indicated item d in Figure 5, 6 and 8)

Split pin missing or damaged

A steel split pin is positioned through the shaft of the drawbar eye and the castellated nut to stop the nut rotating. The split pin must be the correct diameter for the hole in the drawbar eye and the castellated nut, be correctly fitted and not show signs of deterioration that may result in failure of the split pin. (See Figure 8)

Washer missing or damaged

The washer between the castellated nut and the mounting block protects the mounting block from damage from the nut and allows for easier tensioning of the nut. If this washer is missing, the split pin may not be aligned correctly and the eye may be loose. If it is damaged or split it may indicate other issues in the coupling and either needs to be replaced or the coupling checked carefully. (See Figure 10)

Bolt-on Drawbar Eyes

Design and fabrication of mounting backing-plate installation

Special care must be shown when planning and fabricating (welding) the installation of the mounting backing-plate for a bolt-on drawbar eye as the loading will be different when compared to a weld-on drawbar eye. For a bolt-on drawbar eye, the direction of the welds to attach the backing-plate will be perpendicular to the direction of the forces, compared to being in the same direction as the forces for a weld-on eye.

Bolt inspection and maintenance

The bolts used to affix the drawbar eye to the backing plate should be inspected regularly to detect any looseness in the bolts. Where loose bolts are found, these should be removed and replaced, rather than being retightened.

All types of Drawbar Eyes

Drawbar eye bush

The tow eye bush has wear limits before it requires replacement. It may however show signs of damage and if so should also be replaced. Refer to the manufacturers’ wear limits.

For example, a 50mm diameter eye bush is usually allowed to reach 51.5mm diameter before replacement is required. The table below is provided as a guide.

Table 1: Drawbar eye bush wear limits

Pin Size	Max. drawbar eye bush diameter
50mm	51.5mm max
40mm	41.5mm max



Figure 11: Heavily worn and damaged drawbar eye bush

Welding

Where the towing eye is installed using welding, the installation must be in accordance with the manufacturers’ requirements. This usually requires that the mounting is welded into the drawbar structure and not on to the structure. This ensures that the rated load will be able to be carried safely (See figures 12, 13 and 14).

Welds must be continuous (not stitch welded) and welds must be checked for cracks. Welds should be inspected periodically to ensure there are no signs of cracking.

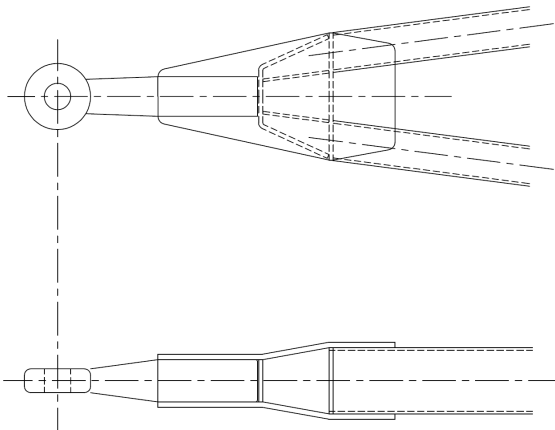


Figure 12: Example of drawbar construction

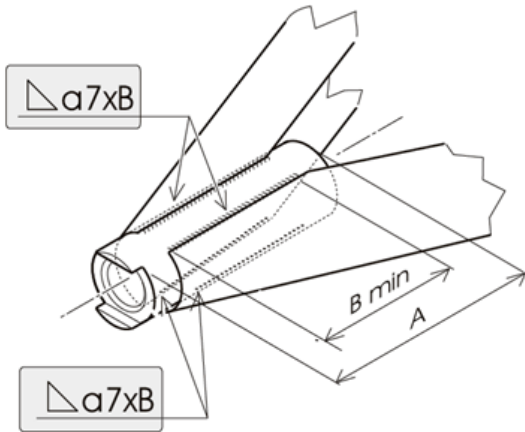


Figure 13: Example of manufacturer’s welding instructions

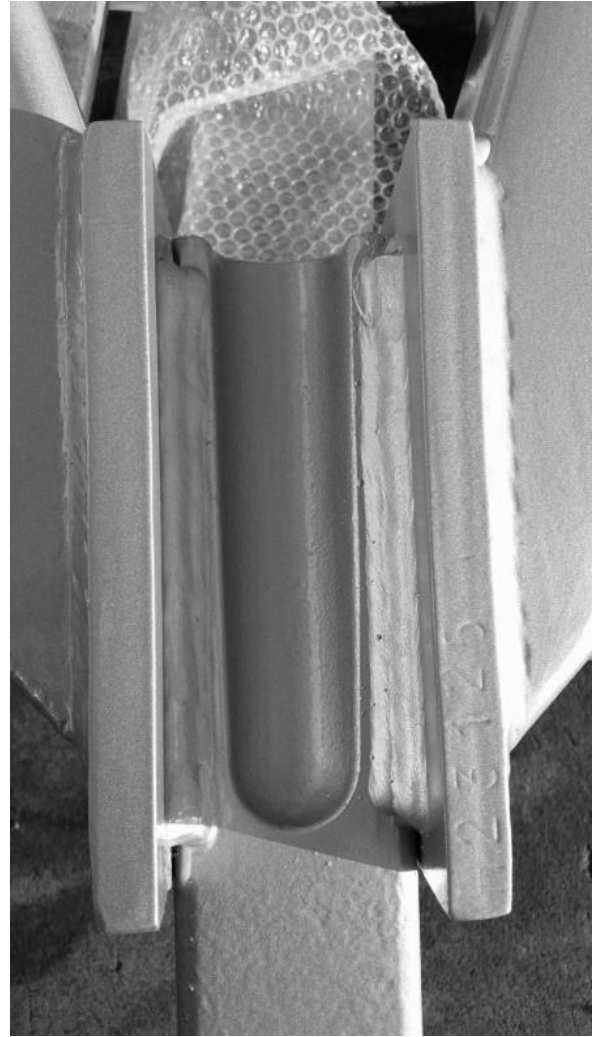


Figure 14: Examples of good design and installation

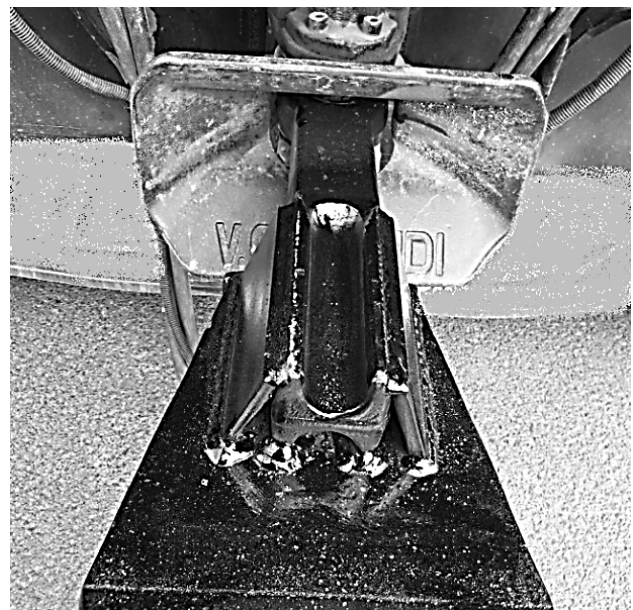


Figure 15: example of poor installation



Figure 16: Example of poor installation

The gusset provides additional support but the lower edge of the toweye is not fully welded to the drawbar. Furthermore, maintenance personnel are unable to check the lower-edge welds for cracking (See figures 15 and 16).

Drawbar Damage

Drawbars and towing eyes can be bent or kinked due to clashes with the towing vehicle structure or the coupling during use. Jack-knifing when reversing to tip is one such instance (See Figure 17).

Check the drawbar for damage or bends and check the towing eye for bends using a straight edge. Damaged or bent components must be repaired or replaced.

Particular attention should be paid for cracks where reinforcements of the drawbar stop, such as rear of the plates in figure 12. This should be conducted on the top, bottom and both sides of the draw bar.

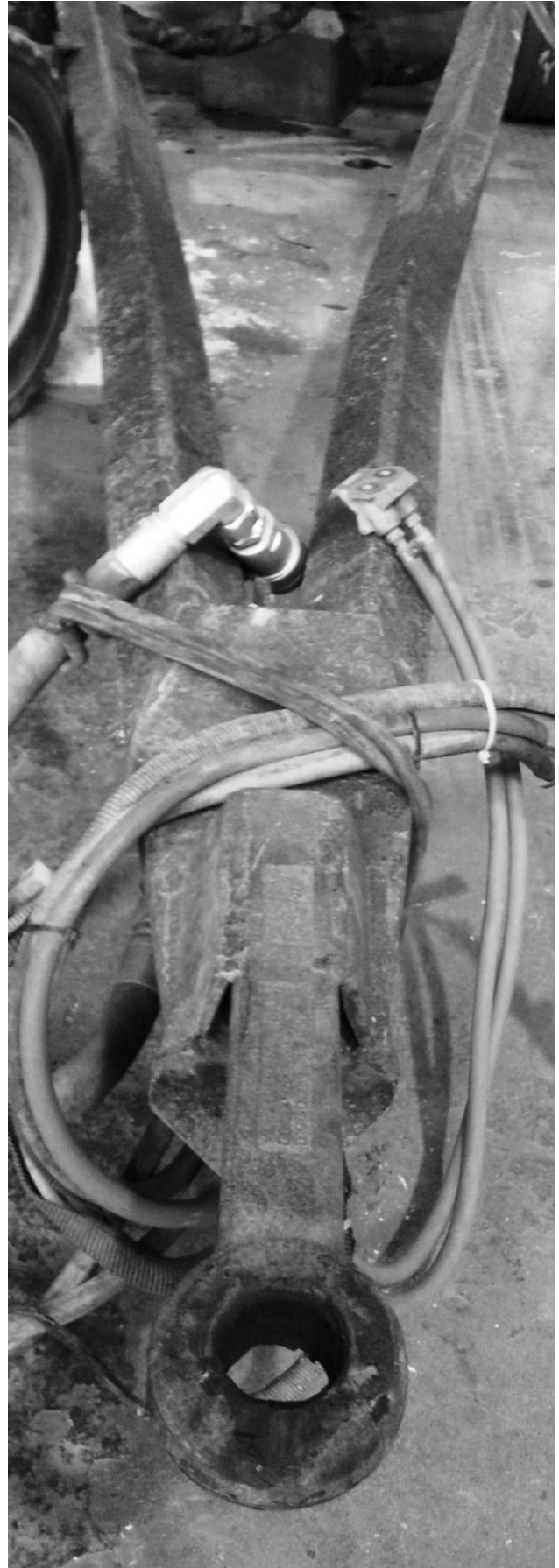


Figure 17: Bent drawbar

The drawbar may also be damaged by tipping through the drawbar. This will have the effect of ‘sandblasting’ and will reduce the metal thickness over time. If there is significant reduction in metal the vehicle should be rejected (see figure 18).



Figure 18: Wear on drawbar

Any other signs of wear or movement

This list of indicators is not exhaustive and there may be other checks that can be performed that may highlight insecure or worn components that could render the coupling unsafe.

Australian Design Rule (ADR) Requirements

Where ADR 62 applies the drawbar eye must display the manufacturers’ name/trademark and the rated D-value and V-value as applicable (Note: D and V-values are required where the drawbar is fixed).

In some instances, the drawbar eye may be marked with the ECE classification in lieu of the values.

Complying with the Heavy Vehicle National Law

The operator of a heavy vehicle must ensure 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.

For more information:

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VSG-4 Revision history		
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Revised	June 2021	Minor review

Drawbar eye inspection checklist

The following checklist outlines some common items that may indicate a drawbar eye or drawbar may be defective and requires a more detailed inspection.

Bolt-in type drawbar eyes	
<input type="checkbox"/>	There is rust residue around or between the eye and the mounting block.
<input type="checkbox"/>	The eye is not hard up against the mounting block.
<input type="checkbox"/>	The eye moves in the mounting block.
<input type="checkbox"/>	There is wear on the face of the locating flange and block.
<input type="checkbox"/>	The eye bush is worn, damaged, distorted or missing
<input type="checkbox"/>	The washer is loose, insecure or not hard up against the mounting block (can moved by hand).
<input type="checkbox"/>	There is rust residue around or between the washer and the mounting block.
<input type="checkbox"/>	Either face of the washer is polished or shows signs of movement (clean).
<input type="checkbox"/>	The washer is mushroomed or otherwise distorted.
<input type="checkbox"/>	The castellated nut is loose or insecure (can moved by hand). <i>Note: Correct tension can only be tested in a workshop using the correct tools.</i>
<input type="checkbox"/>	The castellated nut has mushroomed edges or there is polishing of the contact face.
<input type="checkbox"/>	Split pin is not fitted or is broken.
All types of drawbar eyes	
<input type="checkbox"/>	Any welds attaching the mounting block or weld-on drawbar eye to the drawbar are not the correct dimension, are not in the correct position or are of poor quality.
<input type="checkbox"/>	Any welds are not continuous or have cracks.
<input type="checkbox"/>	The drawbar eye is bent, kinked or otherwise damaged. <i>Note: This damage could have occurred by contacting the towing vehicle or from extreme use (jack knifing)</i>
<input type="checkbox"/>	The drawbar eye or drawbar have significant damage caused by sandblasting (either by a load being tipped through the drawbar or by routine road sandblasting) or other routine use.
Drawbar	
<input type="checkbox"/>	Drawbar is bent cracked or broken