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FREIGHT TRANSPORT ASSOCIATION

## Wheel Security



A best practice guide



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IRTE publishes a monthly magazine *Transport Engineer*, renowned for its incisive features, news analysis and comment as well as a wide range of best practice guides including *Tachograph Systems Compliance*, *Roadworthiness: Industry Best Practice*, *Coupling or Uncoupling & Parking of Large Goods Vehicle Trailers*, *Guide to Tipper Stability*, *Tail lifts – Simple guide for operators* and *Tail lifts – Specification guide for road vehicles*.

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## FREIGHT TRANSPORT ASSOCIATION

### FTA best practice guide to Wheel Security

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Editor: **Andy Mair**

Production: **Hilary Kingdon**

Design: **Tim Holdstock**

This guide focuses on wheel security to identify and share best practice. The best practices highlighted are based on real-life systems used by FTA members and should stimulate ideas to improve your own systems and wheel fitment policies. It should be noted that any specific manufacturer's instructions on wheel fitment and torquing procedures should always be strictly adhered to.

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For details of how to join FTA contact the Member Service Centre on 08717 11 22 22\*

\*Calls may be recorded

FTA represents the freight interests of business throughout the UK. Its members range from small and medium sized businesses to multinational companies involved in operating across modes of transport. Its 14,000 members operate over 200,000 heavy goods vehicles – half of the UK fleet and in excess of one million light vans. They are also responsible for consigning over 90 per cent of freight moved by rail in the UK and consign over 70 per cent of UK visible exports. This unique multi-modal mandate enables FTA to speak authoritatively on all aspects of freight, reflecting the transport needs of industry within the economy.

FTA's role is to help its members to ensure their transport operations are safe, legal and efficient. It achieves this through timely, accessible and relevant information and support founded on the Association's strong representational presence at local, national and European levels. This information is reinforced by industry-leading services. FTA's Vehicle Inspection and Tachograph Analysis Services enable members' legal compliance performance to be regularly audited and benchmarked. FTA's Training team offers member consistently high pass rates in transport qualifications.

Members day-to-day operational management is supported by Shop**fta** in providing transport consumables, such as wheel nut indicators, tyre pressure gauges and tread depth gauges ([www.shop.fta.co.uk](http://www.shop.fta.co.uk)), and FTA's Member Advice Centre which deals with over 30,000 questions each year.

### Acknowledgements

FTA would like to acknowledge the contribution made by ATS Euromaster; IRTE (Institute of Road Transport Engineers) and Sita UK in providing expert technical knowledge, experience and material to assist in the production of this best practice guide.



## Foreword

Wheel security on commercial vehicles remains a high profile issue for the road freight industry. Incidences of loss are thankfully few. However operators, drivers and maintenance providers cannot be complacent. Wheel security is a key part of the O licence commitment to operating well maintained, roadworthy vehicles. When things go wrong, it has potentially serious implications for the safety of other road users as well as the driver, vehicle and load.

Industry has made important progress in reducing the risk of occurrence through the current design of wheel fixings and understanding the reasons for wheel loss. Whilst there are products on the market that can make wheel nut movement more noticeable, or prevent wheel nut movement, operators cannot 'fit and forget'. A good maintenance regime which is underpinned by routine preventative measures as part of driver walk round checks is essential, as are well understood procedures for fitting wheels.

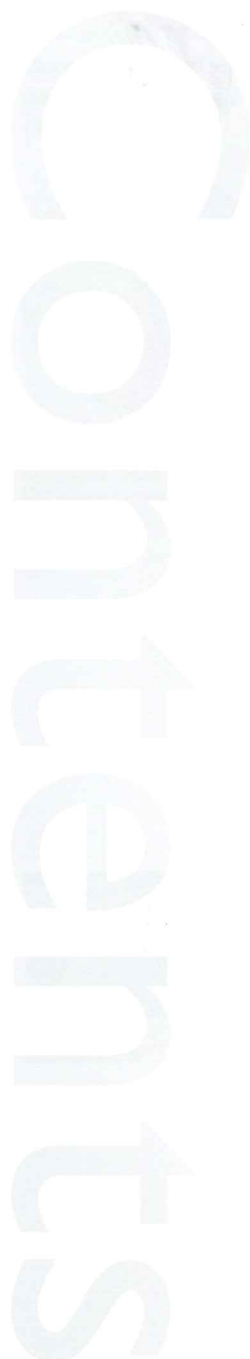
This joint FTA/IRTE publication, and the practical contribution of ATS Euromaster and Sita UK, is most welcome in providing an example of best practice guidance to operators, with whom the responsibility for maintaining roadworthiness ultimately rests. Equally important is the supporting guidance to drivers and consumables to encourage standardised practice to procedures which is highlighted towards the end of the guide.

**Philip Brown**  
*Senior Traffic Commissioner*





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## Introduction

Wheel detachment from vehicles, particularly heavy commercial vehicles, has been a cause for concern for operators for many years. When a wheel becomes detached from a heavy vehicle it may simply come to rest without causing any further damage or harm. However, in the wrong circumstances, when wheels become detached from a moving vehicle, they can accelerate up to around 150 km per hour, going out of control like a bouncing bomb, reaching a height of 50 metres before colliding with other vehicles or road users at an equivalent force of 10 tonnes.

In some cases this has resulted in fatalities, and according to research carried out by the Transport Research Laboratory (TRL) the typical annual frequency of fatalities resulting from wheel loss incidents is between three and seven cases per annum.

There has been a considerable amount of research and investigative work on the subject of wheel loss over the years, and despite efforts to publicise the issue and published advice in various forms, wheel detachment from commercial vehicles remains an issue for the transport industry, although it occurs in a small proportion of overall road accidents.

Whilst it is recognised that the underlying problem of wheel loss is attributed to one of design (as it is fairly unforgiving), there is no doubt that a good maintenance regime together with an understanding of the issues of wheel loss can significantly reduce the risk of a detachment occurring. Adopting a robust wheel checking and fitting policy together with an effective record system will help to:

- maintain wheel security
- reduce the likelihood of wheel detachment
- reduce the likelihood of vehicles attracting prohibitions

The aim of this guide is to gain an understanding of why wheels become detached from vehicles and to provide best practice guidelines for drivers and vehicle maintenance staff on preventing wheel loss. It includes guidance on adopting a policy of a clearly defined, structured and standardised method of wheel checking and fitment. The guide includes details of the most common causes of wheel looseness and what to look for when inspecting road wheels and component parts, and guidance on preparation and wheel fitment procedures to prevent wheel loss.

The guide will be of benefit to drivers, workshop technicians, tyre contractors, transport and workshop management staff.

This guide is based on BS AU50 Part 2 Section 7a 1995, and it is recommended that it should be used in conjunction with the British Standard and specific manufacturer recommendations.

## Research findings

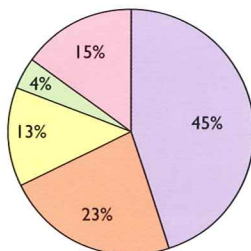
Much research in recent years has been undertaken into determining the cause of wheel loss on commercial vehicles. In 2006, the Transport Research Laboratory (TRL) published a Department for Transport commissioned report into Commercial Vehicle Wheel Security.

The report estimated that the typical annual frequency of wheel fixing problems is as follows.

- Between 7,500 and 11,000 wheel fixing defects
- Between 150 and 400 wheel detachments
- Between 50 and 134 resulting in damage only accidents
- Between 10 and 27 resulting in injury accidents
- Between 3 and 7 fatal accidents

The report suggested that current designs of wheel fixings do provide adequate clamp load when all components are in good condition and properly tightened. However, it also shows that there can be substantial problems involving joint relaxation, torque to clamp ratio and component temperature that can affect the security of the fastening. The data suggests that the factor of safety inherent in the current design is not so high that it can tolerate large amounts of degradation of the components or imperfect maintenance procedures. The report concludes that the current design is **NOT** a maintenance-free design and does, therefore, requires very careful handling.

Wheel stud defects  
– breakdown of  
causes associated with  
defective wheel security  
(TRL report)



- Failed wheel stud
- Worn steel stud
- Stripped thread
- Corroded wheel stud
- Other defect

## Responsibilities for wheel security

### Drivers

Drivers of commercial vehicles have a legal responsibility to ensure that the vehicle they use on the public highway is free from visible defects. Drivers are legally required to report any defects that they have identified in writing.

As part of their pre-use checks drivers should always carry out a visual inspection of the vehicle wheels for security.

Police officers and Vehicle and Operator Services Agency (VOSA) examiners have the power to issue graduated fixed penalty notices. When a fixed penalty notice is issued for a construction and use offence, such as defective wheels and fixings, the examiner may also prohibit the driving of the vehicle on a road. Consideration will be given to the culpability of the driver in respect of vehicle defects and in the main this will be the primary consideration in the issuing of a





fixed penalty notice for roadworthiness offences such as defective wheels and fixings.

### Operators/maintenance staff

It is a requirement of operator licensing for operators to maintain their vehicles in a safe and roadworthy condition at all times. Wheel security defects are considered serious by VOSA and Traffic Commissioners, as they are deemed to be attributed to a poor maintenance regime. Operators should ensure that maintenance policies should be sufficiently robust to prevent wheel loss defects from occurring, and that staff are adequately trained in wheel maintenance procedures.

### Third party maintenance and service providers

Operators who use outside contractors for vehicle maintenance (including tyre companies) should check to ensure that these companies have sufficiently robust wheel inspection and fitment policies in place to prevent wheel loss defects from occurring. It would be prudent for operators to insist on written copies of wheel inspection and fitment policies which may be required to be included in any contractual agreement with the third party agent and that spot checks are undertaken by the operator to check conformance with the policy.

**It should be noted that regardless of any third party maintenance contract, including outside tyre contractors, the operator is ultimately responsible for maintaining vehicle roadworthiness.**

Everyone involved in vehicle maintenance should have their duties and responsibilities clearly defined. Emphasis should be placed on the importance of maintaining roadworthiness and the role they play in ensuring compliance, and a firm understanding of the causes of wheel loss is vital.

### Why do wheel fixings loosen?

Road wheels on large commercial vehicles are subject to a wide variety of forces from the vehicle itself, vibration, cornering forces, heat effects, acceleration and braking.

If one wheel nut loosens then these forces are distributed over the remaining nuts. The majority of the forces are spread to the adjacent nuts causing them to loosen as well. As more nuts become loose the process accelerates as the overall clamping force decreases (clamping force being the loading that is created by the studs and wheel nuts compressing/pinching the wheel(s), hub and drum together). When the clamping force is less than the forces on the wheel, it will move relative to the hub. This results in side loading and a loosening



of the remaining nuts which, if not spotted in time, leads to elongated stud holes, fatigue failure of studs, fretting fatigue cracks and wheel separation.

Relaxation of wheel clamping force can occur due to a loss of tension in the stud. Laboratory test programmes have established that the sequence of events, which precede wheel loss due to relaxation, is as follows.

- Settlement within the fixing leads to a reduction of clamping force
- Clamping force reduction continues as further wear and settlement takes place
- Some of the nuts may become so loose that they exert no effective clamping force on the wheel
- The nuts on the studs that have completely lost their clamping force may spin off over a period of time, or remain seized on the studs; in this eventuality the lack of clamping force will result in elongation of the stud holes, fatigue failure of studs, fretting fatigue cracks and wheel separation
- Insufficient clamping force is recognised as the main reason for wheels becoming detached. Insufficient clamping force can lead to movement at the wheel and hub interfaces causing wear and subsequent loss of stud/bolt tension. Inadequate clamping force can occur if the initial tightening torque is too low, or the applied tightening torque did not result in the intended clamping force possibly due to over-tightening or because mating faces are dirty or damaged

### Wheel fixings can loosen due to a variety of reasons

- The fixing is insufficiently tightened and thus allows the wheel to fret and wear
- The fixing is over-tightened, causing stretched/broken studs or causing studs to be pulled through the hub. It is often an unconscious act for drivers and maintenance staff to over-torque wheels, in the misguided belief that exerting extra pressure on a wheel fixing will prevent them from coming loose. Either way it will result in stud failure due to the fact the elastic limit of the material is exceeded
- Failure to regularly check tightness of wheel fasteners
- Fitment of incompatible wheels
- Fitment of unserviceable wheels and components
- Incorrect lubrication of threads and interfaces. Lack of initial clamping force can be due to high friction loss which can be resolved



*Examples of elongation of stud holes, wheel movement, wear to studs and a cracked wheel*



by the use of appropriate lubrication of the wheel nuts, studs and washers

- Excessive lubrication or incorrect lubrication, eg applied to the mating surfaces of wheels
- Severe corrosion and/or waisting of wheel studs
- Studs not pressed fully into the hub or loose back nuts
- Incorrectly assembled components
- Incorrect assembly, eg not following the correct torque and re-torque procedure
- Paint, rust/scale or dirt on mating surfaces
- Worn wheel spigots
- Fractured or seized wheel nuts washers
- Brake drum securing screws/bolts loose, holding wheel off the hub face
- Inaccurately calibrated torque wrench or calibration date expired
- Incorrect use of air impact tools. This is a common cause of both under-torquing and over-torquing because the actual torque applied depends on a wide range of variables and is not measurable. The power of air impact tools also often leads to problems such as cross-threading and cracked nuts and washers
- Incorrect tightening sequence
- Temperature effects. The clamp load can vary during service due to changes in temperature of the components
- Settlement from any other factor eventually causing the clamping load to become inadequate

In summary, the assembly can only accommodate a very small amount of settlement. The wheel studs are very stiff and the amount of extension caused by the tightening torque is limited, particularly if the stud tension is lower than intended in the first place. Nut movement can be indicated whereas settlement is difficult to detect visually.

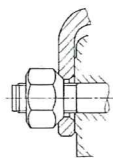
## Types of wheel fixings

Most European truck and trailer manufacturers have standardised spigot type wheel fixings; although wheels designed for old type fixings are still in use. This can be an issue to fitters and technicians who may be confronted with a variety of non-compatible wheel fixings which, if not correctly matched, could result in damage to wheels, hubs and studs. Mismatching prevents correct mating and tightening of the wheel.

Different wheel fixing types are not interchangeable!

## Wheel fixing type

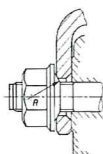
### Conical



This nut matches with a similarly shaped machining around the holes.

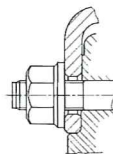
This means that when it is tightened the two faces 'mate' together to both locate and secure the wheel.

### Din spherical



A plain nut is used with a washer that has a spherical facing. The washer matches a spherical shaped machining around the stud holes which, when tightened, locates and secures the wheel.

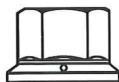
### Spigot



This type of fixing is the most commonly used on heavy vehicles. The design of fixing relies on an accurate fit of the wheel centre on the hub spigot for location purposes and on clamping pressure generated by the large surface area of the fixed washer for securing purposes.

## Spigot type wheel nuts for alloy and steel wheels

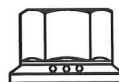
With the increasing popularity of alloy wheels being fitted to trucks, the question of the correct wheel nut fitment is also important.



A spigot wheel nut with one 'O' on the captive washer denotes that the captive washer has been hardened to a degree where it is suitable for **steel wheels only**. Using them with aluminium wheels could cause the washer to crack resulting in a loss of clamping force.



A spigot wheel nut with two 'O's on the captive washer denotes that the washer has undergone a controlled process which allows it to be used **with both steel and aluminium wheels**. Reports suggest that these will become more popular with truck manufacturers now that the technology is available to manufacture them at a reasonable cost.



A spigot wheel nut with three 'O's on the captive washer denotes that the captive washer is suitable for use on **alloy wheels only**. Using this type of wheel nut with steel wheels would lower its life expectancy and therefore is not recommended.

## Driver checks and responsibilities

As part of their pre-use checks, drivers must carry out a visual inspection of the vehicle wheels for security and are legally required to report any defects in writing.

Drivers should check wheels for:

- signs of damage to nuts, studs etc
- cracked wheels, nuts, washers etc
- distorted rims
- elongation of stud holes
- missing, broken or loose fixings/components
- signs of wheel looseness
- bright metal in the area of nut and washer seating
- rust that can be seen radiating out from the area of the nut and washer
- the position of wheel nut indicator devices (if fitted), which can indicate if wheel nuts have moved
- blocked ventilation holes

*Mis-aligned  
wheel nut  
indicators*

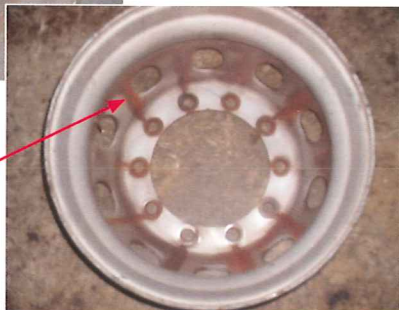
*Elongation  
(ovalation) of  
stud holes*



*Bright metal around the  
seating area of nuts or  
captive washers*

*Cracks in the nave  
radiating from the  
stud hole*

*Rust marks  
running from  
the fixing area*





If looseness of wheels is suspected, the wheel nuts should be checked physically. This should ideally be undertaken by an individual that has received certificated training, using a calibrated torque wrench. Should the driver need to check wheel security with a socket and a bar, such as instances when away from the vehicle depot, then preferably a bar as supplied by the vehicle manufacturer should be utilised, alternatively a bar that is no longer than 500mm (20") to avoid over-tightening (extensions to the bar beyond this length should not be used).

Driver training should include:

- how to set a torque wrench correctly
- the correct torque setting for the vehicle type and model (as per manufacturer's recommendations)
- an understanding of why it is critical that wheel nuts are subject to an initial torque and re-torque
- the correct method of physically using a torque wrench
- why it is important to stop applying further pressure once the torque wrench has reached the required setting
- tell tale signs to look for that will indicate loose wheel nuts
- resetting the torque wrench to zero once it has been used

**Any defects including loose wheel nuts should be reported immediately and the vehicle should not be driven without the defect being investigated and rectified.**

If wheel nuts are found to be loose there is very likely to be a reason for this, therefore the wheel(s) should be removed and all relevant components examined by a competent person to determine causation.



*Physical use of a torque wrench*

## Maintenance of wheels and fixings

There is no doubt that good maintenance practices are a major contributing factor to preventing wheel loss. Inspection of wheels and associated components should be included in routine maintenance of commercial vehicles. Consideration should also be given to implementing a formal policy of checking wheel security on a more frequent basis, such as a weekly check using a torque wrench.

All components will be subject to wear in normal use, and vehicles used in more arduous conditions will be subject to increased wear rates to wheel rims, studs, nut and hubs – remember wheel studs and nuts are not a 'fit and forget' component. Many operators adopt a best practice policy of routinely removing wheels for inspection on an annual basis, usually around the time of MOT, to

carry out a thorough examination of wheel and hub components as best practice. Operators of vehicles used on arduous work and off road activity may need to consider removing wheels for inspection more regularly.

During routine maintenance, vehicles should be inspected for signs of wheel looseness, eg elongated wheel stud holes, bright metal or rust marks around the wheel nuts or washers. If a wheel nut is identified as being loose at either inspection or as part of the driver's checks, the wheel(s) must be removed to determine causation.

### Inspection

Whenever the need arises to remove a wheel(s) to allow for the repair of a part, eg replace road spring, before the wheels are fitted all relevant components, eg studs, nuts, spigot, wheel etc, must also be inspected for serviceability. The wheel(s) should be thoroughly inspected together with associated components for distortion, damage, dents, cracks, corrosion, worn stud holes and condition of the spigot mounting area. Inspect the condition of studs (and their security), wheel nuts, hub, spigot and, where applicable, the brake drum. When working on twin wheel assemblies, both wheels should always be removed for inspection.

**It is vital that the cause of wear or damage to loose wheel nuts and associated components is established and rectified prior to re-fitting or re-tightening wheels.**

Commercial vehicle wheels and associated components are subject to inspection at annual test in accordance with criteria detailed in the Heavy Goods Vehicle Inspection Manual (see section *Annual test requirements for commercial vehicle wheels and components* on page 20).

### Wheel and hub spigot wear

Wheels should not be refitted to hubs with any signs of worn spigots as the wheel will not centralise correctly and will be located eccentrically which will cause imbalance of the wheel in motion and may lead to loosening of the wheels. This principle also applies to the centre bore of the wheel.

Only when it has been established that all components are in a serviceable condition should the wheels be fitted to the vehicle. If any components are found to be excessively worn or damaged, they must be replaced.

Never assume someone else, eg a tyre fitter/contractor, has examined the wheels which are to be fitted – it is the responsibility of the person fitting the wheels to carry out the inspection.



*Debris trapped between wheels*



*Severely dirt-contaminated wheel rim*



*Worn hub spigot and wheel studs*



*Worn wheel centre bore spigot*



*Cracked wheel*



*Cracked washer*



*Washer detached*



*Examples of wear to hub spigots*

### Preparation for wheel fitment

When preparing to fit road wheels to vehicles, it is essential that all mating surfaces are spotlessly clean and free from damage. Particular importance must be paid to the mating faces of the wheels and hub, these must be cleaned thoroughly. When cleaning these areas, care must be taken to ensure that the immediate area surrounding the mating faces is free from debris (such as the wheel nave and brake drum surrounding areas, ie under mud flaps etc) as road dirt, rust or other material may fall between the mating faces as the wheel is refitted resulting in a reduction of the clamping load. (This reduction in clamping load will be exacerbated greatly once the debris breaks free.)

It is important to note that If debris falls between the mating faces of the wheel, the operation of tightening the wheels with a torque wrench may appear to be normal, however the correct clamping load for the wheel assembly will not have been achieved.

The hub spigot and the wheel centre bore must be cleaned to ensure the components are free from corrosion and debris, failure to do so may result in the wheel assembly not seating correctly and, due to resistance between the wheel and the hub, the required clamp load for the wheel will not be achieved.

Corrosion and debris on the threaded area of wheel studs and nuts will cause frictional resistance, and the wheel nuts should move freely on the thread by hand action only.

Any force that is required to turn the wheel nut will not be applied to the wheel mating face and the correct clamping load will not be achieved. In order to minimise any friction of the wheel stud and nut threads, which would reduce the clamping force achieved, the



*Dirt-contaminated components*

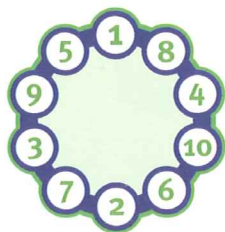


*Wheels cleaned and in a serviceable condition for fitment*





Corroded wheel stud



Wheel nut tightening sequence

wheel studs and nuts should be cleaned down the entire length of the thread and lubricated using light engine oil (lubricant specifically designed for this purpose is available).

**Note:** Some vehicle manufacturer specify that no lubrication should be used on the threads. Always refer to specific manufacturer instructions.

## Wheel fitting/tightening procedure

Ideally wheels should be fitted and torqued when cold to take into account any expansion and contraction of the components. Care should be taken where components such as brake drums have been removed and refitted that they are correctly and fully located prior to fitting the wheel.

### Lubrication

Lubricate the threads of the wheel studs using light engine oil (unless otherwise instructed by the vehicle manufacturer) and place a drop of oil between the captive washer and the nut.

- Never be tempted to paint wheels before fitting or using tools such as a needle gun to clean any surfaces
- Carefully fit the wheels squarely over hub/studs avoiding damage to stud threads. On twin wheel fitments, ensure the tyre valves are correctly aligned
- Fit and run up the wheel nuts by hand initially. If using power tools then only use for the **initial** phase of tightening. The last stages of tightening must be carried out with a torque wrench. The torque wrench must be in good working order and calibrated. **Note:** If an air wrench is used it is advisable to restrict the airflow to the minimum setting, and only run the nut down to the wheel nave and to avoid over-tightening
- Ensure that the torque wrench is set according to the manufacturer's instructions, and that the socket used is of the correct size and depth
- The final tightening of the wheel nuts should be done before fully lowering the wheel to the ground in order that the correct clamping force can be achieved
- Tighten the wheel nuts in the correct sequence illustrated (diametrically opposite in a rotational sequence to ensure mating faces are pulled together squarely and evenly) to the specified torque. Never be tempted to over-tighten as this will stretch the stud

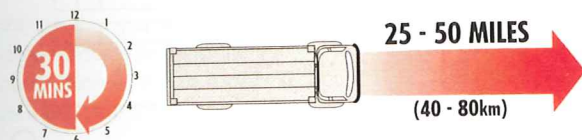
**Note:** If the wheel nuts have been over-tightened during the run up procedure (this will be indicated by no movement of the nut during the torquing procedure) the wheel nuts must be slackened off, re-checked and re-tightened in the correct sequence.



## Wheel re-torque procedure

The phenomenon of settlement in threaded fasteners has been known for a long time. Tension needs to be restored as relaxation in clamping force is likely to occur; as the numerous components that are 'sandwiched' re-settle. It is vital, therefore, that following a wheel fitting, the wheel nuts must be rechecked for tightness after the vehicle has stood for a period of 30 minutes, whether the vehicle has moved or not, or after 40-80 kilometres using a calibrated torque wrench set to the manufacturer's specified torque value.

**Note:** Some vehicle manufacturers do not recognise the 30 minute re-torque procedure. Always refer to specific manufacturer instructions.



When carrying out the re-torque to the wheel nuts, under no circumstances should the wheel nuts be slackened and retightened. Instead the wheel nuts should simply be checked to see if the correct torque is still applied/tightened to the correct torque.

Where possible the re-torque procedure should be carried out to complete the wheel fitment procedure in one operation before the vehicle is put back into service. This may require a short road test of the vehicle to be carried out. If, however, this is impractical then the 30 minute procedure applies. If the vehicle is put into service without a re-torque, then there should be a robust system in place to inform the driver of the vehicle that the re-torque procedure is required and that the wheel nuts are required to be re-checked for tightness after either 30 minutes or after the vehicle has travelled 40 to 80kms (see re-torque label).

**Note:** Due to the operational difficulties associated with the 40-80km re-torque, if it is impractical for the driver to carry out this procedure with a torque wrench, in exceptional circumstance the use of a manufacturer's wheel brace (less than 500mm in length) would suffice, but the distance based re-torque should be carried out at the earliest opportunity.

### Re-torque label

It is recommended that a documented means of ensuring that wheel nuts are always subject to an initial torque and re-torque is in place, and records are kept to form part of the vehicle's maintenance history. The completion of a re-torque label, which is completed each time a wheel is fitted to a vehicle, is common practice across the

industry. If completed and used correctly, this label can provide a historical log of any wheels which have been removed from a vehicle, and the procedure followed for fitment.

A re-torque label can be used to document and monitor the entire wheel change procedure and should include instructions to tyre fitters/workshop technicians and drivers to ensure that the correct procedures have been carried out by all parties involved in wheel fitment.

<b>Wheel Removal Details</b>										<b>Serial No:</b>	
Steer axle (s)		Drive axle (s)		Trailer axle (s)							
O/S		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		Vehicle Reg No <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>			
<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		Trailer ID No <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>			
N/S		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>		<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>					

<b>First Torque</b>		<b>Company</b> .....		<b>Centre</b> .....		○	
Tyre Contractor/Workshop Technician		Wheel nuts torqued to: <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div> lbft or <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div> Nms		Mileage <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>		Time <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>	
Print Name .....		Signature .....		Date <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>		Date <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>	
<b>Re-Torque</b> (Whoever undertakes the re-torque procedure must complete this section)							
Driver/Tyre contractor / Workshop technician (delete as appropriate)							
Wheel nuts re-torqued to: <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div> lbft or <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div> Nms				Mileage <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>		Time <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>	
Print Name .....				Signature .....		Date <div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div>	

### Re-Torque Label

To help prevent wheel loss, wheel nuts must be torqued immediately after fitting a wheel, then re-torqued according to the following.

- Commercial vehicles re-torquing must be done after either 30 minutes standing time or after 40-80Kms (25-50 miles) as laid down in BSAU 50, part 2: section 7a1/995. (Specific manufacturer's instructions may differ, in which case should always be followed).
- Drivers:** If using a torque wrench to carry out the above is impractical, the vehicle wheel brace can be used. You **MUST**, however, still re-check the wheel nuts with a torque wrench set to the appropriate torque at the earliest opportunity.

**INSTRUCTIONS: Party carrying out wheel fitment, eg tyre contractor/workshop technician**

- Fully complete the section overleaf marked 'Wheel Removal Details'.
- After torquing the wheel nuts, fully complete the section 'First Torque'.
- If you carry out the first torque and re-torque of the wheel nuts in one operation, complete the 'Torque and Re-Torque' sections (re-fit wheel nut indicators if fitted).
- 3a Tyre contractor/workshop technician/maintenance provider** – following the completion of all sections of this label, attach the label to a job or inspection card.
- If the re-torque is **NOT** carried out as part of the completed operation, leave the 'Re-Torque' section blank and hand the label to the driver; in his absence attach it to the vehicle's steering wheel or to the driver's wing mirror, or airline coupling if working on lone trailers.

**INSTRUCTIONS: Driver**

- If you find this fully completed label on your vehicle, or it is handed to you, you **MUST** return it to your manager or supervisor for filing.
- If you find this label on your vehicle or it is handed to you and the re-torque section is blank, **IT IS YOUR RESPONSIBILITY** to ensure the wheel nuts are re-torqued.
- If you have a wheel refitted to your vehicle, ensure that the person carrying out the fitment completes this label as instructed above.
- Before using a torque wrench, ensure that you have had training.
- Re-torque the wheel nuts to the correct torque – **DO NOT** apply further pressure once the correct torque has been reached.
- After re-torquing the wheel nuts, complete the 'Re-Torque' section of this label and return it to your manager or supervisor. Refit any wheel nut indicators where fitted.

An example of a re-torque label



## Recommended procedure for completing a re-torque label

Should a wheel or wheels be fitted to a vehicle, a re-torque label should be completed in the following manner:


- Enter vehicle details including vehicle/trailer identification number; and position of the wheel on the vehicle which has been removed
- Upon fitting the wheel, the re-torque label should be completed to indicate that the initial torqueing procedure has been carried out. This includes details of the torque setting applied, date, time, vehicle mileage and who has carried out this procedure
- The re-torque procedure should then be carried out and the re-torque section on the label should then be completed
- Where it is impractical to carry out the re-torque procedure in a single process prior to the vehicle being used, the re-torque and completion of the re-torque section on the label should be carried out by the driver
- If the driver is not available, the label should be placed in a prominent position (such as the steering wheel) so that the driver is made aware of the requirement to carry out the re-torque procedure
- The fully completed re-torque label should be retained with the vehicle records to form part of the vehicle's maintenance history, and provide an audit trail if necessary

It is important that all parties involved with the completion and processing of the re-torque label are fully aware of their responsibilities and have received instruction on what they are required to do to complete the process.

## Devices for preventing wheel loss

There are a number of products on the market designed to make wheel nut movement more noticeable or to prevent nut movement altogether. Generally these devices are either wheel nut locking/retaining devices, or wheel nut movement indicators.

Whilst these devices can compliment a good maintenance system, they do not indicate or eradicate the problem of settlement. It is therefore important that each of these devices is carefully evaluated before being fitted and is only used to complement a full maintenance programme and never replace it.



## Annual test requirements for commercial vehicle wheels and components

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Commercial vehicle wheels and associated components are subject to inspection at annual test in accordance with criteria detailed in the Heavy Goods Vehicle Inspection Manual. Vehicles will be subject to annual test failure for any of the reasons stated below.

### A wheel:

- stud or nut missing or loose or not fulfilling the function of clamping the wheel to the hub
- with any visible elongation of a stud hole
- with a spigot wheel nut washer cracked
- badly damaged or distorted or with a locating spigot or dowel missing
- damaged by the corners of a wheel nut cutting into the material of the wheel
- incompatible with its fixings
- cracked, weld breaking away or an inadequate repair
- made of aluminium alloy repaired by welding
- with a load rating less than that required to support the maximum permissible axle load

### A hub:

- cracked, badly damaged, or with a half shaft bolt, stud or nut loose or missing
- with clearance between a spigot mounted wheel and the hub spigots that exceed 3mm across the diameter

## Enforcement action – defective wheels and components

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As previously mentioned, wheels and components are subject to inspection at annual test by VOSA examiners, and will fail the test for any of the reasons detailed above. VOSA will also check that an operator has a wheel security procedure in place as part of its auditing process. Furthermore the enforcement body also carry out thorough inspections of wheels and components as part of its roadside enforcement activity. VOSA considers wheel security as a serious issue and attributes defects in wheel security to poor maintenance and inadequate driver checks. For this reason it is likely that any defects found with wheels and components at a roadside check would result in a prohibition being issued, which would be marked



'S'. This 'S' marking indicates that the examiner attributes the defect to a significant failure in the operator's maintenance arrangements, and would normally signal a full maintenance investigation by VOSA, possibly leading to a public inquiry.

The severity of the defect when found at a VOSA roadside check would be determined against criteria detailed in VOSA's Categorisation of Defects (see table below), and the appropriate action and prohibition level would be determined accordingly. Too many prohibitions or failure to get them removed, could ultimately lead to the curtailment, suspension or revocation of an operator's licence

CATEGORISATION OF DEFECTS CRITERIA – DETAILS OF VOSA ACTION			
Description of defect	Severity of defect	Action (delayed or immediate prohibition, or inspection notice)	Notes
Any wheel(s) missing		Immediate	
Wheel fractured or welding breaking away	Failure imminent	Immediate	Fracture at the bridge over the valve is not considered a reason for action
	Other than above	Delayed	
Wheel hub fractured	Failure or detachment imminent	Immediate	
	Other than above	Delayed	
Wheel studs elongated/damaged	If visible with wheel nuts in place or detachment likely	Immediate	
	Any stud hole severely worn/elongated	Delayed	
Wheel nut. Washer or stud missing/loose/ fractured, not clamping or fully locating in taper	More than one wheel nut/stud is missing, loose or obviously not clamping or locating in the road wheel taper	Immediate	Some agricultural vehicles have extra fixings for the sole purpose of attaching additional wheels. These are not part of this inspection while additional wheels are not fitted
	More than one spigot wheel nut washer fractured	Immediate	
	Any one stud or nut missing or loose	Delayed	
	Any one spigot wheel nut washer fractured	Delayed	
Excessive clearance between hub spigot and wheel	Diametric aggregate clearance of more than 3mm between the spigot and the locating surface of the wheel	Delayed	
	Other than above	Inspection notice	

## CATEGORISATION OF DEFECTS CRITERIA – DETAILS OF VOSA ACTION

Description of defect	Severity of defect	Action (delayed or immediate prohibition, or inspection notice)	Notes
Tyre retaining ring abutting or fractured	Retaining ring is excessively displaced from its seat and the total displacement is imminent	Immediate	A tyre retaining ring butting causing the flange to lift more than 1.5mm is to be regarded as excessively displaced
Wheel seriously distorted	Affecting steering or vehicle stability	Immediate	
	Other than above	Inspection notice	
Half shaft bolts, nuts or studs loose/missing	Loss of drive or detachment likely	Immediate	
	Other than above	Inspection notice	
Incompatible wheel fitted	Fouling other components where failure of wheel or affected component is likely	Immediate	
	Other than above	Inspection notice	

### Operator Compliance Risk Score (OCRS)

As well as being issued with prohibitions, operators and drivers also risk additional enforcement action if wheels or components are found to be defective.

The Operator Compliance Risk Score (OCRS) system has been developed by VOSA as a way of assigning goods and passenger vehicle operators a rating that allows enforcement officers to identify which vehicles are most likely to be non-compliant. The roadworthiness OCRS score is based on the condition of vehicles, and points are accumulated if vehicles are found to be defective at annual test or roadside examinations. The points are weighted for safety significance. Defects found at annual test are set lower than those found on roadside checks as the emphasis is on the condition of the vehicle in the working environment rather than on the condition at the time of test.

Immediate prohibitions attract more points than those that are delayed. An inspector may decide that a defect indicates a significant failure in the operator's maintenance arrangements and mark it with an 'S' (for 'significant failure'). **This is likely to be the case for wheel and hub defects and significantly increases the points value.** The points value for defective road wheels and components are detailed in the table opposite.

## CALCULATION OF OCRS PROHIBITION AND TESTING POINTS

	Annual test failure points	Delayed prohibition points	Immediate prohibition points	'S' marked delayed prohibition points	'S' marked immediate prohibition points
Defective road wheels/ components	6	12	18	24	36

Vehicle prohibitions and OCRS points are recorded on an operator's record and will increase the likelihood of other vehicles used by the operator being targeted for further enforcement action.

### Graduated fixed penalties

Legislation now permits VOSA examiners to issue fixed penalty notices for vehicle defects which affect roadworthiness, **which include defective road wheels and components.**

Fixed penalties can require the offender to pay a fine and, for certain offences, accept penalty points on their driving licence. Careful consideration has always been given to the culpability of the driver in respect of vehicle defects and in the main this will be the primary consideration in the issuing of a fixed penalty notice for roadworthiness offences. A fixed penalty notice may be issued for the offence where the examiner determines the defect is serious and indicative of a significant breakdown of maintenance procedures (known as an 'S' marked prohibition) if the examiner considers that the defect would have been apparent to the driver on conducting their daily walk around inspection. A fixed penalty may also be issued if the examiner considers that the defect would have been apparent during the driver's use of the vehicle.



**FREIGHT TRANSPORT ASSOCIATION**

HERMES HOUSE, ST JOHN'S ROAD, TUNBRIDGE WELLS, KENT TN4 9UZ

TELEPHONE: 01892 526171 FAX: 01892 534989 WEBSITE: [www.fta.co.uk](http://www.fta.co.uk)

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