

# heavy vehicle servicing

## INFORMATION



NZ TRANSPORT AGENCY  
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## Wheel loss information sheet



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A wheel is subject to a number of forces which act to loosen the wheel nuts.

If one of the wheel nuts loosens then these forces are distributed over the remaining nuts, which can cause the adjacent nuts to loosen as well. As more nuts become loose the process accelerates as the overall clamping force holding the wheel in place decreases.

When the clamping force reduces sufficiently the wheel will move on the hub. This results in side loading and further loosens the remaining nuts, which, if not spotted in time, leads to elongated stud holes, fatigue failure of studs, fretting cracks and in many cases wheel loss.

Loose wheel nuts can occur due to a number of reasons, including: under-

torquing, over-torquing, incompatible parts, poor mating surface condition and through not following the manufacturer's instructions.

The use of impact tools is a common cause of both under-torquing and over-torquing because the actual torque (and therefore clamping force) applied depends on a wide range of factors.

A common approach to the problem of wheel insecurity is to deliberately over-torque. This normally results in stud failure.

Both damaged and dirty mating surfaces lead to a reduction in clamping force. The erosion of dirt or paint over time can cause a settling effect. A build up of grease on mating surfaces will also have the same effect.

## Main causes of wheel loss or wheel insecurity

- Failure to follow manufacturer's instructions for fitting wheels, particularly applicable to after-market products such as aluminium wheels.
- Failure to tighten wheel nuts to the specified torque, in the correct sequence, or fully tightening the wheel nuts one at a time rather than in stages.
- Failure to retighten wheel nuts after a short period of in-service running (between 50 to 100 kms is commonly recommended).
- Failure to regularly check tightness of wheel nuts.
- Over-tightening, causing stretched/broken studs or causing studs to be pulled through the hub.
- Damaged threads on wheel studs and nuts resulting in insufficient clamping force.
- Paint, rust/scale or dirt between contact surfaces of wheels and hubs or nuts. The mating surfaces must be kept clean, and preferably paint free, to reduce settlement.
- Severe corrosion and/or wasting of wheel studs.
- Damage to the mounting surface of the wheels.
- Wheel spigot fixing centre 'ground out' ie enlarged.
- Incorrect matching of wheel nuts and wheels. (Two piece flange nuts for hub mounted wheels and single piece conical seated nuts for stud mounted wheels).
- Incorrect matching of wheels and wheel hubs (hub mounted and stud mounted).
- Incorrect matching of wheel studs and wheel nuts when non-OEM ('aftermarket') wheels have been fitted reducing the stud length available for correct wheel nut engagement (insufficient 'stud stand-out').
- Use of inappropriate (impact tools) or non-calibrated equipment when tightening wheel nuts.

# Inspection of wheels for damage

## Here are some examples of damaged wheels:

Bright metal or rust marks around the wheel nuts or captive washer seating indicating the wheel nut is loose.



Rust marks around a wheel nut is a sure sign that the nut is loose

## Wheels that have been run loose often lead to:

- Damaged studs and or stud holes.



A broken wheel stud - usually caused by over-tightening

- Damage, in the case of wheels using two piece flange nuts, to the seating surface between the base of the flange nut and the corresponding wheel surface preventing sufficient clamping force from being maintained.
- Damage, in the case of stud located wheels with conical seated wheel nuts, to the corresponding wheel nut seat on the wheel.
- Cracking of the wheel disc.



Rust marks indicating loose wheel nuts and cracked wheel disc

# Equipment

- Equipment used to fit wheels needs to be appropriate for the task and in a serviceable condition.
- Torque wrenches should be maintained and calibrated on a regular basis.



Torque wrench in use

# Transport operators

## Operators should:

- Ensure drivers inspect tyres and wheels during pre-trip walk around inspections for signs of damage, cracked or distorted wheel rims, broken or loose fixings, and signs of wheel or wheel nut looseness (bright metal or rust marks around the nuts or captive washer seating).
- Ensure that after a wheel has been fitted the wheel nuts are rechecked for correct torque after a short period of in-service running, between 50 to 100 kms is commonly recommended (do not slacken and re-tighten). Maintenance procedures must include a flag to ensure this has occurred.
- Ensure that wheel nuts are checked for security and tightened to the recommended torque with a calibrated torque wrench at routine maintenance intervals.
- Establish causes of wear and damage on loose nuts before re-tightening.
- Ensure that manufacturer's written instructions are followed by correctly trained persons and that comprehensive maintenance records are kept.
- Consider fitting loose wheel nut indicators as these assist in the visual inspection of wheel nuts and provide an immediate indication when wheel nuts have moved (see images below), or other devices which assist in wheel nut security.



Safe

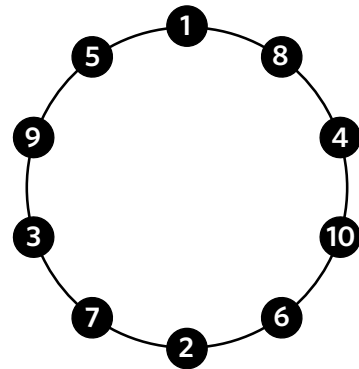


Unsafe

# Maintenance workshops and mechanics

## Maintenance workshops and mechanics should:

- Establish causes of wear and damage on loose nuts before re-tightening.
- Ensure removal and fitting of wheels are carried out to manufacturer's instructions. Lubrication of wheel stud threads and two piece flange wheel nuts may be a part of the fitting procedure.
- Ensure all hub/drum and wheel mating surfaces are clean and allow a flush fit with the mounting surfaces of the wheel. This is critical in maintaining the correct clamping force.
- Use the correct tightening sequence (wheel nut tightening procedures can vary for different types of wheels with different types of wheel nuts). See example top right.
- Ensure nuts run freely over the whole length of the stud thread by hand.
- Use a calibrated torque wrench for the final tightening (do not use power-operated tools (impact wrenches) to tighten wheel nuts to levels approaching the recommended torque setting).
- Ensure that the wheel nuts are re-torqued after a short period of in-service running (between 50 to 100 kms is commonly recommended). See example bottom right of a notification to re-torque wheel nuts.
- Simply retighten nuts to the recommended torque when re-torquing (do not slacken and re-tighten).
- Ensure that manufacturer's written instructions are followed by correctly trained persons and that comprehensive maintenance records are kept.



Example of 10 stud disc wheel tightening sequence

## Certifiers

Heavy vehicle specialist certifiers should ensure that the requirements, which are in force in respect of wheel modifications, are complied with and that the operator has the relevant technical information.

## Vehicle inspectors

Certificate of fitness (CoF) inspections include inspection requirements for wheels and wheel nuts. CoF inspectors should check the condition and security of wheels and wheel nuts and their associated components according to the requirements.

# CAUTION

DATE

SITE

FLEET

REGO

**WHEEL NUTS ON THIS VEHICLE WERE REMOVED AT**

km.

**WHEEL NUTS MUST BE RETORQUED BETWEEN 50KM AND 100KM**

Torque Setting Applied:    ft/lb or Nm Signed

Job Card Serial No.

PRIME MOVER				TRAILER				
1	3	5	9	13	17	21	25	29
		6	10	14	18	22	26	30
FRONT STEER	2 <sup>nd</sup> STEER	FRONT DRIVE	REAR DRIVE TAG	1 <sup>ST</sup> AXLE	2 <sup>nd</sup> AXLE	3 <sup>rd</sup> AXLE	4 <sup>th</sup> AXLE	5 <sup>th</sup> AXLE
2	4	7	11	15	19	23	27	31
		8	12	16	20	24	28	32

**RETORQUE**       km. DATE

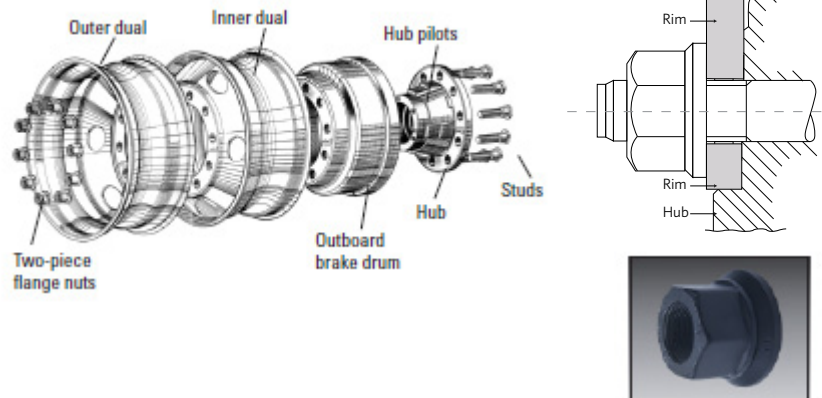
Example of notification to re-torque wheel nuts



# Types of wheels and wheel fixings

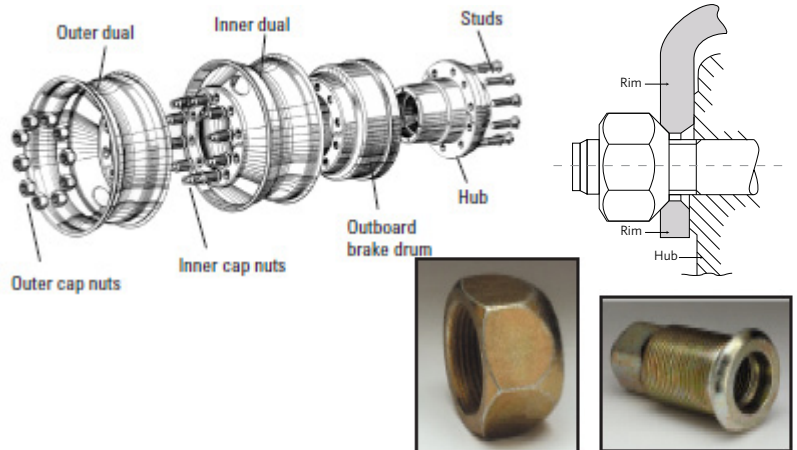
## Hub (spigot) mounted disc wheels

- Hub mounted wheels use a spigot on the wheel hub to locate and centre the wheel rim.
- Wheel security is achieved when the two piece flange nuts are tightened to the recommended torque setting (correct clamping force is maintained).
- Good surface contact between the base of the wheel nut flange and wheel rim is required to maintain wheel security and the correct clamping force.



## Stud mounted disc wheels

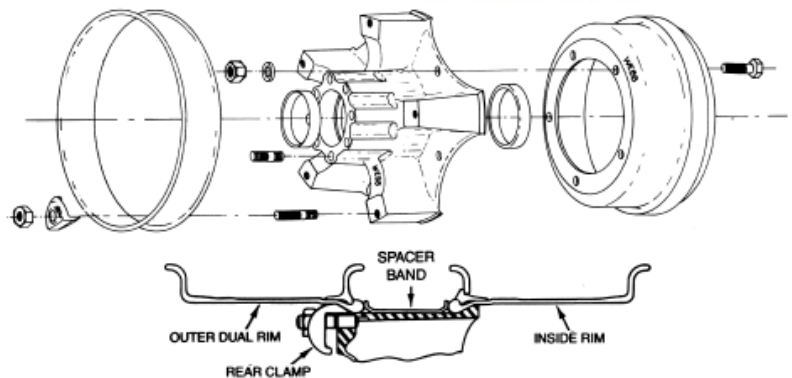
- Stud mounted wheels use conical seated wheel nuts to centre and locate the wheel rim on the wheel studs.
- Conical seated wheel nuts are not suitable for use with hub located wheels.



**Important:** Never mix the type of wheels or wheel nuts used in a disc wheel system as this may result in component damage, loss of wheel nut tension and wheel loss.

## Demountable (Spider) wheel system (Typically spoke wheel)

- A wheel with no centre disc.
- Relies on rim clamps (wedges) to secure the wheel to a cast spoke.
- Rim clamps are fastened by Hex nuts.



If you have any further questions about wheel security please contact the vehicle or wheel manufacturer or their agent, an approved service provider or wheel and tyre specialist.

This information sheet draws on several sources:

*Wheel Loss – no longer a mystery*, published by the IRTE (Institute of Road Transport Engineers), a Professional Sector of SOE (Society of Operations Engineers), an international membership organisation for engineering professionals, which also publishes numerous technical guides supporting industry best practice ([www.soe.org.uk](http://www.soe.org.uk)).

*Commercial Vehicle Wheel Security Industry Advisory Procedure*, published by the Australian Trucking Association (2008) ([www.atatruck.net.au](http://www.atatruck.net.au)).

Images (on this page) are used with permission from the *User's Guide to Wheels and Rims*, published by the Technology & Maintenance Council of the American Trucking Association (ATA). For more information, contact TMC at +01 703 838 1763; [tmc@trucking.org](mailto:tmc@trucking.org); <http://tmc.truckline.com>.

The IRTE and both ATA's assistance is gratefully acknowledged.

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