Ten ways to keep the wheels on your vehicle

One of the most serious things that can occur on the road is for a wheel to come off. If it happens on the front axle, a serious crash is likely to occur. If it happens on a drive or trailer axle, the loose wheel might kill someone. There are a few simple, yet important actions that the mechanic and the driver can take to minimise the risk of 'wheel-offs'. This article will consider the causes and protections that can be taken.

Cause 1:
There is excessive bearing free play and the wheel has been pushing on the main hub nut to the point where it jumps threads.
Protection:
Lift the wheels at every service, rotate them and 'feel' for free play, rotational stiffness and 'grinding'. Fix the bearings or adjust the free play. Correctly adjusted bearings have no evident free play and the wheel rotates smoothly a few times when spun.

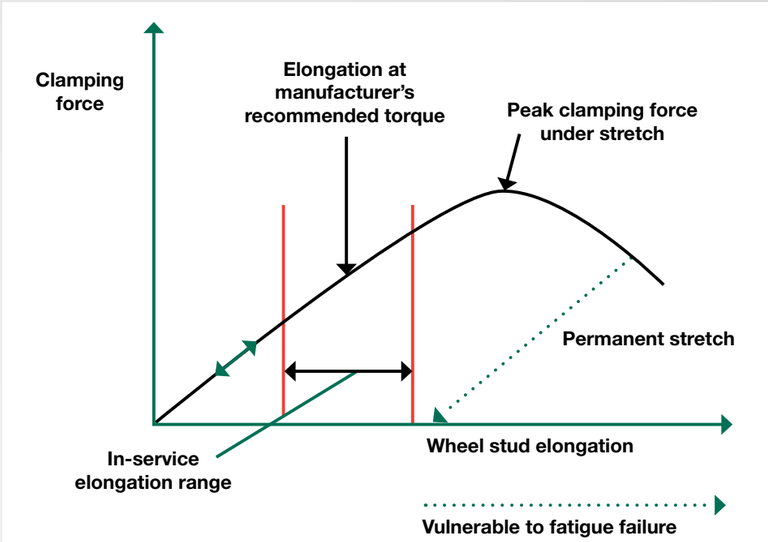
Cause 2:
The wheel was installed onto a dirty, rusted or damaged stub axle or hub assembly. The wheel gets loose in service because it was never correctly 'bedded'.
Protection:
Wire brush the axle and wheel rim before the wheel is installed. Check for mechanical damage to the axle or wheel. Reject the parts if they are distorted or cracked.

Cause 3:
Despite the newly installed wheel appearing to be on tight, the wheel nuts come loose during the first trip.
Protection:
Insist that the driver stops during the first 200 km of the trip and checks that the nuts are tight. Every operator should have a system to identify which wheel has been changed and to alert the driver of this at the start of the trip.
Wheel nut position indicators are useful because it will be immediately obvious if the nuts have turned. Some operators use a different colour indicator to identify that the wheel has been changed. The usual indicator colour is re-installed after the first trip.

Cause 4:
The wheel studs have been stretched by application of excessive tightening torque. The studs can no longer provide the intended clamping force.
Protection:
Do not use a rattle gun to reach the final tightening torque. Use the rattle gun to tighten to less than recommended nut torque. Then use a torque wrench to bring the nut up to the recommended torque.

Cause 5:
The wheel nuts have been tightened to full torque sequentially. Tightening the last wheel nut results in excessive wheel stress, particularly on aluminium wheels. The wheel develops cracks that result in loss of clamping force in service.

EXAMPLE
A cracked aluminium wheel due to incorrect tightening sequence and high rattle gun torque setting.
As shown in the diagram, the wheel stud acts like a powerful spring. If the tightening torque is excessive, the stud might develop a permanent stretch due to in-service forces.



A wheel stud behaves like a powerful spring

Protection:
Set the rattle gun torque limit low. Tighten all the wheel nuts to about one third torque in a 'cross-wheel' sequence. Then go up to a 90 per cent torque setting on the rattle gun. Finish off with a correctly set torque wrench.

Cause 6:
The wheel studs break in service because of excessive tightening torque. The failure mechanism is fatigue cracking that starts in a thread valley. The failure is the result of excessive internal stress that promotes crack development.
Protection:
Avoid over-tightening the wheel nuts (Cause 4). If one nut needs a noticeably higher tightening torque than the others, then something is wrong. Broken studs also indicate that something is wrong. Don't just replace them: find out why.

Cause 7:
The stud threads are in poor condition or there is excessive grit in them. The nuts were tightened with a rattle gun with a high torque setting and it was not obvious that cross threading was occurring. The nuts come loose on one or two threads and this leads to a cascade situation with other nuts working loose.
Protection:
Clean the wheel studs with a wire brush before putting on the nut. Debris and rust are the enemies of correct tightening performance. Reject the wheel nut if it is damaged. Watch the nut as it goes on to see that it is turning freely.

Cause 8:
The studs are mild steel and not mid or high-tensile steel. They stretch readily.
Protection:
Buy studs and nuts of known grade from reliable suppliers.

Cause 9:
The main hub nut was not correctly torqued. The nut comes loose.
Protection:
Always tighten the main hub nut to the axle manufacturer's specification using a torque wrench. Always use a correctly fitting socket. Always check the quality of the thread before installing the nut. Always lock the tabs and/or insert the safety pin. Check that these protections are in good condition. Some axle manufacturers have only a single level of safety in the hub nut design. At least two levels of safety are greatly preferred. In my view, it is unwise to rely only on correct nut torque to hold the main hub nut on.

EXAMPLE
The wheel came off this trailer in-service without the driver realising, resulting in a fatality.

Cause 10:
A stud-piloted wheel was installed onto a hub-piloted axle.
Protections:
The wheel must be the correct type for the axle. Ten-stud disc wheels, which are hub piloted, are now industry standard. Aluminium disc wheels are precisely manufactured and less likely to come off than steel wheels. A wheel stud behaves like a powerful spring.
When over tightened, the stud can experience excessive force in-service that causes permanent stretch. There is no excuse for the wheel installer not knowing the wheel manufacturer's recommended tightening torque. This recommendation assumes that the stud and nut threads are clean and not oiled.
And finally, think about the future. Ensure that your people wear hearing protection and eye protection when they work on wheel-ends.

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