

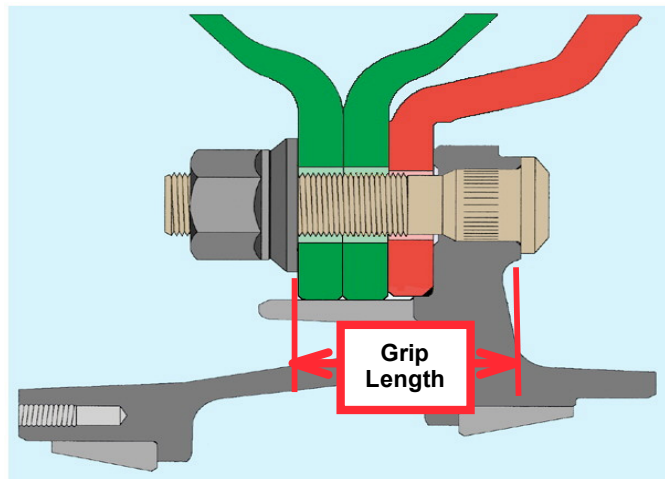
HEAVY DUTY TRUCK WHEEL FAILURE MECHANISM

One of the most common misconceptions revolving around loose commercial truck wheels is how the joint fails, creating the loose condition that can evolve to the wheel or wheels coming off the vehicle.

Wheel(s) are held together by the clamping force that is exerted by the wheel nuts. Think of the wheel end system as a clutch. Just like a clutch in a transmission, if the force (clamp load) is not high enough the clutch (wheels) will slip.

The force, clamp load, created by an M22x1.5 wheel bolt and nut is ~ 50,000 lbs. at a torque of 500 ft-lbs. On a 10-hole system, this is one half million pounds of force.

With this much force, the wheels are compressing and the wheel bolts are stretching. The forces created by these two actions are called preload. When this preload is exceeded by the external load created by the operation of the vehicle, the joint will start to loosen (the pressure on the clutch is exceeded).



The preload is contained within the joint in the area that we call the “grip length.” The grip length is the distance between the head of the wheel bolt and the underside of the nut flange. Even with proper installation torque applied to the nuts, there are a number of items that can cause this grip length to shorten as the vehicle is being operated, thus creating joint failure:

- Component settling
- Excess and uncured paint on the mounting surfaces of the hub, drum or wheels
- Excess rust and corrosion on the pilots for the drum and wheels
- Excess rust on the mounting surface of the hub, drum or wheels
- Dirt or grease on the mounting surface of the hub, drum or wheels

- Hub, brake drum or wheel mounting surfaces worn or not flat
- Improperly assembled components, cocked drum or wheel
- Improper stud installation
- Mixed or incorrect components
- Broken or damaged components

When grip length is compromised, the preload (tension) that holds on the wheels drops, and may drop to an unsafe level. The preload in a standard wheel joint with a forged two piece flange nut has stud stretch and component compression of ~.008" when torqued to 500 ft-lbs. / 50,000 lbs. tension. So a loss of .003" in the preload reduces the tension level to the minimum recommended level of 30,000 lbs.

It is at this point that the nuts may begin to rotate off after joint failure has already occurred.

The failure mechanism now gets very complicated to understand or control. Depending on the reason for grip length failure, size of grip length failure, operating conditions of the vehicle, and the environmental conditions, the length of time before complete failure or a wheel disengaging from the vehicle can vary widely. This may be from a few miles to thousands of miles. All the nuts may back off the wheel bolts or only some may come off, with the other wheel bolts breaking.

There are other maintenance conditions that can also cause joint failure or lack of preload. Wheels may also come loose if the desired tension is not reached during installation by any one or a combination of the following conditions:

- Wheels not torqued properly
- Threads on wheel bolt not properly oiled
- Nuts not properly oiled
- Corrosion on threads of the wheel bolts or nuts
- Worn damaged or stripped threads on the wheel bolts or nuts
- Mixed or improper fastener type for wheel

Again, when joint failure occurs the nuts will begin to back off. But as stated above, the mileage, until wheel disengagement, can vary widely.

Wheel joint failure is not typically created by vibratory action or rotational loosening of the nut. Wheel joint failure is caused by the grip length decreasing or by not reaching the proper tension levels during the installation process. The rotation of the nuts is a symptom of the failure not the cause.

Devices that monitor the rotation on the nut may give a false security to the user. As stated above, the failure mechanism can occur at a very fast rate, and a visual inspection of rotational indicators will not have occurred in these situations.



For more information regarding troubleshooting disc wheel looseness, see the Technical & Maintenance Council's recommended practice RP238 – "Troubleshooting Disc Wheel Looseness."

The Technology & Maintenance Council of the American Trucking Association can be contacted at 950 North Glebe Road, Alexandria, VA 22203. Or by calling 703-838-1763, emailing TMC@Trucking.org or visiting its website – tmc.truckline.com.