Wheel Stud Report / Recommendations for AOR

AOR organised for an engineering analysis to be performed in relation to the torque settings (wheel studs) used by AOR and AOR customers. This was in response to some questions raised across the many AOR Forums. The analysis investigated the below stud loading scenarios for grade 8.8 steel and grade 10.9 steel (wheel studs) subject to 155Nm and 209 Nm.

Stud loading Scenarios

A. 14mm Steel Shaft Subject To T= 155Nm
B. 14mm Steel Shaft Subject To T= 209Nm
C. 12mm Steel Shaft Subject To T= 155Nm
D. 12mm Steel Shaft Subject To T= 209Nm
E. ½ Inch Steel Shaft Subject To T= 155Nm
F. ½ inch Steel Shaft Subject To T= 209Nm

The analysis determined the two advised torque settings (155Nm and 209Nm) are not suitable for the current diameter wheel studs for grade 8.8 steel used by AOR for their wheel studs. Torque parameters should sit between 75% and 90% (75% ideal) of materials proof load. The proof load is the maximum load a material can withstand before it transitions from temporary deformation (elastic behaviour) into permanent deformation (plastic behaviour). Currently most of AOR's torque settings sit above the 75% to 90% proof load threshold and should be readjusted to suit new specific torque settings found below for grade 8.8 Steel and grade 10.9 steel.

G8.8 M12 Stud: 89Nm to 105Nm **(Recommendation = 105Nm)**
G8.8 M14 Stud: 141Nm to 168Nm **(Recommendation = 155Nm)**
G8.8 ½ Inch Stud: 115Nm to 138Nm **(Recommendation 115Nm)**
G10.9 M12 Stud: 126Nm to 151Nm **(Recommendation = 126Nm)**
G10.9 M14 Stud: 201Nm to 239Nm **(Recommendation = 201Nm)**
G10.9 ½ inch Stud: 163Nm to 195Nm **(Recommendation = 163Nm)**

IMPORTANT

These specified torque loads are for dry fitting wheel nuts to studs only. AOR **DOES NOT** recommend using lubricants or anti-seize on wheel nuts or studs as this impacts the dynamics of the torque settings. Instead, the studs should be clean, dry and free from debris before torquing wheel nuts. When lubrication is added it redistributes the stress around the stud more evenly. This lowers the actual amount of torque required to achieve the same clamp force which causes the lubricated clamp force to exceed the calculated dry clamp force resulting in overtightening. This causes increase stress on the wheel studs bringing the pressures closer to the proof pressure which produces fatigue in the stud from oscillating and constant loads. Over time the fatigue reduces the stud's ability to resist its initial proof strength rating where it does not hold the same torque strength it used to which can eventually result in failure of the stud.

Tips to Tightening Wheel Nuts to Studs to Prevent Failure from Over Torquing

- Ensure stud threads are clean and free of dirt, rust, lubrication, and corrosion before winding wheel nuts onto studs. The nut should spin freely on all studs. If it doesn't, replace the nut with a new one. Never use any studs or nuts that are corroded.
- When fitting wheels, ensure the hub surface and back of the wheel (mating surface of wheel to hub) is clean and free from dirt, dust, mud, and any other contaminants.
- Start all nuts onto studs by hand to prevent cross threading. Only use impact/rattle gun to loosely wind nuts close to wheel face. **DO NOT** use impact/rattle gun to achieve the final torque setting as this can give an inaccurate reading. It is very important to use a high quality, properly calibrated torque wrench to achieve final torque.
- Always tighten the wheel nuts to final torque setting when the wheel is firmly sitting on the ground and not in the air.
- If replacing wheel nuts, ensure that the recommended bolt and nut combinations are followed (for Grade Stud 8.8 use Grade 8 Nut, for Grade 10.9 use Grade 12 Nut).
- Ensure that wheel studs are at atmospheric temperature when tightening and not hot. Hot wheel nuts require different torque settings for tightening
- After you pick your trailer up brand new or after its service, the wheel nuts must be re-checked and re-tightened after the first 50 to 100kms driven and then once again after 1000kms drive.

Next Steps

1. AOR have included wheel stud checking as part of their service criteria. Part of the check will be a conversation with the owner to understand the history of wheel stud/nut management with appropriate ongoing strategies agreed within that conversation.
2. AOR have decided to add wheel nut indicators to all new trailers that roll out from the beginning of September 2022. If you would like to purchase wheel nut indicators, please contact the AOR Service Department (the indicators will not be available until the start of September).
3. If you are concerned about your status (history of over tightening) please get in touch with the service team.