



SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) Performance Requirements and Test Procedures for Aftermarket Wheel Fastening Systems on Passenger Cars and Light Trucks

RATIONALE

Original Equipment Manufacturers (OEMs) have control of their wheels, bolts, nuts, and mounting surfaces, and the finishes thereof that are known to affect the wheel fastening system. Their fastening systems can be optimized in the presence of controlling all the components that affect the fastening system. The OEMs all have their own acceptance criteria, so those listed in this document are not applicable.

Aftermarket wheel, bolt, and nut manufacturers design their components to be used in multiple applications and they do not control of all the components. The minimum tension values, at the service torques recommended by the OEMs have been found to be serviceable for aftermarket aluminum wheel fastening system applications. See Table 1.

The name of the document is changed from "Wheel Nut Seat System" to "Wheel Fastening System" to broaden the scope of the components to include wheel nut seats, bolts, nuts, and finishes.

Multiple editorial changes are recommended to clarify the intent of the procedure. The fastener size M14x2.0 is added because it is now relevant and has been tested.

In practice, vehicle manufacturers publish recommended torque for specific vehicles so vehicle owners can retighten their lug nuts. These torques grouped reasonably well by approximate bolt size, hence binning them in Table 1.

At the high end of the torque tolerance there is a concern of stripping the nut and or stretching or fracturing the bolt. It is recommended that no stripping, of the nut and or stretching or fracturing the bolt to be observed at 120% of the service torque.

A formula has been added to determine minimum bolt tensions for specific configurations and applications. Said formula is based on a clutch theory known to be used in the industry rendering the ideal minimum tensions. The formula assumes the ideal friction necessary to disallow relative torsional motion between wheel and hub. The friction in service is not ideal. service friction is reduced by particulates of corrosion, unintended lubricants from tire and axle lube. The service friction factor is found empirically from the frequency distribution of data from measuring tension at torque on copious rundowns using QEM studs, nuts, and wheels of steel and aluminum.

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Documents

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1. SCOPE

This SAE Recommended Practice provides a uniform procedure and performance requirements for evaluating fastening systems for normal highway use on aftermarket passenger cars and light trucks (except dual wheels, which are covered by SAE J1965) and multipurpose passenger vehicles. The fastening system includes the wheel, wheel bolts, and wheel nuts, as well as vehicle mating surface. The coefficients of friction for steel and aluminum mating surfaces are provided based on information available. Many factors must be considered in design and validation of wheel attachments for each specific vehicle. Where the procedure is used for original equipment applications the vehicle manufacturers specifications supersede those noted.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.2 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J328	Wheels - Passenger Car and Light Truck Performance Requirements and Test Procedures
SAE J1102	Mechanical and Material Requirements for Wheel Bolts
SAE J1965	Road Vehicles - Wheels for Commercial Vehicles and Multipurpose Passenger Vehicles - Fixing Nuts - Test Methods
SAE J2283	Mechanical and Material Requirements for One Piece Wheel Nuts
SAE J2315	Wheel Nut Seat Strength
SAE J2530	Aftermarket Wheels - Passenger Car and Light Truck Performance Requirements and Test Procedures

Parisen, J., "Automobile Wheel Attachment Design Considerations," SAE Technical Paper 820340, 1982, <https://doi.org/10.4271/820340>.

2.3 Other Publications

Tire Guide - Complete Tire and Wheel Information for Cars and Trucks, available at Tireguides.com and tel: 561-997-9229.

3. DEFINITIONS

3.1 WHEEL NUT SEAT AND MATING SURFACE

See Figure 1.

3.2 WHEEL BOLT AND NUT SYSTEM – STEEL WHEEL SHOWN ON LEFT

See Figure 1.

3.3 WHEEL BOLT AND TAPPED HOLE SYSTEM – ALUMINUM WHEEL SHOWN ON RIGHT

See Figure 1.

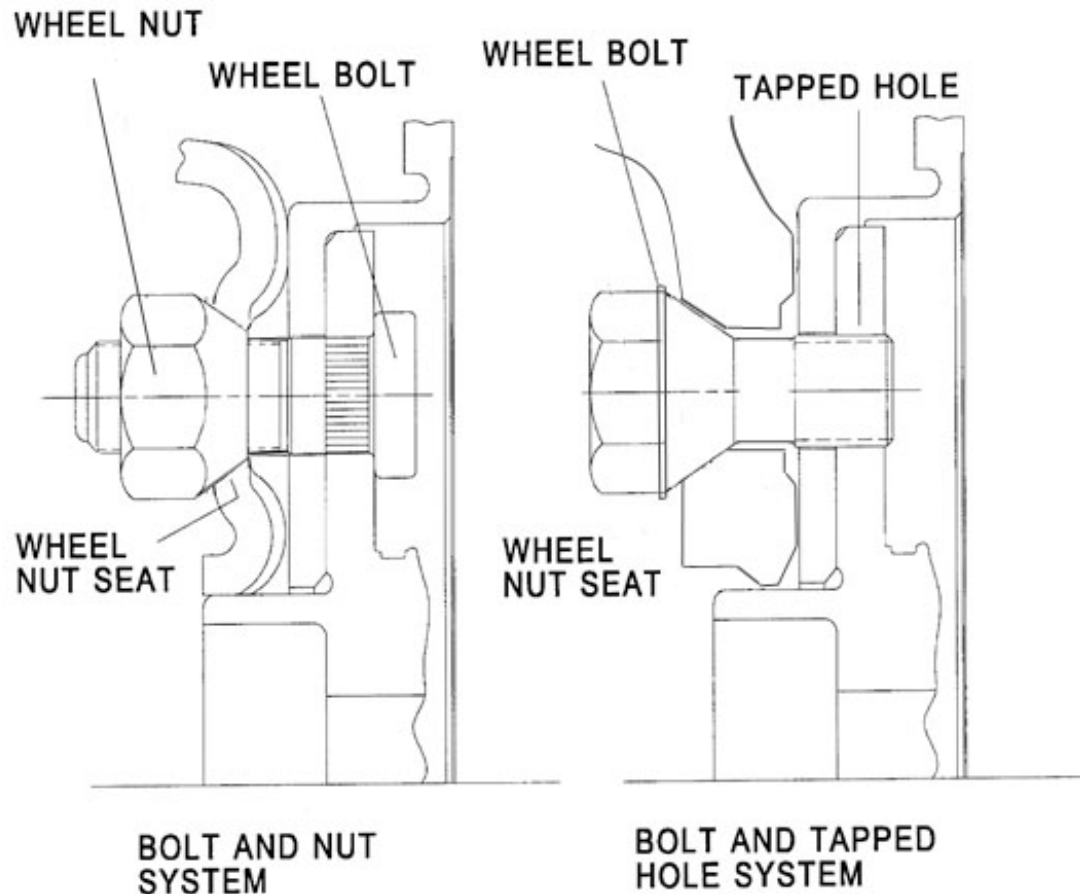


Figure 1 - Definitions

3.4 SERVICE TORQUE

The torque found in the Tire Guide for specific applications.

3.5 SERVICE FRICTION FACTOR (SFF)

The factor that is applied to the ideal minimum tension provided by the clutch theory. The factor compensates for corrosion and road debris that finds its way onto the mounting surface of the wheel or hub.

4. TEST PROCEDURES

4.1 Test Components

Fully processed (including finish) wheels or wheel discs, wheel bolts, and wheel nuts representative of production parts intended for the vehicle. For systems where wheel nuts are tightened onto serrated shank wheel bolts (bolt and nut system), hexagon head test bolts may be used in place of the wheel bolts, but they must be the same thread size and finish with similar hardness as the wheel bolts. For systems where wheel bolts are tightened directly against the wheel and into a tapped hole in the hub or axle (bolt and tapped hole system), special test blocks may be used in place of the hub or axle, but they must be the same thread size, length of thread, material, and finish as the hub or axle tapped hole. All components shall be new (unused) for each test sample.