AEROSPACE RECOMMENDED PRACTICE

ARP5481™ REV. A

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Superseding ARP5481

Recommended Wheel Tie Bolt Preload Procedure

RATIONALE

ARP5481A has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) provides the recommended procedure for obtaining desired preloads in aircraft wheel tie bolts when mounting tires and assembling the wheel. It is generally referred to as the snug-angle bolted joint assembly procedure. It is also known as the “torque-turn” procedure in the heavy equipment ground vehicle industry.

1.1 Purpose

The purpose of this document is to recommend a procedure that will improve the accuracy of the desired pre-load in aircraft wheel tie bolts during installation. It promotes applying a specified angular degree of nut rotation instead of a specified nut torque, to establish bolted joint preload. The preload accuracy, thus achieved, will result in improved wheel and fastener performance in service. Fatigue life failures of wheel bolt bosses and their fasteners will be beneficially affected, as will crack propagation rates.

Maintenance shops and operators who maintain and overhaul aircraft wheels are encouraged to follow this procedure in conjunction with the Component Maintenance Manual (CMM) provided by the wheel and brake manufacturer. In case of a conflict between this document and the CMM, the CMM should be followed and the wheel manufacturer informed of the difference. It is recommended that the wheel designers and manufactures adopt this procedure, incorporate it in their maintenance manuals and recommend it to the maintenance shops and operators as a standard practice.

It is also recommended that the wheel fastening systems be designed with the assumption that less precise methods could actually be employed in service. This will result in robust designs, tolerant of a wider range of maintenance practices.

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For more information on this standard, visit
https://www.sae.org/standards/content/ARP5481A/

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

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

AMS2518 Thread Compound, Anti-Seize, Graphite-Petrolatum

AS28431 Aerospace Signaling Torque Wrenches

2.1.2 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://assist.daps.dla.mil/quicksearch/.

MIL-PRF-83483 Thread Compound, Anti-Seize, Molybdenum-Disulfide and Petrolatum

2.1.3 Other Publications

Applicable Component Maintenance Manual (CMM)

Applicable Technical Order (TO)

3. PROCEDURE

The snug-angle procedure consists of a snugging torque followed by a final angle of nut rotation. It involves lubricating the fasteners, torquing the bolted joints all to a relatively low, snugging value and then rotating the nut of each bolted joint through a specified angle of rotation.

3.1 Anti-Seize Compound and Allowable Coating Thickness

Apply anti-seize compound, preferably AMS2518 or MIL-PRF-83483, to the bolt and nut threads and to all interface or bearing surfaces of the bolt, nut and both washers. Top and bottom surfaces of both washers must be coated. The anti-seize compound must be applied liberally. See Figure 1. Consideration should be given to compatibility of the anti-seize compound with the materials of the bolted joint, including the potential for corrosion, particularly since AMS2518 contains graphite.

The clamped surfaces of the fasteners and the bolted members must be clean and free of any dirt or debris before applying the anti-seize compound.

Consult the applicable CMM or TO for allowable coating thickness on the bolted members. Fasteners are typically plated and clamped parts are typically permitted a thin primer or thin coat of self priming paint only. Paint topcoat or any appreciable thickness of coating on any surface in a bolted joint needs to be carefully considered and is highly discouraged. Painted coatings can influence friction coefficient, may creep or wear away, and can lead to bolt breakage, loss of preload and/or other loose bolted joint problems.

Do not heat the anti-seize compound to facilitate coverage. This causes separation of the constituents. AMS 2518 is especially prone to oil separation and should be mixed thoroughly prior to application. Do not thin the compound since this also promotes separation.

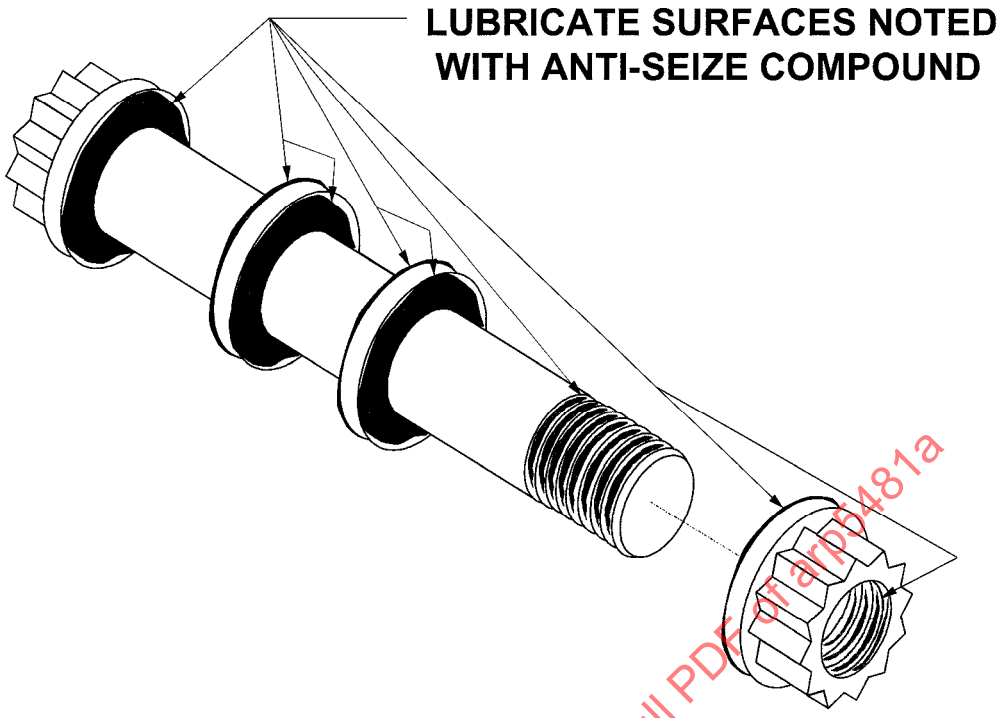

FIGURE 1 – ANTI-SEIZE COMPOUND APPLICATION LOCATIONS

3.2 Snugging Torque

The purpose of snugging torque is to make certain the clamped member surfaces are in contact with a desired amount of minimum preload. This snugging torque is determined by the wheel manufacturer from bolt strain gauge or ultrasonic nondestructive test (NDT) data (refer to Section 6), and is listed in the wheel CMM or TO. Its magnitude is sized to accurately obtain the final preload.

Make sure the snugging torque is the correct torque for the anti-seize compound being used, as some wheel manufacturers distinguish between the two compounds.

Apply the snugging torque in a crisscross-tightening pattern or to two bolts at a time (automatic wrenching equipment), approximately 180 degrees apart. The nut must be rotating when the final snugging torque is applied. After the snugging torque is applied, the bolt assembly must be checked to assure the bolted joints are completely snugged.

No additional torque tolerance beyond the capabilities of the equipment should be specified. The resultant tolerance range of the torque actually applied depends on the quality of the tools used by the assembler, which should be suitable for the use intended. These tools may include torque wrenches or automatic wrenching equipment. Consideration should be given to the accuracy of the equipment when operating at the relatively low torque levels of the snug angle tightening method. Typical torque tolerances for automated and manual torque wrenches are ±5% of the maximum capacity of the tool. Note that this will be greater than 5% of the snugging torque value applied to the fasteners. Use of a proper torque wrench, such as per AS28431, is recommended. A proper torque wrench is defined as one that is not of an impact type and where the required torque falls within 20-80% of the full capacity of the wrench.

CAUTION: The use of impact (pulse) tools is not recommended. These devices should not be used unless specifically addressed by the wheel manufacturer, or referenced in the CMM or TO instructions.

The resulting final preload is dependent on the initial preload obtained by the snugging torque. Wide variance in the initial preload due to the snugging torque results in a corresponding variance in the final preload. Consistency of bolted joint procedures during assembly contributes to a properly bolted assembly.