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AEROSPACE STANDARD

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FASTENER TORQUE FOR THREADED APPLICATIONS, DEFINITIONS OF

1. SCOPE:

This SAE Aerospace Standard (AS) is intended for use by those involved in the design of aircraft, missile, or space systems, and their support equipment to define the various types of fastener torque.

2. REFERENCES:

There are no referenced publications specified herein.

3. GENERAL:

Torque is the force or turning moment tending to produce rotation. It is expressed in terms of applied load and the length of the moment arm applying it, usually in pound-inches, pound-feet, or Newton-meters (lb-in, lb-ft, N·m). The torque definitions given herein are those which are commonly used in the aerospace industry. These definitions are considered necessary for a more thorough understanding of aerospace torque terms.

For all of the included fastener torque definitions, actual torque values apply under the prescribed conditions of lubrications, materials, surface finish, etc., set forth for the specific fastening system. Each torque term in brackets shall be the preferred term. Torque terms not in brackets should be discouraged in any new formal documentation.

It should be noted that the included torque definitions apply equally to both internal and external threaded parts that may or may not have a self-locking feature. For all of the following definitions, the fastener shall be considered:

a. Seated when its bearing surface contacts the material being joined, and any additional applied torque will produce a residual axial stress in either the male (bolt) or female (nut) component.

3. (Continued):

b. Unseated when the application of removal torque disengages the bearing surface of the fastener from the material being joined, reducing the axial stress to zero.

4. DEFINITIONS:

4.1 [APPLIED TORQUE]: The torque transmitted to the fastener by the installation tool.

4.2 [ASSEMBLY SEQUENCE]: A method (see Figure 1) indicating sequence of assembling fasteners in a prescribed pattern. Also: Installation Sequence, Tightening Sequence, Torquing Sequence.

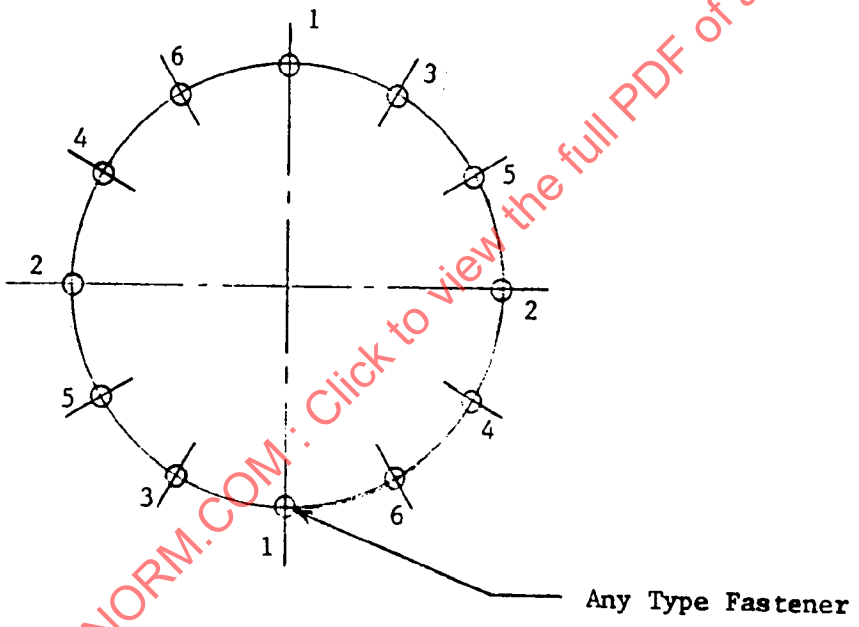

FIGURE 1 - Typical Diagram Indicating Sequence of Assembling Fasteners

4.3 ASSEMBLY TORQUE: See [Installation Torque].

4.4 [BREAKAWAY TORQUE]: For fasteners incorporating self-locking torque, this is the torque required to initiate relative motion between male and female threads when the self-locking mechanism is fully engaged and there is no contact between the bearing surface of the fastener and the material being joined. Breakaway torque can be prefixed with the words MAXIMUM or MINIMUM, and shall be measured in the loosening direction.

4.5 BREAKLOOSE TORQUE: See [Unseating Torque].

4.6 CAM OUT-TORQUE: See [Torque Out].

4.7 [DOUBLE TORQUE]: This is the torque required to fully seat the materials being joined where moderate interferences, sheet gaps, or form-in-place gasket material are present in the assembly. It includes loosening the fasteners after the first application of installation torque and retorquing to ensure proper assembly. Also: Retorque.

4.8 [FREE RUNNING TORQUE]: This shall be the torque required to overcome kinetic friction between mating threads. This torque can be measured in either a loosening or tightening direction. Free running torque shall not include any component of torque required to overcome a self-locking feature or axial load in a fastener assembly. Free running torque is not applicable where a self-locking mechanism is present in the fastener being torqued. Also: No Load Torque.

4.9 INSTALLATION SEQUENCE: See [Assembly Sequence].

4.10 [INSTALLATION TORQUE]: This shall be the design torque applied at final assembly. It shall include the net effect of the following:

a. The torque required to overcome kinetic friction between mating bearing faces and between mating threads

b. The torque required to overcome the self-locking feature (if any)

c. The torque required to apply the desired axial load to a fastener assembly

The installation torque may be prefixed by the words MAXIMUM or MINIMUM when referring to the toleranced torque values of the nominal installation torque. The installation torque shall be measured only in the tightening direction.
Also: Assembly Torque, Tightening Torque.

4.11 [LIMITING TORQUE]: This is the predetermined torque level, which, when reached during the torquing procedure, shall cause the torquing element of the fastener to become disengaged. This disengagement may be a permanent separation of the torquing element from the fastener or it may be simply a "clutch" device that is actuated at a predetermined torque value. The predetermined torque value normally is not greater than the maximum installation torque.

4.12 [MULTIPLE TORQUE]: This is the torque required to seat the parts to be assembled where relatively heavy interferences exist in the assembly. It consists of applying the installation torque several times until the nut or bolt does not rotate during two successive applications of the installation torque.

4.13 [NET TORQUE]: This shall be the component of the installation torque available for axially loading a fastener assembly after overcoming all frictional and mechanical forces not inducing axial tension. (Net Torque = Installation Torque - torque required to overcome frictional (Prevailing Torque) and mechanical forces.) Also: Preload Torque.

4.14 NO LOAD TORQUE: See [Free Running Torque].

4.15 OVER TIGHTENING TORQUE: See [Over Torque].

4.16 [OVER TORQUE]: This shall be the torque required to initially move the wrenched fastener from the installed condition. Over torque is always measured in the tightening direction and it usually exceeds the maximum limit of the desired installation torque. It is normally used to:

a. Break loose the heat seizure effects before encountering the corrosive effects when the fastener assembly is disassembled

b. Initially deform the captive internal thread element on blind fasteners with threaded cores

Also: Over Tightening Torque.

4.17 PRELOAD TORQUE: See Net Torque.

4.18 [PREVAILING TORQUE]: This shall be the torque required to overcome kinetic friction of the mating threads plus the torque required to overcome the locking feature when 100% of the locking feature is engaged and fastener is unseated. The word "prevailing" shall be understood as the average locking torque when it is not prefixed by the words MAXIMUM or MINIMUM. Prevailing torque shall not contain any torque component for axial load in the fastener assembly. The prevailing torque can be measured in either a loosening or a tightening direction while the fastener is in motion. Also: Self-Locking Torque, Run Down Torque.

4.19 Retorque: See [Double Torque].

4.20 RUN DOWN TORQUE: See [Prevailing Torque].

4.21 [SEATING TORQUE]: This shall be the torque required to bring the bearing faces into the seated position. This torque shall be measured only in the tightening direction.

4.22 SELF-LOCKING TORQUE: See [Prevailing Torque].

4.23 SHEAR OUT TORQUE: See Torque Out.

4.24 SINGLE TORQUE: This shall be the installation torque applied once per assembly, usually applied to freely fitting parts, where there are no interference fits to hinder the seating of mating parts.

4.25 TEAR OUT TORQUE: See [Torque Out].

4.26 TIGHTENING SEQUENCE: See [Assembly Sequence].

4.27 TIGHTENING TORQUE: See [Installation Torque].