



AEROSPACE INFORMATION REPORT

AIR6151™**REV. C**

Issued 2011-05
Reaffirmed 2019-03
Revised 2024-01

Superseding AIR6151B

Torque, Threaded Application, Electrical Connector,
Accessory and Terminal Board Installation

RATIONALE

Revision required to clarify torque values, update references, and provide minor editorial errors as need.

1. SCOPE

This SAE Aerospace Information Report (AIR) is intended to provide guidelines to tightening methods and torque values as applied to electrical connectors, related hardware and switches, relays, circuit breakers, and A-A-59125 type terminal boards. The connectors and associated hardware discussed herein are typically manufactured from aluminum alloy, high-grade engineering thermoplastics, or corrosion-resistant steel, and typically plated with a protective/conductive coating. These guidelines may be used where no rules have been mandated either contractually or otherwise.

1.1 Purpose

To aid in the proper assembly of electrical connectors, related hardware and switches, relays, circuit breakers, and terminal boards in order to avoid damage by over torque or the loosening of parts while in service.

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 +1 724-776-4970 (outside USA), www.sae.org.

AS50151 Connectors, Electrical, Circular Threaded, AN Type, General Specification for

AS81511 Connectors, Electrical, Circular, High Density, Quick Disconnect, Environment Resisting and Accessories, General Specification for

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2024 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: [SAE AIR6151C](http://www.sae.org/standards/content/AIR6151C/)

For more information on this standard, visit
<https://www.sae.org/standards/content/AIR6151C/>

Documents
Document Sharing Hub

AS81703	Connectors, Electric, Circular, Miniature, Rack and Panel or Push-Pull Coupling, Environment Resisting
AS85049	Connector Accessories, Electrical, General Specification for
AS85049/1	Connector Accessories, Electrical, Backshell, Environmental, Cable Sealing, Straight, Grounding (without Strain Relief), Category 1C (for AS50151 Solder Type, V Thread of AS310XX Classes A, B, C, or K Connectors, AS95234 Connectors)
AS85049/2	Connector Accessories, Electrical, Backshell, Environmental, Cable Sealing, Straight, Category 1C (for AS50151 Solder Type, V Thread of AS310XX Classes A, B, C, or K Connectors, AS95234 Connectors)
AS85049/4	Connector Accessories, Electrical, Backshell, Cable Sealing, Straight, Set-up, Category 1A (for MIL-DTL-22992 Connectors, Classes C, J, and R)
AS85049/42	Connector Accessories, Electrical, Nonenvironmental, Strain Relief, Straight, Category 4A (for AS50151 Solder Type, V Thread of MS310X Classes A, B, C, or K Connectors)

2.1.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-DTL-22992	Connectors, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type, General Specification for
MIL-DTL-26482	Connectors, Electrical (Circular, Miniature, Quick Disconnect, Environment Resisting) Receptacles and Plugs
MIL-DTL-26500	Connectors, General Purpose, Electrical, Miniature, Circular, Environment Resisting, General Specification for
MIL-DTL-27599	Connector, Electrical, Miniature, Quick Disconnect (for Weapons Systems), Established Reliability
MIL-DTL-28840	Connectors, Electrical, Circular, Threaded, High Density, High Shock, Shipboard, Class D, General specification for
MIL-DTL-38999	Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts
MIL-DTL-83723	Connectors, Electrical, Circular (Environment resisting) Receptacles and Plugs
MIL-PRF-28876	Connectors, Fiber Optics, Circular, Plug And Receptacle Style, Multiple Removable Termini, General Specification For

2.2 Definitions

2.2.1 APPLIED TORQUE

The torque transmitted to the thread by the installation tool.

2.2.2 ASSEMBLY SEQUENCE

A method indicating sequence of assembling fasteners in a prescribed pattern. Also called installation sequence, tightening sequence, or torquing sequence.

2.2.3 ASSEMBLY 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.

2.2.4 BREAKAWAY TORQUE

This is the torque required to initiate relative motion between male and female threads. Breakaway torque can be prefixed with the words maximum or minimum and shall only be measured in the loosening direction.

2.2.5 OVER TORQUE

This shall be the torque required to initially move the wrench thread from the installed condition. Over torque is always measured in the tightening direction and exceeds the maximum limit of the desired installation torque. Also called over tightening torque.

2.2.6 PREVAILING TORQUE

This shall be the torque required to overcome kinetic friction of mating threads plus the torque required to overcome the locking feature when 100% of the locking feature is engaged and the threads are unseated. The word "prevailing" shall be understood as the average torque when it is not prefixed by the words maximum or minimum. The prevailing torque can be measured in either a loosening or tightening direction. Also called run down torque/running torque.

2.2.7 SINGLE TORQUE

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

2.2.8 TORQUE

Torque is the result of force times radius. Typically measured in units of inch-ounces, inch-pounds, foot-pounds, Newton-meters, kilogram-centimeters, etc. (see 3.1 and Table 6).

2.2.9 TORQUE OUT

This term refers to a general type of torsional failure where any fastener component reacting to the applied torque disengages or fails. This term is also used when referring to other types of torquing elements such as interference fits.

2.2.10 UNSEATING TORQUE

This shall be the torque required to initially move the fastener from the installation torque condition. The unseating torque shall always be measured in a loosening direction. Also called breakaway torque.

3. REQUIREMENTS

3.1 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 in inch-pounds (in-lb). The torques specified herein are those commonly used in the aerospace industry and do not represent thread strength values for qualification testing. It is the responsibility of the user/installer to determine the best torque for the application and to select the appropriate tools and holding devices for the work and the user conditions.

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 locking feature. For all the following torque definitions, the threaded components 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 or female component.
- b. Unseated when the application of removal torque disengages the bearing surface of the threaded component from the material being joined, reducing the axial stress to zero.

3.2 Material

Torque requirements specified herein shall apply to threaded components such as couplings, nuts, screws, bolts, studs, and inserts. These items may be separate hardware or integral parts of such components as connectors, backshells, or clamps. They will usually be made of corrosion-resistant steel, high-grade engineering thermoplastic, or aluminum alloy coated with a protective coating. Threads may be locked by lockwashers, self-locking inserts, anti-decoupling devices, or liquid locking compounds. Threads that are locked by deformed metal threads in inserts or contain a material compound that provides a locking feature may be coated with a thread lubricant.

3.3 Temperature Effects

For ambient temperatures outside the range of -1 to 93 °C (30 to 200 °F) allowance must be made for mechanical property differences from tabulated room temperature values. These properties include tensile strength, yield strength, modulus of elasticity, etc. Where bolts and flange materials are generically dissimilar, such as aluminum and corrosion-resistant steel or steel and brass, differences in thermal expansion may cause preload increase or decrease with temperature. Allowance must be made for these changes.

4. TORQUE REQUIREMENTS

4.1 Screw Torque

Recommended torque for corrosion-resistant or plated steel screws is listed in Table 1. Column 1 is for standard installation into aluminum or corrosion-resistant steel. Column 2 is for installation into composite material regardless of thread length or aluminum material with less than three full threads of engagement. Column 3 is for installation in high vibration (engine) areas, clinch nuts, and ground straps.

Table 1 - Corrosion-resistant/plated steel screw torque, inch-pounds

Screw Size	Column 1 Min/Max	Column 2 Min/Max	Column 3 Min/Max
2-56	1.5/ 2.5	1.2/ 2.0	2.0/ 2.5
4-40	3.5/ 4.5	2.8/ 3.6	3.5/ 4.5
6-32	5.0/ 7.0	4.0/ 5.6	5.5/ 6.5
8-32	7.0/ 9.0	5.6/ 7.2	7.5/ 8.5
10-32	9.0/11.0	7.2/ 8.8	8.5/10.5
.250-20	11.0/13.0	8.8/10.4	10.5/15.5