SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE MA4534

Issued 1993-09
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Socket Wrenches, Hand (Metric)

1. SCOPE:

This SAE Aerospace Standard covers high strength commercial sockets and universal sockets which possess the strength, clearances, and internal wrenching design so configured that, when mated with hexagon (6 point) fasteners, they shall transmit torque to the fastener without bearing on the outer 5% of the fastener's wrenching points. This document provides additional requirements beyond ANSI B107.5 appropriate for aerospace use.

Inclusion of dimensional data in this document is not intended to imply all of the products described therein are stock production sizes. Consumers are requested to consult with manufacturers concerning lists of stock production sizes.

1.1 Classification:

Sockets and universal sockets covered by this document shall be of the following classes and styles as specified:

a. Class 1 - Sockets, double hexagon (12 point)
   (1) Style A - Regular length
   (2) Style B - Long length
   (3) Style C - Mid length

b. Class 3 - Universal sockets, double hexagon (12 point)

2. APPLICABLE DOCUMENTS:

2.1 The following documents of the issue in effect on the date of invitations for bid or request for proposal form a part of this document to the extent specified herein.

2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AS478	Identification - Marking Methods
MA1547	Wrench, Twelve Spline, Metric

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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2.1.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A 754 Coating Thickness by X-ray Fluorescence, Standard Test Method for
ASTM B 487 Measurement of Metal and Oxide Coating Thickness, Examination of a Cross Section
ASTM B 499 Measurement of Coating Thickness by the Magnetic Method, Standard Test Method for
ASTM B 504 Measurement of Thickness of Metallic Coatings by the Coulometric Method, Standard Test Method for
ASTM B 530 Measurement of Coating Thickness by the Magnetic Method: Electrodeposited Nickel Coatings of Magnetic and Nonmagnetic Substrates, Standard Test Method for
ASTM B 568 Measurement of Coating Thickness by X-ray Spectrometry, Standard Test Method for
ASTM B 571 Adhesion of Metallic Coatings, Standard Test Methods for
ASTM B 748 Measurement of Thickness of Metallic Coatings by Measurement of Cross Section with a Scanning Electron Microscope, Standard Test Method for

2.1.3 ANSI Publications: Available from American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

ANSI B107.5 Sockets Wrenches, Hand (Metric Series)

3. REQUIREMENTS:

3.1 General:

Unless otherwise specified herein, all dimensions and attributes shall be in conformance with ANSI B107.5.

3.2 Materials:

The materials used in the manufacture of the sockets and universal sockets shall be steel, the chemical composition and heat treatment of which shall be such as to produce tools conforming to the physical requirements specified herein. Failure under load shall not result in fragmentation of the socket. Powdered metal or cast steel shall not be used.

3.3 Marking:

The sockets shall be marked in a permanent manner with the country of origin and the manufacturer's name, or with a trademark of such known character that the source of manufacture may be readily determined. In addition, the tools shall be marked in a permanent manner with the nominal wrench opening. Marking methods shall be in accordance with AS478.

3.4 Hardness:

Sockets shall be heat treated to a hardness of 40 to 54 Rockwell C.

3.5 Test Loads:

When tested as specified, sockets shall withstand the applicable cyclic and proof test loads specified in Table 1 and Table 2 without failure or permanent deformation (set) which might affect the durability or serviceability of the sockets.

TABLE 1 - Class 1, Socket, Test Loads by SQ DR Size
(Torque in Newton-Meters)

Size	1/4 Proof	1/4 Cyclic	3/8 Proof	3/8 Cyclic	1/2 Proof	1/2 Cyclic	3/4 Proof	3/4 Cyclic
5	17	12						
5.5	22	15						
6	28	20	28	20				
7	42	29	42	29				
8	58	41	62	43				
9	70	49	89	62				
10	70	49	120	84	155	108		
11	70	49	155	108	195	136		
12	70	49	205	144	240	168		
13	70	49	260	182	295	206		
14	70	49	280	196	350	245		
15			280	196	420	294		
16			280	196	485	340		
17			280	196	560	392		
18			280	196	680	476		
19			280	196	680	476		
20			280	196	680	476		
21			280	196	680	476		
22			280	196	680	476	1530	1070
23					680	476	1670	1170
24					680	476	1800	1260
25					680	476	1955	1370
26					680	476	2030	1420
27					680	476	2030	1420
28					680	476	2030	1420
30					680	476	2030	1420
32					680	476	2030	1420
34							2030	1420
36							2030	1420
41							2030	1420
46							2030	1420
50							2030	1420
55							2030	1420
60							2030	1420

TABLE 2 - Class 3, Universal Socket, Test Loads by SQ DR Size
(Torque in Newton-Meters)

Hex Size	1/4 Proof	1/4 Cyclic	3/8 Proof	3/8 Cyclic
5	17	12		
6	28	20		
7	42	29	42	29
8	56	39	62	43
9	56	39	89	62
10	56	39	105	70
11	56	39	110	77
12	56	39	110	77
13	56	39	110	77
14			110	77
15			110	77
16			110	77
17			110	77
18			110	77
19			110	77
21			110	77
22			110	77

3.6 Coatings:

Two types of protective finish are covered. Chromium plate will be furnished unless otherwise specified.

3.6.1 Chromium Plate: Sockets shall have a protective decorative nickel-chromium plating. The plating shall be adherent, smooth, continuous, and free from uncoated areas, pits, blisters, nodules, and any other defects which would interfere with their serviceability. The nickel thickness shall be a minimum 0.005 mm. The chromium thickness shall be a minimum 0.00018 mm. There shall be no other undercoat on the tool. Visible contact marks resulting from electroplating operations shall be confined to the interior surface of the wrenching and drive openings.

3.6.2 Black Oxide or Phosphate Treatment: The sockets shall be coated with a chemically produced oxide or phosphate coating followed with a coating of rust preventive oil. All external surfaces shall have a maximum roughness height value of 0.0063 mm.

3.7 Wrench Design:

The internal wrenching design of all sockets shall be so configured that, when mated with hexagon (6-point) fasteners, they shall transmit torque to the fastener without bearing on the outer 5% of the fastener's wrenching points (see Figure 1).

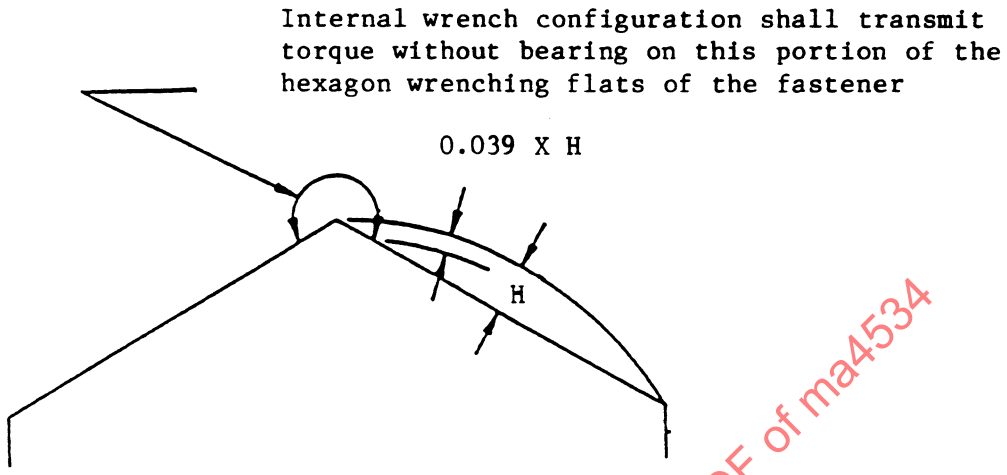

FIGURE 1 - Internal Wrench Engagement

3.8 Workmanship:

All items covered herein shall be free from fins, burrs, external sharp or rough edges, corners or surfaces and other defects which may impair their serviceability or durability. The inside edges of the sockets shall be chamfered.

3.8.1 Foreign Object Damage: It is important to avoid damage to aircraft engines due to foreign objects. Rips, tears, broaching slugs, burrs, slivers, and/or any material which could be removed during gaging, load testing, or normal use and/or any indication of rust shall be unacceptable.

4. TEST PROCEDURES:

4.1 Hardness:

Hardness testing procedures shall be in accordance with ANSI B107.5.

4.2 Socket Load:

Sockets shall meet the applicable fragmentation test loads specified in 4.3.3 and the cyclic and proof test loads specified in Table 1 and Table 2 using the test procedures specified in ANSI B107.5. Adequate safeguards for personnel and property shall be employed in conducting all tests. Approved eye protection shall be worn at all times and equipment safety shields shall be in place when tests are in progress.

4.3 Qualification Tests:

To qualify the design and processes a sample tool shall be subjected to the following qualification tests. The manufacturer shall maintain a record of compliance with the wrench design test for each hexagon size and a record of compliance with the cyclic load test for each class, style, and size socket. Retest shall be required whenever the design or method of manufacture is changed.

4.3.1 Wrench Design: Conformance of the wrench design to the requirements of 3.5 shall be demonstrated on a sample tool by the use of a mandrel or a template. The mandrel or template shall conform with the requirements of Figure 2.

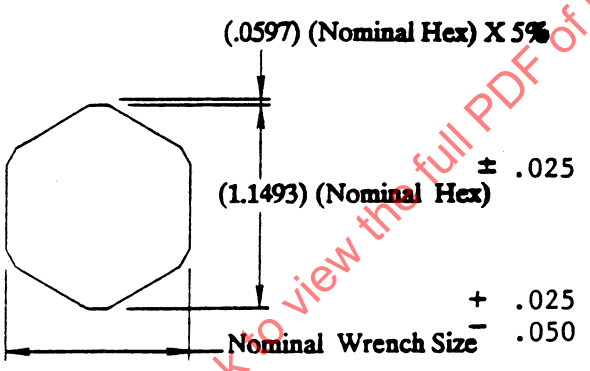

FIGURE 2 - Mandrel for Wrench Design Test Procedure

4.3.1.1 The mandrel shall be of a nonferrous or ferrous material. When a nonferrous material is used, torque shall be applied by the wrench to the mandrel to a level sufficient to cause an impression on the mandrel indicative of the loading pattern between the wrench and the mandrel. When ferrous material is used, blueing shall be applied to the flats of the mandrel prior to the application of torque. Using the sample wrench, apply torque to the mandrel to a level sufficient to show the loading pattern. Care shall be taken to minimize mandrel distortion so that the true loading pattern can be discerned. The resulting loading pattern on the mandrel shall not extend to the corners of the mandrel.

4.3.1.2 The template shall be used in conjunction with an optical comparator. The centerline of the wrench configuration shall be placed on the centerline of the template and rotated until a point of contact between the wrench configuration and the template is established. The point of contact shall not be on the corners of the template.