SAE Aerospace
An SAE International Group

METRIC AEROSPACE STANDARD

SAE MA4360 | REV. A

Issued 1993-03
Reaffirmed 2004-01
Revised 2013-03

Superseding MA4360

(R) Metric Wrenches: 6 & 12 Point Flare Nut, Non-distorting

RATIONALE

The update of MA4360 is to incorporate improvements compiled from customer feedback. The improvements include size corrections and the acceptance of alternate coatings (used in lieu of nickel chromium plating).

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1. SCOPE

This SAE Metric Aerospace Standard (MA) covers metric double end flare nut wrenches that are designed with the following requirements:

a. Non-distorting usage.

b. Possessing the strength, clearances, and internal wrenching design to be used on hydraulic tube fittings that conform to the requirements of SAE J514.

c. Transmitting torque to tube fittings without bearing on the apex of fitting wrenching points.

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

1.1 Purpose

These tools are used for tightening and loosening hydraulic flare nut (tube) fittings.

2. 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 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.

AMS4118 Aluminum Alloy, Rolled or Cold Finished Bars, Rods, and Wire, 4.0Cu - 0.70Mn - 0.60Mg - 0.50Si (2017; -T4, -T451), Solution Heat Treated

AS478 Identification Marking Methods

AS4984 Coating Requirements for Aerospace Hand Tools

J514 Hydraulic Tube Fittings

2.2 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

B46.1 Surface Texture, Surface Roughness, Waviness and Lay

B107.17 Gages and Mandrels for Wrench Openings, Reference

2.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E4 Standard Practices for Force Verification of Testing Machines

ASTM E18 Standard Test Methods for Rockwell Hardness of Metallic Materials

3. CLASSIFICATION

3.1 This document covers a limited number of wrench opening sizes, as required, to accommodate the needs of SAE J514 and for wrench types that are commercially available in accordance with the requirements of this document.

3.2 Wrenches shall be of the following Types, Classes, Styles, Designs, and Sizes. See Section 5.

Type I - Flare Nut Wrenches

Class 1 - Metric Double Flare Nut

a. Style A - Wrenches shall have a protective nickel-chromium finish in accordance with 4.7.1.

   Design (a) - 15 degree heads 6 point
   Design (b) - 15 degree heads 12 point

b. Style B - Wrenches shall have a protective black oxide, phosphate finish or other black finish coatings in accordance with 4.7.1.

   Design (a) - 15 degree heads 6 point
   Design (b) - 15 degree heads 12 point

4. REQUIREMENTS

4.1 Illustrations

The illustrations shown are descriptive and not restrictive, and are included for the convenience of requisitioning and purchasing officers. They are not intended to preclude the purchase of wrenches that are otherwise in accordance with this document.

4.2 Materials

Unless otherwise specified, the materials used in the manufacture of wrenches shall be steel. The chemical composition and heat treatment shall be such as to produce wrenches conforming to the physical requirements specified. Powder metal or cast steel shall not be used.

4.3 Marking

The wrenches shall be marked in a permanent manner with the country of origin and manufacturer's name or with a trademark so that the source of manufacture may be readily determined. In addition, the wrenches shall be marked in a permanent manner with the nominal opening size. Marking requirements shall be in accordance with AS478.

4.4 Edges and Corners

All edges and sharp corners, capable of causing injury, not otherwise covered herein, shall have sharp edges removed by rounding, chamfering, or other means.

4.5 Internal Wrenching Configuration

The internal 6 & 12 point wrenching configuration surfaces shall conform to Figure 1 and be finished in a smooth and well defined manner (not smeared or torn). These openings shall be chamfered on both sides to provide a lead in for the working surfaces.

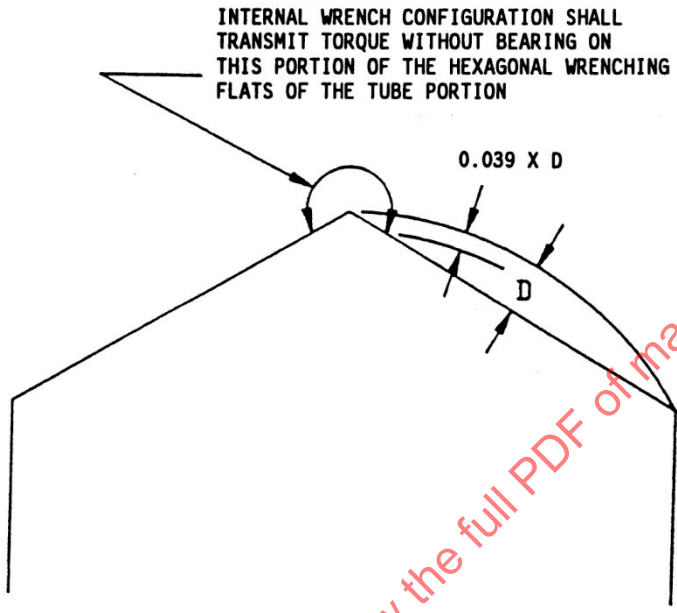

FIGURE 1 - INTERNAL WRENCH ENGAGEMENT

Tolerance for flare nut openings shall be such as to ensure acceptance when gaged in accordance with requirements of ASME B107.17M.

4.6 Hardness

Unless otherwise specified, wrenches shall be hardened throughout to a Rockwell hardness of not less than 40 Rc nor more than 54 Rc. When grinding is necessary to prepare the test surface, the amount removed must not exceed 0.007 inch on the surface contacted by the indenter. Hardness definitions, nomenclature, and procedures used can be found in ASTM E18.

4.7 Surface Finish

All surfaces shall be thoroughly cleaned, free from cracks, and essentially free from burrs, pits, nodules, and other detrimental defects. Areas ground, buffed, or finished by an equivalent method shall have a bright finish with a maximum surface roughness of 32 microinches for Style A wrenches and a maximum surface roughness of 64 microinches for Style B wrenches. Surfaces not ground or buffed shall have a surface conforming to good commercial practice and the surface roughness shall not exceed 250 microinches.

Forge flash shall be removed from the periphery of the drive end for a minimum of 180 degrees (90 degrees on each side of the centerline of slotted openings on flare nut(s) or longitudinal axis, or both portions of the wrench. Any remaining surfaces between the wrench end(s) shall blend smoothly with adjacent surfaces. External sharp edges shall be broken to a 0.015 inch radius minimum, and shall not project more than 0.015 inch from adjacent surfaces.

4.7.1 Coatings

Wrenches shall be protected with the following three types as specified within AS4984B.

Type I - Nickel Chromium coating
Type II - Black Oxide, Black Phosphate, or other black finish coatings
Type III - Alternate coating (Used in lieu of Nickel chromium plating)

4.8 Tests

The load tests required herein are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting these tests.

Microinch measurements shall be made with a surface measuring instrument using a 0.03 inch roughness width cutoff. All surface roughness values shall be rated as arithmetical averages. Definitions and nomenclature used can be found in ASME B46.1.

All wrenches shall be capable of meeting the aluminum mandrel test, as specified in the applicable tables, when performed in accordance with the following procedures.

4.8.1 Aluminum Mandrel Test

The wrenches shall achieve the torque loads in Table 1 when subjected to the following: Mandrels constructed from aluminum, conforming to AMS4118 and to Figure 2, shall be used. The wrench shall be placed on the mandrel and located centrally to the 0.140 inch long portion of the mandrel. See Figures 2 and 3. Care shall be exercised to maintain the face of the wrench parallel to the face of the mandrel during the test. Force shall be applied to the wrench to transmit the required test load between the wrench and torque tester. See Figure 3. This shall be done a total of three times on each mandrel, rotating the wrench 30 degrees to the next gripping position of the wrench after each torque cycle. If the corners of the mandrel are deformed so that the test load values cannot be met, the wrench shall not comply with these requirements.

TABLE 1 - ALUMINUM MANDREL TEST

Wrench Size (mm)	Across Flats Tolerance (mm)	Across Corners Minimum (mm)	Torque Load (In-Lb/Nm)
7	+0.025 – 0.050	7.79	70.80 / 8
8	+0.025 – 0.050	8.95	139.84 / 15.8
9	+0.025 – 0.050	10.11	179.67 / 20.3
10	+0.025 – 0.050	11.27	220.29 / 24.89
11	+0.025 – 0.050	12.40	260.21 / 29.4
12	+0.025 – 0.076	13.53	296.50 / 33.5
13	+0.025 – 0.076	14.67	336.33 / 38
14	+0.025 – 0.076	15.80	379.70 / 42.9
15	+0.025 – 0.076	16.92	415.10 / 46.9
16	+0.025 – 0.076	18.06	469.97 / 53.1
17	+0.025 – 0.076	19.20	524.85 / 59.3
18	+0.025 – 0.076	20.35	600.08 / 67.8
19	+0.025 – 0.076	21.49	674.43 / 76.2
20	+0.025 – 0.076	22.46	724.87 / 81.9
21	+0.025 – 0.076	23.78	775.32 / 87.6

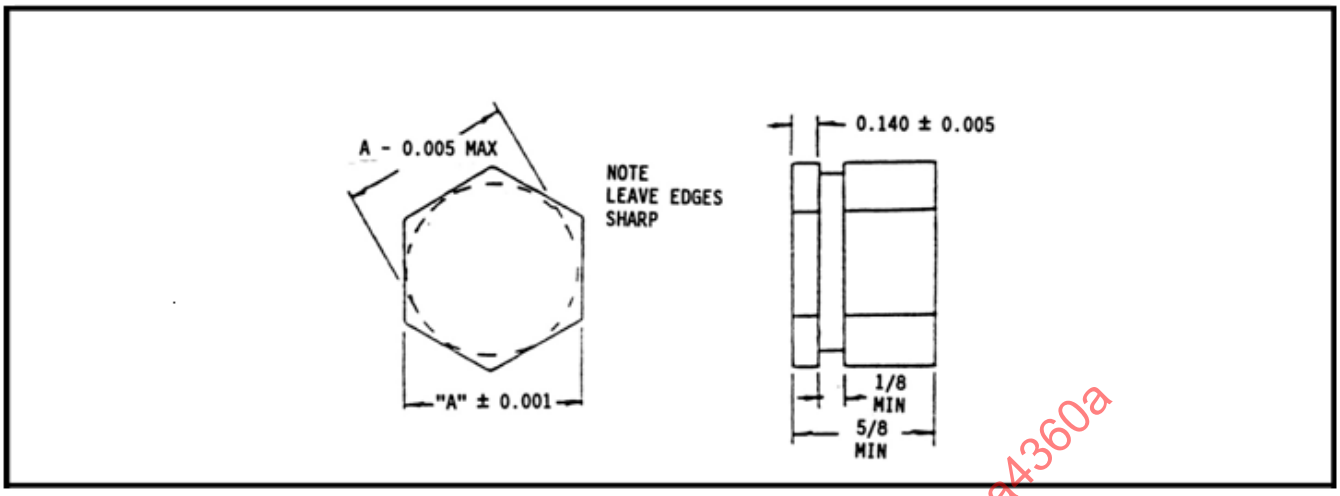

FIGURE 2 - SPECIMEN FOR ALUMINUM MANDREL TEST

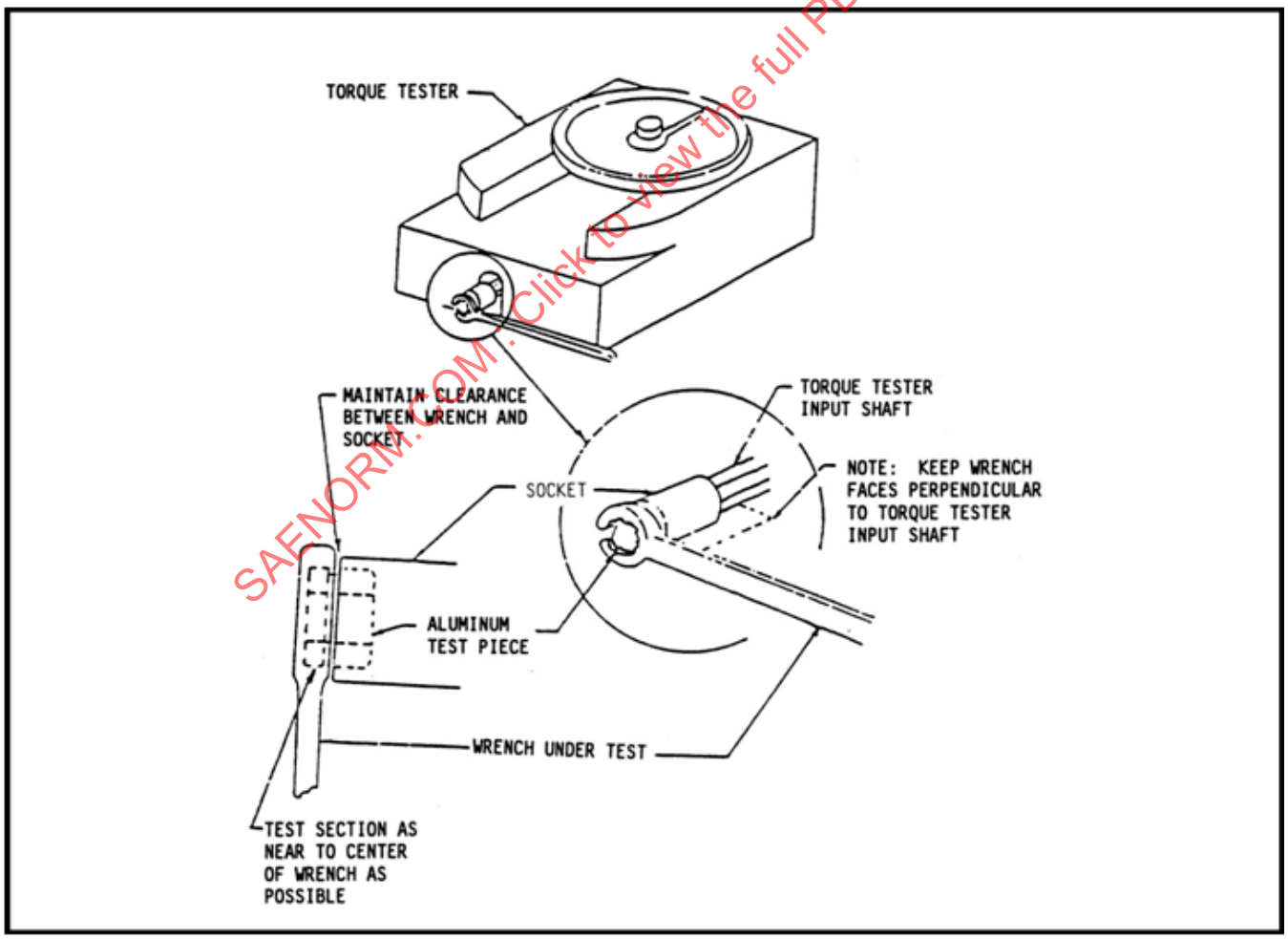

FIGURE 3 - TYPICAL TEST SETUP FOR ALUMINUM MANDREL TEST

4.8.2 Qualification Test

As a design and process qualification test, the manufacturer shall maintain a record of compliance with the tube fitting distortion test of 4.9.4.1 for the flare nut(s) of a sample tool. The test shall be required whenever the design or method of manufacture is significantly changed.

4.8.2.1 Tube Fitting Distortion Test

The wrenches shall achieve the torque loads in Table 2 when subjected to the following: Place a socket of the same size as the flare nut to be tested on a torque tester. See Figure 4. Insert into the socket the corresponding size Style "B" nut conforming to the requirements of SAE J514. A Class 2B, go and no-go thread gage shall be used. If the no-go end of the gage enters into the nut, it shall not bottom. The nut should be free of imperfections, and the go gage should turn freely the full length of the fitting. A light oil should be used on the threads for this test to minimize thread variables.

After threading the gage to the bottom of the nut, the gage should be backed up one full turn. The wrench should be placed on the fitting with the center of the wrench as near to the center of the fitting as possible by inserting the nut only as far into the socket as is necessary to hold it securely when the torque is applied to it (approximately 1/8 inch). The wrench shall then be brought up to one half the torque load specified for the wrench. This shall be done three times at one half torque, rotating the wrench 30 degrees to the next gripping position of the wrench, after each single torque cycle. (In the case of Style E wrenches, this shall be to the next ratcheting position.) Then while constantly rotating the thread gage by hand, clockwise and counterclockwise, through a short arc (1/16 to 1/8 turn), sufficiently to keep the gage in motion, the wrench should be brought up to the torque where the gage can no longer be turned by hand. This procedure should be repeated a total of six times, rotating the wrench 30 degrees to the next gripping position of the wrench after each single torque cycle, as before. The three lowest torque readings, at which the thread gage can no longer be turned by hand, shall be averaged. This value shall be no lower than the values specified in Table 2.

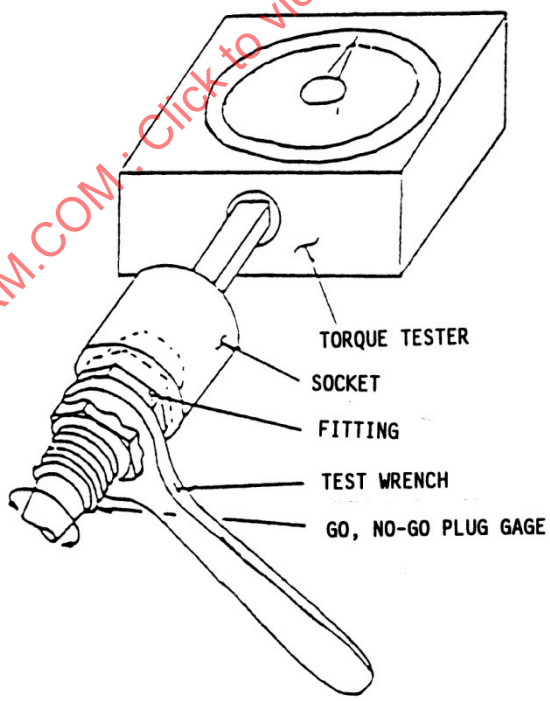

FIGURE 4 - TEST SETUP FOR TUBE FITTING DISTORTION TEST