

Metric Sockets, Wrenches, Hand Twelve Point, High Strength, Thin Wall

RATIONALE

The creation of AS955 is to incorporate improvements compiled from customer feedback. AS955 supersedes MA4534 and MA4535.

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Document Sharing Hub

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1. SCOPE

This SAE Aerospace Standard (AS) covers high strength thin wall (commercial) metric sockets, universal metric sockets, metric box wrenches and metric torque adaptors which possess the strength, clearances, and internal wrenching design so configured that, when mated with 12 point fasteners conforming to the requirement of ISO 4095, they shall transmit torque to the fastener without bearing on the outer 5% of the fastener's wrenching points. This standard provides additional requirements beyond ASME B107.100 and B107.5M appropriate for aerospace use.

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. The dimensional limits of box and combination wrench lengths have been established to provide configuration control for tool storage applications.

1.1 Classification

Metric sockets and wrenches covered by this AS shall be of the following types, classes, and styles, as specified:

1.1.1 Type I Metric Sockets

Class 1: Metric Sockets

Style A - Regular length

Style B - Mid length

Style C - Long length

Class 2: Universal Joint Metric Sockets

1.1.2 Type II Metric Box Wrenches, Double Head

Class 1: 15 degree offset each end

Style A: Regular length

Style B: Long length

Class 2: Deep offset each end

Style A: Regular length

Class 3: Modified offset each end

Style A: Short length

Style B: Regular length

1.1.3 Type III: Metric Combination Wrench

Class 1: 15 degree offset each end:

Style A: Extra short length

Style B: Short length

Style C: Regular length

Style D: Long length

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.

AS478N	Identification Marking Methods
AS4984A	Coating Requirements for Aerospace Hand Tools
MA4534	Socket Wrenches, Hand (Metric)
MA4535	Wrenches, Box and Open End Combination Twelve Point, High Strength, Thin Wall, Metric

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.

ASME B46.1	Surface Texture
ASME B107.4	Driving and Spindle Ends for Portable, Hand, Air and Electric Tools
ASME B107.5M	Socket Wrenches, Hand (Metric Series)
ASME B107.100	Flat Wrenches
ASME B107.17	Gages and Mandrels for Wrench Openings

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 E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials, Standard Methods of Test For
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2.4 ISO Publications

Available from International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41-22-749-01-11, www.iso.org.

ISO 4095	Fasteners for Aerospace Construction - Bi-hexagonal (Metric)
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3. REQUIREMENTS

3.1 Illustrations

The illustrations shown herein are descriptive, not restrictive, and are not intended to preclude sockets, universal sockets, box wrenches and combination wrenches which are otherwise in accordance with this document.

3.2 Materials

Unless otherwise specified hereinafter, the materials used in the manufacture of the sockets, universal sockets, box wrenches and combination wrenches 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. Powdered metal or cast steel shall not be used.

3.3 Marking

The sockets, universal sockets, box wrenches and combination wrenches shall be marked in a permanent manner with the nominal wrench opening size. In addition, the tools shall be marked with the country of origin and the manufacturer's name or with a trademark of known character that the source of manufacture may be determined. Marking requirement shall be in accordance with AS478N.

3.4 Square Drive Ends

3.4.1 Drive End Dimensions

Internal drive end dimensions shall conform to ASME B107.4. External drive tangs in accordance with ASME B107.4 shall be used to judge the following requirements:

3.4.1.1 Internal Drive Opening

All internal drive openings shall be broached or formed in a smooth and well defined manner. Tools having internal drive openings shall be firmly attachable to corresponding size external drive tangs by one of the following methods.

3.4.1.1.1 Detent

All four faces of the internal drive opening shall be recessed so that one of the recesses engages the spring loaded steel ball on the corresponding external drive. If the internal drive end thickness is less than twice the dimension D_f in Table 7 of ASME B107.4, the recess shall be centered in the internal drive opening within 0.25 mm.

3.4.1.1.2 Cross-Hole

One or more of the faces of the internal drive opening shall be drilled with a cross-hole to engage the spring loaded steel ball or plunger on the corresponding external drive. If the internal drive end thickness is less than twice the dimension D_f in Table 7 of ASME B107.4, the cross-hole(s) shall be centered in the internal drive opening within 0.25 mm.

3.4.2 Tang Engagement and Disengagement

The detachable sockets and universal sockets shall be so designed that external tangs can be inserted into the corresponding internal openings without undue force and shall be manually detachable without the use of any tools or keys, and meet the minimum force requirements to remove the external tang as specified in applicable tables of ASME B107.4. Binding between surfaces and corners shall not be evident.

3.5 Hardness

Unless otherwise specified herein, sockets, universal sockets, box wrenches and combination wrenches shall be hardened throughout to a Rockwell hardness of not less than 40 nor more than 54 on the "C" scale. Hardness definitions, nomenclature and procedures used herein can be found in ASTM E 18. When grinding is necessary to prepare the test surface, the amount removed must not exceed 0.18 mm on the surface contacted by the indenter.

3.6 Finish

Wrenches shall be protected with one of the following three types as specified within AS4984A

Type I - Nickel Chromium coating

Type II - Black Oxide or Black Phosphate or Other Black Finish Coatings

Type III - Alternate coating (Used in lieu of Nickel Chromium coating)

3.6.1.1 Surface Finish Requirements of Nickel Chromium Plate

On all Type I sockets and universal sockets, the outer longitudinal surface or major diameter thereof shall be bright with 30 μ in maximum Ra, except where knurled or grooved. The remaining exterior longitudinal socket surface shall be 150 μ in maximum Ra. On all Type II box wrenches and Type III combination wrenches, a minimum of 180 degrees of the outer periphery of the box ends (90 degrees on each side of the longitudinal axis of the wrench) shall be 30 μ in maximum Ra. Microinch measurements shall be made with a surface-measuring instrument using a 0.030 in roughness width cutoff. Definitions and nomenclature used herein can be found in ASME B46.1

3.6.2 Black Oxide or Phosphate Treatment

The tools 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 Ra roughness height value of 250 μ in. Microinch measurements shall be made with a surface-measuring instrument using a 0.76 mm roughness width cutoff. Definitions and nomenclature used herein can be found in ASME B46.1

3.6.3 Surface Condition

All external surfaces shall be free from pits, nodules, forge flash, burrs, cracks, and other detrimental defects. The external forge flash shall blend smoothly with adjacent surfaces except that the forge flash shall be completely removed from the periphery of the heads of box wrenches and combination wrenches and from that portion of the handle which shall be essentially straight and uniform in section dimensions.

3.7 Test Loads

The items covered herein shall withstand the proof loads set forth in the applicable tables, without failure or permanent deformation (set) which might affect durability or serviceability of the tools. 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 in place when tests are in progress.

3.7.1 Mandrels for Wrench Openings

Wrench openings shall be tested on hexagonal mandrels. The size of all mandrels shall conform to the dimensions and tolerances specified in Table 1. The fourth column of Table 1 (Mandrel Engagement Maximum Depth) does not apply when testing Type II box wrenches and Type III combination wrenches.

Mandrels shall be hardened to a Rockwell hardness of not less than 55 on the "C" scale and shall have smoothly finished wrench engagement surfaces.

TABLE 1 - HEXAGON MANDREL DIMENSIONS AND ENGAGEMENT DATA

For Wrench Sizes (mm)	Hexagonal Mandrel Across Flats Tolerances (mm)		Mandrel Across Corners (Ref) (mm)	Mandrel Engagement Maximum Depth of Insertion (mm)	No Bearing Area for Mandrel (Ref) (mm)
	Plus	Minus			
3.2	0.025	0.05	3.68	1.3	0.01
4	0.025	0.05	4.60	1.6	0.01
4.5	0.025	0.05	5.17	1.8	0.01
5	0.025	0.05	5.75	2	0.01
5.5	0.025	0.05	6.32	2.4	0.02
6	0.025	0.05	6.90	2.6	0.02
7	0.025	0.05	8.05	3.2	0.02
8	0.025	0.05	9.19	4	0.02
9	0.025	0.05	10.34	4.4	0.03
10	0.025	0.05	11.49	4.8	0.03
11	0.025	0.05	12.64	5.6	0.03
12	0.025	0.076	13.79	6	0.04
13	0.025	0.076	14.94	6.4	0.04
14	0.025	0.076	16.09	7	0.04
15	0.025	0.076	17.24	7.4	0.04
16	0.025	0.076	18.39	8	0.05
17	0.025	0.076	19.54	8.8	0.05
18	0.025	0.076	20.69	9.6	0.05
19	0.025	0.076	21.84	10.2	0.06
20	0.025	0.076	22.99	10.6	0.06
21	0.025	0.076	24.14	11.2	0.06
22	0.025	0.076	25.28	11.8	0.07
23	0.025	0.076	26.43	12.2	0.07
24	0.025	0.076	27.58	12.8	0.07

TABLE 1 - HEXAGON MANDREL DIMENSIONS AND ENGAGEMENT DATA (CONTINUED)

For Wrench Sizes (mm)	Hexagonal Mandrel Across Flats Tolerances (mm)		Mandrel Across Corners (Ref) (mm)	Mandrel Engagement Maximum Depth of Insertion (mm)	No Bearing Area for Mandrel (Ref) (mm)
	Plus	Minus			
25	0.025	0.076	28.73	13.4	0.07
26	0.025	0.076	29.88	13.8	0.08
27	0.025	0.076	31.03	14.4	0.08
28	0.025	0.076	32.18	15	0.08
29	0.025	0.076	33.33	15.4	0.09
30	0.025	0.076	34.48	16	0.09
31	0.025	0.076	35.63	16.4	0.09
32	0.025	0.076	36.78	16.8	0.10
33	0.025	0.076	37.93	17.2	0.10
34	0.025	0.076	39.08	17.6	0.10
35	0.025	0.076	40.23	18.4	0.10
36	0.025	0.076	41.37	19.2	0.11
38	0.025	0.076	43.67	20.2	0.11
40	0.025	0.177	45.97	21.2	0.12
41	0.025	0.177	47.12	21.6	0.12
42	0.025	0.177	48.27	22	0.13
46	0.025	0.177	52.87	24	0.14
50	0.025	0.177	57.47	26.4	0.15
54	0.025	0.177	62.06	28.4	0.16
55	0.025	0.177	63.21	28.8	0.16
58	0.025	0.177	66.66	30.2	0.17
60	0.025	0.177	68.96	31.2	0.18
70	0.025	0.177	80.45	36	0.21
74	0.025	0.177	85.05	37.92	0.22

3.7.2 Test Plug

3.7.2.1 Type I, Class 1 Metric Sockets

A square test plug of suitable strength and complying with the minimum dimensional requirements of the external drive tang specified in ASME B107.4 shall be employed. The test plug may be driven by any suitable manual or mechanical means. The socket shall then be engaged on the end of the mandrel to a maximum depth in accordance with Table 1. A stop may be set at the outer end of the test plug to prevent slippage of the socket end-wise from the mandrel.

3.7.2.2 Type I, Class 2 Metric Universal Sockets

A test plug as in 3.7.2.1 shall be used except that a means shall be provided to keep universal socket parts in the axis about which the load is applied.