ASME B107.100-2010

(Revision and Incorporation of ASME B107.6, B107.8, B107.9, B107.21, B107.39, B107.40, and B107.66)

Flat Wrenches

AN AMERICAN NATIONAL STANDARD

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Flat Wrenches

AN AMERICAN NATIONAL STANDARD

ASME
SETTING THE STANDARD

Three Park Avenue • New York, NY • 10016 USA

Date of Issuance: October 15, 2010

This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this document. Periodically certain actions of the ASME B107 Committee may be published as Cases. Cases and interpretations are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

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FOREWORD

The American National Standards Committee B107 on Socket Wrenches and Drives was originally under the sponsorship of The American Society of Mechanical Engineers (ASME). It was subsequently reorganized as an ASME Standards Committee, and its title was changed to Hand Tools and Accessories. In 1996, the Committee's scope was expanded to include safety considerations.

The purpose of B107.100 is to define essential performance and safety requirements specifically applicable to combination wrenches; box wrenches, double head; open end wrenches, double head; flare nut; adjustable wrenches; and ratcheting box wrenches. It specifies test methods to evaluate performance related to the defined requirements and safety, and indicates limitations of safe use.

This Standard was designated "Wrenches" when it was first issued in 2002. It superseded the following ASME standards: B107.6, Combination Wrenches; B107.9, Box Wrenches, Double Head; B107.39, Open End Wrenches, Double Head; and B107.40, Wrenches, Flare Nut.

This current edition has been redesignated as "Flat Wrenches" and incorporates the additional following standards:

(a) B107.8, Adjustable Wrenches, approved by the American National Standards Institute on November 8, 2007

(b) B107.21, Wrench, Crowfoot, approved by the American National Standards Institute on April 5, 2005

(c) B107.66, Ratcheting Box Wrenches, approved by the American National Standards Institute on November 8, 2007

In addition to the consolidation of these individual wrench standards into B107.100, principal changes are the uniform inclusion of performance requirements and test methods that evaluate both performance and safety as well as uniform format for sections on definitions, references, performance requirements, tests, and safety requirements and limitations of use.

Members of the Hand Tools Institute, Wrench Standards Committee through their knowledge and hard work have been major contributors to the development of the B107 Standards. Their active efforts in the promotion of these standards are acknowledged and appreciated.

The format of this Standard is in accordance with *The ASME Codes & Standards Writing Guide 2000.* Requests for interpretations of the technical requirements of this Standard should be expressed in writing to the Secretary, B107 Standards Committee, at the address below.

Suggestions for the improvement of this Standard are welcome. They should be addressed to The American Society of Mechanical Engineers, Secretary, B107 Standards Committee, Three Park Avenue, New York, NY 10016-5990.

The requirements of this Standard become effective at the time of publication.

This revision was approved as an American National Standard on March 11, 2010.

ASME B107 COMMITTEE
Hand Tools and Accessories

(The following is the roster of the Committee at the time of approval of this Standard.)

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CORRESPONDENCE WITH THE B107 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B107 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the standard, the paragraph, figure or table number(s), and be written as a Question and a Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the standards to which the proposed Case applies.

Interpretations. Upon request, the B107 Standards Committee will render an interpretation of any requirement of the Code. Interpretations can only be rendered in response to a written request sent to the Secretary of the B107 Standards Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Code for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B107 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B107 Standards Committee.

ASME B107.6

COMBINATION WRENCHES

1 SCOPE

This Standard provides performance and safety requirements for combination wrenches. Except where indicated, these requirements also apply to wrenches described in B107.9, Box Wrenches, Double Head; B107.39, Open End Wrenches, Double Head; and B107.40, Wrenches, Flare Nut.

Inclusion of dimensional data in this Standard 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.

2 CLASSIFICATION

(a) B107.6 — Combination wrench, open end and 15 deg offset box opening

(b) B107.9 — Box wrench, double head

Type I: 15 deg offset each end

Type II: modified offset each end

Type III: deep offset each end

(c) B107.39 — Open end wrench, double head

Type I: engineer's wrench, 15 deg angle

Type II:

Class 1: 30 deg and 60 deg angle wrench

Class 2: 15 deg and 60 deg ignition wrench

Class 3: 15 deg and 60 deg angle wrench

Type III: tappet wrench, 15 deg angle

(d) B107.40 — Flare nut wrench

Type I: double head

Type II: combination, open end and 15 deg offset slotted box end

3 REFERENCES

The following is a list of publications referenced in this Standard. The latest available edition shall be used.

ASME B107.17M, Gages, Wrench Openings, Reference

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B 537, Standard Practice for Rating of Electroplated Panels Subjected to Atmospheric Exposure

ASTM B 571, Standard Practice for Qualitative Adhesion Testing of Metallic Coatings

ASTM D 968, Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM E 18, Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

Publisher: American Society of Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care

Publisher: Hand Tools Institute (HTI), 25 North Broadway, Tarrytown, NY 10591 (www.hti.org)

4 PERFORMANCE REQUIREMENTS

The illustrations shown herein are descriptive and not restrictive, and are not intended to preclude the manufacture of wrenches that are otherwise in accordance with this Standard. Inch table values are in inches unless otherwise specified. Metric table values are in millimeters unless otherwise specified. Wrenches shall pass applicable tests in section 5. Conformance with marking and other requirements not determined by test shall be verified by visual examination.

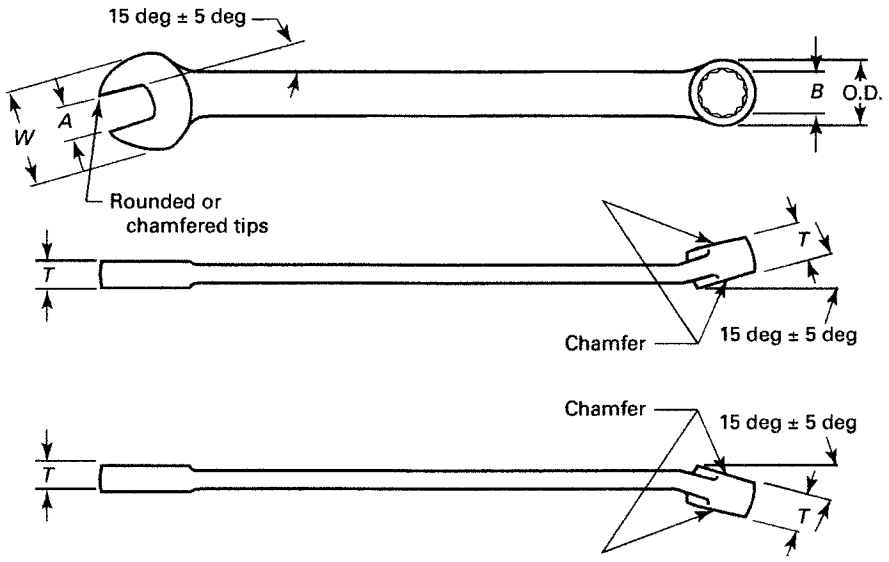
4.1 Design

Wrenches shall provide a well proportioned comfortable handgrip and be similar to the figure to which reference is made. The engaging surfaces of the wrench openings shall be finished in a smooth and well-defined manner. Wrenches that have a box end design shall be chamfered on at least one side to provide a lead for the working surfaces. The tips of all open ends shall have no burrs.

4.1.1 Wrench Openings. Wrench openings shall be such as to ensure acceptance when gaged with gages conforming to ASME B107.17M, and shall conform to one of the following wrenching opening designs:

(a) Standard Single or Double Hexagon Configuration. This design consists of a simple geometric single (6-point) hexagon or a double (12-point) hexagon configuration having an across-flats and an across-corner shape for fitting with hexagon fasteners.

Fig. 1 Combination Wrench



(b) Modified Single or Double Hexagon Configuration. This design consists of a geometric single (6-point) hexagon or a double (12-point) hexagon configuration that does not contact on the fasteners corners.

(c) Open End Configuration. This design consists of a simple geometric configuration having an across-flats shape suitable for use on hexagonal and square-headed bolts and nuts.

4.1.2 B107.6 Combination Wrenches. B107.6 combination wrenches shall have one open end and one 15 deg offset box opening (see Fig. 1).

4.1.3 B107.9 Box Wrenches. B107.9 box wrenches shall have two box ends.

4.1.4 B107.39 Open End Wrenches. B107.39 open end wrenches shall have two open ends.

4.1.5 B107.40 Flare Nut Wrenches. B107.40 flare nut wrenches shall have two 6- or 12-point slotted box wrench ends of different sizes (Type I) or one open end and one with a 6- or 12-point slotted box opening of identical nominal size (Type II) for use with hexagonal flare nuts.

4.2 Materials

The materials used in the manufacturing of wrenches shall be such as to produce wrenches conforming to this Standard.

4.3 Markings

Each wrench shall be marked on one of the faces or on the handle, as close to each head as is practical, in a legible and permanent manner with the respective nominal wrench opening as shown in the first column of the applicable table. In addition to size markings, each wrench shall be marked in a legible and permanent manner with manufacturer's name or trademark of such known character that the manufacturer may be readily determined.

Marking shall be as permanent as the normal life expectancy of the wrench to which it is applied (providing the marked surface has not been subjected to a fretting or abrading action) and be capable of withstanding the cleaning procedures normally experienced during its intended use. The marked area of the wrench may be exempt from the corrosion test in para. 5.3.4 when mutually agreed upon by the manufacturer and customer.

4.4 Hardness

Wrenches shall be heat treated to 38 HRC to 55 HRC when tested as specified in para. 5.1.

4.5 Proof Torque

When tested as specified, wrenches shall withstand the proof torque specified in the applicable tables without failure or permanent deformation (set) that might affect the durability or serviceability of the wrenches. See Tables 1 and 1M.

4.6 Finish

4.6.1 Surface Finish (See Fig. 2). All surfaces shall be free from cracks and essentially free from burrs, pits, nodules, and other detrimental conditions. Flash shall be completely removed from the periphery of the heads of all box ends, from the circumference of all open ends,

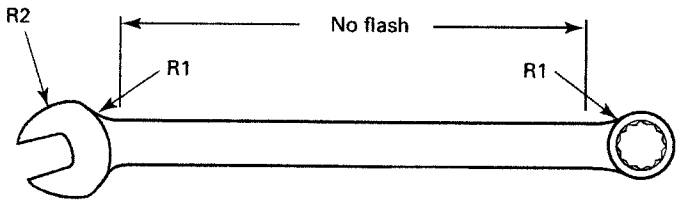
Table 1 Combination Wrench (Inch)

Nominal Wrench Opening Across Flats, *A* or *B*	Maximum Width of Open Head, *W*	Maximum Outside Diameter of Box Head, O.D.	Maximum Permitted Eccentricity of Box Head Opening to Outside Diameter	Thickness of Heads, *T*		Proof Torque, lbf-in.	
				Maximum Open Head	Maximum Box Head	Minimum Open Head	Minimum Box Head
1/8	0.359	0.297	0.015	0.141	0.172	20	60
5/32	0.438	0.313	0.015	0.141	0.172	35	90
3/16	0.500	0.375	0.015	0.172	0.203	45	150
7/32	0.563	0.406	0.015	0.172	0.234	50	165
1/4	0.654	0.478	0.015	0.205	0.295	67	220
9/32	0.688	0.500	0.015	0.215	0.300	78	248
5/16	0.811	0.572	0.015	0.223	0.330	138	275
11/32	0.813	0.612	0.015	0.237	0.335	193	275
3/8	0.906	0.663	0.015	0.250	0.344	275	605
7/16	0.996	0.730	0.015	0.281	0.391	413	715
1/2	1.192	0.824	0.015	0.344	0.394	550	1,020
9/16	1.272	0.924	0.018	0.375	0.425	770	1,500
5/8	1.402	1.000	0.018	0.380	0.531	1,100	2,200
11/16	1.536	1.094	0.020	0.400	0.535	1,375	2,640
3/4	1.672	1.175	0.020	0.406	0.594	1,650	2,860
13/16	1.828	1.344	0.020	0.516	0.609	2,200	3,300
7/8	1.959	1.375	0.023	0.516	0.688	2,475	3,630
15/16	2.078	1.469	0.023	0.594	0.701	3,025	4,510
1	2.250	1.531	0.020	0.625	0.719	3,575	5,390
1 1/16	2.344	1.688	0.023	0.625	0.790	3,850	5,940
1 1/8	2.500	1.724	0.023	0.656	0.860	4,400	6,430
1 3/16	2.630	1.813	0.023	0.688	0.890	5,200	7,200
1 1/4	2.766	1.906	0.023	0.719	0.940	5,775	7,920
1 5/16	2.938	2.063	0.027	0.719	0.940	6,600	8,400
1 3/8	3.063	2.113	0.027	0.750	0.940	7,425	8,970
1 7/16	3.188	2.227	0.027	0.813	0.953	8,250	9,240
1 1/2	3.375	2.395	0.027	0.813	1.008	8,500	10,365
1 9/16	3.563	2.438	0.027	0.813	1.031	8,750	11,495
1 5/8	3.625	2.641	0.031	0.813	1.063	9,000	12,800
1 11/16	3.750	2.790	0.031	0.813	1.063	10,500	13,570
1 3/4	4.000	2.938	0.031	0.875	1.125	11,100	14,300
1 13/16	4.188	2.938	0.037	0.875	1.125	11,750	15,100
1 7/8	4.344	3.125	0.037	0.938	1.125	12,400	15,900
2	4.469	3.125	0.037	0.938	1.125	13,650	17,400
2 1/16	4.594	3.313	0.037	0.938	1.234	14,300	18,200
2 1/8	5.000	3.313	0.046	0.938	1.234	14,900	19,000
2 3/16	5.000	3.313	0.046	0.938	1.234	15,500	19,700
2 1/4	5.000	3.313	0.050	0.938	1.234	16,200	20,500

Table 1M Combination Wrench (Metric)

Nominal Wrench Opening Across Flats, *A* or *B*	Maximum Width of Open Head, *W*	Maximum Outside Diameter of Box Head, O.D.	Maximum Permitted Eccentricity of Box Head Opening to Outside Diameter	Thickness of Heads, *T*		Proof Torque, N·m	
				Maximum Open Head	Maximum Box Head	Minimum Open Head	Minimum Box Head
4	10.8	7.6	0.38	3.7	4.0	4	12
5	12.5	9.0	0.38	3.9	4.6	5	17
5.5	15.5	11.8	0.38	5.3	6.0	5	18
6	17.3	12.7	0.38	5.8	7.4	7	20
7	18.3	14.3	0.38	6.3	7.7	8	27
8	21.4	15.0	0.38	6.3	8.2	15	30
9	21.8	17.4	0.38	6.6	9.0	21	40
10	26.0	18.8	0.38	6.9	9.0	31	71
11	26.0	19.9	0.38	7.0	10.0	46	80
12	27.7	21.4	0.46	8.0	10.0	49	91
13	30.2	23.1	0.46	8.9	10.5	62	115
14	32.8	24.4	0.46	8.9	11.5	86	158
15	34.8	26.0	0.46	8.9	11.5	104	200
16	36.4	27.0	0.46	9.4	12.1	124	248
17	39.7	29.3	0.46	9.8	12.7	139	267
18	41.3	29.3	0.46	10.0	12.7	155	304
19	42.7	31.2	0.46	10.1	14.8	186	323
20	46.4	32.9	0.51	11.4	14.8	217	347
21	47.6	33.8	0.51	11.7	16.3	248	372
22	48.3	35.6	0.51	12.0	16.3	279	408
23	52.4	37.3	0.51	12.4	16.5	310	455
24	53.5	38.1	0.51	12.5	17.8	341	509
25	55.7	40.2	0.51	12.7	17.9	372	559
26	57.2	42.2	0.58	14.0	18.0	403	608
27	60.2	44.2	0.58	14.7	19.8	432	671
28	62.3	45.3	0.58	14.9	19.8	497	710
29	65.5	45.3	0.58	14.9	19.8	514	750
30	67.0	47.5	0.58	15.2	20.0	570	795
31	68.6	48.6	0.58	15.2	20.5	610	850
32	71.0	49.8	0.58	15.7	22.0	650	905
33	73.0	50.3	0.58	15.7	22.3	700	950
34	75.0	52.0	0.58	16.0	23.2	745	994
36	76.8	56.1	0.58	19.0	25.1	894	1 165
41	88.9	62.9	0.70	19.3	25.3	1 154	1 579
46	95.3	68.0	0.70	22.4	25.8	1 453	2 067
50	103.2	76.0	0.70	25.0	27.6	1 716	2 512

Fig. 2 Finish Requirements



and from that portion of the handle that shall be essentially straight and uniform in sectional dimensions, as shown in Fig. 2. Any remaining flash on any surface (see R1 in Fig. 2) shall blend smoothly with adjacent surfaces; external sharp edges shall be broken to 0.016 in. (0.38 mm) radius minimum, and shall not project more than 0.016 in. (0.38 mm) from adjacent surfaces.

4.6.2 Coatings. The coating shall be adherent, smooth, continuous, and free from uncoated areas, pits, blisters, nodules, and any other conditions that would interfere with their protective value and serviceability. Plating contact marks should be kept to a minimum. The wrench shall be coated with one of the coatings in accordance with (a), (b), (c), or (d) below. The customer may specify the type of coating required.

(a) Nickel-Chromium. Wrenches shall have a protective-decorative nickel-chromium plating. The nickel thickness shall be a minimum of 0.000150 in. (0.0038 mm). The chromium thickness shall be a minimum of 0.000003 in. (0.000076 mm). A nickel-iron undercoating (16% iron max.) may be substituted for nickel.

(b) Phosphate. Wrenches shall have a chemically produced phosphate coating followed by a coating of rust preventive.

(c) Oxide. Oxide coated wrenches shall have a coating consisting of a chemically produced oxide followed by a coating of rust preventive.

(d) Alternative Coatings. Wrenches not falling within one of the coating types listed above shall be finished in accordance with predetermined requirements between manufacturer and customer. Alternative coatings may be used in lieu of nickel-chromium and shall be subjected to the Alternative Coating Test as specified in para. 5.3.

5 TESTS

Many of the tests herein are inherently hazardous, and adequate safeguards for personnel and property shall be employed in conducting these tests. These tests are designed to evaluate the tools and materials and do not condone the use of the tools in an environment, or in a manner, inconsistent with safe use of the tools.

5.1 Hardness

Hardness shall be tested in accordance with ASTM E 18. Surface preparation may be necessary to ensure that the hardness of the substrate material is measured.

5.2 Proof Torque Test

Proof Torque Test shall be conducted to determine conformance with the applicable proof torque requirement specified in para. 4.5.

5.2.1 Wrench Preparation. To prepare the wrench for test, suitable reference lines may be scribed on the head and handle. After application of proof torque, examination for permanent deformation shall be made.

5.2.2 Mandrels for Wrench Openings. Suitable mandrels shall fit into the wrench opening and provide proper support and necessary strength for the proof torque applied. The wrenches shall be tested on hexagonal mandrels. Mandrels shall conform to the dimensions and tolerances of Tables 2 and 2M. Mandrels shall be hardened to not less than 55 HRC and smoothly finished on the wrench engaging surfaces.

5.2.3 Application of Proof Torque. The proof torque specified in the applicable table is the torque applied to the test mandrel that tends to rotate the mandrel about its longitudinal axis. Wrench openings shall be gaged prior to testing. The torque shall be applied to mandrels that are fully seated and extend through the wrenching surfaces. The force required to produce the torque shall be applied as far from the mandrel as practical.

(a) Box Ends and Slotted Box Ends. Box ends and slotted box ends shall be torqued to the proof torque. Following the removal of the proof torque, they shall be regaged. Any box end or slotted box end that does not sustain the proof torque, cracks, fractures, or slips on mandrel, or does not meet gage requirements after torquing has failed the test. Wrench failure has also occurred if there is visible permanent distortion in the handle and/or permanent deformation of the box end with respect to the handle in excess of 5 deg.

(b) Open Ends. Open ends shall be torqued to the proof torque. Following the removal of the proof torque,

Table 2 Hexagon Mandrel Dimensions (Inch)

Nominal Size of Wrench Opening	Mandrel Size	Across Flats Tolerance		Across Corners, Min. [Note (1)]
		Plus	Minus	
1/8	0.125	0.001	0.002	0.1403
5/32	0.156	0.001	0.002	0.1745
3/16	0.188	0.001	0.002	0.2095
13/64	0.203	0.001	0.002	0.2268
7/32	0.219	0.001	0.002	0.2440
15/64	0.234	0.001	0.002	0.2610
1/4	0.250	0.001	0.002	0.2780
9/32	0.281	0.001	0.002	0.3133
5/16	0.313	0.001	0.002	0.3495
11/32	0.344	0.001	0.002	0.3860
3/8	0.375	0.001	0.002	0.4225
7/16	0.438	0.001	0.002	0.4935
1/2	0.500	0.001	0.003	0.5635
9/16	0.563	0.001	0.003	0.6339
5/8	0.625	0.001	0.003	0.7055
11/16	0.688	0.001	0.003	0.7769
3/4	0.750	0.001	0.003	0.8485
13/16	0.813	0.001	0.003	0.9201
7/8	0.875	0.001	0.003	0.9917
15/16	0.938	0.001	0.003	1.0631
1	1.000	0.001	0.003	1.1297
1 1/16	1.063	0.001	0.003	1.2013
1 1/8	1.125	0.001	0.003	1.2728
1 3/16	1.188	0.001	0.003	1.3430
1 1/4	1.250	0.001	0.003	1.4160
1 5/16	1.313	0.001	0.003	1.4870
1 3/8	1.375	0.001	0.003	1.5590
1 7/16	1.438	0.001	0.003	1.6310
1 1/2	1.500	0.001	0.003	1.7020
1 9/16	1.563	0.001	0.007	1.7700
1 5/8	1.625	0.001	0.007	1.8410
1 11/16	1.688	0.001	0.007	1.9120
1 3/4	1.750	0.001	0.007	1.9830
1 13/16	1.813	0.001	0.007	2.0540
1 7/8	1.875	0.001	0.007	2.1240
1 15/16	1.938	0.001	0.007	2.1950
2	2.000	0.001	0.007	2.2660
2 1/16	2.063	0.001	0.007	2.3370
2 1/8	2.125	0.001	0.007	2.4080
2 3/16	2.188	0.001	0.007	2.4790
2 1/4	2.250	0.001	0.007	2.5490

NOTE:

(1) For sizes over 1 1/2 in. not listed, multiply nominal size by 1.133055 for mandrel dimension across corners.

Table 2M Hexagon Mandrel Dimensions (Metric)

Nominal Size of Wrench Opening and Mandrel	Across Flats Tolerance		Across Corners, Min. [Note (1)]
	Plus	Minus	
3.2	0.025	0.050	3.57
4	0.025	0.050	4.46
5	0.025	0.050	5.58
5.5	0.025	0.050	6.13
6	0.025	0.050	6.68
6.3	0.025	0.050	7.02
7	0.025	0.050	7.79
8	0.025	0.050	8.95
9	0.025	0.050	10.11
10	0.025	0.050	11.27
11	0.025	0.050	12.40
12	0.025	0.076	13.53
13	0.025	0.076	14.67
14	0.025	0.076	15.80
15	0.025	0.076	16.92
16	0.025	0.076	18.06
17	0.025	0.076	19.20
18	0.025	0.076	20.35
19	0.025	0.076	21.49
20	0.025	0.076	22.64
21	0.025	0.076	23.78
22	0.025	0.076	24.93
23	0.025	0.076	26.07
24	0.025	0.076	27.20
25	0.025	0.076	28.27
26	0.025	0.076	29.38
27	0.025	0.076	30.53
28	0.025	0.076	31.67
29	0.025	0.076	32.81
30	0.025	0.076	33.96
31	0.025	0.076	35.10
32	0.025	0.076	36.25
33	0.025	0.076	37.38
34	0.025	0.076	38.52
35	0.025	0.076	39.68
36	0.025	0.076	40.83
38	0.025	0.076	43.11
40	0.025	0.177	45.32
41	0.025	0.177	46.45
42	0.025	0.177	47.59
46	0.025	0.177	52.12
50	0.025	0.177	56.65

NOTE:

(1) For sizes over 36 mm not listed, multiply nominal size by 1.133055 for mandrel dimension across corners.

they shall be regaged. Open ends that do not sustain the proof torque, cracks, fracture, or slip on the mandrel or exhibit visible handle distortion have failed the test. Wrench failure has also occurred if the open end jaws spread in excess of the "NO GO" gage as specified by ASME B107.17M size by more than the following:

(1) 0.002 in. (0.05 mm) for wrench opening sizes up to and including 1 in. (25 mm)

(2) 0.003 in. (0.08 mm) for wrench opening sizes larger than 1 in. (25 mm)

5.3 Alternative Coating Tests

The Alternative Coating Tests consist of an adhesion, abrasion, and corrosion test specified in paras. 5.3.2, 5.3.3, and 5.3.4. The Alternative Coating Test may also be performed to certify nickel-chromium coating. Passing the Alternative Coating Tests, when agreed to by the customer, exempts the manufacturer from the nickel-chromium thickness requirement of para. 4.6.2(a).

5.3.1 Test Preparation. The quantity and condition of the sample wrenches used for the following testing shall be per the manufacturer's standard practice or as mutually agreed to by the manufacturer and the customer.

5.3.2 Coating Adhesion Test. Sample wrenches shall pass the file or grind-saw test of ASTM B 571.

5.3.3 Coating Abrasion Test. Sample wrenches shall have no base material exposed when subjected to 100 L of falling sand test of ASTM D 968 Method A.

5.3.4 Coating Corrosion Test. Sample wrenches shall be tested for corrosion resistance by exposure to a 48 hr salt spray test, as specified in ASTM B 117, without falling below the ASTM B 537 rating of 6.

6 SAFETY REQUIREMENTS AND LIMITATIONS OF USE

Instructors and employers shall stress proper use and safety in the use of wrenches, information about which can be found in the HTI publication, *Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care.*

ASME B107.8

ADJUSTABLE WRENCHES

1 SCOPE

This Standard provides performance and safety requirements for open-end adjustable wrenches, with rack and worm adjustment, generally used on both hexagonal and square fasteners. Inclusion of dimensional data in this Standard is not intended to imply that all products described herein are stock production sizes. Consumers are requested to consult with manufacturers concerning lists of production sizes.

2 DEFINITIONS

adjusting worm: portion of the wrench used to adjust the clearance between the fixed and movable jaw.

fixed jaw: portion of the frame that contacts the fastener.

frame: portion of the wrench containing the fixed jaw and handle.

handle: portion of the wrench by which the tool is held.

movable jaw: movable portion of the wrench that contacts the fastener.

proof torque: predetermined test torque to which a sample is subjected.

worm pin: pin used to retain the adjusting worm in the frame.

worm spring: spring used to induce friction between the frame and adjusting worm for holding the adjusting worm in any preset position.

See Fig. 1 as applicable.

3 REFERENCES

The following is a list of publications referenced in this Standard. The latest edition shall be used.

ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B 537, Standard Practice for Rating of Electroplated Panels Subjected to Atmospheric Exposure

ASTM B 571, Standard Practice for Qualitative Adhesion Testing of Metallic Coatings

ASTM D 968, Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM E 18, Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

SAE J1703, Motor Vehicle Brake Fluid

Publisher: Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001 (www.sae.org)

Guide to Hand Tools — Selection, Safety Tips, and Proper Use and Care

Publisher: Hand Tools Institute (HTI), 25 North Broadway, Tarrytown, NY 10591 (www.hti.org)

4 CLASSIFICATION

Adjustable wrenches shall be of the following types:
Type I: Standard openings
Type II: Wide openings

5 PERFORMANCE REQUIREMENTS

The figures in this Standard are descriptive and not restrictive, and are not intended to preclude the manufacture of wrenches that are otherwise in accordance with this Standard.

5.1 Design

Wrenches shall consist essentially of a frame (fixed jaw and handle), a movable jaw, and a jaw opening adjustment mechanism. The angle of the opening of the jaw shall be in accordance with Fig. 2. When the wrench is in the full open position, the jaw shall extend to provide full contact across the flat hexagonal bar of a size that fits the full jaw opening specified for Type I wrenches. The wrench shall be designed to allow free movement of the working parts. The wrench may be provided with or without a movable, jaw-locking device.

Wrenches shall pass applicable tests in section 6. Conformance with marking and other requirements not determined by test shall be verified by visual examination.

5.1.1 Frame (Fixed Jaw and Handle). Means shall be provided in the wrench end of the frame for accepting the assembly of the movable jaw and adjusting mechanism. The handgrip end of the handle may be provided with a hole.

Fig. 1 Definitions

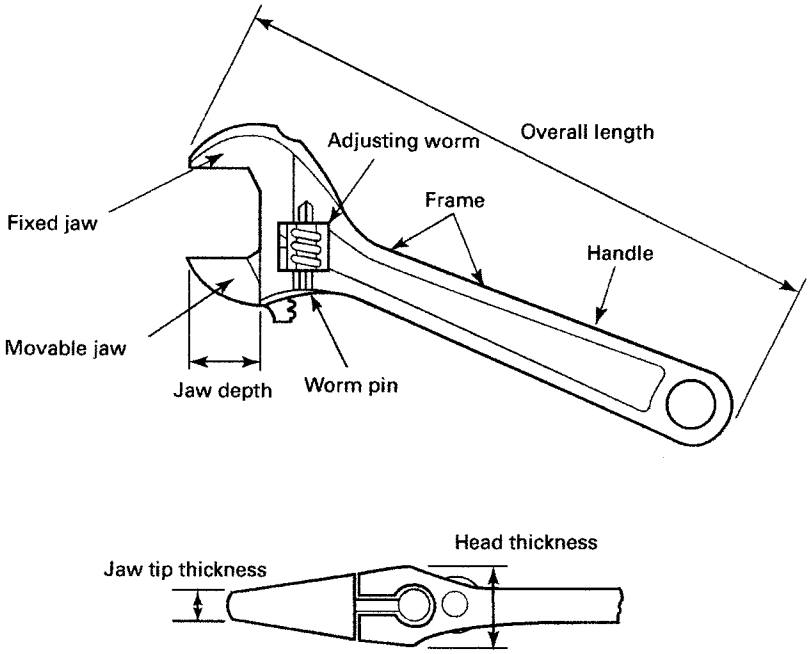


Fig. 2 Test Configuration

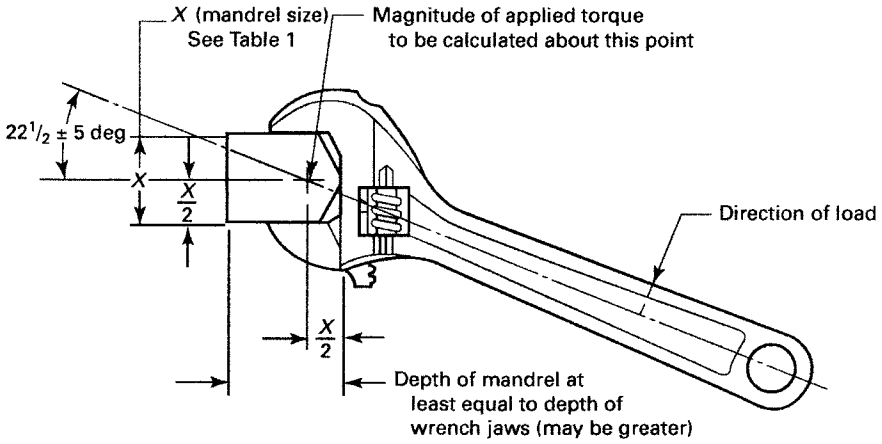
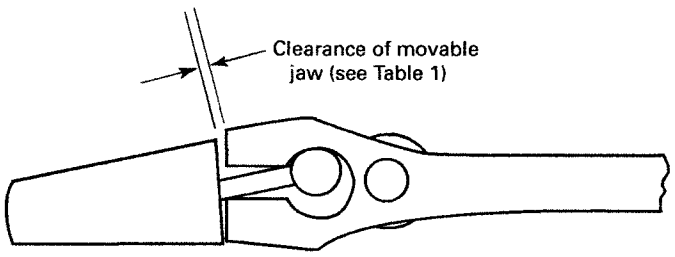


Table 1 Wrench Properties

Nominal Size, in.	Overall Length, in. [Note (1)] Min.	Overall Length, in. [Note (1)] Max.	Min. Jaw Depth, in. Type 1 and 2	Full Opening of Jaw Not Less Than, in. Type 1	Full Opening of Jaw Not Less Than, in. Type 2	Thickness, in. Max. Jaw Tip	Thickness, in. Max. Head	Thickness, in. Max. Handle	Maximum Clearance of Movable Jaw (See Fig. 3), in.	Maximum Parallelism of Movable Jaw (See Fig. 5, Dimension Y), in.	Min. Proof Torque, lbf-in.	Mandrel Sizes, X, Across Flats, +0.000/ −0.005 in.
4	3.5	4.5	0.43	0.504	...	0.250	0.375	0.350	0.012	0.007	600	0.500
6	5.5	6.5	0.65	0.756	0.938	0.281	0.455	0.420	0.012	0.008	1,450	0.750
8	7.5	8.5	0.81	0.947	1.125	0.343	0.575	0.470	0.015	0.008	2,700	0.938
10	9.5	10.5	0.98	1.133	1.290	0.437	0.665	0.570	0.015	0.009	4,500	1.125
12	11.5	12.5	1.14	1.321	1.500	0.531	0.805	0.600	0.015	0.010	7,650	1.312
15	14.5	15.5	1.46	1.698	...	0.625	1.000	0.688	0.015	0.012	15,000	1.688
16	15.7	16.7	1.62	1.875	...	0.656	1.031	0.688	0.015	0.012	15,000	1.875
18	17.5	19.0	1.78	2.062	...	0.718	1.218	0.750	0.015	0.015	20,000	2.062
20	19.5	21.0	2.06	2.375	...	0.781	1.312	0.750	0.015	0.015	20,000	2.375
24	23.5	25.0	2.11	2.438	...	0.906	1.438	0.875	0.018	0.018	25,000	2.438

NOTE:
(1) Overall length is to be measured with comfort grips removed.

Fig. 3 Jaw Clearance Measurement



5.1.2 Movable Jaw. The movable jaw shall be designed to permit free travel throughout the range of opening.

5.1.3 Adjusting Mechanism. The adjusting mechanism shall allow the movable jaw to be positioned at any point in its range and shall include means to hold the movable jaw in position.

5.1.4 Clearance of Movable Jaw. Clearance between the movable jaw and the slide rail of the fixed jaw at any opening within the specified capacity shall not exceed the values shown in Table 1 (see Fig. 3).

5.1.5 Parallelism of Jaw Surfaces. When tested as specified in para. 6.4, jaws shall be parallel within the limits of clearance for the size specified in Table 1.

5.2 Materials

The materials used in the manufacture of the wrenches shall be such as to produce tools conforming to this Standard.

5.3 Marking

Wrenches shall be marked in a legible and permanent manner with the manufacturer's name or with a trademark of such known character that the manufacturer may be readily determined. Marking shall be as permanent as the normal life expectancy of the wrench to which it is applied (providing the marked surface has not been subjected to a fretting or abrading action) and be capable of withstanding the cleaning procedures normally experienced during its intended use. The marked area of the wrench may be exempt from the Corrosion Test in para. 6.5.4 when mutually agreed to by the manufacturer and the customer.

5.4 Hardness

The frame (fixed jaw and handle) and movable jaw shall show a hardness of not less than 40 HRC nor more than 50 HRC when tested as specified in para. 6.1.

5.5 Proof Torque

Wrenches shall withstand the proof torque specified herein for the appropriate size without failure or permanent deformation (set) that might affect the durability or serviceability of the wrench. There shall be no formation of cracks or fracture of any part of the wrench. After proof torque tests, there shall be no resultant binding or loosening of the movable jaw. Before and after the proof torque test, each wrench shall be opened and closed to verify the wrench operates over the full range of the jaw opening.

5.6 Finish

5.6.1 Surface Finish. Wrenches shall be free from rust, fins, burrs, pits, nodules, and other conditions that may impair their performance, durability, or safety. The external forge flash shall be removed to blend smoothly with adjacent surfaces.

5.6.2 Coatings. The frame and the movable jaw shall have one or more of the coatings described below, with the exception of zinc. Adjusting mechanism consisting of worm and worm pin, when provided, shall have any of the following coatings:

(a) Nickel-Chromium Plate. On wrenches with decorative nickel-chromium plating, the minimum thickness shall be 0.00015 in. for nickel and 0.000003 in. for chrome, unless the wrench passes the test in para. 6.5. Nickel iron undercoating (16% iron max.) may be substituted for nickel.

(b) Phosphate. Wrenches having a chemically produced phosphate coating also shall have a coating of rust preventive.

(c) Oxide. Wrenches having a coating consisting of a chemically produced oxide also shall have a coating of rust preventive.

(d) Zinc. Adjusting worms and worm pins may have a coating of electrodeposited zinc of 0.0003 in. minimum thickness.

(e) Alternative Coatings. Alternative coatings may be used in lieu of nickel-chromium and shall be subjected to the Alternative Coating Test, as specified in para. 6.5.

5.7 Comfort Grips

When comfort grips are furnished on handles, they shall be made of rubber, plastic, or other suitable material capable of normal use without deteriorating or rubbing off, and shall pass the solvent test specified in para. 6.7. The comfort grips shall remain permanently attached under normal use of the tool. Unless specifically designed, labeled, and tested for such use, tools with comfort grips shall not be advertised or marked as having any nonconductive or electrically insulating properties.

6 TESTS

Many of the tests herein are inherently hazardous, and adequate safeguards for personnel and property shall be employed in conducting these tests.

6.1 Hardness

Hardness shall be tested in accordance with ASTM E 18. Surface preparation may be necessary to ensure that the hardness of the substrate material is measured.

6.2 Clearance of Movable Jaw

The clearance of the movable jaw shall be measured, before proof torque testing, throughout its operating range to determine compliance with para. 5.1.4. With the movable jaw pressed firmly by hand to one side, a feeler gage of the applicable size specified in Table 1 shall not enter the space between one side of the movable jaw base and the slide rail of the fixed jaw (see Fig. 3). The test shall then be repeated with the jaw pressed to the opposite side.

6.3 Proof Torque

6.3.1 Mandrels for Wrench Openings. Wrenches shall be tested on a mandrel conforming to Table 1 and Fig. 4 for the size of wrench indicated.

6.3.2 Wrench Preparation. To prepare the wrench for test, suitable reference lines may be scribed on the frame. After application of proof torque, examination for permanent deformation shall be made.

6.3.3 Application of Proof Torque. The torque shall be applied with a suitable torque-producing machine. The torque shall be applied and then removed. The direction of loading shall be as shown in Fig. 2. It is important that the jaws are tight on the mandrel; otherwise, secondary stress will be introduced by the mandrel.

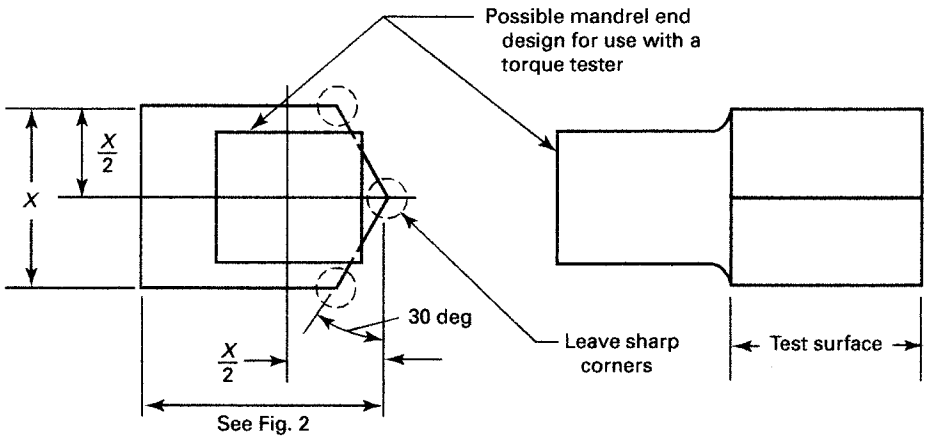
6.4 Parallelism of Jaw Surfaces

The parallelism of opposite jaw faces shall be measured before and after torque tests to determine compliance with para. 5.1.5. The parallelism shall be determined by the use of a gage block and step block conforming to the requirements shown in Fig. 5. With the gage block placed between the jaw faces as near to the bottom of the opening as possible (see Fig. 5), insert the step block between the jaw tip and the surface of the gage block. The GO portion of the step block shall enter the space between the jaw tip and the gage block and the NO GO portion of the step block shall not enter the space between the jaw tip and the gage block.

6.5 Alternative Coating Test

The test consists of an adhesion, abrasion, and corrosion test specified in paras. 6.5.2, 6.5.3, and 6.5.4.

Fig. 4 Mandrel Configuration



6.5.1 Test Preparation. The quantity and condition of the wrenches used for this testing shall be per the manufacturer's standard practice or as mutually agreed upon by the manufacturer and the customer.

6.5.2 Adhesion Test. Sample wrenches shall pass the file or grind-saw test of ASTM B 571.

6.5.3 Abrasion Test. Sample wrenches shall have no base material exposed after being subjected to 100 L of falling sand, per ASTM D 968 Method A.

6.5.4 Corrosion Test. The exterior surfaces of sample wrenches shall be tested for corrosion resistance by exposure to a 48 hr salt spray test, as specified in ASTM B 117, without falling below the ASTM B 537 rating of 6.

6.6 Drop Test

The wrench shall be dropped on concrete from a height of 6 ft 12 times. The movable jaw shall be at least halfway open when dropped. After this test, all component parts shall remain properly assembled, and the movable jaw and adjustment mechanism shall work satisfactorily.

6.7 Comfort Grip Solvent Test

6.7.1 Purpose. This test is used to ensure that comfort grips have adequate resistance to solvents encountered during normal use.

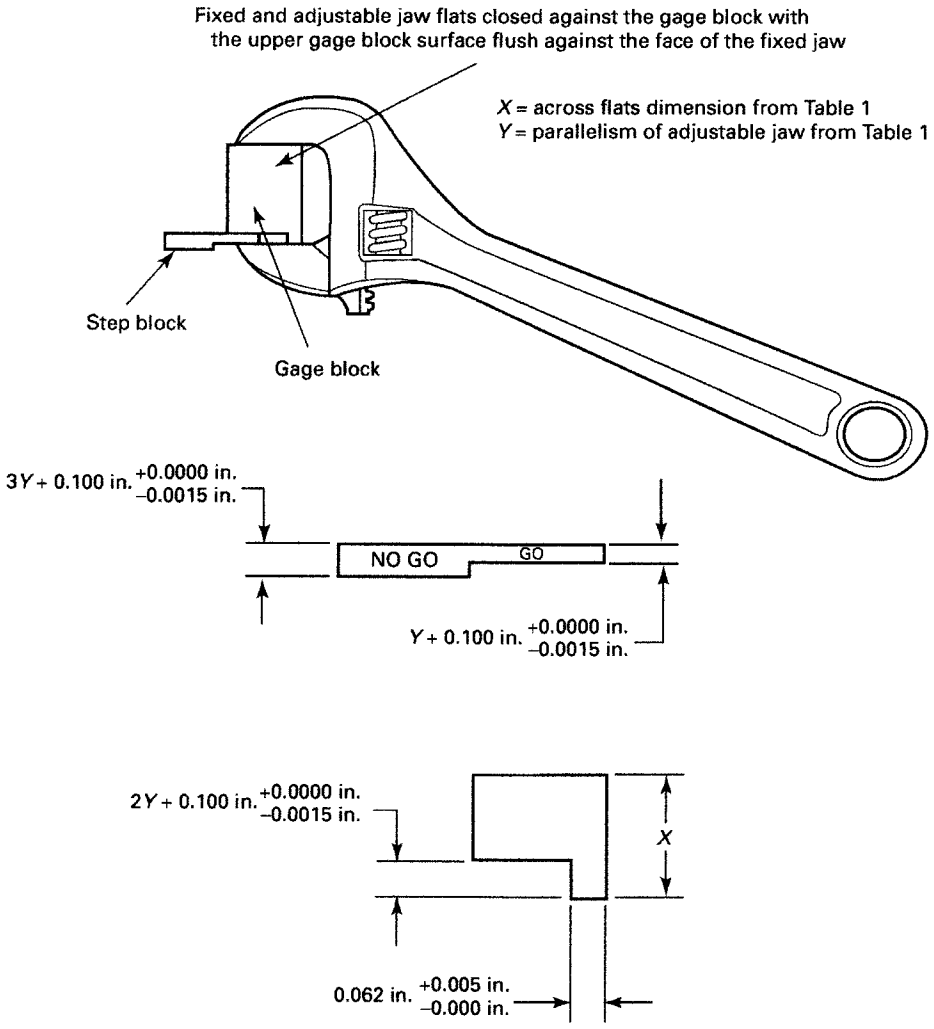
6.7.2 Apparatus. Any suitable container for the solvent may be used. Care should be taken to provide adequate ventilation of solvent fumes.

6.7.3 Procedure. Solvent tests shall be conducted at room temperature. The material being tested shall be fully immersed in the test fluids specified herein. New samples shall be used for each test fluid. Samples shall be immersed for 15 min to 20 min, removed, and allowed to dry for 24 hr to 28 hr. Test fluids are SAE J1703 brake fluid, gasoline, ethylene glycol, and ethyl alcohol. There shall be no significant swelling or surface attack of the material being tested. Comfort grips shall be tested while attached to the handles. Cushion grip throats, inserts, and sleeves that are not dependent on friction or adhesives for attachment may be tested separately.

7 SAFETY REQUIREMENTS AND LIMITATIONS OF USE

Instructors and employers shall stress the proper use and safety in the use of adjustable wrenches, information about which can be found in the HTI publication, *Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care.*

Fig. 5 Parallelism Measurement



ASME B107.9

BOX WRENCHES, DOUBLE HEAD

1 SCOPE

This Standard provides the tables and figures for box wrenches. Performance and safety requirements are provided in B107.6.

2 CLASSIFICATION

Box wrench, double head

Type I: 15 deg offset each end

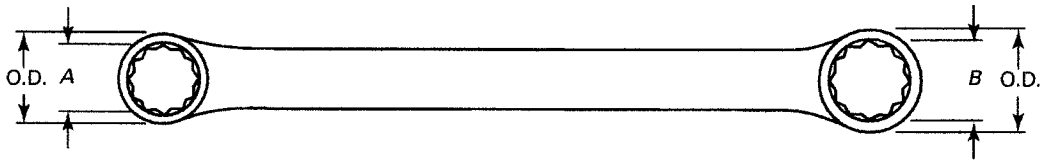
Type II: modified offset each end

Type III: deep offset each end

3 REFERENCES

See references in ASME B107.6, Combination Wrenches.

Fig. 1 Type I Box Wrench



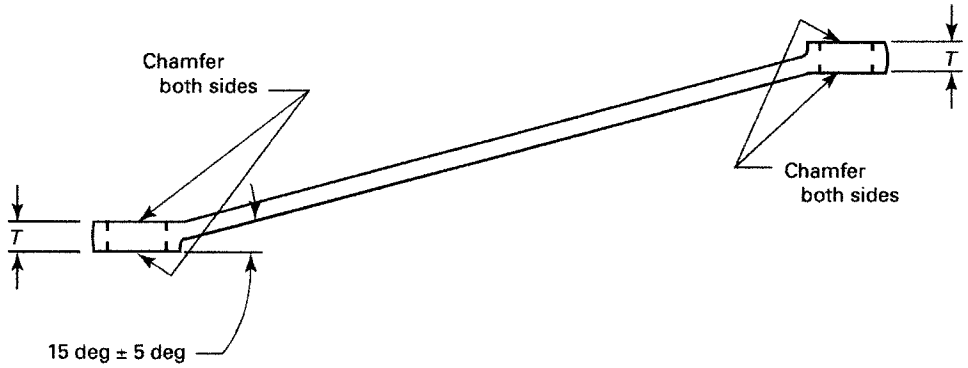


Fig. 2 Type I Box Wrench (Alternate Construction)

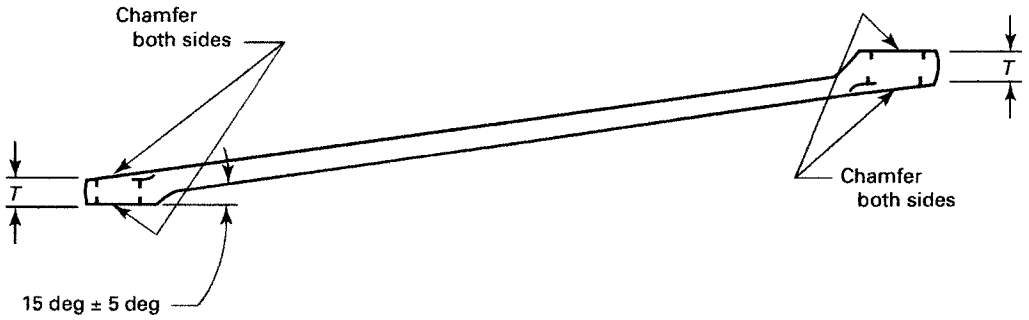
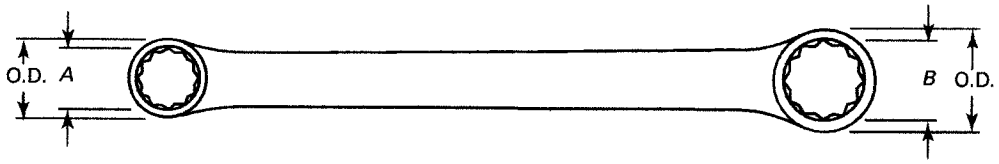


Fig. 3 Type II Box Wrench



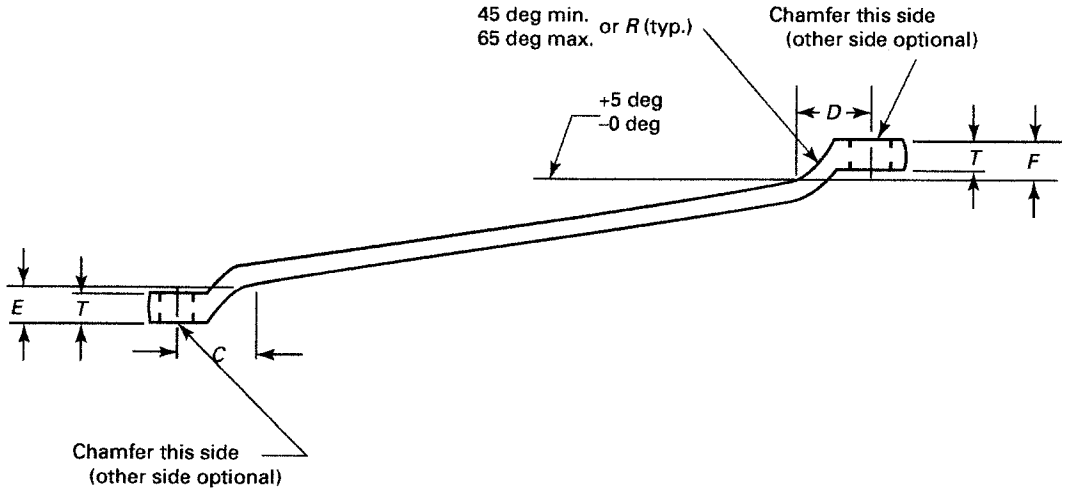


Fig. 4 Type III Box Wrench

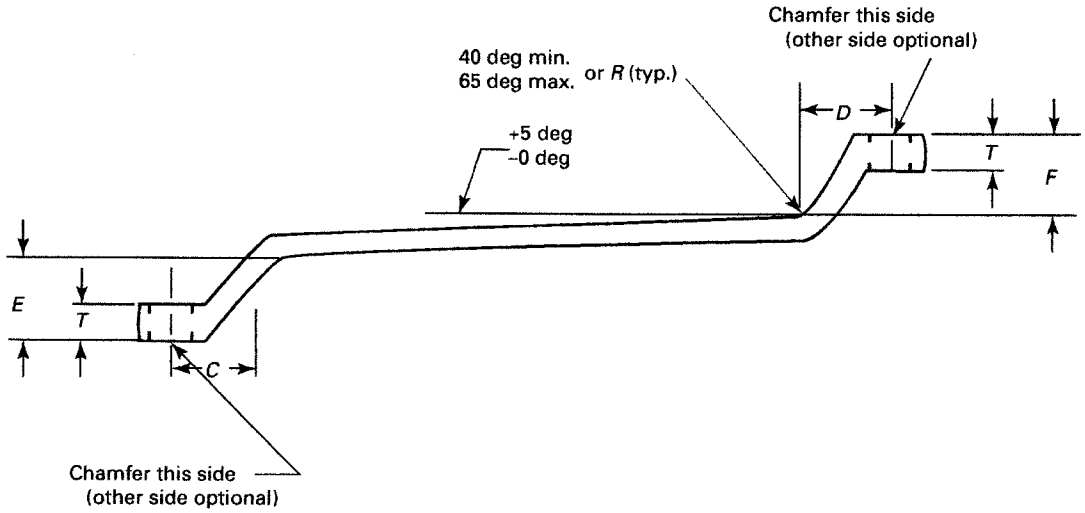


Table 1 Box Wrench (Inch)

Nominal Wrench Opening Across Flats		Outside Diameter of Box Head, O.D.		Permitted Eccentricity of Box Head Opening to Outside Diameter		Thickness of Box Head, *T*		Center Line of Opening to Point Where Offset Blends With Handle *C* and *D*				Height From Opening to Point Where Offset Blends With Handle *E* and *F*				Proof Torque, lbf-in.	
								Type II		Type III		Type II		Type III			
Small Head, *A*	Large Head, *B*	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.
3/16	13/64	0.375	0.391	0.015	0.015	0.203	0.203	0.906	0.906	0.906	0.906	0.156	0.188	0.188	0.250	150	165
3/16	7/32	0.375	0.406	0.015	0.015	0.203	0.234	...	...	0.906	0.969	...	...	0.188	0.281	150	165
7/32	15/64	0.406	0.406	0.015	0.015	0.234	0.234	0.969	1.125	0.969	1.031	0.188	0.219	0.281	0.281	165	184
7/32	1/4	0.406	0.478	0.015	0.015	0.234	0.295	0.969	1.125	0.969	1.250	0.188	0.219	0.281	0.219	165	220
1/4	9/32	0.478	0.500	0.015	0.015	0.295	0.300	1.125	1.125	1.250	1.250	0.219	0.219	0.219	0.281	220	248
1/4	5/16	0.478	0.572	0.015	0.015	0.295	0.330	1.125	1.125	1.250	1.375	0.219	0.275	0.219	0.297	220	275
5/16	11/32	0.572	0.612	0.015	0.015	0.330	0.335	1.125	1.188	1.375	1.375	0.275	0.281	0.297	0.344	275	275
5/16	3/8	0.572	0.663	0.015	0.015	0.330	0.344	1.125	1.188	1.375	1.375	0.275	0.287	0.297	0.500	275	605
3/8	7/16	0.663	0.730	0.015	0.015	0.344	0.391	1.188	1.375	1.375	1.375	0.287	0.295	0.500	0.500	605	715
7/16	1/2	0.730	0.824	0.015	0.015	0.391	0.394	1.375	1.603	1.375	1.438	0.295	0.297	0.500	0.500	715	1,020
7/16	9/16	0.730	0.924	0.015	0.018	0.391	0.425	...	...	1.375	1.438	...	...	0.500	0.500	715	1,500
1/2	9/16	0.824	0.924	0.015	0.018	0.394	0.425	1.603	1.792	1.438	1.438	0.297	0.375	0.500	0.500	1,020	1,500
9/16	5/8	0.924	1.000	0.018	0.018	0.425	0.531	1.792	2.051	1.438	1.563	0.375	0.452	0.500	0.625	1,500	2,200
19/32	25/32	0.969	1.250	0.018	0.020	0.438	0.602	...	...	...	...	...	...	...	...	1,850	3,080
5/8	11/16	1.000	1.109	0.018	0.020	0.531	0.535	2.051	2.217	1.563	1.563	0.452	0.461	0.625	0.719	2,200	2,640
5/8	3/4	1.000	1.175	0.018	0.020	0.531	0.594	2.051	2.276	1.563	1.688	0.452	0.500	0.625	0.750	2,200	2,860
11/16	3/4	1.109	1.175	0.020	0.020	0.535	0.594	2.217	2.276	1.563	1.688	0.461	0.500	0.719	0.750	2,640	2,860
11/16	13/16	1.109	1.344	0.020	0.020	0.535	0.609	...	...	1.563	1.688	...	...	0.719	0.750	2,640	3,300
3/4	13/16	1.175	1.344	0.020	0.020	0.594	0.609	2.276	2.477	...	...	0.500	0.625	...	...	2,860	3,300
3/4	7/8	1.175	1.375	0.020	0.020	0.594	0.688	2.276	2.518	1.688	1.750	0.500	0.625	0.750	0.750	2,860	3,630
13/16	7/8	1.344	1.375	0.020	0.020	0.609	0.688	2.477	2.518	1.688	1.750	0.625	0.625	0.750	0.750	3,300	3,630
13/16	15/16	1.344	1.469	0.020	0.023	0.609	0.701	...	...	1.688	2.063	...	...	0.750	0.750	3,300	4,510
7/8	15/16	1.375	1.469	0.020	0.023	0.688	0.701	2.518	2.790	1.750	2.063	0.625	0.688	0.750	0.750	3,630	4,510
15/16	1	1.469	1.531	0.023	0.023	0.701	0.719	2.790	2.826	2.063	2.063	0.688	0.750	0.750	1.000	4,510	5,390
15/16	1 1/16	1.469	1.688	0.023	0.023	0.701	0.790	...	...	...	...	...	...	...	...	4,510	5,940
1	1 1/16	1.531	1.688	0.023	0.023	0.719	0.790	2.826	3.500	...	...	0.750	0.766	...	...	5,390	5,940
1 1/16	1 1/8	1.688	1.724	0.023	0.023	0.790	0.860	3.500	3.875	2.188	2.438	0.766	0.797	1.000	1.000	5,940	6,430
1 1/16	1 1/4	1.688	1.906	0.023	0.023	0.790	0.940	3.500	4.125	...	...	0.766	0.875	...	...	5,940	7,920
1 1/8	1 3/16	1.724	1.813	0.023	0.023	0.860	0.890	3.875	3.875	...	...	0.797	0.797	...	...	6,430	7,200
1 1/8	1 5/16	1.724	2.063	0.023	0.027	0.860	0.940	3.875	4.250	...	...	0.797	0.875	...	...	6,430	8,400

Table 1 Box Wrench (Inch) (Cont'd)

Nominal Wrench Opening Across Flats		Outside Diameter of Box Head O.D.		Permitted Eccentricity of Box Head Opening to Outside Diameter		Thickness of Box Head, *T*		Center Line of Opening to Point Where Offset Blends With Handle *C* and *D*				Height From Opening to Point Where Offset Blends With Handle *E* and *F*				Proof Torque, lbf-in.	
								Type II		Type III		Type II		Type III			
Small Head, *A*	Large Head, *B*	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.
1 1/8	1 3/8	1.724	2.113	0.023	0.027	0.860	0.940	...	...	2.438	2.536	...	...	1.000	1.000	6,430	8,970
1 3/16	1 5/16	1.813	2.063	0.023	0.027	0.890	0.940	3.875	4.250	...	...	0.797	0.875	...	...	7,200	8,400
1 1/4	1 5/16	1.906	2.063	0.023	0.027	0.940	0.940	4.125	4.250	...	...	0.875	0.875	...	...	7,920	8,400
1 1/4	1 3/8	1.906	2.113	0.023	0.027	0.940	0.940	...	...	...	...	...	...	...	...	7,920	8,970
1 1/4	1 7/16	1.906	2.227	0.027	0.027	0.940	0.953	...	...	2.563	2.813	...	...	1.000	1.000	7,920	9,240
1 5/16	1 1/2	2.063	2.395	0.027	0.027	0.940	1.008	...	...	2.563	2.813	...	...	1.000	1.188	8,400	10,365
1 3/8	1 7/16	2.113	2.227	0.027	0.027	0.940	0.953	4.250	4.375	...	...	1.125	1.175	...	...	8,970	9,240
1 3/8	1 1/2	2.113	2.395	0.027	0.027	0.940	1.008	...	...	2.563	2.813	...	...	1.000	1.188	8,970	10,365
1 7/16	1 1/2	2.227	2.395	0.027	0.027	0.953	1.008	...	...	2.813	2.813	...	...	1.000	1.188	9,240	10,365
1 7/16	1 5/8	2.227	2.641	0.027	0.031	0.953	1.063	...	...	2.813	2.813	...	...	1.000	1.313	9,240	12,800
1 1/2	1 5/8	2.395	2.641	0.027	0.031	1.008	1.063	4.375	4.500	...	...	1.225	1.325	...	...	10,365	12,800
1 1/2	1 11/16	2.395	2.790	0.027	0.031	1.008	1.063	...	...	2.813	2.813	...	...	1.188	1.313	10,365	13,570

Table 1M Box Wrench (Metric)

Nominal Wrench Opening Across Flats		Outside Diameter of Box Head O.D.		Permitted Eccentricity of Box Head Opening to Outside Diameter		Thickness of Box Head, *T*		Center Line of Opening to Point Where Offset Blends With Handle *C* and *D*				Height From Opening to Point Where Offset Blends With Handle *E* and *F*				Proof Torque, N·m	
								Type II		Type III		Type II		Type III			
Small Head, *A*	Large Head, *B*	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.
6	7	12.7	14.3	0.38	0.38	7.4	7.7	16.3	20.0	20.3	21.6	4.5	5.0	5.0	5.1	20	27
6	8	12.7	15.0	0.38	0.38	7.4	8.2	...	...	...	...	...	...	...	...	20	30
7	8	14.3	15.0	0.38	0.38	7.7	8.2	20.0	25.0	...	...	5.0	6.0	...	...	27	30
7	9	14.3	17.4	0.38	0.38	7.7	9.0	20.0	30.0	...	...	5.0	7.1	...	...	27	40
8	9	15.0	17.4	0.38	0.38	8.2	9.0	25.0	30.0	21.6	22.9	6.0	7.1	5.1	7.0	30	40
8	10	15.0	18.8	0.38	0.38	8.2	9.0	25.0	31.8	...	...	6.0	7.3	...	...	30	71
9	10	17.4	18.8	0.38	0.38	9.0	9.0	30.0	31.8	22.9	24.1	7.1	7.3	7.0	7.6	40	71
9	11	17.4	19.9	0.38	0.38	9.0	10.0	30.0	35.3	22.9	29.6	7.1	7.3	7.0	8.5	40	80
10	11	18.8	19.9	0.38	0.38	9.0	10.0	31.8	35.3	24.1	29.6	7.3	7.3	7.6	8.5	71	80
10	12	18.8	21.4	0.38	0.46	9.0	10.0	31.8	35.6	...	...	7.3	7.5	...	...	71	91
10	13	18.8	23.1	0.38	0.46	9.0	10.5	31.8	41.3	...	...	7.3	7.5	...	...	71	115
11	12	19.9	21.4	0.38	0.46	10.0	10.0	35.3	35.6	29.6	30.0	7.3	7.5	8.5	9.5	80	91
11	13	19.9	23.1	0.38	0.46	10.0	10.5	35.3	41.3	...	...	7.3	7.5	...	...	80	115
12	13	21.4	23.1	0.46	0.46	10.0	10.5	35.6	41.3	30.0	30.6	7.5	7.5	9.5	10.0	91	115
12	14	21.4	24.4	0.46	0.46	10.0	11.5	35.6	41.6	30.0	30.6	7.5	9.5	9.5	10.2	91	158
13	14	23.1	24.4	0.46	0.46	10.5	11.5	41.3	41.6	30.6	30.6	7.5	9.5	10.0	10.2	115	158
13	15	23.1	26.0	0.46	0.46	10.5	11.5	41.3	42.2	30.6	33.5	7.5	11.0	10.0	10.8	115	200
14	15	24.4	26.0	0.46	0.46	11.5	11.5	41.6	42.2	30.6	33.5	9.5	11.0	10.2	10.8	158	200
15	16	26.0	27.0	0.46	0.46	11.5	12.1	...	...	33.5	34.0	...	...	10.8	11.4	200	248
15	17	26.0	29.3	0.46	0.46	11.5	12.7	42.2	54.0	33.5	35.8	11.0	12.7	10.8	11.4	200	267
15	18	26.0	29.3	0.46	0.46	11.5	12.7	42.2	56.9	...	...	11.0	12.7	...	...	200	304
16	17	27.0	29.3	0.46	0.46	12.1	12.7	52.1	54.0	34.0	35.8	12.7	12.7	11.4	11.4	248	267
16	18	27.0	29.3	0.46	0.46	12.1	12.7	52.1	56.9	34.0	37.0	12.7	12.7	11.4	12.7	248	304
16	19	27.0	31.2	0.46	0.46	12.1	14.8	...	...	...	...	...	...	...	...	248	323
17	19	29.3	31.2	0.46	0.46	12.7	14.8	54.0	57.8	35.8	41.7	12.7	12.7	11.4	13.3	267	323
18	19	29.3	31.2	0.46	0.46	12.7	14.8	56.9	57.8	37.0	41.7	12.7	12.7	12.7	13.3	304	323
18	20	29.3	32.9	0.46	0.51	12.7	14.8	...	...	37.0	42.5	...	...	12.7	14.0	304	347
18	21	29.3	33.8	0.46	0.51	12.7	16.3	56.9	63.5	...	...	12.7	16.2	...	...	304	372
19	20	31.2	32.9	0.46	0.51	14.8	14.8	57.8	63.2	41.7	42.5	12.7	16.2	13.3	14.0	323	347
19	21	31.2	33.8	0.46	0.51	14.8	16.3	...	...	41.7	44.2	...	...	13.3	20.3	323	372

Table 1M Box Wrench (Metric) (Cont'd)

Nominal Wrench Opening Across Flats		Outside Diameter of Box Head O.D.		Permitted Eccentricity of Box Head Opening to Outside Diameter		Thickness of Box Head, *T*		Center Line of Opening to Point Where Offset Blends With Handle *C* and *D*				Height From Opening to Point Where Offset Blends With Handle *E* and *F*				Proof Torque, N·m	
								Type II		Type III		Type II		Type III			
Small Head, *A*	Large Head, *B*	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Max.	Large Head, *B*, Max.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.	Small Head, *A*, Min.	Large Head, *B*, Min.
19	22	31.2	35.6	0.46	0.51	14.8	16.3	57.8	66.0	...	...	12.7	16.6	...	...	323	408
20	22	32.9	35.6	0.51	0.51	14.8	16.3	63.2	66.0	42.5	45.7	16.2	16.6	14.0	20.3	347	408
21	22	33.8	35.6	0.51	0.51	16.3	16.3	63.5	66.0	...	...	16.2	16.6	...	...	372	408
21	23	33.8	37.3	0.51	0.51	16.3	16.5	63.5	68.6	44.2	45.7	16.2	16.6	20.3	20.3	372	455
21	24	33.8	38.1	0.51	0.51	16.3	17.8	63.5	71.6	...	...	16.2	17.1	...	...	372	509
22	23	35.6	37.3	0.51	0.51	16.3	16.5	...	...	45.7	45.7	...	...	20.3	20.3	408	455
22	24	35.6	38.1	0.51	0.51	16.3	17.8	66.0	71.6	45.7	50.0	16.6	17.1	20.3	20.6	408	509
23	24	37.3	38.1	0.51	0.51	16.5	17.8	68.6	71.6	...	...	16.6	17.1	...	...	455	509
24	26	38.1	42.2	0.51	0.58	17.8	18.0	71.6	75.7	50.0	56.0	17.1	18.1	20.6	26.8	509	608
24	27	38.1	44.2	0.51	0.58	17.8	19.8	71.6	88.9	...	...	17.1	19.4	...	...	509	671
25	28	40.2	45.3	0.51	0.58	17.9	19.8	71.8	89.8	52.8	61.9	18.1	19.4	25.0	29.7	559	710
26	29	42.2	45.3	0.58	0.58	18.0	19.8	75.7	93.7	56.0	61.9	18.1	20.2	26.8	32.1	608	750
27	30	44.2	47.5	0.58	0.58	19.8	20.0	88.9	94.5	...	...	19.4	21.8	...	...	671	795
27	32	44.2	49.8	0.58	0.58	19.8	22.0	88.9	96.8	61.9	63.9	19.4	21.8	29.7	37.5	671	905
28	32	45.3	49.8	0.58	0.58	19.8	22.0	...	...	...	...	...	...	...	...	710	905
30	32	47.5	49.8	0.58	0.58	20.0	22.0	94.5	96.8	...	...	21.8	21.8	...	...	795	905

ASME B107.21

WRENCH, CROWFOOT

1 SCOPE

This Standard provides performance and safety requirements for crowfoot wrenches having a wrench component of the open end type or flare nut type. Each type is designed to receive the external drive end of a socket wrench handle. Inclusion of dimensional data in this Standard 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.

2 CLASSIFICATION

Type I: Crowfoot wrench, flare nut
Class 1: standard duty (see Fig. 1)
Class 2: heavy duty (see Fig. 2)
Type II: Crowfoot wrench, open end
Class 1: standard duty
Class 2: heavy duty

3 REFERENCES

The following is a list of publications referenced in this Standard. The latest editions should be used.

ASME B107.4, Driving and Spindle Ends for Portable Hand, Impact, Air, and Electric Tools (Percussion Tools Excluded)

ASME B107.17M, Gages, Wrench Openings, Reference

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B 537, Standard Practice for Rating of Electroplated Panels Subjected to Atmospheric Exposure

ASTM B 571, Standard Test Methods for Adhesion of Metallic Materials

ASTM D 968, Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM E 18, Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care

Publisher: Hand Tools Institute (HTI), 25 North Broadway, Tarrytown, NY 10591 (www.hti.org)

4 PERFORMANCE REQUIREMENTS

The illustrations shown herein are descriptive and not restrictive, and are not intended to preclude the manufacture of wrenches that are otherwise in accordance with this Standard.

4.1 Marking

Each wrench shall be marked in a permanent manner with the nominal wrench opening size and the manufacturer's name or trademark of such known character that the manufacturer may be readily determined.

4.2 Materials

The materials used in the manufacture of the wrenches shall be such as to produce wrenches conforming to this Standard.

4.3 Hardness

The wrench shall be heat treated to a hardness of 38 HRC to 54 HRC.

4.4 Proof Torque

When tested as specified, wrenches shall withstand the proof torque specified in the applicable tables without failure or permanent deformation (set), which might affect durability or serviceability of the wrenches.

4.5 Wrench Openings

4.5.1 Wrench openings shall be such as to ensure acceptance when gaged with gages conforming to ASME B107.17M.

4.5.2 Internal drive end dimensions shall conform to ASME B107.4, except as noted in para. 4.7. Two sides of the internal drive square shall be parallel to the longitudinal axis of the socket wrench within ±3 deg.

4.5.3 The wrench opening shall conform to one of the following wrenching opening designs:

(a) Standard Single or Double Hexagon Configuration. This design consists of a simple geometric single

Fig. 1 Type I, Class 1 Crowfoot Wrench, Flare Nut, Standard Duty

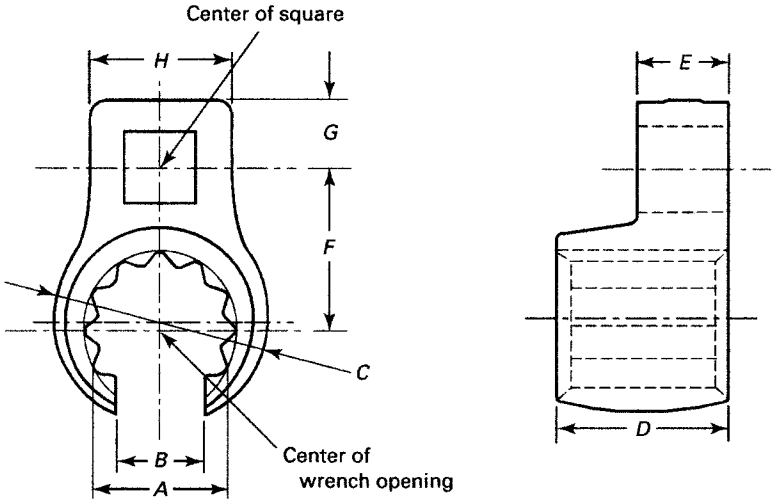
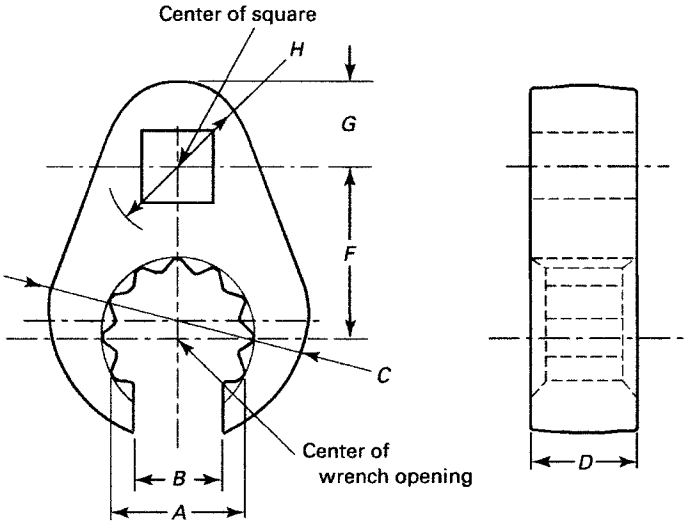


Fig. 2 Type I, Class 2 Crowfoot Wrench, Flare Nut, Heavy Duty



(6-point) hexagon or a double (12-point) hexagon configuration having an across-flats and an across-corner shape for fit up with hexagon fasteners.

(b) Modified Single or Double Hexagon Configuration. This design consists of a geomtric single (6-point) hexagon or a double (12-point) hexagon configuration having an across-flats and a modified or radial relieved across-corner shape to ensure noncontact with the corners of hexagon and 12-point fasteners.

(c) Open End Configuration. This design consists of a simple geometric configuration having an across-flats shape for fit up with hexagon fasteners.

4.6 Finish

Wrenches shall be free from rust, burrs, pits, nodules, blisters, cracks, or other conditions that may impair serviceability, safety, durability, or appearance.

4.6.1 Surface Finish. Forge flash shall be completely removed from the periphery of the drive end and the flare nut and open end portions of the wrench. Any remaining forge flash on any remaining surfaces between the heads shall blend smoothly with adjacent surfaces. External sharp edges shall be broken to 0.016 in. (0.41 mm) radius minimum, and shall not project more than 0.016 in. (0.41 mm) from adjacent surfaces.

4.6.2 Coatings. The wrench shall be coated with one of the coatings in accordance with para. 4.6.2(a), (b), or (c).

(a) Nickel-Chromium Plate. The coatings shall be electrodeposited metals consisting of nickel followed by chromium. The minimum thickness shall be 0.00015 in. (0.0038 mm) for nickel or iron-nickel, and 0.000003 in. (0.000076 mm) for chromium, unless the wrench passes the test in para. 5.3.

(b) Oxide Coating or Phosphate Coating. Coating shall consist of a chemically produced oxide or phosphate, followed with a coating of rust preventive.

(c) Alternative Coatings. Alternative coatings may be used in lieu of nickel-chromium and shall be subjected to the Alternative Coating Test as specified in para. 5.3.

4.7 Design

Wrenches shall be designed to allow accessibility to fasteners in confined and restricted areas. The internal drive surfaces, and the nut and bolt head engaging surfaces of the flare nut and open end openings, shall be finished in a smooth and well-defined manner. The corners and/or serrations in the openings shall be clearly defined (not smeared or torn).

Type I wrenches shall be chamfered on both sides to provide a lead for the working surfaces. The slotted opening on Type I wrenches, and tips of all open ends on Type II wrenches, shall be chamfered or rounded to eliminate burrs.

When the internal drive end is furnished with a hole or recess for engagement of the ball/plunger on corresponding external drive end, and the length of engagement of the external drive tang is less than twice the dimension of D_f in Table 7 of ASME B107.4, the hole or recess shall be central in the corresponding internal drive.

4.7.1 Type I, Flare Nut. Type I wrenches shall have the flare nut design (see Figs. 1 and 2). The wrench shall have an internal drive opening at one end and a wrench opening to drive hexagonal fasteners. See Tables 1 through 4M. The slotted opening may be rotated from the centerline of the wrench.

4.7.2 Type II, Open End. Type II wrenches shall have the open end design (see Fig. 3). The wrench shall have an internal drive opening at one end and open wrench end at the other end. See Tables 5 through 7.

5 TESTS

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

5.1 Hardness

Hardness shall be tested in accordance with ASTM E 18. When surface preparation is necessary, the amount of material removed shall not exceed 0.007 in. (0.18 mm) in the area contaced by the indenter.

5.2 Proof Torque Test

5.2.1 Mandrels for Wrench Openings. The wrenches shall be tested on mandrels conforming to Table 8 or Table 8M as applicable. Mandrels shall be hardened to a minimum of 55 HRC and smoothly finished on the wrench engaging surfaces.

5.2.2 Application of Proof Torque. Wrench openings shall be gaged prior to testing. The torque shall be applied with a suitable torque producing machine to mandrels that are fully seated and extend through the wrenching surfaces. Above 50% of peak value, torque shall be applied at a speed of 15 deg/min to 30 deg/min until peak value is verified, then torque shall be released. Following the removal of the proof torque, wrench openings will be regaged. Wrenches that do not sustain the proof torque or crack, fracture, or slip on the mandrel, have failed the test. The wrench shall also be considered to have failed the test if there is permanent spreading of the open end jaw in excess of the "NO GO" gage sizes of ASME B107.17M by more than the following at the tips:

Table 1 Type I, Class 1, Flare Nut, 1/4 in. Square Drive, Standard Duty

Nominal Wrench Opening, *A*	Dimensions, in.							Minimum Proof Torque, lbf-in.
	Slot Opening, *B*, Min.	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Drive End Thickness, *E*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Width, *H*, Max.	
3/16	0.105	0.437	0.312	0.250	0.484	0.265	0.515	50
7/32	0.105	0.437	0.312	0.250	0.484	0.265	0.515	50
1/4	0.117	0.500	0.312	0.250	0.484	0.265	0.515	60
9/32	0.117	0.500	0.312	0.250	0.484	0.265	0.515	60
5/16	0.142	0.535	0.344	0.282	0.484	0.265	0.515	75
11/32	0.142	0.562	0.344	0.282	0.484	0.265	0.515	75
3/8	0.193	0.625	0.531	0.312	0.531	0.265	0.515	75
7/16	0.255	0.719	0.593	0.312	0.578	0.265	0.515	200
1/2	0.317	0.812	0.593	0.312	0.625	0.265	0.515	200
9/16	0.343	0.875	0.593	0.312	0.656	0.265	0.515	225

Table 2 Type I, Class 1, Flare Nut, 3/8 in. Square Drive, Standard Duty

Nominal Wrench Opening, *A*	Dimensions, in.							Minimum Proof Torque, lbf-in.
	Slot Opening, *B*, Min.	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Drive End Thickness, *E*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Width, *H*, Max.	
3/8	0.193	0.625	0.624	0.406	0.531	0.328	0.656	150
7/16	0.255	0.719	0.624	0.406	0.578	0.328	0.656	175
1/2	0.317	0.812	0.624	0.406	0.625	0.328	0.656	200
9/16	0.343	0.875	0.624	0.406	0.656	0.328	0.656	225
5/8	0.406	0.998	0.750	0.406	0.765	0.328	0.656	250
11/16	0.442	1.091	0.750	0.406	0.812	0.328	0.656	310
3/4	0.443	1.185	0.781	0.406	0.859	0.328	0.656	450
13/16	0.531	1.263	0.781	0.406	0.906	0.328	0.656	450
7/8	0.531	1.357	0.812	0.406	1.000	0.328	0.656	625
15/16	0.578	1.435	0.812	0.406	1.000	0.328	0.656	625
1	0.656	1.513	0.843	0.406	1.047	0.328	0.656	625
1 1/16	0.656	1.590	0.843	0.406	1.078	0.328	0.656	625

(*a*) 0.002 in. for nominal wrench openings 3/16 in. to 1 in.

(*b*) 0.003 in. for nominal wrench openings 1 1/16 in. to 2 1/4 in.

(*c*) 0.004 in. for nominal wrench openings 2 5/16 in. to 3 1/8 in.

5.3 Alternative Coating Test

This test consists of an adhesion, abrasion, and corrosion test specified in paras. 5.3.2, 5.3.3, and 5.3.4.

5.3.1 Test Preparation. The quantity and condition of the wrenches used for the following testing shall be per the manufacturer's standard practice or as mutually agreed to by the manufacturer and the customer. If the wrench does not have sufficient surface area to conduct the tests, a 3/4 in. combination wrench, or a 4 in. x 6 in. panel(s) per ASTM B 537/ASTM D 968 Method A, shall be used.

5.3.2 Adhesion Test. Test specimens shall pass the file or grind-saw test of ASTM B 571.

5.3.3 Abrasion Test. Test specimens shall have no base material exposed after being subjected to 100 L of falling sand per ASTM D 968 Method A.

5.3.4 Corrosion Test. Test specimens shall be tested for corrosion resistance by exposure to a 48 hr salt spray test, as specified in ASTM B 117, without falling below the ASTM B 537 rating of 6.

6 DESIGNATIONS

Wrenches shall be designated by the following data in the sequence shown: type, class, size of drive, size and type of openings (6- or 12-point), and coating.

EXAMPLE: Wrench Type I crowfoot wrench, flare nut, Class 2, heavy duty, 3/8 in. square drive, 1/2 in. 12-point opening, black oxide.

Table 3 Type I, Class 1, Flare Nut, ½ in. Square Drive, Standard Duty

Nominal Wrench Opening, *A*	Dimensions, in.							Minimum Proof Torque, lbf-in.
	Slot Opening, *B*, Min.	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Drive End Thickness, *E*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Width, *H*, Max.	
1 1/8	0.755	1.688	0.937	0.531	1.172	0.438	0.875	825
1 3/16	0.812	1.750	0.937	0.531	1.203	0.438	0.875	825
1 1/4	0.890	1.844	0.937	0.531	1.250	0.438	0.875	825
1 5/16	0.916	1.906	0.937	0.531	1.281	0.438	0.875	900
1 3/8	1.015	2.000	1.000	0.531	1.328	0.438	0.875	900
1 7/16	1.015	2.062	1.000	0.531	1.359	0.438	0.875	900
1 1/2	1.015	2.125	1.000	0.531	1.391	0.438	0.875	900
1 9/16	1.063	2.188	1.000	0.531	1.438	0.438	0.875	1,100
1 5/8	1.130	2.281	1.000	0.531	1.469	0.438	0.875	1,100
1 11/16	1.265	2.375	1.062	0.531	1.531	0.438	0.875	1,100
1 3/4	1.265	2.438	1.062	0.531	1.562	0.438	0.875	1,150
1 13/16	1.265	2.531	1.062	0.531	1.609	0.438	0.875	1,200
1 7/8	1.265	2.625	1.124	0.531	1.656	0.438	0.875	1,200
1 15/16	1.265	2.688	1.124	0.531	1.688	0.438	0.875	1,200
2	1.515	2.781	1.124	0.531	1.734	0.453	0.906	1,400
2 1/16	1.515	2.844	1.187	0.531	1.766	0.453	0.906	1,450
2 1/8	1.515	2.904	1.187	0.531	1,812	0.453	0.906	1,450
2 3/16	1.515	3.000	1.187	0.531	1,844	0.453	0.906	1,500
2 1/4	1.515	3.094	1.187	0.531	1.891	0.453	0.906	1,500
2 5/16	1.515	3.156	1.250	0.531	1.922	0.453	0.906	1,500
2 3/8	1.630	3.250	1.250	0.531	1.969	0.469	0.938	1,600
2 7/16	1.630	3.312	1.250	0.531	2.000	0.469	0.938	1,650
2 1/2	1.630	3.609	1.250	0.531	2.047	0.469	0.938	1,700
2 9/16	1.755	3.500	1.312	0.531	2.109	0.469	0.938	1,750
2 5/8	2.015	3.562	1.312	0.531	2.141	0.469	0.938	1,800
2 11/16	2.015	3.625	1.312	0.531	2.172	0.469	0.938	1,800
2 3/4	2.015	3.719	1.312	0.531	2.219	0.484	0.969	1,850
2 13/16	2.015	3.781	1.374	0.531	2.250	0.484	0.969	1,900
2 15/16	2.015	3.938	1.374	0.531	2.328	0.484	0.969	1,950
3 1/8	2.015	4.188	1.374	0.531	2.453	0.484	0.969	2,000

7 SAFETY REQUIREMENTS AND LIMITATIONS OF USE

Instructors and employers shall stress safety and proper use of crowfoot wrenches. Information can be found in the HTI publication, *Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care.*

If using a crowfoot wrench for torque measuring applications, consult the torque instrument manufacturer's literature for a correction formula for accessories.

Table 4 Type I, Class 2, Flare Nut, 3/8 in. Square Drive, Heavy Duty (Inch)

Nominal Wrench Opening, *A*	Dimensions, in.						Minimum Proof Torque, lbf-in.
	Slot Opening, *B*, Min.	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Diameter, *H*, Max.	
3/8	0.193	0.891	0.406	0.656	0.470	0.938	240
7/16	0.255	1.000	0.406	0.656	0.470	0.938	320
1/2	0.317	1.094	0.468	0.719	0.470	0.938	400
9/16	0.343	1.219	0.468	0.828	0.470	0.938	510
5/8	0.406	1.296	0.468	0.828	0.470	0.938	625
11/16	0.442	1.406	0.562	0.859	0.470	1.060	750
3/4	0.442	1.515	0.562	0.859	0.470	1.060	880
13/16	0.531	1.719	0.593	0.922	0.470	1.190	1,025
7/8	0.531	1.719	0.593	0.922	0.470	1.190	1,180
15/16	0.578	1.984	0.641	1.000	0.470	1.190	1,280
1	0.656	1.984	0.641	1.000	0.470	1.190	1,480

Table 4M Type I, Class 2, Flare Nut, 3/8 in. Square Drive, Heavy Duty (Metric)

Nominal Wrench Opening, *A*	Dimensions, mm						Minimum Proof Torque, N·m
	Slot Opening, *B*, Min.	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Diameter, *H*, Max.	
9	4.5	22.9	10.3	16.7	11.9	23.8	25
10	4.8	24.0	10.3	16.7	11.9	23.8	30
11	6.4	25.4	10.3	16.7	11.9	23.8	35
12	7.0	27.0	10.3	18.3	11.9	23.8	40
13	8.0	27,8	11.9	18.3	11.9	23.8	45
14	8.7	31.0	11.9	21.0	11.9	23.8	55
15	10.3	32.1	11.9	21.0	11.9	23.8	65
16	10.3	32.9	11.9	21.0	11.9	23.8	75
17	11.1	35.7	14.3	21.8	11.9	26.9	85
18	11.1	36.1	14.3	21.8	11.9	26.9	95
19	11.1	36.1	14.3	21.8	11.9	26.9	105
20	12.0	43.7	16.3	23.4	11.9	30.2	120
21	13.5	43.7	16.3	23.4	11.9	30.2	130
22	13.5	43.7	16.3	23.4	11.9	30.2	145

Fig. 3 Type II, Crowfoot Wrench, Open End

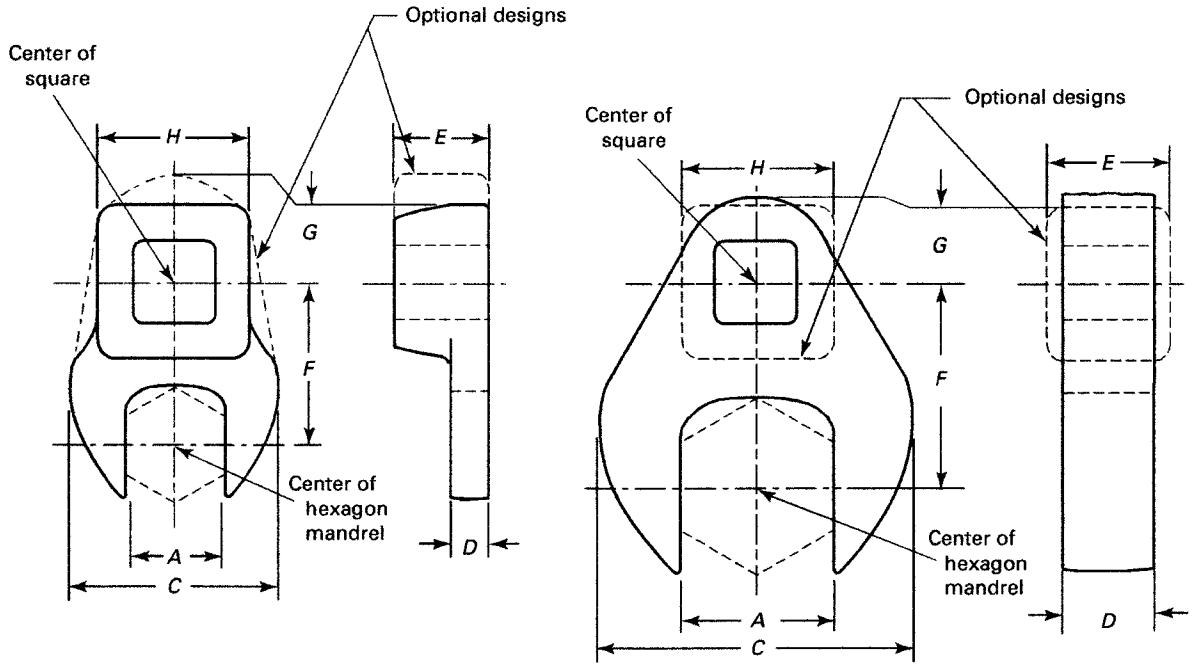


Table 5 Type II, Class 1, Open End, 3/8 in. Square Drive, Standard Duty (Inch)

Nominal Wrench Opening, *A*	Dimensions, in.						Min. Proof Torque, lbf-in.
	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Drive End Thickness, *E*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Width, *H*, Max.	
3/8	0.951	0.250	0.656	0.750	0.375	0.750	105
7/16	0.951	0.250	0.656	0.750	0.375	0.750	140
1/2	1.137	0.270	0.656	0.820	0.375	0.750	175
9/16	1.270	0.270	0.656	0.955	0.375	0.750	210
5/8	1.387	0.350	0.656	1.000	0.375	0.750	263
11/16	1.570	0.350	0.656	1.117	0.438	1.000	315
3/4	1.625	0.350	0.719	1.125	0.438	1.000	368
13/16	1.750	0.350	0.719	1.141	0.438	1.000	420
7/8	1.812	0.370	0.719	1.156	0.438	1.000	473
15/16	2.010	0.370	0.719	1.188	0.438	1.000	525
1	2.078	0.375	0.719	1.188	0.438	1.000	578
1 1/16	2.215	0.375	0.719	1.219	0.438	1.000	630
1 1/8	2.125	0.375	0.719	1.219	0.438	1.000	700
1 3/16	2.156	0.375	0.719	1.250	0.438	1.000	770
1 1/4	2.188	0.375	0.719	1.281	0.438	1.000	840
1 5/16	2.188	0.375	0.719	1.344	0.438	1.000	910
1 3/8	2.438	0.375	0.719	1.344	0.438	1.000	980
1 7/16	2.438	0.375	0.719	1.406	0.438	1.000	1,050
1 1/2	2.625	0.375	0.719	1.469	0.438	1.125	1,120
1 9/16	2.625	0.375	0.719	1.500	0.438	1.125	1,190
1 5/8	2.750	0.375	0.719	1.531	0.438	1.125	1,260
1 11/16	2.750	0.375	0.719	1.594	0.438	1.125	1,330
1 3/4	2.938	0.375	0.719	1.594	0.438	1.125	1,400
1 13/16	2.938	0.375	0.719	1.656	0.438	1.125	1,470
1 7/8	3.250	0.375	0.719	1.656	0.438	1.125	1,540
1 15/16	3.375	0.375	0.719	1.750	0.438	1.125	1,540
2	3.500	0.500	0.812	1.781	0.520	1.125	1,540
2 1/16	3.500	0.500	0.812	1.812	0.520	1.125	1,540
2 1/8	3.625	0.500	0.812	1.830	0.520	1.125	1,540
2 3/16	3.688	0.500	0.812	1.906	0.520	1.125	1,540
2 1/4	3.938	0.500	0.812	1.969	0.520	1.125	1,540
2 5/16	4.000	0.500	0.812	2.000	0.520	1.125	1,540
2 3/8	4.188	0.500	0.812	2.156	0.520	1.125	1,540
2 7/16	4.188	0.500	0.812	2.281	0.520	1.125	1,555
2 1/2	4.312	0.500	0.812	2.312	0.580	1.125	1,600
2 9/16	4.375	0.500	0.812	2.344	0.580	1.125	1,660
2 5/8	4.625	0.500	0.812	2.469	0.580	1.125	1,760
2 11/16	4.750	0.500	0.812	2.500	0.580	1.125	1,830
2 3/4	4.812	0.500	0.812	2.531	0.640	1.285	1,900
2 13/16	4.812	0.500	0.812	2.656	0.640	1.285	2,075
2 7/8	5.125	0.500	0.812	2.688	0.640	1.285	2,135
2 15/16	5.188	0.500	0.812	2.719	0.640	1.285	2,200
3	5.188	0.500	0.812	2.719	0.640	1.285	2,200

Table 5M Type II, Class 1, Open End, 3/8 in. Square Drive, Standard Duty (Metric)

	Dimensions, mm						
Nominal Wrench Opening, *A*	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Drive End Thickness, *E* Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Width, *H*, Max.	Min. Proof Test Torque, N·m
9	23.7	6.5	16.7	20.0	9.5	19.5	12
10	24.2	6.5	16.7	20.0	9.5	19.5	16
11	24.2	6.5	16.7	20.0	9.5	19.5	18
12	28.5	7.0	16.7	22.0	9.5	19.5	20
13	28.5	7.0	16.7	22.0	9.5	19.5	24
14	30.5	7.0	16.7	22.0	9.5	19.5	30
15	35.0	9.0	16.7	24.0	9.5	19.5	33
16	35.0	9.0	16.7	24.5	9.5	19.5	36
17	36.5	9.0	16.7	25.5	9.5	19.5	39
18	41.6	9.0	16.7	28.5	11.0	25.5	41
19	41.6	9.0	18.3	28.5	11.0	25.5	45
20	41.6	9.0	18.3	31.0	11.0	25.5	48
21	44.5	9.5	18.3	31.5	11.0	25.5	53
22	44.5	9.5	18.3	33.5	11.0	25.5	57
23	52.0	10.0	18.3	36.0	11.0	25.5	60
24	52.0	10.0	18.3	37.0	11.0	25.5	65

Table 6 Type II, Class 1, Open End, 1/2 in. Square Drive, Standard Duty

	Dimensions, in.						
Nominal Wrench Opening, *A*	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Drive End Thickness, *E*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Width, *H*, Max.	Min. Proof Torque, lbf-in.
15/16	1.968	0.656	0.656	1.795	0.531	1.031	2,800
1	1.968	0.656	0.656	1.795	0.531	1.031	2,900
1 1/16	2.156	0.656	0.656	1.795	0.562	1.031	3,000
1 1/8	2.250	0.656	0.656	1.812	0.594	1.031	3,100
1 3/16	2.380	0.656	0.656	1.812	0.594	1.031	3,200
1 1/4	2.500	0.656	0.656	2.045	0.594	1.031	3,300
1 5/16	2.620	0.656	0.656	2.045	0.594	1.031	3,400
1 3/8	2.750	0.656	0.656	2.045	0.594	1.031	3,500
1 7/16	2.880	0.656	0.656	2.045	0.594	1.031	3,600
1 1/2	3.000	0.656	0.656	2.045	0.594	1.031	3,700
1 9/16	3.130	0.656	0.656	2.045	0.594	1.031	3,800
1 5/8	3.250	0.656	0.656	2.045	0.594	1.031	4,000
1 11/16	3.380	0.656	0.656	2.295	0.594	1.031	4,200
1 3/4	3.500	0.656	0.656	2.295	0.594	1.031	4,400
1 13/16	3.620	0.656	0.656	2.295	0.594	1.031	4,600
1 7/8	3.750	0.656	0.656	2.295	0.594	1.031	4,800
2	4.000	0.656	0.656	2.295	0.594	1.031	5,000
2 1/4	4.250	0.656	0.656	2.545	0.594	1.031	5,000
2 3/8	4.406	0.656	0.656	2.545	0.594	1.031	5,000
2 7/16	4.406	0.656	0.656	2.545	0.594	1.031	5,000
2 1/2	4.406	0.656	0.656	2.545	0.594	1.031	5,000

Table 7 Type II, Class 2, Open End, 3/8 in. Square Drive, Heavy Duty

Nominal Wrench Opening, *A*	Dimensions, in.						Min. Proof Torque, lbf-in.
	Head Width, *C*, Max.	Head Thickness, *D*, Max.	Drive End Thickness, *E*, Max.	Center Distance, *F*, Max.	Drive Square Location, *G*, Max.	Drive End Width, *H*, Max.	
3/8	0.937	0.390	0.440	0.688	0.656	0.750	150
7/16	1.015	0.405	0.440	0.750	0.656	0.750	200
1/2	1.187	0.405	0.440	0.797	0.656	0.750	250
9/16	1.265	0.405	0.440	0.844	0.656	0.750	300
5/8	1.375	0.405	0.440	0.891	0.656	0.750	375
11/16	1.500	0.405	0.440	0.969	0.656	1.000	450
3/4	1.625	0.405	0.440	1.108	0.719	1.000	525
13/16	1.828	0.425	0.440	1.176	0.719	1.000	600
7/8	1.890	0.425	0.440	1.274	0.719	1.000	675
15/16	2.015	0.425	0.440	1.156	0.719	1.000	750
1	2.110	0.425	0.440	1.409	0.719	1.000	825
1 1/16	2.125	0.425	0.440	1.219	0.719	1.000	900
1 1/8	2.125	0.425	0.440	1.219	0.719	1.000	1,000
1 3/16	2.188	0.425	0.440	1.281	0.719	1.000	1,100
1 1/4	2.203	0.425	0.440	1.281	0.719	1.000	1,200
1 5/16	2.203	0.425	0.440	1.344	0.719	1.000	1,300
1 3/8	2.422	0.425	0.440	1.344	0.719	1.000	1,400
1 7/16	2.442	0.425	0.440	1.406	0.719	1.000	1,500
1 1/2	2.594	0.425	0.440	1.469	0.719	1.125	1,600
1 9/16	2.594	0.425	0.440	1.469	0.719	1.125	1,700
1 5/8	2.734	0.425	0.440	1.531	0.719	1.125	1,800
1 11/16	2.734	0.425	0.440	1.594	0.719	1.125	1,900
1 3/4	2.922	0.425	0.440	1.594	0.719	1.125	2,000
1 13/16	2.922	0.425	0.440	1.656	0.719	1.125	2,100
1 7/8	3.234	0.425	0.440	1.656	0.719	1.125	2,200
1 15/16	3.234	0.425	0.440	1.719	0.719	1.125	2,200
2	3.469	0.500	0.562	1.719	0.812	1.125	2,200
2 1/16	3.469	0.500	0.562	1.781	0.812	1.125	2,200
2 1/8	3.656	0.500	0.562	1.906	0.812	1.125	2,200
2 3/16	3.656	0.500	0.562	1.906	0.812	1.125	2,200
2 1/4	3.906	0.500	0.562	1.969	0.812	1.125	2,200
2 5/16	3.906	0.500	0.562	2.031	0.812	1.125	2,200
2 3/8	4.156	0.500	0.562	2.156	0.812	1.125	2,200
2 7/16	4.156	0.500	0.562	2.281	0.812	1.125	2,200
2 1/2	4.344	0.500	0.625	2.344	0.812	1.125	2,200
2 9/16	4.344	0.500	0.625	2.344	0.812	1.125	2,200
2 5/8	4.594	0.500	0.625	2.469	0.812	1.125	2,200
2 11/16	4.594	0.500	0.625	2.469	0.812	1.125	2,200
2 3/4	4.781	0.500	0.656	2.531	0.812	1.250	2,200
2 13/16	4.781	0.500	0.656	2.531	0.812	1.250	2,200
2 7/8	5.141	0.500	0.656	2.594	0.812	1.250	2,200
2 15/16	5.141	0.500	0.656	2.719	0.812	1.250	2,200
3	5.141	0.500	0.656	2.719	0.812	1.250	2,200

Table 8 Hexagon Mandrel Dimensions (Inch)

Nominal Wrench Opening, in.	Hexagon Mandrel Dimensions, in.		
	Across Flats Tolerances		Across Corners, Min. [Note (1)]
3/16	+0.001	−0.002	0.2095
7/32	+0.001	−0.002	0.2440
1/4	+0.001	−0.002	0.2780
9/32	+0.001	−0.002	0.3133
5/16	+0.001	−0.002	0.3495
11/32	+0.001	−0.002	0.3860
3/8	+0.001	−0.002	0.4225
7/16	+0.001	−0.002	0.4935
1/2	+0.001	−0.003	0.5635
9/16	+0.001	−0.003	0.6339
5/8	+0.001	−0.003	0.7055
11/16	+0.001	−0.003	0.7769
3/4	+0.001	−0.003	0.8485
13/16	+0.001	−0.003	0.9201
7/8	+0.001	−0.003	0.9917
15/16	+0.001	−0.003	1.0631
1	+0.001	−0.003	1.1297
1 1/16	+0.001	−0.003	1.2013
1 1/8	+0.001	−0.003	1.2728
1 3/16	+0.001	−0.003	1.3443
1 1/4	+0.001	−0.003	1.4160
1 5/16	+0.001	−0.003	1.4870
1 3/8	+0.001	−0.003	1.5590
1 7/16	+0.001	−0.003	1.6310
1 1/2	+0.001	−0.003	1.7020
1 9/16	+0.001	−0.007	1.7700
1 5/8	+0.001	−0.007	1.8410
1 11/16	+0.001	−0.007	1.9120
1 3/4	+0.001	−0.007	1.9830
1 13/16	+0.001	−0.007	2.0540
1 7/8	+0.001	−0.007	2.1240
1 15/16	+0.001	−0.007	2.1950
2	+0.001	−0.007	2.2660
2 1/16	+0.001	−0.007	2.3370
2 1/8	+0.001	−0.007	2.4080
2 3/16	+0.001	−0.007	2.4790
2 1/4	+0.001	−0.007	2.5490
2 5/16	+0.001	−0.007	2.6210
2 3/8	+0.001	−0.007	2.6910
2 7/16	+0.001	−0.007	2.7620
2 1/2	+0.001	−0.007	2.8330
2 9/16	+0.001	−0.008	2.9030
2 5/8	+0.001	−0.008	2.9740
2 11/16	+0.001	−0.008	3.0450
2 3/4	+0.001	−0.008	3.1160
2 13/16	+0.001	−0.008	3.1870
2 15/16	+0.001	−0.008	3.3280
3	+0.001	−0.008	3.3990
3 1/8	+0.001	−0.008	3.5410

NOTE:

(1) For sizes not listed, multiply nominal size by 1.133055 for mandrel dimension across corners. Applicable to mandrels over 1 1/2 in. nominal size.

Table 8M Hexagon Mandrel Dimensions (Metric)

Nominal Size of Wrench Opening, mm	Hexagon Mandrel Dimensions, mm		
	Across Flats Tolerances		Across Corners, Min. [Note (1)]
	Plus	Minus	
9	0.025	0.050	10.11
10	0.025	0.050	11.27
11	0.025	0.050	12.40
12	0.025	0.076	13.53
13	0.025	0.076	14.67
14	0.025	0.076	15.80
15	0.025	0.076	16.92
16	0.025	0.076	18.06
17	0.025	0.076	19.20
18	0.025	0.076	20.35
19	0.025	0.076	21.49
20	0.025	0.076	22.64
21	0.025	0.076	23.78
22	0.025	0.076	24.93
23	0.025	0.076	26.07
24	0.025	0.076	27.20

NOTE:

(1) For sizes not listed, multiply nominal size by 1.133055 for mandrel dimension across corners.

ASME B107.39

OPEN END WRENCHES, DOUBLE HEAD

1 SCOPE

This Standard provides the tables and figures for open end wrenches. Performance requirements, tests, and safety requirements and limitations of use are provided in B107.6.

2 CLASSIFICATION

Open end wrench, double head

Type I: Engineer's wrench, 15 deg angle

Type II:

Class 1: 30 deg and 60 deg angle wrench

Class 2: 15 deg and 60 deg ignition wrench

Class 3: 15 deg and 60 deg angle wrench

Type III: Tappet wrench, 15 deg angle

3 REFERENCES

See references in ASME B107.6, Combination Wrenches.

Fig. 1 Type I Engineer's Wrench

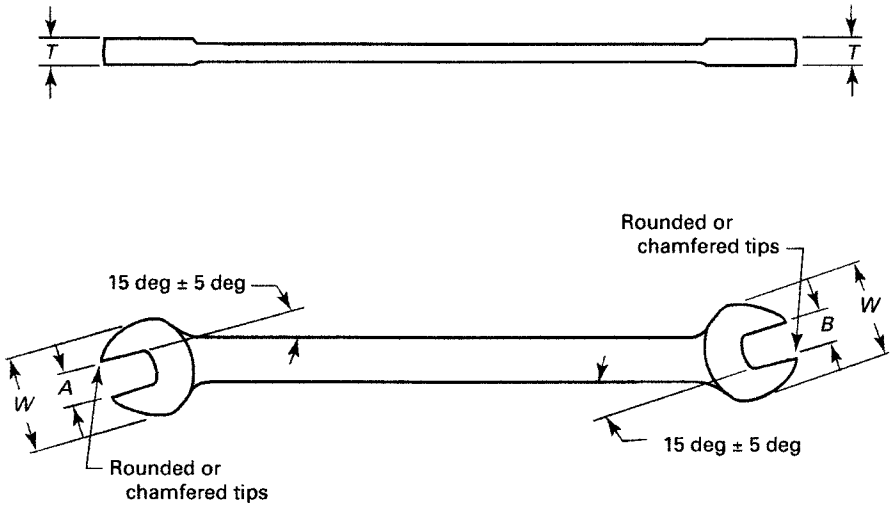


Fig. 2 Type II, Class 1 Angle Wrench

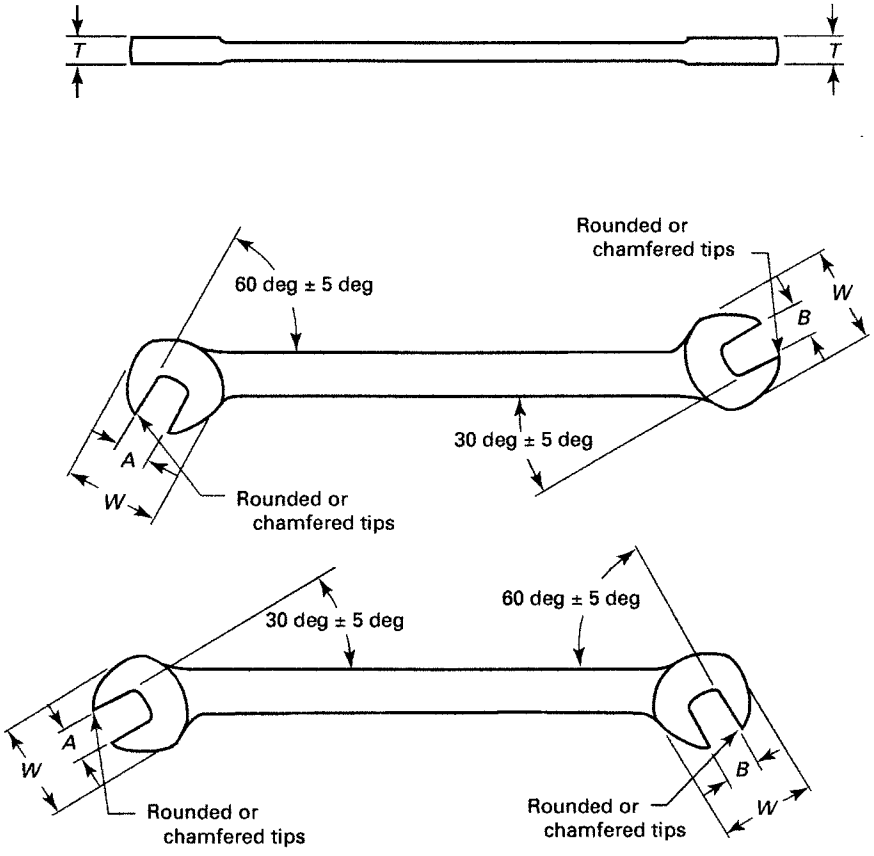


Fig. 3 Type II, Classes 2 and 3 Angle Wrench

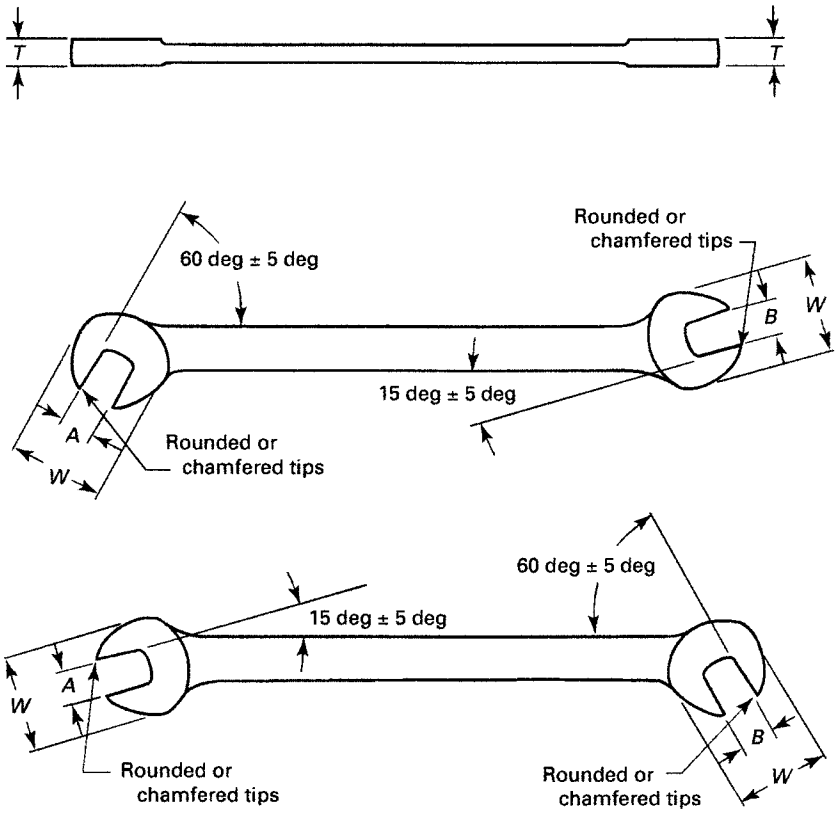


Fig. 4 Type III Tappet Wrench

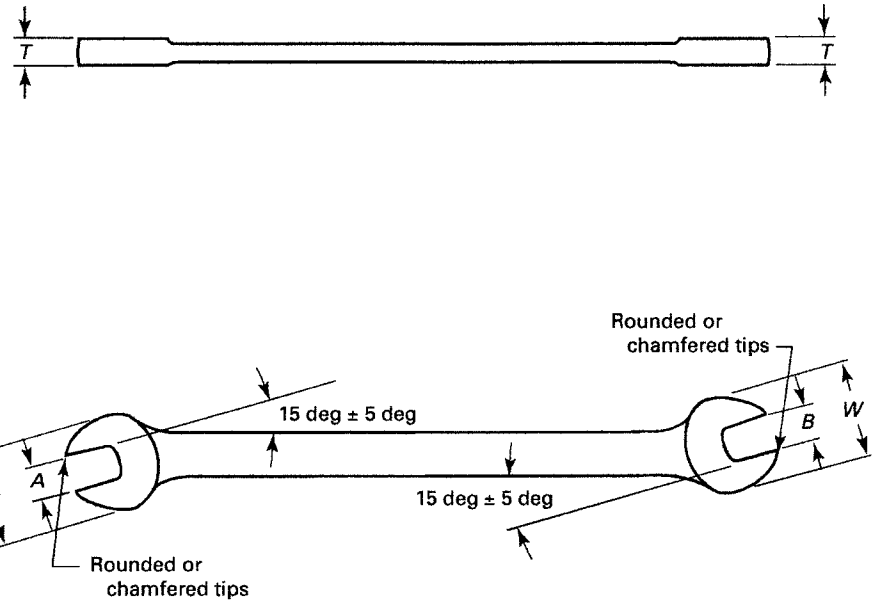


Table 1 Type I Engineer's Wrench (Inch)

Nominal Wrench Opening Across Flats		Maximum Width of Open Head		Maximum Thickness of Open Head		Minimum Proof Torque, lbf-in.	
Small Head, *A*	Large Head, *B*	Small Head, *W*	Large Head, *W*	Small Head, *T*	Large Head, *T*	Small Head	Large Head
3/16	7/32	0.500	0.563	0.172	0.172	45	50
3/16	1/4	0.500	0.654	0.172	0.205	45	67
1/4	9/32	0.654	0.688	0.205	0.215	67	78
1/4	5/16	0.654	0.811	0.205	0.223	67	138
5/16	11/32	0.811	0.813	0.223	0.237	138	193
5/16	3/8	0.811	0.906	0.223	0.250	138	275
5/16	7/16	0.811	0.996	0.223	0.281	138	413
3/8	7/16	0.906	0.996	0.250	0.281	275	413
3/8	1/2	0.906	1.142	0.250	0.344	275	550
13/32	1/2	0.949	1.142	0.266	0.344	344	550
7/16	1/2	0.996	1.142	0.281	0.344	413	550
1/2	9/16	1.142	1.272	0.344	0.375	550	770
9/16	5/8	1.272	1.402	0.375	0.380	770	1,100
5/8	11/16	1.402	1.536	0.380	0.400	1,100	1,375
5/8	3/4	1.402	1.672	0.380	0.406	1,100	1,650
11/16	3/4	1.536	1.672	0.400	0.406	1,375	1,650
11/16	13/16	1.536	1.828	0.400	0.516	1,375	2,200
3/4	13/16	1.672	1.828	0.406	0.516	1,650	2,200
3/4	7/8	1.672	1.959	0.406	0.516	1,650	2,475
13/16	7/8	1.828	1.959	0.516	0.516	2,200	2,475
13/16	15/16	1.828	2.078	0.516	0.594	2,200	3,025
7/8	15/16	1.959	2.078	0.516	0.594	2,475	3,025
7/8	1	1.959	2.250	0.516	0.625	2,475	3,575
7/8	1 1/16	1.959	2.344	0.516	0.625	2,475	3,850
15/16	1	2.078	2.250	0.594	0.625	3,025	3,575
15/16	1 1/16	2.078	2.344	0.594	0.625	3,025	3,850
1	1 1/16	2.250	2.344	0.625	0.625	3,575	3,850
1	1 1/8	2.250	2.500	0.625	0.656	3,575	4,400
1	1 1/2	2.250	3.375	0.625	0.813	3,575	8,500
1 1/16	1 1/8	2.344	2.500	0.625	0.656	3,850	4,400
1 1/16	1 1/4	2.344	2.766	0.625	0.719	3,850	5,775
1 1/8	1 1/4	2.500	2.766	0.656	0.719	4,400	5,775
1 1/8	1 5/16	2.500	2.938	0.656	0.719	4,400	6,600
1 1/8	1 3/8	2.500	3.063	0.656	0.750	4,400	7,425
1 3/16	1 5/16	2.630	2.938	0.688	0.719	5,200	6,600
1 1/4	1 5/16	2.766	2.938	0.719	0.719	5,775	6,600
1 1/4	1 3/8	2.766	3.063	0.719	0.750	5,775	7,425
1 1/4	1 7/16	2.766	3.188	0.719	0.813	5,775	8,250
1 3/8	1 7/16	3.063	3.188	0.750	0.813	7,425	8,250
1 3/8	1 1/2	3.063	3.375	0.750	0.813	7,425	8,500
1 7/16	1 5/8	3.188	3.625	0.813	0.813	8,250	9,000
1 7/16	1 13/16	3.188	4.188	0.813	0.875	8,250	11,750
1 1/2	1 5/8	3.375	3.625	0.813	0.813	8,500	9,000

Table 1M Type I Engineer's Wrench (Metric)

Nominal Wrench Opening Across Flats		Maximum Width of Open Head		Maximum Thickness of Open Head		Minimum Proof Torque, N·m	
Small Head, *A*	Large Head, *B*	Small Head, *W*	Large Head, *W*	Small Head, *T*	Large Head, *T*	Small Head	Large Head
6	7	17.3	18.3	5.8	6.3	7	8
6	8	17.3	21.4	5.8	6.3	7	15
7	8	18.3	21.4	6.3	6.3	8	15
7	9	18.3	21.8	6.3	6.6	8	21
8	9	21.4	21.8	6.3	6.6	15	21
8	10	21.4	26.0	6.3	6.9	15	31
9	10	21.8	26.0	6.6	6.9	21	31
9	11	21.8	26.0	6.6	7.0	21	46
10	11	26.0	26.0	6.9	7.0	31	46
11	13	26.0	30.2	7.0	8.9	46	62
12	13	27.7	30.2	8.0	8.9	49	62
12	14	27.7	32.8	8.0	8.9	49	86
13	15	30.2	34.8	8.9	8.9	62	104
14	15	32.8	34.8	8.9	8.9	86	104
14	16	32.8	36.4	8.9	9.4	86	124
15	17	34.8	39.7	8.9	9.8	104	139
15	18	34.8	41.3	8.9	10.0	104	155
16	17	36.4	39.7	9.4	9.8	124	139
16	18	36.4	41.3	9.4	10.0	124	155
17	19	39.7	42.7	9.8	10.1	139	186
18	19	41.3	42.7	10.0	10.1	155	186
18	21	41.3	47.6	10.0	11.7	155	248
19	22	42.7	48.3	10.1	12.0	186	279
20	21	46.4	47.6	11.4	11.7	217	248
20	22	46.4	48.3	11.4	12.0	217	279
21	22	47.6	48.3	11.7	12.0	248	279
21	23	47.6	52.4	11.7	12.4	248	310
21	24	47.6	53.5	11.7	12.5	248	341
22	24	48.3	53.5	12.0	12.5	279	341
24	26	53.5	57.2	12.5	12.8	341	403
24	27	53.5	60.2	12.5	14.7	341	432
25	27	55.7	60.2	12.7	14.7	372	432
25	28	55.7	62.3	12.7	14.9	372	497
27	29	60.2	65.5	14.7	14.9	432	514
27	30	60.2	67.0	14.7	14.9	432	570
27	32	60.2	71.0	14.7	15.7	432	650
28	30	62.3	67.0	14.9	14.9	497	570
30	32	67.0	71.0	14.9	15.7	570	650
32	36	71.0	76.8	15.7	19.0	650	894
36	41	76.8	88.9	19.0	19.3	894	1 154

Table 2 Type II, Class 1 Angle Wrench, 30 deg/60 deg Head Offsets (Inch)

Nominal Size of Wrench Opening Across Flats, *A* or *B*	Maximum Width of Open Head, *W*	Maximum Thickness of Open Head, *T*	Minimum Proof Torque, lbf-in.
1/4	0.654	0.205	67
5/16	0.811	0.223	138
11/32	0.813	0.237	193
3/8	0.906	0.250	275
7/16	0.996	0.281	413
1/2	1.142	0.344	550
9/16	1.272	0.375	770
5/8	1.402	0.380	1,100
11/16	1.536	0.400	1,375
3/4	1.672	0.406	1,650
13/16	1.828	0.516	2,200
7/8	1.959	0.516	2,475
15/16	2.078	0.594	3,025
1	2.250	0.625	3,575
1 1/16	2.344	0.625	3,850
1 1/8	2.500	0.656	4,400
1 3/16	2.630	0.688	5,200
1 1/4	2.766	0.719	5,775
1 5/16	2.938	0.719	6,600
1 3/8	3.063	0.750	7,425
1 7/16	3.188	0.813	8,250
1 1/2	3.375	0.813	8,500
1 5/8	3.625	0.813	9,000
1 11/16	3.750	0.813	10,500
1 3/4	4.000	0.875	11,100
1 13/16	4.188	0.875	11,750
1 7/8	4.344	0.938	12,400
2	4.469	0.938	13,650

Table 2M Type II, Class 1 Angle Wrench, 30 deg/60 deg Head Offsets (Metric)

Nominal Size of Wrench Opening Across Flats, *A* or *B*	Maximum Width of Open Head, *W*	Maximum Thickness of Open Head, *T*	Minimum Proof Torque, N·m
9	21.8	6.6	21
10	26.0	6.9	31
11	26.0	7.0	46
12	27.7	8.0	49
13	30.2	8.9	62
14	32.8	8.9	86
15	34.8	8.9	104
16	36.4	9.4	124
17	39.7	9.8	139
18	41.3	10.0	155
19	42.7	10.1	186
21	47.6	11.7	248
22	48.3	12.0	279
24	53.5	12.5	341
27	60.2	14.7	432

Table 3 Type II, Class 2 Ignition Wrench, 15 deg and 60 deg Head Offsets (Inch)

Nominal Wrench Opening Across Flats, *A* or *B*		Maximum Width of Open Head		Maximum Thickness of Open Head		Minimum Proof Torque, lbf-in.	
15 deg Head	60 deg Head	15 deg Head, *W*	60 deg Head, *W*	15 deg Head, *T*	60 deg Head, *T*	15 deg Head	60 deg Head
1/8	1/8	0.359	0.359	0.141	0.141	15	15
5/32	5/32	0.438	0.438	0.141	0.141	20	20
3/16	3/16	0.500	0.500	0.156	0.156	24	24
7/32	7/32	0.563	0.563	0.172	0.172	28	28
15/64	1/4	0.600	0.654	0.188	0.205	38	38
1/4	15/64	0.654	0.600	0.205	0.188	38	38
1/4	1/4	0.654	0.654	0.205	0.205	38	38
9/32	9/32	0.688	0.688	0.215	0.215	43	43
9/32	5/16	0.688	0.811	0.215	0.223	43	62
5/16	9/32	0.811	0.688	0.223	0.215	62	43
5/16	5/16	0.811	0.811	0.223	0.223	62	62
11/32	11/32	0.813	0.813	0.237	0.237	105	105
11/32	3/8	0.813	0.906	0.237	0.250	105	105
3/8	11/32	0.906	0.813	0.250	0.237	105	105
3/8	3/8	0.906	0.906	0.250	0.250	105	105

Table 3M Type II, Class 2 Ignition Wrench, 15 deg and 60 deg Head Offsets (Metric)

Nominal Wrench Opening Across Flats, *A* or *B*		Maximum Width of Open Head		Maximum Thickness of Open Head		Minimum Proof Torque, N·m	
15 deg Head	60 deg Head	15 deg Head, *W*	60 deg Head, *W*	15 deg Head, *T*	60 deg Head, *T*	15 deg Head	60 deg Head
3.2	5.5	8.9	15.5	3.4	5.3	1	4
4	5	10.8	12.5	3.7	3.9	2	3
5	4	12.5	10.8	3.9	3.7	3	2
5.5	3.2	15.5	8.9	5.3	3.4	4	1
6	7	17.3	18.3	5.8	6.3	6	7
7	6	18.3	17.3	6.3	5.8	7	6
8	9	21.4	21.8	6.3	6.6	13	19
9	8	21.8	21.4	6.6	6.3	19	13
10	11	26.0	26.0	6.9	7.0	28	41
11	10	26.0	26.0	7.0	6.9	41	28

Table 4 Type II, Class 3 Angle Wrench, 15 deg and 60 deg Head Offsets (Inch)

Nominal Wrench Opening Across Flats, *A* or *B*, Head	Maximum Width of Open Head, *W*	Maximum Thickness of Open Head, *T*	Minimum Proof Torque, lbf-in.
11/32	0.781	0.203	40
3/8	0.781	0.203	40
7/16	0.906	0.250	75
1/2	1.063	0.250	100
9/16	1.188	0.266	150
5/8	1.313	0.266	200
11/16	1.438	0.297	300
3/4	1.578	0.328	500
13/16	1.625	0.297	700
7/8	1.813	0.297	825
15/16	1.938	0.297	900
1	2.109	0.328	1,700
1 1/16	2.125	0.328	1,700
1 1/8	2.297	0.359	2,250
1 3/16	2.400	0.360	2,375
1 1/4	2.500	0.359	2,500
1 5/16	2.688	0.344	2,800
1 3/8	2.750	0.422	3,200
1 7/16	2.813	0.422	3,500
1 1/2	3.000	0.422	3,800
1 9/16	3.120	0.440	4,300
1 5/8	3.250	0.470	4,750
1 11/16	3.380	0.500	5,200
1 3/4	3.500	0.530	5,700
1 13/16	3.620	0.530	6,200
1 7/8	3.750	0.560	6,700
1 15/16	3.880	0.560	7,250
2	4.000	0.590	7,800

Table 4M Type II, Class 3 Angle Wrench, 15 deg and 60 deg Head Offsets (Metric)

Nominal Wrench Opening Across Flats, *A* or *B*, Head	Maximum Width of Open Head, *W*	Maximum Thickness of Open Head, *T*	Minimum Proof Torque, N·m
9	19.8	5.1	4.5
10	19.8	5.1	4.5
11	23.1	6.4	8
12	26.9	6.4	10
13	26.9	6.4	11
14	30.2	6.9	17
15	33.0	6.9	20
16	33.3	6.9	25
17	36.6	7.6	34
18	40.0	7.6	42
19	40.1	7.6	55
21	42.0	7.6	79
22	46.0	7.6	95
24	49.3	7.6	110
27	54.0	8.4	190
28	58.4	9.1	210
30	63.5	9.1	250
32	64.0	9.1	280
36	71.4	10.7	395
41	82.6	11.9	530
46	92.0	13.5	700
50	100.1	15.0	840

Table 5 Type III Tappet Wrench, 15 deg Angle (Inch)

Nominal Wrench Opening Across Flats		Maximum Width of Open Head		Maximum Thickness of Open Head		Minimum Proof Torque, lbf-in.	
Small Head, *A*	Large Head, *B*	Small Head, *W*	Large Head, *W*	Small Head, *T*	Large Head, *T*	Small Head	Large Head
5/16	3/8	0.750	0.938	0.218	0.218	75	120
3/8	7/16	0.938	1.187	0.218	0.218	120	165
7/16	1/2	1.187	1.290	0.218	0.218	165	286
7/16	17/32	1.187	1.290	0.218	0.218	165	300
1/2	9/16	1.290	1.437	0.218	0.218	286	355
9/16	5/8	1.437	1.500	0.218	0.234	355	432
5/8	11/16	1.500	1.598	0.234	0.234	432	516
11/16	3/4	1.598	1.705	0.234	0.234	516	607
3/4	7/8	1.705	1.990	0.234	0.234	607	812
13/16	7/8	1.840	1.990	0.234	0.234	710	812
15/16	1	2.115	2.250	0.250	0.250	941	1,053
1 1/16	1 1/8	2.357	2.494	0.250	0.250	1,318	1,494
1 1/4	1 5/16	2.768	2.905	0.260	0.260	1,886	2,100
1 3/8	1 7/16	3.042	3.179	0.277	0.277	2,326	2,564
1 1/2	1 5/8	3.315	3.589	0.291	0.291	2,815	3,353
1 11/16	1 7/8	3.725	4.136	0.315	0.315	3,641	4,550

Table 5M Type III Tappet Wrench, 15 deg Angle (Metric)

Nominal Wrench Opening Across Flats		Maximum Width of Open Head		Maximum Thickness of Open Head		Minimum Proof Torque, N·m	
Small Head, *A*	Large Head, *B*	Small Head, *W*	Large Head, *W*	Small Head, *T*	Large Head, *T*	Small Head	Large Head
6	7	16.4	18.4	4.0	4.0	4	6
8	9	20.4	21.9	4.2	4.2	9	13
8	10	20.4	24.4	4.2	4.5	9	17
10	11	24.4	26.4	4.5	4.5	17	21
12	13	28.4	30.4	4.7	4.8	26	32
12	14	28.4	32.4	4.7	4.8	26	38
13	15	30.4	34.4	4.8	4.8	32	46
14	15	32.4	34.4	4.8	4.8	38	46
16	18	36.6	41.0	5.0	5.1	53	71
17	19	38.8	43.2	5.1	5.6	62	81
19	22	43.2	48.3	5.6	6.0	81	116
21	24	46.3	52.3	6.0	6.0	103	143
27	30	56.0	62.0	7.1	7.1	187	238

ASME B107.40

WRENCHES, FLARE NUT

1 SCOPE

This Standard provides the tables and figures for flare nut wrenches. Performance requirements, tests, and safety requirements and limitations of use and safety requirements are provided in B107.6.

2 CLASSIFICATION

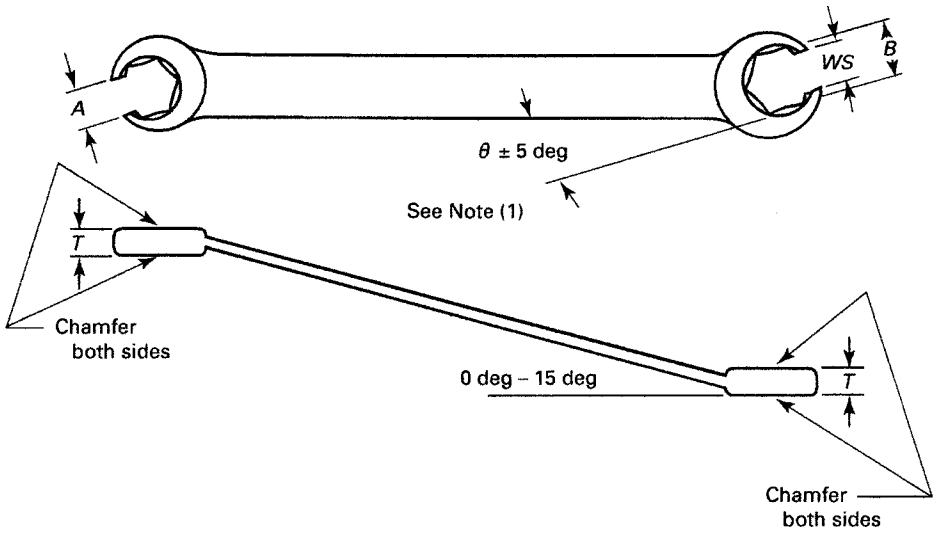
Type I: double head

Type II: combination, open end and 15 deg offset slotted box end

3 REFERENCES

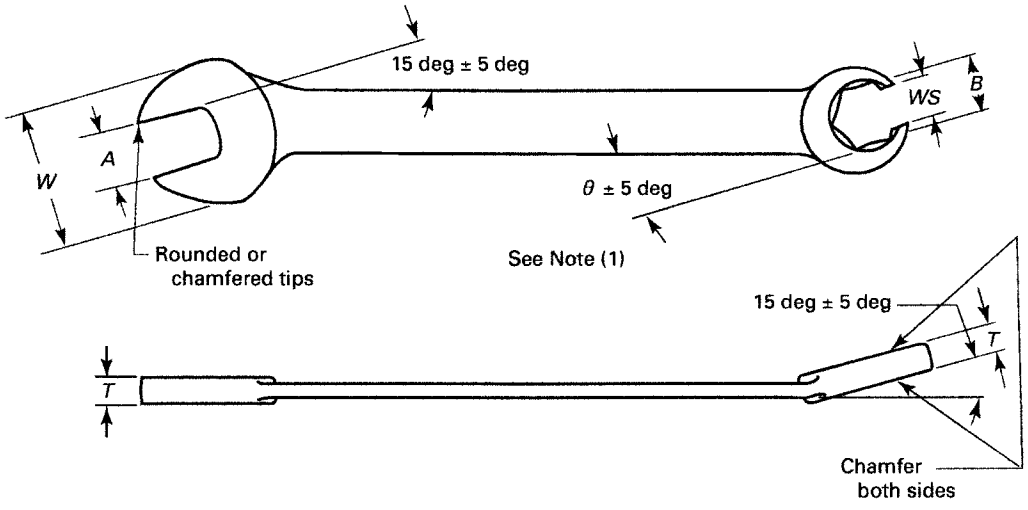
See references in ASME B107.6, Combination Wrenches.

Fig. 1 Type I Flare Nut Wrench



NOTE:
(1) Theta (θ) to be 0 deg or an increment of $7\frac{1}{2}$ deg.

Fig. 2 Type II Flare Nut Combination Wrench



NOTE:
(1) Theta (θ) to be 0 deg or an increment of $7\frac{1}{2}$ deg.

Table 1 Type I Flare Nut Wrench (Inch)

Nominal Wrench Opening Across Flats		Maximum Outside Diameter of Head, O.D.		Minimum Width of Slot in Head, *WS*		Maximum Thickness of Head, *T*		Minimum Proof Torque, lbf-in.	
Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*
1/4	5/16	0.656	0.750	0.109	0.141	0.291	0.344	110	170
5/16	3/8	0.750	0.875	0.141	0.188	0.344	0.406	170	240
3/8	7/16	0.875	0.938	0.188	0.250	0.406	0.453	240	320
7/16	1/2	0.938	1.156	0.250	0.313	0.453	0.484	320	400
1/2	9/16	1.156	1.188	0.313	0.344	0.484	0.484	400	510
5/8	11/16	1.281	1.438	0.406	0.438	0.625	0.625	625	750
5/8	3/4	1.281	1.438	0.406	0.438	0.625	0.625	625	880
5/8	13/16	1.281	1.500	0.406	0.531	0.625	0.625	625	1025
3/4	13/16	1.438	1.500	0.438	0.531	0.625	0.625	880	1025
3/4	7/8	1.438	1.641	0.438	0.531	0.625	0.625	880	1180
3/4	1	1.438	1.750	0.438	0.656	0.625	0.813	880	1510
7/8	15/16	1.641	1.750	0.531	0.578	0.625	0.813	1,180	1,340
7/8	1	1.641	1.750	0.531	0.656	0.625	0.813	1,180	1,510
7/8	1 1/8	1.641	1.938	0.531	0.750	0.625	0.875	1,180	1,880
15/16	1 1/16	1.750	1.813	0.578	0.656	0.813	0.813	1,340	1,700
1	1 1/16	1.750	1.813	0.656	0.656	0.813	0.813	1,510	1,700

Table 1M Type I Flare Nut Wrench (Metric)

Nominal Wrench Opening Across Flats		Maximum Outside Diameter of Head, O.D.		Minimum Width of Slot in Head, *WS*		Maximum Thickness of Head, *T*		Minimum Proof Torque, N·m	
Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*	Small Head, *A*	Large Head, *B*
7	8	17.3	19.0	4.5	4.5	7.6	8.5	15	20
7	9	17.3	22.0	4.5	4.7	7.6	10.0	15	25
8	10	19.0	23.5	4.5	5.5	8.5	10.5	20	30
9	11	22.0	24.0	4.7	6.4	10.0	10.5	25	35
10	12	23.5	25.5	5.5	7.0	10.5	11.1	30	40
11	13	24.0	27.0	6.4	8.5	10.5	11.1	35	45
12	14	25.5	28.0	7.0	9.5	11.1	12.0	40	55
13	14	27.0	28.0	8.5	9.5	11.1	12.0	45	55
15	17	30.2	32.2	10.3	12.0	12.0	13.5	65	85
16	17	31.2	32.2	10.3	12.0	12.0	13.5	75	85
16	18	31.2	33.6	10.3	12.5	12.0	14.7	75	95
18	20	33.6	37.5	12.5	14.0	14.0	14.7	95	120
19	21	35.9	41.3	13.0	15.1	14.7	15.2	105	130
19	22	35.9	41.3	13.0	15.9	14.7	15.2	105	145

Table 2 Type II Flare Nut Combination Wrench (Inch)

Nominal Opening Across Flats, *A* or *B*	Maximum Width of Open Head, *W*	Maximum Outside Diameter of Flare Head, O.D.	Minimum Width of Slot in Flare Head, *WS*	Maximum Thickness of Open Head, *T*	Maximum Thickness of Flare Head, *T*	Minimum Proof Torque, lbf-in.	
						Open Head	Flare Head
5/16	0.811	0.750	0.141	0.344	0.344	138	170
3/8	0.906	0.875	0.188	0.406	0.406	275	240
7/16	1.031	0.938	0.250	0.453	0.453	413	320
1/2	1.219	1.156	0.313	0.484	0.484	550	400
9/16	1.281	1.188	0.344	0.484	0.484	770	510
5/8	1.406	1.281	0.406	0.484	0.625	1,100	625
11/16	1.563	1.438	0.438	0.563	0.625	1,375	750
3/4	1.672	1.438	0.438	0.563	0.625	1,650	880
13/16	1.828	1.500	0.531	0.594	0.625	2,200	1,025
7/8	1.938	1.641	0.531	0.625	0.625	2,475	1,180
15/16	2.094	1.750	0.578	0.656	0.813	3,025	1,340
1	2.250	1.750	0.656	0.750	0.813	3,575	1,510

Table 2M Type II Flare Nut Combination Wrench (Metric)

Nominal Opening Across Flats, *A* or *B*	Maximum Width of Open Head, *W*	Maximum Outside Diameter of Flare Head, O.D.	Minimum Width of Slot in Flare Head, *WS*	Maximum Thickness of Open Head, *T*	Maximum Thickness of Flare Head, *T*	Minimum Proof Torque, N·m	
						Open Head	Flare Head
8	21.4	19.0	4.5	8.5	8.5	15	20
9	21.8	22.0	4.7	10.0	10.0	21	25
10	26.0	23.5	5.5	10.5	10.5	31	30
11	26.0	24.0	6.4	10.5	10.5	46	35
12	27.7	25.5	7.0	10.5	11.1	49	40
13	30.2	27.0	8.5	11.0	11.1	62	45
14	32.8	28.0	9.5	12.0	12.0	86	55
15	34.8	30.2	10.3	12.0	12.0	104	65
16	36.4	31.2	10.3	12.0	12.0	124	75
17	39.7	32.2	12.0	13.5	13.5	139	85
18	41.0	33.6	12.5	13.5	14.0	155	95
19	42.7	35.9	13.0	14.0	14.7	186	105

ASME B107.66

RATCHETING BOX WRENCHES

1 SCOPE

This Standard provides performance and safety requirements for ratcheting box wrenches used in hexagonal and double hexagonal wrenching applications. Consumers are requested to consult with manufacturers concerning lists of production sizes, lengths, and configurations.

2 DEFINITIONS

reversing torque: force to rotate the wrench in the ratcheting or nonloading direction.

shifter: device to control reversing mechanism.

3 REFERENCES

The following documents are referenced in this Standard. The latest available edition shall be used.

ASME B107.17M, Gages, Wrench Openings, Reference

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM B 571, Standard Test Methods for Qualitative Adhesion Testing of Metallic Coatings

ASTM D 968, Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM E 18, Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM E 92, Standard Test Method for Vickers Hardness of Metallic Materials

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care

Publisher: Hand Tools Institute (HTI), 25 North Broadway, Tarrytown, NY 10591 (www.hti.org)

4 CLASSIFICATION

Type I: laminated construction (see Figs. 1 and 2)
Type II: nonlaminated construction (see Figs. 3 and 4)

5 PERFORMANCE REQUIREMENTS

5.1 Design

Wrenches shall be designed to afford a well proportioned, comfortable handgrip. The engaging surfaces of the wrench openings shall be finished in a smooth and well-defined manner. The offset version (Fig. 2) shall have the reversing feature. Wrenches shall pass tests in section 6.

Nonratcheting wrenching ends shall meet the requirements as detailed below.

(a) Open ends shall comply with ASME B107.39.
(b) Solid box ends shall comply with ASME B107.9.
(c) Flare nut ends shall comply with ASME B107.40.

5.2 Materials

The materials used in the manufacture of wrenches shall be such as to produce wrenches conforming to the performance requirements of this Standard.

5.3 Markings

Each wrench shall be marked in a legible and permanent manner with the respective nominal wrench opening size(s) and with the manufacturer's name or a trademark of such known character that the manufacturer may be readily determined.

5.4 Hardness

The housing of the ratchet, the ratchet mechanism, and wrench openings shall have a hardness of 38 HRC to 55 HRC.

5.5 Proof Torque

Wrenches shall withstand the proof torque specified in Tables 1 and 1M without failure or any permanent deformation (set).

5.6 Reversing Torque

Reversing torque shall not exceed the maximum requirement in Tables 1 and 1M after Proof Torque Test.

5.7 Wrench Openings

Wrench openings shall be such as to ensure acceptance when gaged with gages conforming to ASME B107.17M and shall conform to one of the following wrenching opening designs:

(a) standard single or double hexagon configuration, consisting of a single geometric single (6-point) hexagon

Fig. 1 Laminated

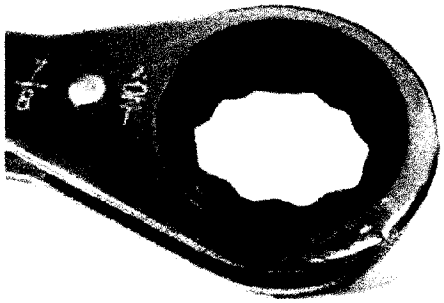


Fig. 2 Laminated (Offset)

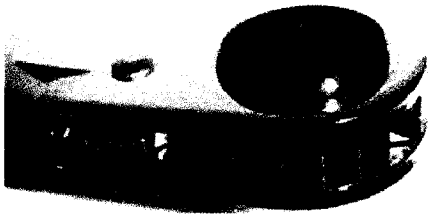


Fig. 3 Nonlaminated

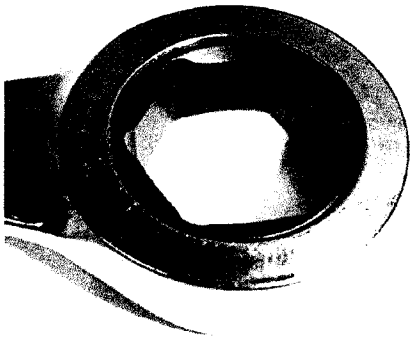


Fig. 4 Nonlaminated (With Reversing Mechanism)

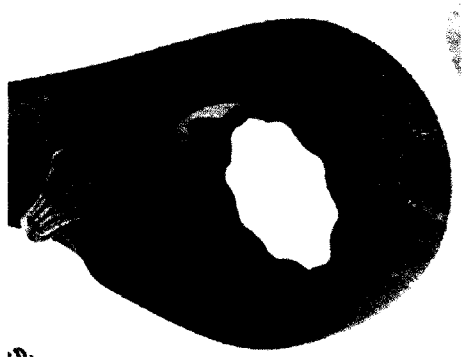


Table 1 Torque Requirements (Inch)

Nominal Wrench Opening Across-Flats, in.	Proof Torque, lbf-in.		Maximum Reversing Torque, ozf-in.	Maximum Mandrel Insertion Depth, in.
	Type I	Type II		
5/32	100	100	10	0.178
3/16	125	125	10	0.203
1/4	144	144	10	0.295
9/32	162	162	10	0.300
5/16	180	180	10	0.330
11/32	270	270	10	0.335
3/8	360	360	25	0.344
7/16	480	480	25	0.391
1/2	600	600	25	0.413
9/16	720	750	25	0.425
19/32	810	935	40	0.438
5/8	900	1,100	40	0.531
11/16	930	1,320	40	0.535
3/4	960	1,430	40	0.594
25/32	980	1,540	50	0.602
13/16	1,000	1,650	50	0.688
7/8	1,060	1,815	50	0.609
15/16	1,224	2,255	50	0.701
1	1,280	2,695	50	0.719
1 1/16	1,380	2,970	75	0.790
1 1/8	1,460	3,215	75	0.860
1 1/4	1,760	3,960	75	0.940
1 5/16	1,825	4,200	100	0.940
1 3/8	1,910	4,485	100	0.940
1 7/16	1,925	4,620	100	0.953
1 1/2	2,120	5,185	100	1.008

Table 1M Torque Requirements (Metric)

Nominal Wrench Opening Across-Flats, mm	Proof Torque, N·m		Maximum Reversing Torque, N·m	Maximum Mandrel Insertion Depth, mm
	Type I	Type II		
6	14	14	0.07	7.4
7	18	18	0.07	7.7
8	21	21	0.07	8.2
9	34	34	0.07	9.0
10	43	43	0.07	9.0
11	52	52	0.07	10.0
12	59	59	0.18	10.0
13	70	70	0.18	10.5
14	79	79	0.18	11.5
15	90	100	0.18	11.5
16	102	124	0.28	12.1
17	104	134	0.28	12.7
18	106	152	0.28	12.7
19	108	162	0.28	14.8
20	111	174	0.35	14.8
21	114	186	0.35	16.3
22	119	240	0.35	14.8
23	122	228	0.35	16.5
24	139	255	0.35	17.8
25	156	300	0.35	17.9
26	165	304	0.35	18.0
27	164	366	0.35	19.8
28	173	355	0.35	19.8
29	178	375	0.35	19.8
30	185	398	0.35	20.0
31	193	425	0.35	21.0
32	201	453	0.35	22.0

or a double (12-point) hexagon configuration having an across-flats and an across-corner shape for fitting with hexagon fasteners

(b) modified single or double hexagon configuration, consisting of a geometric single (6-point) hexagon or a double (12-point) hexagon configuration having an across-flats and a modified or radial relieved across-corners shape that does not contact on the fasteners corners

5.8 Finish

Surfaces shall have a rust preventive treatment and be essentially free from burrs, pits, cracks, nodules, and other conditions (including flash) that would adversely affect the performance or safety of the wrench. When provided, coatings shall be adherent, smooth, continuous, and free from any conditions that would interfere with their protective value, safety, and function.

5.9 Wrench End

The ratcheting end shall include a head for housing a ratchet mechanism, a ratchet mechanism, and a wrench opening. Ratcheting action may be reversible.

6 TESTS

Many of the tests herein are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting these tests. Separate wrenches shall be used for each test.

6.1 Hardness

Hardness shall be tested in accordance with ASTM E 18. Microhardness is acceptable when tested in accordance with ASTM E 92.

6.2 Proof Torque

The Proof Torque Test shall be conducted to determine conformance with the applicable proof torque requirement specified in para. 5.5.

6.2.1 Wrench Preparation. Suitable reference lines may be scribed on the head and handle to assist in examination for permanent deformation (set) after application of proof torque.

Table 2 Hexagon Mandrel Dimensions (Inch)

Nominal Size Across-Flats	Across-Flats Tolerances		Across-Corners, Min.
3/16	0.001	−0.002	0.2095
7/32	0.001	−0.002	0.2440
1/4	0.001	−0.002	0.2780
9/32	0.001	−0.002	0.3133
5/16	0.001	−0.002	0.3495
11/32	0.001	−0.002	0.3860
3/8	0.001	−0.002	0.4225
7/16	0.001	−0.002	0.4935
1/2	0.001	−0.002	0.5635
9/16	0.001	−0.003	0.6339
19/32	0.001	−0.003	0.6697
5/8	0.001	−0.003	0.7055
11/16	0.001	−0.003	0.7769
3/4	0.001	−0.003	0.8485
25/32	0.001	−0.003	0.8843
13/16	0.001	−0.003	0.9201
7/8	0.001	−0.003	0.9917
15/16	0.001	−0.003	1.0631
1	0.001	−0.003	1.1297
1 1/16	0.001	−0.003	1.2013
1 1/8	0.001	−0.003	1.2728
1 1/4	0.001	−0.003	1.4160
1 5/16	0.001	−0.003	1.4870
1 3/8	0.001	−0.003	1.5590
1 7/16	0.001	−0.003	1.6310
1 1/2	0.001	−0.003	1.7020

Table 2M Hexagon Mandrel Dimensions (Metric)

Nominal Size Across-Flats	Across-Flats Tolerances		Across-Corners, Min.
6	0.025	−0.050	6.68
6.3	0.025	−0.050	7.02
7	0.025	−0.050	7.79
8	0.025	−0.050	8.95
9	0.025	−0.050	10.11
10	0.025	−0.050	11.27
11	0.025	−0.050	12.40
12	0.025	−0.050	13.53
13	0.025	−0.050	14.67
14	0.025	−0.050	15.80
15	0.025	−0.050	16.92
16	0.025	−0.050	18.06
17	0.025	−0.050	19.20
18	0.025	−0.050	20.35
19	0.025	−0.050	21.49
20	0.025	−0.050	22.64
21	0.025	−0.050	23.78
22	0.025	−0.050	24.93
23	0.025	−0.050	26.07
24	0.025	−0.050	27.20
25	0.025	−0.050	28.27
26	0.025	−0.050	29.38
27	0.025	−0.050	30.53
28	0.025	−0.050	31.67
29	0.025	−0.050	32.81
30	0.025	−0.050	33.96
31	0.025	−0.050	35.10
32	0.025	−0.050	36.25

6.2.2 Mandrels. Mandrels shall conform to the dimensions and tolerances of Tables 2 and 2M. Mandrels shall be hardened to not less than 55 HRC and smoothly finished on the wrench engaging surfaces.

6.2.3 Application of Proof Torque. Wrench openings shall be gaged for conformance to ASME B107.17M prior to testing. The wrench opening shall then be engaged on the end of a mandrel to a depth no greater than specified in Tables 1 and 1M. The force required to produce the torque shall be applied as far from the mandrel as practical, so that the whole wrench is tested. Proof Torque Test speed shall not be faster than 30 deg/min after the torque has reached 50% of the specified proof table value. Any wrench opening that cracks, fractures, or does not gage shall have failed the test.

6.3 Reversing Torque

Type II wrenches shall be tested for reversing torque after they have been tested for proof torque. Each wrench shall be rotated 360 deg after the proof load test and before measuring reversing torque. The reversing torque shall not exceed the requirements in Tables 1 and 1M.

6.4 Plating Test

Plated surfaces shall be subjected to the tests detailed in paras. 6.4.1 and 6.4.2.

6.4.1 Coating Adhesion Test. Sample wrenches shall pass the file or grind-saw test of ASTM B 571.

6.4.2 Coating Abrasion Test. Sample wrenches shall have no base material exposed when subjected to 100 L of falling sand when tested per ASTM D 968 Method A.

6.5 Drop Test

Wrenches shall be dropped from a height of 6 ft onto a concrete surface 12 times. On wrenches with protruding shifters the tester should attempt to have the shifter strike first on the concrete at least twice during the test. There shall be no physical failure of any component, and the wrench must be fully functional after this test.

6.6 Cycle Test

The applied torque for cycle testing shall be 35% of the proof torque specified in Tables 1 and 1M. Samples shall be tested at a rate not to exceed 60 cycles per minute. Ratcheting gear mechanism shall withstand a cycle test of 5,000 cycles in the clockwise and 5,000 in the counterclockwise directions. Wrenches without reversing feature shall be tested for 5,000 cycles in one direction only. There shall be no physical failure of any

component, and the wrench must be fully functional after the test.

7 SAFETY REQUIREMENTS AND LIMITATIONS OF USE

(a) Instructors and employers shall stress proper use and safety in the use of wrenches, information about which can be found in the HTI publication, *Guide to Hand Tools — Selection, Safety Tips, Proper Use and Care.*

(b) Bolts or nuts may require removal or installation torque that may exceed the test torques herein and for these applications a ratcheting box wrench **should not be used.** A fixed box end wrench should be used.

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