

ASME B107.66

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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

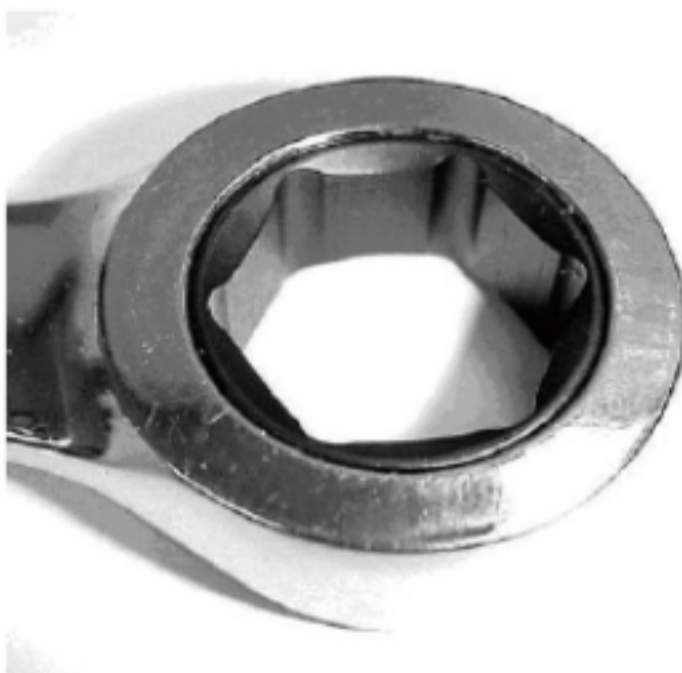


Fig. 4 Nonlaminated (With Reversing Mechanism)

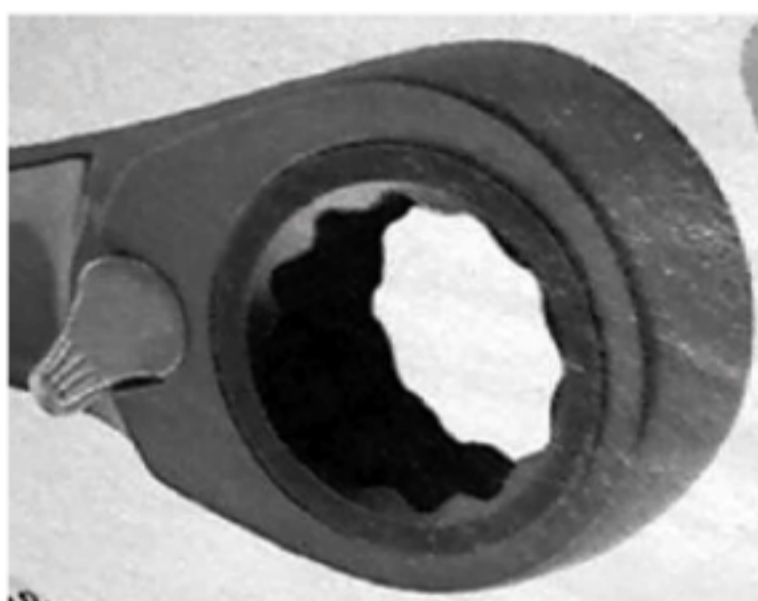


Table 1 Torque Requirements (Inch)

| Nominal Wrench Opening Across-Flats, in. | Proof Torque, lbf-in. | | Maximum Reversing Torque, ozf-in. | Maximum Mandrel Insertion Depth, in. |
|--|-----------------------|---------|--------------------------------------|---|
| | Type I | Type II | | |
| $\frac{5}{32}$ | 100 | 100 | 10 | 0.178 |
| $\frac{3}{16}$ | 125 | 125 | 10 | 0.203 |
| $\frac{1}{4}$ | 144 | 144 | 10 | 0.295 |
| $\frac{9}{32}$ | 162 | 162 | 10 | 0.300 |
| $\frac{5}{16}$ | 180 | 180 | 10 | 0.330 |
| $\frac{11}{32}$ | 270 | 270 | 10 | 0.335 |
| $\frac{3}{8}$ | 360 | 360 | 25 | 0.344 |
| $\frac{7}{16}$ | 480 | 480 | 25 | 0.391 |
| $\frac{1}{2}$ | 600 | 600 | 25 | 0.413 |
| $\frac{9}{16}$ | 720 | 750 | 25 | 0.425 |
| $\frac{19}{32}$ | 810 | 935 | 40 | 0.438 |
| $\frac{5}{8}$ | 900 | 1,100 | 40 | 0.531 |
| $\frac{11}{16}$ | 930 | 1,320 | 40 | 0.535 |
| $\frac{3}{4}$ | 960 | 1,430 | 40 | 0.594 |
| $\frac{25}{32}$ | 980 | 1,540 | 50 | 0.602 |
| $\frac{13}{16}$ | 1,000 | 1,650 | 50 | 0.688 |
| $\frac{7}{8}$ | 1,060 | 1,815 | 50 | 0.609 |
| $\frac{15}{16}$ | 1,224 | 2,255 | 50 | 0.701 |
| 1 | 1,280 | 2,695 | 50 | 0.719 |
| $1\frac{1}{16}$ | 1,380 | 2,970 | 75 | 0.790 |
| $1\frac{1}{8}$ | 1,460 | 3,215 | 75 | 0.860 |
| $1\frac{1}{4}$ | 1,760 | 3,960 | 75 | 0.940 |
| $1\frac{5}{16}$ | 1,825 | 4,200 | 100 | 0.940 |
| $1\frac{3}{8}$ | 1,910 | 4,485 | 100 | 0.940 |
| $1\frac{7}{16}$ | 1,925 | 4,620 | 100 | 0.953 |
| $1\frac{1}{2}$ | 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. |
|------------------------------|----------------------------|--------|----------------------|
| $\frac{3}{16}$ | 0.001 | -0.002 | 0.2095 |
| $\frac{7}{32}$ | 0.001 | -0.002 | 0.2440 |
| $\frac{1}{4}$ | 0.001 | -0.002 | 0.2780 |
| $\frac{9}{32}$ | 0.001 | -0.002 | 0.3133 |
| $\frac{5}{16}$ | 0.001 | -0.002 | 0.3495 |
| $\frac{11}{32}$ | 0.001 | -0.002 | 0.3860 |
| $\frac{3}{8}$ | 0.001 | -0.002 | 0.4225 |
| $\frac{7}{16}$ | 0.001 | -0.002 | 0.4935 |
| $\frac{1}{2}$ | 0.001 | -0.002 | 0.5635 |
| $\frac{9}{16}$ | 0.001 | -0.003 | 0.6339 |
| $\frac{19}{32}$ | 0.001 | -0.003 | 0.6697 |
| $\frac{5}{8}$ | 0.001 | -0.003 | 0.7055 |
| $\frac{11}{16}$ | 0.001 | -0.003 | 0.7769 |
| $\frac{3}{4}$ | 0.001 | -0.003 | 0.8485 |
| $\frac{25}{32}$ | 0.001 | -0.003 | 0.8843 |
| $\frac{13}{16}$ | 0.001 | -0.003 | 0.9201 |
| $\frac{7}{8}$ | 0.001 | -0.003 | 0.9917 |
| $\frac{15}{16}$ | 0.001 | -0.003 | 1.0631 |
| 1 | 0.001 | -0.003 | 1.1297 |
| $1\frac{1}{16}$ | 0.001 | -0.003 | 1.2013 |
| $1\frac{1}{8}$ | 0.001 | -0.003 | 1.2728 |
| $1\frac{1}{4}$ | 0.001 | -0.003 | 1.4160 |
| $1\frac{5}{16}$ | 0.001 | -0.003 | 1.4870 |
| $1\frac{3}{8}$ | 0.001 | -0.003 | 1.5590 |
| $1\frac{7}{16}$ | 0.001 | -0.003 | 1.6310 |
| $1\frac{1}{2}$ | 0.001 | -0.003 | 1.7020 |

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.

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 |

6.4.1 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.