

Tubular box spanners

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Co-operating organizations

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

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Air Ministry	Institute of Marine Engineers
Associated Offices' Technical Committee	Institute of Petroleum
Association of Consulting Engineers	Institution of Civil Engineers
(Incorporated)	Institution of Gas Engineers
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	Radio Industry Council
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The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Federation of British Hand Tool Manufacturers	Society of British Aircraft Constructors
General Post Office	Telephone Manufacturers Technical Development Committee
Leicester Technical College	Spanner Manufacturers
National Association of Drop Forgers and Stampers	Individual large users

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Foreword

This standard makes reference to the following British Standards:

BS 57, *B.A. screws, bolts, nuts and plain washers.*

BS 860, *Table of approximate comparison of hardness scales.*

BS 916, *Black bolts, screws and nuts.*

BS 970, *Wrought steels.*

BS 1083, *Precision hexagon bolts, screws, nuts and plain washers.*

BS 1750, *Bolting for the petroleum industry.*

BS 1768, *Unified precision hexagon bolts, screws, nuts (UNC and UNF threads) and plain washers — normal series.*

BS 1769, *Unified black hexagon bolts, screws and nuts and plain washers — heavy series.*

BS 1981, *Unified machine screws and machine screw nuts.*

BS 2708, *Unified black square and hexagon bolts, screws and nuts (UNC and UNF threads). Normal series.*

BS A102, *Steel bolts (Unified hexagon and UNF threads) for aircraft.*

This British Standard has been prepared under the authority of the Mechanical Engineering Industry Standards Committee and forms one of a series relating to the main types and ranges of spanners.

The specification relates entirely to box spanners of the tubular type as it is intended that a separate standard will be prepared for the forged type and for socket spanners.

The composition and layout are directly related to the latest revision of BS 192, the title of which has been amended to “*Open-ended spanners (not including B.A. sizes)*”, except that while the spanners in BS 192 are dealt with throughout on a single-ended basis, those in this specification are treated entirely as double-ended.

Spanner dimensions are included for all the main hexagon ranges as in BS 192 but it should be noted that the dimensions across flats are given in two grades, A and B. The reason for this is that provision has been made for alternative types of steels from which the spanners may be manufactured, Grade A referring to the better quality steel which is heat treated, and Grade B to steel with a much lower carbon content, which is not heat treated. The apparent anomaly in the tables, where Grade B spanners are given first and are to closer limits of tolerance, is explained by the fact that dimensional allowance has to be made for distortion resulting from the heat treatment of Grade A spanners.

The marking of the spanners has been complicated by the necessity to indicate those which are intended for use on the various Unified hexagons. The problem has been solved in a manner identical with that put forward in BS 192, and the system requires the use of simple figures derived from the decimal equivalent of the size across flats. Investigations have shown that newcomers to the engineering industry experience no more and probably less, difficulty in mastering this method of nomenclature than the old fractional markings, which tended to be confusing because of their obvious difference from the size of the actual jaw opening in some cases, e.g., the large Whitworth range.

There is a popular custom, whereby a series of tubular spanners is nested for convenience of storage or carrying but, after reviewing the matter, it was not considered advisable to include any provision for this practice in the specification.

A table of spanners for metric hexagons is included. This has had to be prepared on a more or less arbitrary basis for the same reason that applied in BS 192, i.e. because of the lack of co-ordinated specifications for metric bolts and nuts.

As the use of the large Whitworth hexagons is still widespread, references to the relevant spanners have been incorporated in the table for the B.S. series.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18 and an inside back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard relates to tubular box spanners suitable for the following hexagon standards or ranges:

BS 1768, *Unified precision hexagon bolts, screws, nuts (UNC and UNF threads) and plain washers. Normal series.*

BS 1769, *Unified black hexagon bolts, screws, nuts (UNC and UNF) and plain washers. Heavy series.*

BS 1981, *Unified machine screws and machine screw nuts.*

BS 1083, *Precision hexagon bolts, screws, nuts (BSW and BSF threads) and plain washers.*

BS 916, *Black bolts and nuts. Hexagon and square, BSW and BSF.*

BS 57, *B.A. screws, bolts, nuts and plain washers.*

Whitworth large hexagons (originally specified in BS 190, now obsolete).

Metric hexagons.

NOTE The spanners specified are also suitable for all the bolt sizes given in BS A102¹⁾ and for all the bolt head and most of the nut sizes used by the petroleum industry and specified in BS 1750²⁾.

The specification includes clauses for material, heat treatment, marking, tests and dimensional details together with requirements for the tommy bars by which the spanners are operated.

2 Material for spanners

Tubular box spanners complying with the provisions of this British Standard shall be manufactured from seamless steel tubing of any of the types given below:

a) Grade A spanners.

- i) Steel having a carbon content of not less than 0.30 per cent and not more than 0.40 per cent.

NOTE Steel to specification En. 8B or En. 8E of BS 970³⁾, is considered a suitable material.

- ii) Alloy steel complying with any appropriate specification in BS 970³⁾.

Grade A spanners shall be heat treated as specified in Clause 4.

b) Grade B spanners.

Steel having a maximum carbon content of 0.20 per cent. Grade B spanners shall not be heat treated.

3 Material for tommy bars

Tommy bars complying with the provisions of this British Standard shall be manufactured from steel having a carbon content of not less than 0.30 and not more than 0.40 per cent with a yield point of not less than 40 tons per sq. in.

4 Heat treatment and hardness for Grade A spanners

Grade A spanners shall be subjected to the heat treatment and tempering necessary to produce the following hardness figures, in all cases using a load of 30 kg.:

- a) *When manufactured from the steel specified in 2 a) i):* hardness within the range 200/235 on the diamond pyramid hardness scale or the equivalent on other scales⁴⁾.
- b) *When manufactured from the steel specified in 2 a) ii):* hardness within the range 235/300 on the diamond pyramid hardness scale or the equivalent on other scales.

5 Tommy bar holes

a) *Position.* Each spanner shall be provided with two sets of holes which are located as near as practicable to the change of section at each end of the spanner and which shall be at 90 degrees to each other. See Figure 1.

b) *Size.* The diameter of the holes shall be such as will permit entry of a tommy bar of the appropriate size given in Table 2, Table 3, Table 4, Table 5 and Table 6, when the bar is on the maximum limit of tolerance for its diameter but will not permit entry of the next larger diameter of tommy bar.

6 Designation and marking

Spanners in accordance with this British Standard shall be designated and marked according to the requirements specified below which vary according to the range of hexagon sizes for which they are designed.

The marking shall be plain and indelible and shall be adjacent to each formed end.

¹⁾ BS A102, "Steel bolts (Unified hexagons and UNF threads) for aircraft".

²⁾ BS 1750, "Bolting for the petroleum industry".

³⁾ BS 970, "Wrought steels".

⁴⁾ BS 860, "Approximate comparison of hardness scales".

The spanners are considered as being double-ended in all cases, each end being intended for a size in the same hexagon range as the opposite end and being marked appropriately in accordance with the following clauses.

It is recommended that hexagons from two different ranges should not be associated on any one spanner.

a) *Spanners for Unified hexagons in BS 1768, BS 1769 and BS 1981.* The marking (which shall also be the designation or nominal size) shall be a number derived from the decimal equivalent of the nominal fractional size across flats of the hexagon, followed by the sign A/F.

This number shall be rounded off to two decimal places and the decimal point shall be omitted.

This requirement shall not debar any manufacturer from including, at his option, any additional mark associated with the size.

The following are examples of this type of marking:

34 A/F represents a spanner for a No. 8 pressed nut.

94 A/F represents a spanner for a $\frac{5}{8}$ in. diameter Normal series bolt and nut.

162 A/F represents a spanner for a 1 in. diameter Heavy series bolt and nut.

A manufacturer could add the marks $\frac{11}{32}$ A/F, $\frac{15}{16}$ A/F and $1\frac{5}{8}$ A/F respectively to the above if he so desired.

b) *Spanners for B.S. hexagons in BS 1083 and BS 916 and for Whitworth large hexagons.* Two fractions shall be marked on each end of these spanners.

The first shall represent the nominal diameter of a bolt, the head of which corresponds to a hexagon size in BS 1083 or BS 916.

This fraction shall be followed by the sign BS.

The second fraction shall represent the nominal diameter of a bolt, the head of which corresponds to a hexagon, in the Whitworth large hexagon range.

This shall be followed by the sign W.

The following is an example of this marking:

$\frac{3}{8}$ BS

$\frac{5}{16}$ W

The designation or nominal size shall be either one or both of the fractions followed by "BS" or "Whitworth," as applicable.

c) *Spanners for B.A. hexagons.* The marking (which shall also be the designation or nominal size) shall be the appropriate number followed by the sign BA.

The following are examples of this marking:

4 BA

2 BA

d) *Spanners for metric hexagons.* The marking shall be the nominal internal size across the flats of the hexagon expressed in millimetres, followed by the sign mm. This is also the designation.

The following is an example of this marking:

10 mm $\times$ 11 mm

7 Finish

The formed ends shall be co-axial and the end faces shall be at 90 degrees to the axis of the tube.

The formed ends and the external surfaces shall be free from burrs and cracks.

The surface finish of Grade A spanners shall be blued, oil-black, or sandblasted and oiled.

The surface finish of Grade B spanners shall be by blueing or mottling.

The surface finish of both Grades A and B may be varied by agreement between the purchaser and the manufacturer.

8 Performance test

Every spanner and tommy bar shall be capable of passing the appropriate test given below:

a) *Grade A and Grade B spanners.*

i) Each end of the spanner to be tested shall be placed in turn upon the head of a rigidly held bolt, the head dimensions of which comply with the provisions of BS 1083, BS 1768, BS 1769, BS 1981, BS 916, BS 57, Whitworth large hexagons or metric hexagons, whichever is appropriate to the size of the spanner being tested.

For testing Grade A spanners, the test bolt shall be manufactured from high tensile steel having a tensile strength of 55/65 tons per sq in.

NOTE One of the En. 16 specifications from BS 970⁵⁾, is recommended as suitable.

For testing Grade B spanners, the test bolt shall be manufactured from mild steel.

⁵⁾ BS 970, "Wrought steels".

ii) After placing the spanner on the bolt head, a tommy bar of the correct diameter for the holes in the spanner (see Table 2, Table 3, Table 4, Table 5 or Table 6), but 50 per cent longer than the lengths given in the tables, shall be inserted through the set of holes remote from the end under test.

A turning moment shall then be manually applied to the tommy bar and the spanner shall withstand the maximum torque which can be applied by hand without distortion of the hexagon or other damage or, alternatively, the test bolt shall be sheared.

b) *Tommy bars.* Each tommy bar shall be capable of withstanding the turning moment specified in Clause 8 a) above, for the largest appropriate nominal size of Grade A spanner, tested on a high tensile steel bolt. On completion of the test, the tommy bar shall not be distorted or otherwise damaged.

9 General dimensions

The general dimensions of tubular box spanners shall be those specified in Table 2, Table 3, Table 4, Table 5 and Table 6, according to the type of hexagon for which the spanners are designed.

The internal width across flats on each formed end shall be maintained for a minimum depth from the end face of 1.25 T, where T is the maximum thickness of a standard ordinary nut (see Figure 1).

10 Tolerances

a) *Tube wall.* The limits of tolerance on the mean thickness of the tube wall shall be those given below:

i) Grade A spanners.

Wall thickness of tube	Limits of tolerance
Up to and including 0.080 in.	± 0.003 in.
Over 0.080 in.	± 0.004 in.

ii) Grade B spanners. The limits of tolerance shall be plus or minus one gauge for all mean thicknesses of tube wall.

b) *Formed ends of spanner.* The thickness of the wall at each formed end shall not vary by more than plus or minus one gauge from the mean thickness of the tube wall appropriate to the spanner.

11 Tommy bars

The tommy bars for use with box tubular spanners shall be produced to the dimensions in Table 2 to Table 6 inclusive and shall be designated by the diameter as given in the same tables.

The tommy bars shall be of good commercial finish and the ends shall be either chamfered or radiused.

The material from which the bars are manufactured shall be that given in Clause 3 and the test shall be that given in Clause 8 b).

NOTE The maximum length of any tommy bar in Table 2 and Table 4 is 12 in. This length applies to spanners for all bolts with diameters from 1 in. to 2 in. inclusive.

The following are among the reasons for this condition:

- The spanners and tommy bars are often required in easily portable sets and, in such cases, bars over 12 in. long tend to become too heavy.
- The 12 in. length is in accordance with the maximum generally supplied by the manufacturer and is intended mainly for nipping purposes. Users often provide their own tommy bars but the 12 in. bar can be extended, if necessary to give longer leverage, by the use of a tubular or other suitable extension piece.

Table 1 — Maximum dimensions across flats of hexagons

All dimensions are in inches;

1	2	3	4	5	6	7	8		9
Nominal diameter of bolt or nut	Unified hexagons: Normal series BS 1768	Unified hexagons: Heavy series BS 1769	Unified machine screw and machine screw nut hexagons BS 1981			B.S. hexagons BS 916 and BS 1083	B.A. hexagons BS 57		Whitworth large hexagons (BS 190 obsolete)
			Nominal size of screw	Nominal size and type of nut	Across flats		BA No.	Across flats	
0.112 (No. 4)			No. 4	No. 4 precision	0.1875		11	0.103	
0.138 (No. 6)			No. 6: No. 8	No. 4 pressed	0.250		10	0.117	
0.164 (No. 8)				No. 6 precision					
0.190 (No. 10)			No. 10	No. 6 pressed	0.3125		9	0.131	
		No. 8 precision				8	0.152		
	No. 10 precision			7	0.172				
$\frac{3}{16}$		No. 8 pressed		0.3438		6	0.193	0.445	
		No. 10 pressed		0.3750					
$\frac{1}{4}$	0.4375			$\frac{1}{4}$ in. precision	0.4375	0.445	5	0.220	
				$\frac{1}{4}$ in. pressed			4	0.248	
$\frac{5}{16}$	0.500			$\frac{5}{16}$ in. precision	0.500	0.525			0.525
				$\frac{5}{16}$ in. pressed	0.5625		3	0.282	
							2	0.324	0.600
$\frac{3}{8}$	0.5625			$\frac{3}{8}$ in. precision	0.5625	0.600	1	0.365	
				$\frac{3}{8}$ in. pressed	0.6250		0	0.413	0.710
$\frac{7}{16}$	0.6250 (0.6875 for nut)					0.710			0.820
$\frac{1}{2}$	0.750	0.875				0.820			0.920
$\frac{9}{16}$	0.8125 (0.875 for nut)					0.920			1.010
$\frac{5}{8}$	0.9375	1.0625				1.010			1.100
$\frac{11}{16}$						1.100 ^a			1.200
$\frac{3}{4}$	1.125	1.250				1.200			1.300
$\frac{7}{8}$	1.3125	1.4375				1.300			1.480
1	1.500	1.625				1.480			1.670
$1\frac{1}{8}$		1.8125				1.670			1.860
$1\frac{1}{4}$		2.000				1.860			2.050
$1\frac{3}{8}$		2.1875				2.050			2.220
$1\frac{1}{2}$		2.375				2.220			2.410
$1\frac{5}{8}$						2.410			2.580
$1\frac{3}{4}$		2.750				2.580			2.760
2		3.125				2.760			3.150
$2\frac{1}{2}$						3.150			—
^a $1\frac{11}{16}$ in. B.S. is not included in BS 916 or BS 1083.									

^a $\frac{11}{16}$ in. B.S. is not included in BS 916 or BS 1083.