BRITISH STANDARD

BS 3594-1: 1963

Incorporating Amendment Nos. 1 and 2

Specification for

Pipe wrenches —

Part 1: Stillson type wrenches

Confirmed January 2011

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This British Standard, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 2 April 1963

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The following BSI references relate to the work on this standard:
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Amendments issued since publication

Amd. No.	Date of issue	Comments
6273	November 1967	
7773	August 1993	Indicated by a sideline in the margin

Contents

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Foreword

This standard makes reference to the following British Standards:

BS 309, *Whiteheart malleable iron castings.*

BS 310, *Blackheart malleable iron castings.*

BS 427, *Method for Vickers hardness test. Part 1: Testing of metals.*

BS 970, *Wrought steels. En series.*

BS 1133-6, *Temporary prevention of corrosion during transportation and storage.*

BS 1387, *Steel tubes and tubulars suitable for screwing to BS 21 pipe threads.*

BS 1408, *Patented cold drawn steel spring wire.*

BS 1449, *Steel plate, sheet and strip.*

This British Standard has been prepared under the authority of the Mechanical Engineering Industry Standards Committee. Its publication will be followed by Part 2, "*Footprint type wrenches*", and then Part 3, "*Chain type wrenches*".

Pipe wrenches are often used on scaffolding at considerable heights and in many other dangerous situations where failure of the tool could result in serious accident. The committee responsible for the preparation of this standard has given realistic consideration to these hazards, and in addition to requirements to be met in manufacture has laid down stringent static load and combined static/shock load tests which the finished wrench shall be capable of passing. The tests are related to functional proof loads established by experiment and not to unrealistic "failure loads" as are sometimes quoted.

NOTE A table from which metric equivalents can be calculated is given in an Appendix. The figures in British units are to be regarded as the standard. More accurate conversions should be based on the tables in BS 350, "*Conversion factors and tables*".

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a 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.

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1 Scope

This British Standard relates to the essential dimensions, quality, finish, testing and marking of pipe wrenches of the Stillson type as illustrated in Figure 1 and Figure 2 in nominal sizes as follows:

8 in; 10 in; 12 in; 14 in; 18 in; 24 in; 36 in and 48 inch.

2 Nomenclature and definitions

For the purpose of this British Standard the nomenclature of Figure 1 has been adopted together with the following definitions:

a) *Nominal size*. The nominal size of a Stillson type wrench is the overall length of the tool when the jaws are open to maximum capacity (see Figure 1).

b) *Maximum capacity*. The maximum capacity of a Stillson type wrench is the distance between jaws measured when the end of the movable jaw is flush with the back face of the frame as shown in Figure 1 and Figure 2 (i.e. the maximum diameter of pipe that can be gripped with safety).

3 Materials

The components of Stillson type wrenches shall be manufactured from the following materials:

a) *Handle*. From steel conforming to BS EN 10083-1[1], 2C50 or 2C55 or from steel conforming to BS 970-1[2], 060 A62.

b) *Movable jaw*. From steel conforming to BS EN 10083-1[1], 2C50 or 2C55 or from steel conforming to BS 970-1[2], 060 A62.

c) *Frame*. From Whiteheart malleable iron, or from Blackheart malleable iron conforming to BS 6681[3], or from spheroidal graphite iron, conforming to BS 2789.[4]

d) *Spring (or springs)*. From any spring steel selected from BS 1449[5] or BS 5216.[6]

e) *Adjusting nut*. From any carbon steel selected from BS 970-1.[2]

f) *Hinge pin*. From any carbon steel selected from BS 970-1.[2]

Materials superior in mechanical properties to those specified above may be used, provided that the provisions of this specification are met in full.

4 Heat treatment and hardness

The heat treatment and hardness of components of Stillson type wrenches shall be as follows:

a) *Handle and movable jaw*. After forging, the grain structure of the steel shall be suitably refined.

The jaws shall be locally hardened and tempered in order to provide hardness values within the range 600 to 700HV 30[7] when measured at any point within the triangular profile of any tooth.

At no point on the shank of the handle, nor on the shank of the movable jaw shall hardness values be in excess of 400HV 30.[7]

The transitional hardness zone (see Figure 1) between 600 to 700HV 30 and 400HV 30[7], shall not extend beyond a point defined as twice the height of the teeth measured back from the tooth root.

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[1] BS EN 10083 "*Quenched and tempered steels*, Part 1, *Technical delivery conditions for special steels*".

[2] BS 970 "*Specification for wrought steels for mechanical and allied engineering purposes,* Part 1, *General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels*".

[3] BS 6681 "*Specification for malleable cast iron*".

[4] BS 2789 "*Specification for spheroidal graphite or nodular graphite cast iron*".

[5] BS 1449 "*Steel plate, sheet and strip*".

[6] BS 5216 "*Specification for patented cold drawn steel wire for mechanical springs*".

[7] BS 427 "*Method for Vickers hardness test*, Part 1, *Testing of metals*".

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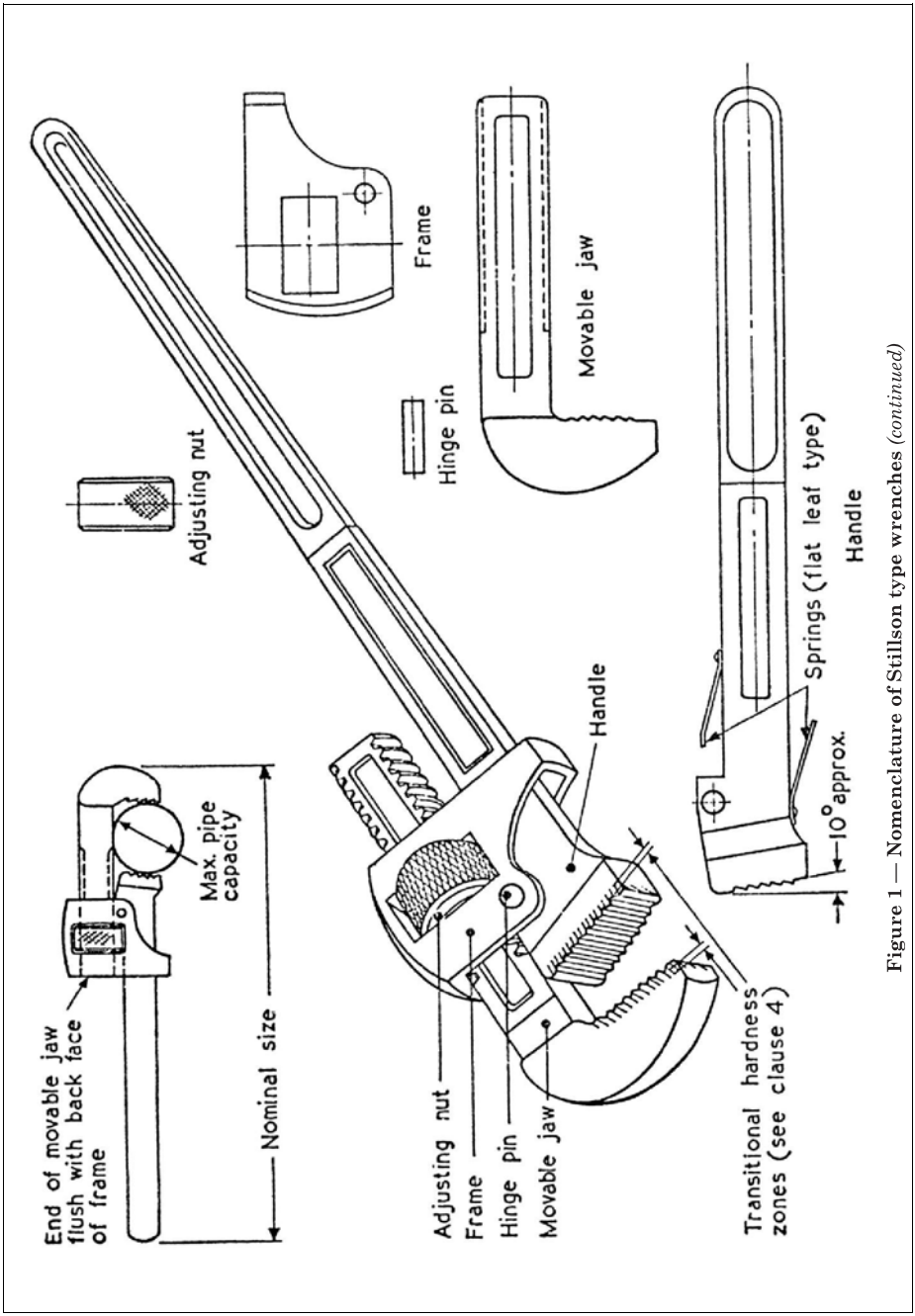

Figure 1 — Nomenclature of Stillson type wrenches *(continued)*

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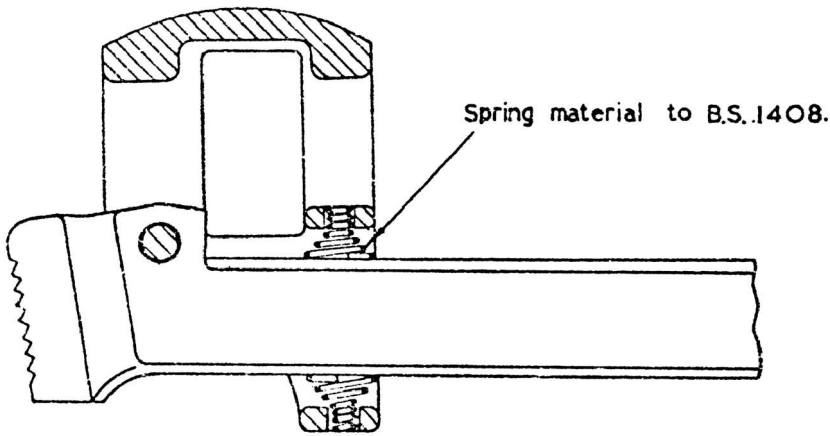

Figure 1 — Nomenclature of Stillson type wrenches *(concluded)*

5 Manufacture

Stillson type wrenches shall comply with the following requirements:

a) *Handle*.

i) The handle shall be a one piece forging with integral teeth.

ii) The teeth shall be of adequate number, shape and size to enable the assembled tool to meet the test requirements of Clause **9** without slipping, and to grip positively, during normal operation, any appropriate diameter of pipe within the safe capacity as given in Table 1.

iii) The toothed portion of the handle shall be so positioned that the common plane of the crests of the teeth shall be inclined at an angle of approximately 10° relative to a plane perpendicular to the longitudinal axis of the handle (see Figure 1). The crests of the teeth shall be parallel and shall be square relative to the lateral axis of the handle.

b) *Movable jaw*.

i) The movable jaw shall be a one piece forging with integral teeth.

ii) The teeth shall be of adequate number, shape and size to enable the assembled tool to meet the test requirements of Clause **9** without slipping, and to grip positively, during operation, any appropriate diameter of pipe within the safe capacity as given in Table 1.

iii) The shank of the movable jaw shall be threaded in order to engage the internal threads of the adjusting nut [see sub-clause **5** c)].

iv) The toothed portion of the movable jaw shall be so positioned that the common plane of the crests of the teeth shall be square relative to the longitudinal axis of the threaded shank. The crests of the teeth shall be parallel and shall be square relative to the lateral axis of the threaded shank.

c) *Adjusting nut*. The adjusting nut shall be cylindrical; knurled or longitudinally serrated and threaded internally with Acme style threads to engage the threads of the movable jaw. The threads shall be of sufficiently robust form and pitch that with the jaws set at any point of adjustment within the appropriate maximum capacity (Table 1) the wrench shall be capable of passing the static load and static/shock load tests as laid down in Clause **9**.

d) *Frame*. The frame shall be a one piece casting.

e) *Hinge pin*. When in position the hinge pin shall have heads formed at each end by riveting or spinning or alternatively shall be provided with equally effective securing means.

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f) *Spring (or springs).* One or more springs shall be provided, adequately to balance the movable jaw so that its action is smooth and unimpeded in both directions over the full length of traverse. The spring or springs shall be retained in position by positive means.

g) *All components*. All components shall be free from cracks, flaws and other deleterious defects.

6 Dimensions and capacities

a) *Dimensions.* The dimensions of Stillson type wrenches shall be as given in Table 1.

b) *Capacities.* The maximum capacities of Stillson type wrenches shall be as given in Table 1.

7 Finish

All components of Stillson type wrenches shall be finished smooth, free from flashes, burrs and other imperfections. The grip portion of the handle and the outer surfaces of the frame may be painted, stove-enamelled or self-finished and each finished tool shall be given suitable anti-corrosion treatment in accordance with BS 1133-6, "*Temporary prevention of corrosion during transportation and storage*".

Any other finish shall be the subject of agreement between purchaser and manufacturer.

8 Marking

Each Stillson type wrench shall be plainly and indelibly marked in a prominent position with the manufacturer's name and/or trade mark and the nominal size of the wrench. Wrenches complying wholly with the provisions of this specification should be marked with the British Standard number, i.e. BS 3594.

With the exception of the certification mark (see Note below) the application of any other mark shall be the subject of agreement between purchaser and manufacturer.

NOTE The mark BS 3594 on the product is an assurance by the manufacturer that the goods have been manufactured in full conformity with the requirements of this British Standard.

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9 Testing

Each Stillson type wrench shall be capable of passing the following tests:

For the tests a cylindrical steel test bar shall be rigidly mounted in a test rig such as that illustrated diagrammatically in Figure 3. Alternative designs of rig including automatic devices are equally permissible, provided that identical test conditions are imposed.

The test bar shall be of diameter equal to the appropriate maximum capacity of the wrench under test as given in Table 1, column 2. It shall be hardened and tempered to give hardness readings within the range 300 to 380HV 30 when measured at any point on its circumferential surface.

The wrench shall be mounted in the rig with the teeth in normal working engagement with the test bar (see Figure 2 and Figure 3) and a load shall be applied at point P sufficient to result in a proof torque appropriate to the nominal size as given in Table 1, column 6.

The load shall then be reduced by 25 per cent and with this load in operation, the shock load appropriate to the nominal size, as given in Table 1, column 7, shall be applied at point P.

Following these tests, the wrench shall release freely when the direction of force on the handle is reversed. The teeth shall then grip and release freely without recourse to alteration of the adjusting nut.

On removal from the test rig the wrench shall be capable of normal finger and thumb adjustment over the whole length of traverse. The component parts shall not have suffered any measurable permanent set, nor shall examination with the naked eye reveal evidence of damage or displacement.

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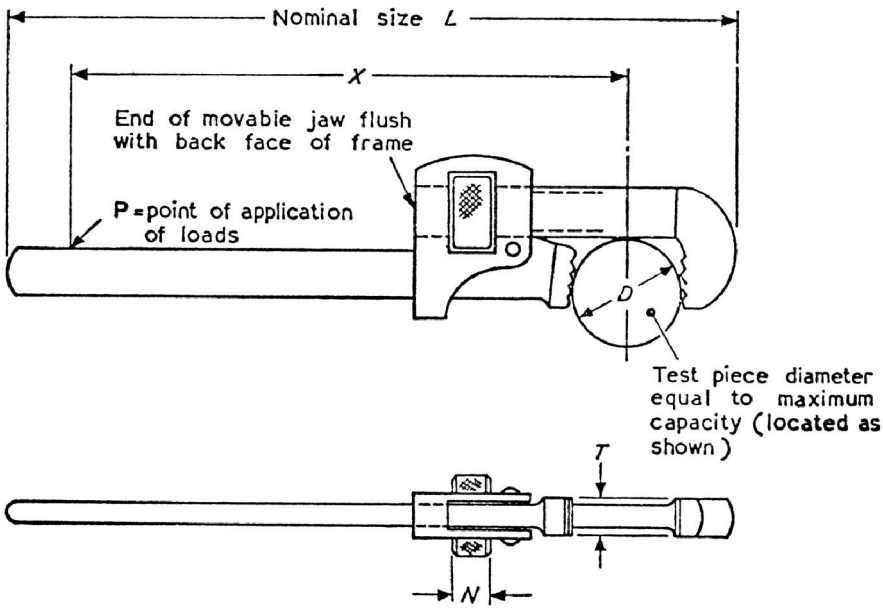

Figure 2 — Dimensions of Stillson type wrenches and test data

Table 1 — Dimensions and test loads

1	2	3	4	5	6	7
Nominal size *L*	**Maximum (safe) capacity** *D*[a]	**Minimum jaw thickness** *T*	**Minimum length of nut** *N*	**Load position** *X*	**Proof torque**	**Shock load dropped through 2 ft at P**
in	in	in	in	in	lbf/.in	lb
8	1.072	½	$^{15}/_{32}$	6	1 800	30
10	1.346	⅝	$^{17}/_{32}$	8	3 000	30
12	1.687	$^{11}/_{16}$	⅝	9	5 000	30
14	1.919	$^{13}/_{16}$	$^{11}/_{16}$	$10^{1}/_{2}$	7 000	40
18	2.394	$^{27}/_{32}$	$^{23}/_{32}$	$14^{1}/_{2}$	10 000	40
24	3.014	$^{15}/_{16}$	1	20	15 000	50
36	4.019	$1^{1}/_{8}$	$1^{3}/_{8}$	$30^{1}/_{2}$	24 000	60
48	5.534	$1^{5}/_{32}$	$1^{3}/_{8}$	41	32 000	60

[a] Equal to maximum outside diameter of black tube to BS 1387, "*Steel tubes and tubulars*".

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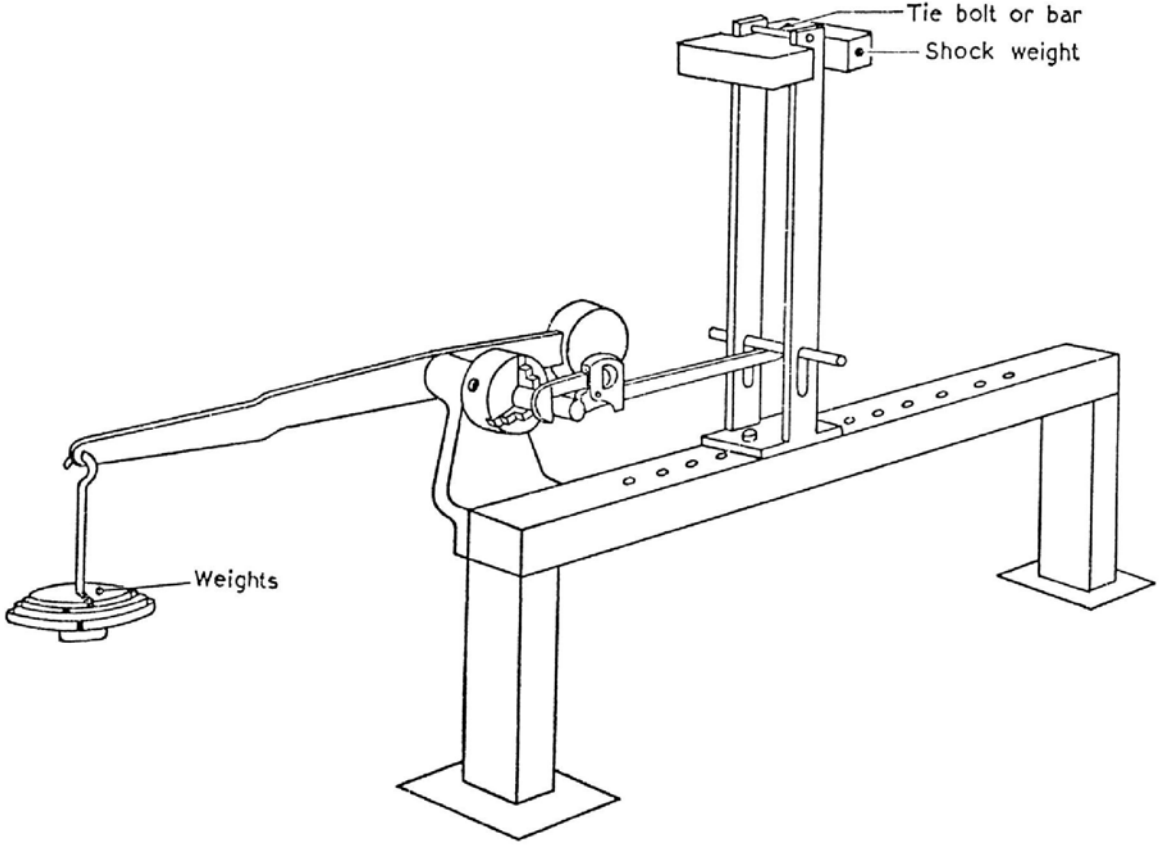

Figure 3 — Diagrammatic arrangement of test rig (See Clause **9**)

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Appendix Table for conversion of inches to approximate millimetre equivalents

Fractions of an inch into millimetres

inch	mm	inch	mm
⅛	3.2	1	25.4
¼	6.4	2	50.8
5/16	7.9	3	76.2
⅜	9.5	4	101.6
½	12.7	5	127.0
⅝	15.9	6	152.4
¾	19.0	7	177.8
⅞	22.2	8	203.2
		9	228.6
		10	254.0

Example: Find 3⅝ inches in millimetres: 3 inches = 76.2; ⅝ inch = 15.9 millimetres.
Hence 76.2 + 15.9 millimetres = 92.1 millimetres = 3⅝ inches.

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