BS 4074:2000

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# Specification for steel trench struts

ICS 91.220

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee B/514/28, Props, tubes and couplers, upon which the following bodies were represented:

Health and Safety Executive
UK Steel Association
Co-opted member

This British Standard, having been prepared under the direction of the Sector Committee for Building and Civil Engineering, was published under the authority of the Standards Committee and comes into effect on 15 October 2000



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# Contents

# Foreword

This British Standard has been prepared by Subcommittee B/514/28. Together with BS EN 1065:1999, it supersedes BS 4074:1982, which is withdrawn.

Safe working loads of trench struts are not specified in this standard. It is recommended that the axial concentric compression working load of trench struts be less than 30 kN.

The principal changes from the 1982 edition are as follows.

a) Adjustable telescopic steel props (previously known as metal props), which are primarily intended for use in falsework and other structures requiring temporary compression support members, are now covered in BS EN 1065:1999.

b) The title has been changed to *Specification for steel trench struts* to describe the common usage of the product more accurately.

c) The details for designing a trench strut according to its geometric characteristics have been amended to include thinner-walled thread-rolled outer tubes and thinner-walled higher-strength inner tubes, which will result in lighter, more economical designs.

d) Cut threads on the outer tubes are no longer included.

e) A test to verify that the component parts of trench struts do not become inadvertently disengaged in use has been added.

f) There is now a requirement aimed at preventing shear failure caused by any reduction in the pin cross-section.

g) There is now a requirement to mark trench struts with the year of manufacture.

The previously accepted characteristic resistance, $f_k$, of trench struts has been retained at 50.0 kN.

Examples of calculations on trench strut pin connections are given in annex A.

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**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 11 and a back cover.

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## 1 Scope

This British Standard specifies requirements for adjustable compression tubular steel trench struts. The requirements relate to materials, design, dimensions, strength and resistance to unintentional disengagement. The dimensions specified include the lengths fully open and fully closed.

The standard does not give information on the use of trench struts.

NOTE 1 The requirements of this standard are intended to ensure that the struts will have a characteristic resistance of 50 kN at all extensions. The standard does not specify a requirement for this characteristic resistance or a means of verifying it. Annex A gives examples of calculations on trench strut pin connections.

NOTE 2 Various protective finishes are specified in BS EN 1065:1999.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication applies.

BS EN 1562, *Founding — Malleable cast irons*.

BS EN 1563, *Founding — Spheroidal graphite cast iron*.

## 3 Definitions

For the purposes of this standard, the following definitions apply.

**3.1**

**trench strut**

compression member, of adjustable length, intended for use as a temporary horizontal support for building and civil engineering works

NOTE See Figure 1.

**3.2**

**claw plate**

plate with upturned corners, which is welded to a tube end and is intended to grip a timber waler

**3.3**

**collar nut**

internally threaded casting, incorporating a handle and a podger hole, providing fine adjustment to a trench strut

**3.4**

**outer tube**

larger diameter tube, one end of which is threaded and slotted

**3.5**

**inner tube**

smaller diameter tube provided with holes for the coarse adjustment of the trench strut

**3.6**

**length fully open**

distance measured between the outer faces of the claw plates when the pin is in the hole furthest from the inner tube claw plate and the collar nut is at its maximum distance from the outer tube claw plate

**3.7**

**length fully closed**

distance measured between the outer faces of the claw plates when the pin is in the hole nearest the inner tube claw plate and the collar nut is at its minimum distance from the outer tube claw plate

**3.8**

**pin**

component which is inserted through one of the holes in the inner tube, via the slot in the outer tube, and rests on the collar nut, to secure the inner tube at a particular extension and to transfer forces

**3.9**

**tube overlap**

length of inner tube remaining in the outer tube

## 4 Designation

The designation of a trench strut shall consist of the following:

a) the description "trench strut";

b) the number and date of this British Standard, i.e. BS 4074:2000;

c) the size number as given in Table 1, according to the length fully open.

EXAMPLE A trench strut with a length fully closed of 0.3 m, a length fully extended of 0.48 m and a minimum tube overlap of 117 mm would be designated as follows:

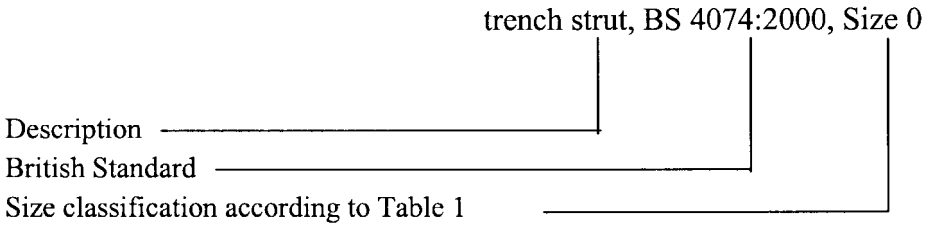


**Table 1 — Principal dimensions of trench struts**

| Size | Length m | | Minimum tube overlap mm |
|---|---|---|---|
| | Fully closed | Fully open | |
| 0 | 0.30 ± 0.05 | 0.48 ± 0.05 | 117 |
| 1 | 0.45 ± 0.05 | 0.68 ± 0.05 | 155 |
| 2 | 0.68 ± 0.05 | 1.06 ± 0.05 | 155 |
| 3 | 1.06 ± 0.05 | 1.67 ± 0.05 | 155 |
| NOTE These requirements are intended to ensure that the struts will have a characteristic resistance of 50 kN at all extensions. | | | |

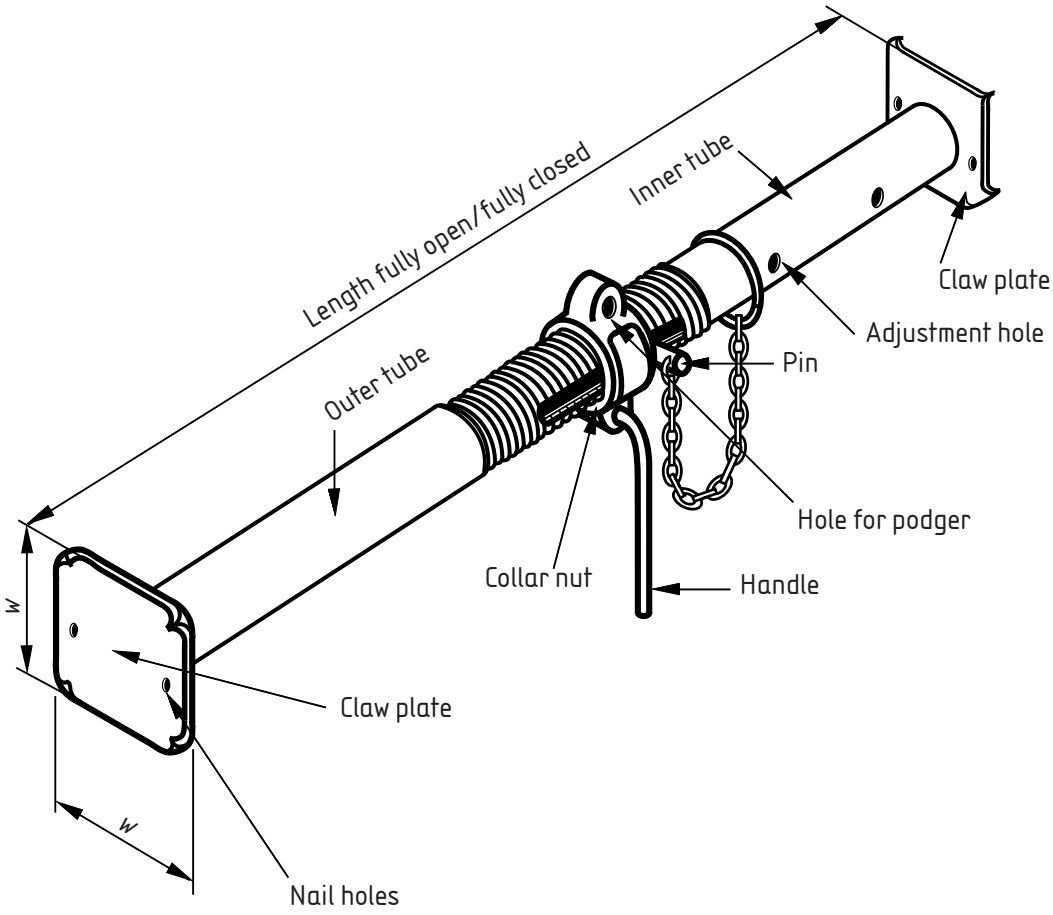


**Figure 1 — Steel trench strut**

## 5 Materials

**5.1** Tubes, claw plates, pins and handles shall be manufactured from steels capable of meeting the strength requirement given in clause **7** and having a specified minimum yield strength ($R_{eH}$) not exceeding 400 N/mm$^2$.

NOTE Some grades of steel specified within the standards listed in annex B will meet this requirement.

Materials for tubes and claw plates shall be suitable for welding.

**5.2** Collar nuts shall be manufactured from cast iron conforming to either BS EN 1562 or BS EN 1563.

## 6 Construction

### 6.1 Dimensions

**6.1.1** Principal dimensions shall conform to those specified for one of the sizes given in Table 1, subject to a tolerance of $\pm$50 mm on the length fully open and the length fully closed.

**6.1.2** The inner tube shall have a nominal outside diameter of 48.3 mm and a minimum nominal wall thickness of 3.2 mm.

**6.1.3** The coarse adjustment holes in the inner tube shall be concentric with the tube's cross-sectional axis to within 0.5 mm. The holes shall be drilled and shall not exceed 17.8 mm in diameter.

**6.1.4** The outer tube shall have a nominal outside diameter of 60.3 mm and a nominal wall thickness of 3.6 mm.

**6.1.5** The thread on the outer tube shall be generated by a thread rolling process and the profile shall be trapezoidal. The lead of the thread shall be not less than 6 mm nor greater than 10 mm. The nominal depth of the thread shall be not less than 0.25 times the nominal pitch of the thread. The clearances between the outer tube thread and the collar nut thread shall conform to Figure 2.

Dimensions in millimetres

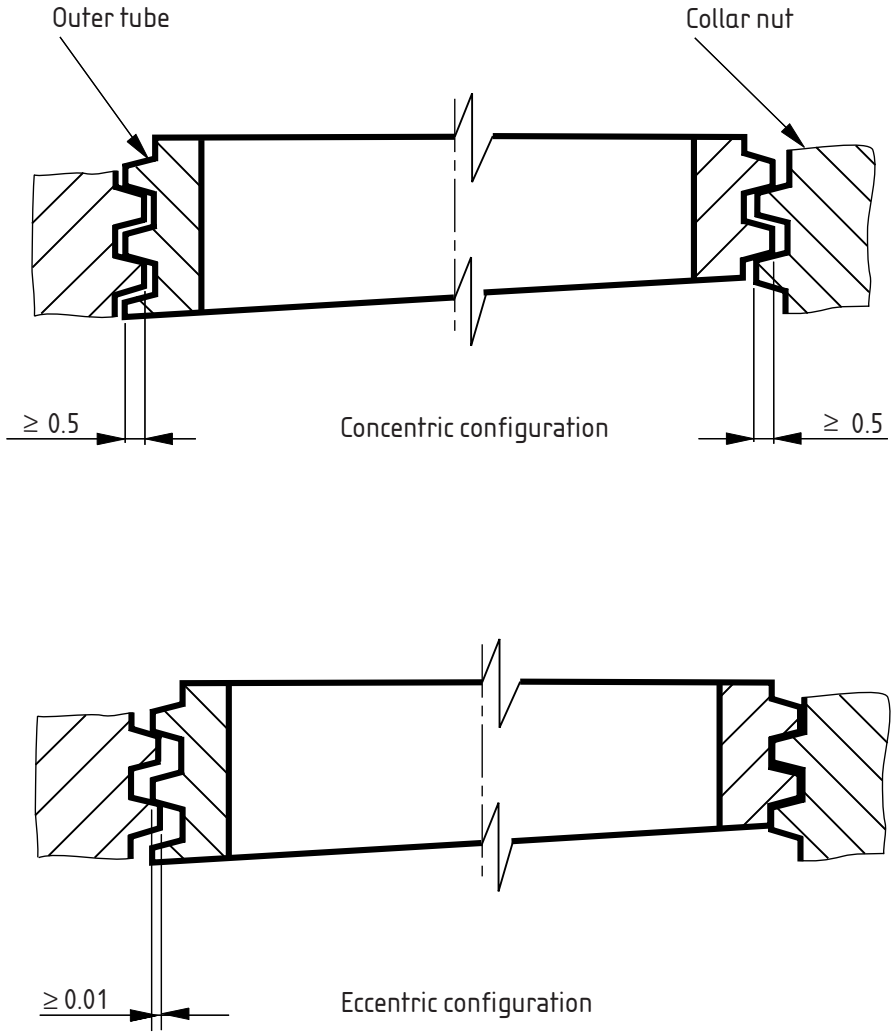


**Figure 2 — Thread and collar nut clearances**

The calculated thickness, $t$, of the threaded tube, shown in Figure 3, shall be not less than 2.5 mm. Thickness $t$ is calculated as follows:

$$t = \frac{c - b_{av}}{2}$$

where

$c$ is the thread root diameter;

$b_{av}$ is the mean bore, calculated as follows:

$$b_{av} = \frac{b_{min} + b_{max}}{2}$$

where

$b_{min}$ is the minimum bore;

$b_{max}$ is the maximum bore.

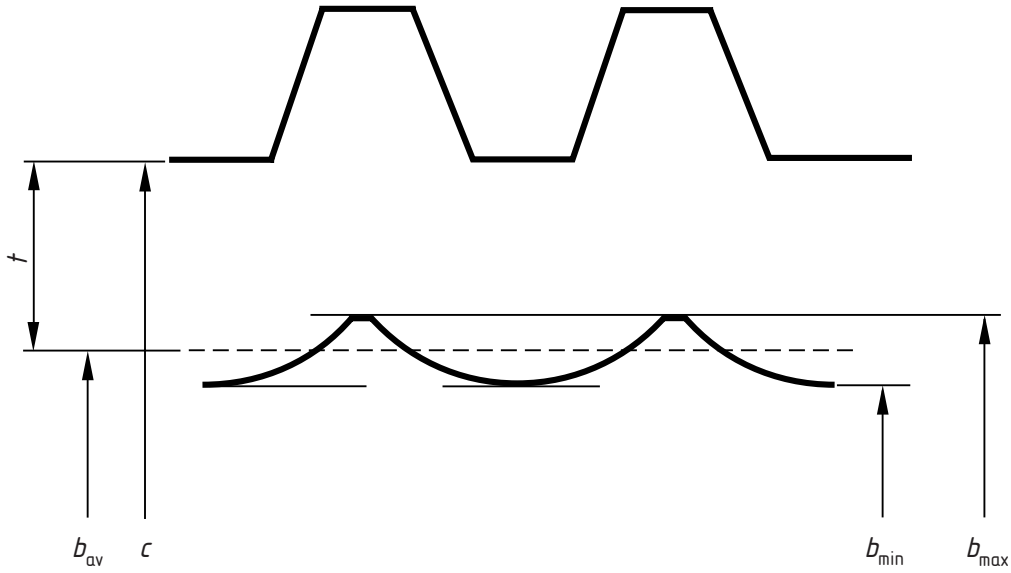


**Figure 3 — Calculated thickness, *t*, of threaded tube**

**6.1.6** Claw plates shall have a minimum thickness of 6.0 mm and a minimum width, *w* (see Figure 1), of 75 mm. They shall be provided with a claw at each of the four corners, together with a minimum of two diametrically opposed holes of at least 6 mm diameter (see Figure 1).

NOTE Additionally, claw plates may be provided with a centrally positioned hole for particular purposes.

**6.1.7** Claw plates shall be positioned centrally on the tubes by means of a continuous ring with a minimum throat thickness of 2 mm, fillet welded, such that the centre of the claw plate is within 3 mm of the longitudinal axis of the tube to which it is attached.

**6.1.8** Claw plates shall be welded square to the axis of the tube, subject to a maximum tolerance of 1°.

**6.1.9** The pin shall have a minimum diameter of 15 mm, and a minimum length of 90 mm which can contact the flange of the collar nut. The pin shall be held captive to the trench strut.

**6.1.10** Where a pin has any reduction in its cross-sectional area (such as holes for cables or chains), a means shall be provided to ensure that this portion of the pin is located outside the collar nut major diameter when the pin is fully inserted.

**6.1.11** The collar nut shall be provided with a pivoting handle at least 180 mm long. The nominal diameter of the handle shall be at least 15 mm. Diametrically opposite the handle, the collar nut shall have a hole with a minimum diameter of 16 mm for use with a podger (see Figure 1).

**6.1.12** The flange of the collar nut on which the pin bears shall have a minimum outside diameter of 76 mm and a minimum thickness of 5 mm (see Figure 4). The thread in the collar nut shall engage the thread on the outer tube by at least 30 mm and with at least four complete turns of the collar nut thread. The collar nut shall run freely on the outer tube thread.

Dimensions in millimetres

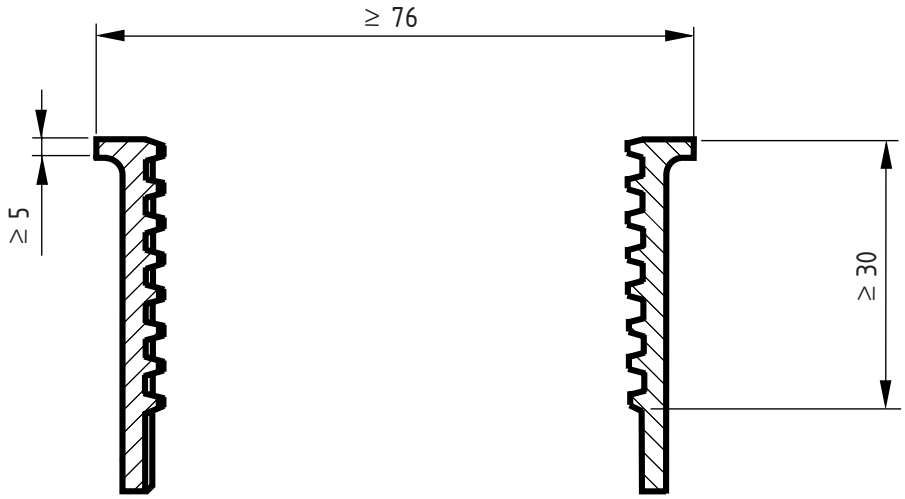


**Figure 4 — Dimensions of collar nut**

### 6.2 Finish

Sharp edges and burrs shall be removed. Components shall be finished so that they are able to move freely within each other.

NOTE This standard does not specify requirements for protective finishes. If no other finish is specified, it is recommended that trench struts be painted. Attention is drawn to the range of protective finishes specified in BS EN 1065:1999 for adjustable telescopic steel props.

### 6.3 Length adjustment

**6.3.1** Each trench strut shall incorporate a means of length adjustment, with provision for both coarse and fine adjustment, which shall allow adjustment of the trench strut over the range of lengths given in Table 1. Length adjustment shall be by means of a collar nut and thread, in conjunction with a pin inserted through slots in the outer tube and holes in the inner tube.

**6.3.2** The effective length of the outer tube slots shall be greater than the distance between the centres of adjacent holes in the inner tube.

**6.3.3** When the trench strut is in the fully extended position, the minimum tube overlap shall conform to Table 1.

### 6.4 Unintentional disengagement

Trench struts shall be provided with a means of preventing the two tubes from unintentional disengagement. When the trench strut is tested in accordance with annex C, the inner tube shall remain captive to the outer tube.

## 7 Strength

The minimum yield strength of the outer tube, inner tube, claw plates and pin shall conform to Table 2.

**Table 2 — Minimum yield strength**

| Component | Minimum yield strength N/mm$^2$ | Symbol |
|---|---|---|
| Outer tube | 190 | $R_{eH}$ |
| Inner tube | 281 | $R_{eH}$ |
| Claw plates | 235 | $R_{eH}$ |
| Pin | 280 | $R_e$ |

## 8 Marking

Trench struts shall be marked with at least the following information:

a) the number and date of this British Standard, i.e. BS 4074:2000[1)];

b) the manufacturer's or supplier's name or trade mark;

c) the year of manufacture (last two digits).

The marking shall be impressed or embossed on the trench strut or on a steel plate welded to the trench strut. It shall be legible after any protective coating has been applied. The height of the characters shall be at least 4 mm and their depth at least 0.2 mm.

[1)] Marking BS 4074:2000 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

# Annex A (informative)
# Examples of calculations on trench strut pin connections

NOTE The equations given in this annex are based on those given in BS EN 1065:1999, and are included for the convenience of the user of this standard.

## A.1 Shear resistance of pin

The total shear resistance ($R_{s.p}$) of the pin is given by:

$$R_{s.p} = (0.6 \times A_s \times R_m \times 2) \geq (f_k \times 1.14)$$

where

$R_m$ is the minimum specified tensile strength of the pin material;

$A_s$ is the cross-sectional area of the pin;

$f_k$ is the characteristic resistance of the trench strut.

## A.2 Bearing resistance of holes in inner tube

The total bearing resistance ($R_{b.t}$) of the inner tube holes is given by:

$$R_{b.t} = (2.12 \times R_{eH} \times 2 \times t \times d) \geq (f_k \times 1.14)$$

where

$R_{eH}$ is the minimum specified yield strength of the inner tube;

$t$ is the nominal wall thickness of the inner tube;

$d$ is the nominal diameter of the pin;

$f_k$ is the characteristic resistance of the trench strut.

# Annex B (informative)
# Typical materials

The standards listed in Table B.1 include grades of steel which will meet the requirements specified in **5.1**.

NOTE The titles of the current editions of these standards are given in the Bibliography.

**Table B.1 — Typical materials**

| Trench strut component | Materials specification |
|---|---|
| Tubes | BS EN 10210-1 |
| | BS EN 10210-2 |
| | BS EN 10219-1 |
| | BS EN 10219-2 |
| | ISO 2937 |
| | ISO 3304 |
| | ISO 3305 |
| Claw plates | BS EN 10025 |
| | BS EN 10113 |
| | BS EN 10155 |
| Pins and handles | BS EN 10083-1 |
| | BS EN 10083-2 |

## Annex C (normative)
## Test for unintentional disengagement

**C.1** Suspend the inner tube vertically by its claw plate, in a location high enough to allow the outer tube to fall freely from the fully closed position.

**C.2** Raise the outer tube until the trench strut is in the fully closed position.

**C.3** Allow the outer tube to fall under gravity.

**C.4** Perform the procedure **C.1** to **C.3** three times on the same trench strut.

**C.5** Determine whether the inner tube is still captive to the outer tube.

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# Bibliography

## Standards publications

BS EN 1065:1999, *Adjustable telescopic steel props — Product specifications, design and assessment by calculation and tests.*

BS EN 10025:1993, *Hot-rolled products of non-alloy structural steels — Technical delivery conditions.*

BS EN 10083-1:1991, *Quenched and tempered steels — Part 1: Technical delivery conditions for special steels.*

BS EN 10083-2:1991, *Quenched and tempered steels — Part 2: Technical delivery conditions for unalloyed quality steels.*

BS EN 10113-1:1993, *Hot-rolled products in weldable fine grain structural steels — Part 1: General delivery conditions.*

BS EN 10113-2:1993, *Hot-rolled products in weldable fine grain structural steels — Part 2: Delivery conditions for normalized/normalized rolled steels.*

BS EN 10113-3:1993, *Hot-rolled products in weldable fine grain structural steels — Part 3: Delivery conditions for thermomechanical rolled steels.*

BS EN 10155:1993, *Structural steels with improved atmospheric corrosion resistance — Technical delivery conditions.*

BS EN 10210-1:1994, *Hot finished structural hollow sections of non-alloy and fine grain structural steels — Part 1: Technical delivery requirements.*

BS EN 10210-2:1997, *Hot finished structural hollow sections of non-alloy and fine grain structural steels — Part 2: Tolerances, dimensions and sectional properties.*

BS EN 10219-1:1997, *Cold formed welded structural sections of non-alloy and fine grain steels — Part 1: Technical delivery requirements.*

BS EN 10219-2:1997, *Cold formed welded structural sections of non-alloy and fine grain steels — Part 2: Tolerances, dimensions and sectional properties.*

ISO 2937:1974, *Plain end seamless steel tubes for mechanical application.*

ISO 3304:1985, *Plain end seamless precision steel tubes — Technical conditions for delivery.*

ISO 3305:1985, *Plain end welded precision steel tubes — Technical conditions for delivery.*

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