

# INTERNATIONAL STANDARD

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## **Welded steel tubes for pressure purposes — Technical delivery conditions —**

### **Part 1:**

Unalloyed steel tubes with specified room  
temperature properties

*Tubes soudés en acier pour service sous pression — Conditions techniques de  
livraison —*

*Partie 1: Tubes soudés en aciers non alliés avec caractéristiques spécifiées à  
température ambiante*



Reference number  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 9330-1 was prepared by Technical Committee ISO/TC 17, *Steel*.

It constitutes a partial revision of ISO 2604-3 : 1975 and ISO 2604-6 : 1978.

ISO 9330 consists of the following parts, under the general title *Welded steel tubes for pressure purposes — Technical delivery conditions*:

- *Part 1: Unalloyed steel tubes with specified room temperature properties*
- *Part 2: Electric resistance and induction welded unalloyed and alloyed steel tubes with specified elevated temperature properties*
- *Part 3: Electric resistance and induction welded unalloyed and alloyed steel tubes with specified low temperature properties*
- *Part 4: Submerged arc-welded unalloyed and alloyed steel tubes with specified elevated temperature properties*
- *Part 5: Submerged arc-welded unalloyed and alloyed steel tubes with specified low temperature properties*

Annex A of this part of ISO 9330 is for information only.

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# Welded steel tubes for pressure purposes — Technical delivery conditions —

## Part 1:

## Unalloyed steel tubes with specified room temperature properties

### 1 Scope

**1.1** This part of ISO 9330 specifies the technical delivery conditions for welded tubes of circular cross-section, made of unalloyed quality steel with specified room temperature properties. These tubes are intended for pressure purposes including the transport of fluids under pressure.

Certain application standards and regulations permit the use of these tubes up to 350 °C (see annex A).

NOTE — The word "tube" is synonymous with "pipe".

**1.2** See ISO 404 for general technical delivery requirements.

### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9330. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9330 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 377 : 1985, *Wrought steel — Selection and preparation of samples and test pieces*.

ISO 404 : 1981, *Steel and steel products — General technical delivery requirements*.

ISO 1106-3 : 1984, *Recommended practice for radiographic examination of fusion welded joints — Part 3: Fusion welded circumferential joints in steel pipes of up to 50 mm wall thickness*.

ISO 3205 : 1976, *Preferred test temperatures*.

ISO 2566-1 : 1984, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*.

ISO 4200 : 1985, *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length*.

ISO 4948-1 : 1982, *Steels — Classification — Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition*.

ISO 5252 : 1977, *Steel tubes — Tolerance systems*.

ISO 6761 : 1981, *Steel tubes — Preparation of ends of tubes and fittings for welding*.

ISO 6892 : 1981, *Metallic materials — Tensile testing*.

ISO 7438 : 1985, *Metallic materials — Bend test*.

ISO 8492 : 1986, *Metallic materials — Tube — Flattening test*.

ISO 8493 : 1986, *Metallic materials — Tube — Drift expanding test*.

ISO 9302 : 1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Electromagnetic testing for verification of hydraulic leak-tightness*.

ISO 9303 : 1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Full peripheral ultrasonic testing for the detection of longitudinal imperfections*.

ISO 9304 : 1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Eddy current testing for the detection of imperfections*.

ISO 9402 : 1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Full peripheral magnetic transducer/flux leakage testing of ferromagnetic steel tubes for the detection of longitudinal imperfections*.

ISO 9764 : 1989, *Electric resistance and induction welded steel tubes for pressure purposes — Ultrasonic testing of the weld seam for the detection of longitudinal imperfections*.

ISO 9765 : — <sup>1)</sup>, *Submerged arc-welded steel tubes for pressure purposes — Ultrasonic testing of the seam for the detection of longitudinal and/or transverse imperfections.*

### 3 Symbols and denominations

#### 3.1 Fundamental symbols

$D$  = specified external diameter

$\delta$  = specified wall thickness

#### 3.2 Symbols for tolerances

See ISO 5252.

#### 3.3 Symbols for tests

##### 3.3.1 Tensile test

See ISO 6892.

##### 3.3.2 Flattening test

$H$  = distance between platens

$K$  = constant factor of deformation

##### 3.3.3 Hydraulic test

PE = test pressure

$\sigma$  = stress which occurs in the metal during the test

### 4 Information to be supplied by the purchaser

#### 4.1 Mandatory information

The purchaser shall state in his enquiry and order the following information:

- the denomination "tube";
- the manufacturing process;
- reference to the relevant dimensional standard;
- dimensions (outside diameter  $\times$  wall thickness), in millimetres (see 7.1);
- length (see 7.2);
- tolerance for exact lengths greater than 12 mm and for submerged arc-welded tubes (see 7.3.3);

- reference to this part of ISO 9330;
- steel grade (see table 4);
- type of inspection and testing and corresponding document (see 9.1 and clause 12).

#### 4.2 Optional information

Enquiries and orders for tubes in accordance with this part of ISO 9330 shall be supplemented, if it is deemed necessary by the purchaser, with the indication of one or more of the following optional requirements which are the subject of special agreements:

- steel-making process (see 5.1);
- special tolerances on outside diameter and wall thickness (see tables 7 and 8);
- requirements concerning possible repair by welding (see 8.1.4);
- special straightness requirements (see 8.1.5);
- requirements for trimming the internal weld seam of electric resistance or induction welded tubes (ERW) (see 7.3.2);
- product chemical analysis (see 9.2);
- leak tightness test (see 9.4.2);
- specific marking (see 10.2);
- protective coating (see clause 11).

#### 4.3 Example of an order

Example of an order for an electric-resistance welded tube conforming to the dimensional standard ISO 4200, with an external diameter of 168,3 mm, a wall thickness of 4 mm and a standard length (random length) of 4 m to 8 m, made of steel grade TW 360 with specified room-temperature properties, to be submitted to specific inspection and testing involving the issuing of an inspection certificate:

**Tube ERW ISO 4200 — 168,3  $\times$  4 — 4 to 8 — ISO 9330 —  
1 TW 360 — inspection certificate**

### 5 Manufacturing process

#### 5.1 Steel-making process

Unless otherwise agreed at the time of ordering, the steel-making process is at the option of the manufacturer.

If he so requests, the purchaser shall be informed of the steel-making process used.

1) To be published.

## 5.2 Deoxidation process

Steels intended for the production of tubes covered by this part of ISO 9330 shall be killed, except for steel TW 320 which may be semikilled.

## 5.3 Product-making process for tubes

Tubes covered by this part of ISO 9330 may be hot-finished or cold-finished. The terms "hot-finished" and "cold-finished" apply to the condition of the tube before it is heat-treated in accordance with 5.4. Unless otherwise agreed, the process of manufacture is left to the discretion of the manufacturer.

Before commencing production, the manufacturer shall take appropriate measures to ensure that the tubes are manufactured to a consistent quality.

Welding may be either longitudinal or spiral (see table 1). The welding process shall be butt welding (grades TW 320 and TW 360 only), electric resistance welding or submerged arc-welding.

### NOTES

1 A welded tube is a tubular product obtained by shaping a flat-rolled product and then welding the edges. The weld may be longitudinal or spiral.

2 Tubes manufactured by the butt welding process have a longitudinal weld which is formed by means of pressure applied by mechanically operated rolls on the edges of the strip. These edges were heated to welding temperature in a furnace.

No filler metal is used during the welding process.

3 Tubes manufactured by the electric resistance welding process have a longitudinal or spiral weld formed by means of pressure applied to the edges of the strip. These edges were heated to welding temperature by the resistance to the passage of an electric current at, and adjacent to, these surfaces. The electric current may be passed either by direct contact or induction methods.

No filler metal is used during the welding process.

4 Tubes manufactured by the submerged arc-welding process have a longitudinal or spiral weld deposited automatically without the application of pressure to the plate or strip edges.

Welding is carried out by means of a bare wire electrode, the arcs being enveloped in a granular flux, some of which fuses to form a removable slag covering. At least one pass is made on the inside and one pass on the outside of the tube.

5 The finished tubes shall not include welds used for joining lengths of the hot or cold, flat-rolled strip prior to tube forming.

Table 1 — Manufacturing processes for tubes

| Nomenclature     | Description                              | Weld position          | Symbol |
|------------------|------------------------------------------|------------------------|--------|
| Pressure welding | Electric resistance and induction welded | Longitudinal or spiral | ERW    |
|                  | Butt welded                              | Longitudinal           | BW     |
| Fusion welding   | Submerged arc-welded                     | Longitudinal or spiral | SAW    |

## 5.4 Heat treatment and delivery condition

The tubes covered by this part of ISO 9330 shall be supplied in one of the delivery conditions indicated in tables 2 and 3.

Table 2 — Delivery conditions

| Welding process                                                                                                                                                                                                                                                                                                            | Method of forming and finishing     |                                                                                       |                                                                                       |                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------|
|                                                                                                                                                                                                                                                                                                                            | Hot formed, welded and hot finished | Cold formed, welded and hot finished                                                  | Cold formed and welded                                                                | Cold formed, welded and cold drawn |
| Butt welding<br>(see 5.3, note 2)                                                                                                                                                                                                                                                                                          | No heat treatment                   |                                                                                       |                                                                                       | Normalizing <sup>2)</sup>          |
| Electric resistance welding<br>(see 5.3, note 3)                                                                                                                                                                                                                                                                           |                                     | No heat treatment<br>Subcritical annealing <sup>2)</sup><br>Normalizing <sup>2)</sup> | Subcritical annealing <sup>1)</sup> 3)<br>Normalizing <sup>1)</sup> 3)                | Normalizing <sup>2)</sup>          |
| Submerged arc-welding<br>(see 5.3, note 4)                                                                                                                                                                                                                                                                                 | Normalizing                         |                                                                                       | No heat treatment<br>Subcritical annealing <sup>2)</sup><br>Normalizing <sup>2)</sup> |                                    |
| 1) At the option of the manufacturer, the heat treatment may be carried out on the whole tube or only on the weld zone.<br>2) The heat treatment is carried out on the whole tube.<br>3) Unless otherwise agreed at the time of ordering, grades TW 320, TW 360, TW 410 and TW 430 may be supplied without heat treatment. |                                     |                                                                                       |                                                                                       |                                    |