

INTERNATIONAL  
STANDARD

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11961

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**Petroleum and natural gas industries —  
Steel pipes for use as drill pipe —  
Specification**

**iTeh STANDARD PREVIEW**

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*Industrie du pétrole et du gaz naturel — Tubes d'acier pour tiges de  
forage — Spécifications*

*ISO 11961:1996*

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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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11961 was prepared by Technical Committee ISO/TC 67, *Materials and equipment for petroleum and natural gas industries*, Subcommittee SC 5, *Casing and tubing*.

Annexes A to C form an integral part of this International Standard.

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## Introduction

This International Standard, based on API Spec 5D:1992, *Specification for drill pipe*, includes requirements of various nature. These are identified by the use of certain words or phrases.

- **Shall** is used to indicate that a provision is mandatory.
- **Should** is used to indicate that a provision is not mandatory, but recommended as good practice.
- **May** is used to indicate that a provision is optional.

In addition, in certain cases, this International Standard offers **Alternative requirements**. These offer different options, either:

- **At purchaser's discretion** in which case such option shall be mentioned on the purchase order. These cases are recognized by the use of the words or phrases such as **alternative** or **at purchaser's discretion**.
- **At manufacturer's discretion** in which case such option shall be notified to the purchaser. Such cases are identified by the use of the phrase **at manufacturer's discretion**.
- **By agreement between purchaser and manufacturer**. Such cases are recognized by the use of the phrase **by agreement between interested parties**.

This International Standard, when this phrase is used, intends to

either

waive the application of a requirement (either mandatory or recommended) and leave it to both purchaser and manufacturer to use the requirement or not;

or

offer one (or several) alternative requirement(s), the selection of which is left to both purchaser and manufacturer.

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# Petroleum and natural gas industries — Steel pipes for use as drill pipe — Specification

## 1 Scope

**1.1** This International Standard specifies the technical delivery conditions for steel drill pipes suitable for use in drilling and producing operations.

The applicable sizes, masses and end finishes are described in annex A.

**1.2** The products described by this International Standard are gathered in two groups as follows:

- Group 1: all grade E drill pipe.
- Group 3: all drill pipe in high strength grades X95, G105 and S135.

**1.3** Supplementary requirements, that may be agreed between interested parties, for non-destructive inspection, impact testing of group 1 pipe, alternative temperature of impact testing and test certificates are specified in annex B.

## 2 Normative references

The following standards include provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 6892:1984, *Metallic materials — Tensile testing*.

ISO 7500-1:1986, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile testing machines*.

ISO/TR 9769:1991, *Steel and iron — Review of available methods of analysis*.

API Spec 5D:1992, *Specification for drill pipe*.

ASTM A370-94, *Test Methods and Definitions for Mechanical Testing of Steel Products*.

ASTM E23-94b, *Test Methods for Notched Bar Impact Testing of Metallic Materials*.

ASTM E83-94, *Practice for Verification and Classification of Extensometers*.

## 3 Definitions

For the purpose of this international Standard, the following definitions apply.

**3.1 defect:** Imperfection of sufficient magnitude to warrant rejection of the product based on the stipulations of this International Standard.

**3.2 drill pipe:** Heavy seamless pipe used to rotate bit and circulate the drilling mud; these pipe are coupled together by means of tool joints.

**3.3 imperfection:** Discontinuity or irregularity in the product detected by methods outlined in this International Standard.

**3.4 interested parties:** The manufacturer and the purchaser of the products.

**3.5 manufacturer:** Firm, company or corporation responsible for making the product to warrant that the product conforms to this International Standard. The manufacturer may be either a pipe mill or a processor. The manufacturer is responsible for compliance with all the applicable provisions of this International Standard.

**3.6 pipe mill:** Firm, company or corporation that operates pipe making facilities.

**3.7 processor:** Firm, company or corporation that operates facilities capable of heat treating pipe made by a pipe mill.

**3.8 seamless pipe:** A wrought steel tubular product made without a welded seam, manufactured by hot working steel, and if necessary, by subsequently cold finishing the hot-worked tubular product to produce the desired shape, dimensions, and properties.

**3.9 special processes:** Final operations which are performed during pipe manufacturing that affect product attributes, except chemistry and dimensions.

NOTE 1 The special processes are heat treatment and, if applicable, cold finishing.

**3.10 lot:** Those lengths of pipe with the same specified dimensions and grade which are heat treated as part of a continuous operation (or batch), and are of a single heat of steel, or from different heats that are grouped according to a documented procedure which will ensure that the appropriate requirements of this International Standard are met.

## 4 Information to be supplied by the purchaser

**4.1** In placing orders for drill pipe to be manufactured in accordance with this International Standard, the purchaser shall specify the following on the purchase order.

Stipulation	Section
International Standard ISO 11961	—
Quantity	—
Internal-upset, external-upset or internal-external-upset (for welding)	table A.1, column 7
Label-1 or outside diameter	table A.1, column 3
Label-2 or wall thickness	table A.1, column 4
Grade	table A.1, column 6
Length range	7.5, table 6
Delivery date and shipping instructions	—
Inspection by purchaser	annex C

**4.2** The purchaser should also state on the purchase order his requirements concerning the following stipulations, which are optional with the purchaser.

Stipulation	Section
Heat treatment of drill pipe	5.2
Heat and supplementary analyses	8.2
Pipe coatings	clause 10
Drill pipe with special threads or end finish	7.9
Pipe ends	7.9
Marking requirements	9.1
Non-destructive inspection (N5 notch)	B.1
Impact testing of group 1	B.3
Alternative temperature for impact testing	B.4
Test certificates	B.2

## 5 Process of manufacture

### 5.1 General

The various grades and groups of steel furnished to this International Standard shall be made to a fine grain practice. Steel made to fine grain practice contains one or more grain refining elements, such as aluminium, niobium, vanadium or titanium in amounts intended to result in the steel having a fine austenitic grain size.

Pipe furnished to this International Standard shall be made by the seamless process. Cold drawn drill pipe without appropriate heat treatment is not acceptable.

### 5.2 Heat treatment

The heat treating process shall be performed according to a documented procedure.

#### 5.2.1 Group 1

Drill pipe shall be normalized or, at the manufacturer's discretion normalized and tempered or quenched and tempered full length. Upset drill pipe shall be heat treated full length after upsetting.

#### 5.2.2 Group 3

Unless otherwise agreed between interested parties, drill pipe furnished to this International Standard shall be quenched and tempered or normalized and tempered. Upset drill pipe shall be heat treated full length after upsetting.



### 5.3 Traceability

The manufacturer shall establish and follow procedures for maintaining heat and/or lot identity until all required heat and/or lot tests are performed and conformance with the specified requirements has been shown.

## 6 Material requirements

### 6.1 Chemical requirements

Drill pipe furnished to this International Standard shall conform to the chemical requirements in table 1.

**Table 1 — Chemical requirements**

Group	Phosphorus max. %	Sulfur max. %
All groups	0,030	0,030

### 6.2 Mechanical properties requirements

#### 6.2.1 Tensile properties

6.2.1.1 Pipe furnished to this International Standard shall conform to the tensile requirements specified in table 2 for the particular grade ordered.

When elongation is recorded or reported, the record or report shall show the nominal width of the test specimen when strip specimens are used, the diameter and gauge length when round bar specimens are used, or state when full section specimens are used.

The tensile properties, except elongation, of the upset ends shall comply with the requirements given for the pipe body. In case of dispute, the properties (except elongation) of the upset shall be determined from a tensile test specimen cut from the upset.

**Table 2 — Tensile requirements**

Grade	Yield strength		Tensile strength
	min. N/mm <sup>2</sup>	max. N/mm <sup>2</sup>	min. N/mm <sup>2</sup>
E75	517	724	689
X95	655	862	724
G105	724	931	793
S135	931	1 138	1 000

6.2.1.2 The minimum elongation in 50,8 mm gauge length shall be that determined by the following formula:

$$e = 1\,944 \frac{A^{0,2}}{U^{0,9}}$$

where

- e* is the minimum elongation in 50,8 mm gauge length, in percent rounded to nearest 0,5 %;
- A* is the cross-sectional area of the tensile test specimen, in square millimetres, based on specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 10 mm<sup>2</sup>, or 490 mm<sup>2</sup>, whichever is smaller;
- U* is the specified tensile strength, in newtons per square millimetre.

The minimum elongations for both round bar tensile specimens (the 8,75 mm diameter with 35,6 mm gauge length, and the 12,5 mm diameter with 50,8 mm gauge length) shall be determined with an area *A* of 130 mm<sup>2</sup>.

#### 6.2.2 Yield strength

The yield strength shall be the tensile stress required to produce a total elongation of the gauge length, as determined by an extensometer, as follows:

Grade	Total extension of gauge length, %
E75	0,5
X95	0,5
G105	0,6
S135	0,7

#### 6.2.3 Longitudinal impact requirements

##### 6.2.3.1 Group 1

By agreement between interested parties, pipe furnished to this International Standard shall conform to the requirements specified in clause B.3.

##### 6.2.3.2 Group 3

Material shall conform to the requirements specified in table 3. These requirements apply for a test temperature of 21 °C ± 2,8 °C.

### 6.2.3.3 Alternative low temperature energy requirements

By agreement between interested parties, pipe furnished to this International Standard shall conform to the requirements specified in clause B.4.

**Table 3 — Impact energy requirements**

Specimen size mm	Minimum average energy of each set of three specimens J	Minimum energy of any specimen of a set J
10 × 10	54	47
10 × 7,5	43	38
10 × 5	30	26

## 7 Dimensions, masses, tolerances and pipe ends

In the dimensional tables 4 and 5, pipe is designated by labels and by outside diameter. The outside diameter size of external-upset pipe is the outside diameter of the body of the pipe, not the upset portion.

### 7.1 Dimensions and masses

Pipe shall be furnished in the sizes, wall thicknesses and masses (as given in tables 4 and 5) as specified on the purchase order. All dimensions shown without tolerances are related to the basis for design and are not subject to measurement to determine acceptance or rejection of product.

### 7.2 Diameter

The outside diameter shall be within the tolerances specified in 7.8.1. (Inside diameters are governed by the outside diameter and mass tolerances.)

### 7.3 Wall thickness

The wall thickness at any place shall not be less than the thickness given in tables 4 and 5 minus the permissible under-tolerance specified in 7.8.2.

### 7.4 Mass

The masses, determined as described in 8.4.5, shall conform to the calculated masses as specified herein

(or adjusted calculated masses) for the end finish specified on the purchase order, within the tolerances stipulated in 7.8.3. Calculated masses shall be determined in accordance with the following formula:

$$m_L = (m_{pe} \times L) + m_w$$

where:

$m_L$  is the calculated mass of a piece of pipe of length  $L$ , in kilograms;

$m_{pe}$  is the lineic mass, in kilograms per metre;

$L$  is the length of pipe, including end finish, as defined in 7.5, in metres;

$m_w$  is the mass gain or loss due to end finishing, in kilograms.

For plain-end non-upset pipe,  $m_w$  equals zero.

### 7.5 Length

Pipe shall be furnished in range lengths conforming to table 6 as specified on the purchase order. Length determination shall be in metres and hundredths of meter.

### 7.6 Straightness

Deviation from straight, or chord height, shall not exceed either of the following:

- 0,2 % of the total length of the pipe measured from one end of the pipe to the other end (see figure 1);
- 3,18 mm maximum drop in the transverse direction in the 1,52 m length at each end (see figure 2).

### 7.7 Drift requirements

Each length of group 1 external upset drill pipe, except label 3-1/2-13.3, shall be tested throughout the length of the upset pipe with a cylindrical drift mandrel having a diameter,  $d$ , 4,76 mm smaller than the tabulated  $d$  of the drill pipe, and a length of 102 mm.

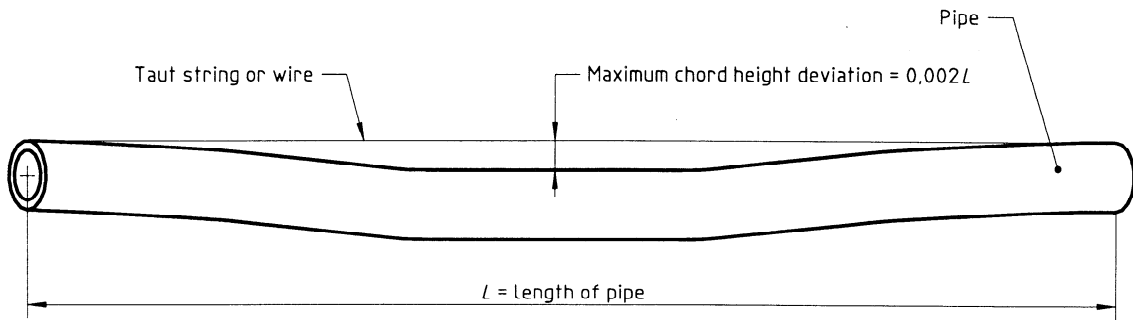


Figure 1 — Measuring of full length straightness

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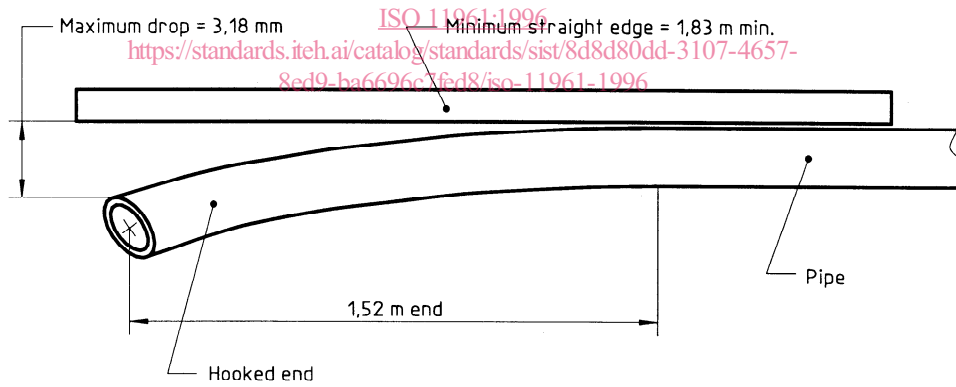


Figure 2 — Measuring of end straightness

Table 4 — Dimensions and masses (Group 1) — Upset drill pipe for weld-on tool joints (See figure 3)

Labels <sup>1)</sup>	Outside diameter	Wall thickness	Inside diameter	Calculated mass <sup>2)</sup>		Upset dimensions <sup>3), 4)</sup>						Length end of pipe to taper fadeout $L_{eu} + l_{eu}$ max. mm
				Plain end	Upset	Inside diameter at end of pipe <sup>5)</sup>	Length internal upset <sup>7), 8)</sup>	Length internal taper	Length external upset	Length external taper	Length external taper	
1	2	$t$	$d_{iu}$	$m_{pe}$	$m_u$	$D_{ou}$	$d_{ou}$	$L_{iu}$	$l_{iu}$	$L_{eu}$	$l_{eu}$	$L_{eu}$
		mm	mm	kg/m	kg	mm	mm	mm	mm	min. mm	min. mm	max. mm
<b>Internal-upset drill pipe</b>												
2-7/8	10.40	9,19	54,65	14,47	1,45	73,02	33,34	44,45	38,10	—	—	—
3-1/2	9.50	6,45	76,00	13,21	2,00	88,90	57,15	44,45	—	—	—	—
3-1/2	13.30	9,35	70,20	18,26	2,00	88,90	49,21	44,45	38,10	—	—	—
3-1/2	15.50	11,40	66,10	21,79	1,54	88,90	49,21	44,45	38,10	—	—	—
4 <sup>9)</sup>	11.85	6,65	88,30	15,68	1,91	101,60	74,61	44,45	—	—	—	—
4	14.00	8,38	84,84	19,31	2,09	101,60	69,85	44,45	50,80	—	—	—
4-1/2 <sup>9)</sup>	13.75	6,88	100,54	18,27	2,36	114,30	85,72	44,45	—	—	—	—
5 <sup>9)</sup>	16.25	7,52	111,96	22,10	3,00	127,00	95,25	44,45	—	—	—	—
<b>External-upset drill pipe</b>												
2-3/8	6.65	7,11	46,11	9,31	0,82	67,46	46,10	—	—	38,10	38,10	101,60
2-7/8	10.40	9,19	54,65	14,47	1,09	81,76	54,63	—	—	38,10	38,10	101,60
3-1/2	9.50	6,45	76,00	13,21	1,18	97,13	76,00	—	—	38,10	38,10	101,60
3-1/2	13.30	9,35	70,20	18,26	1,82	97,13	66,09	57,15	50,80	38,10	38,10	101,60
3-1/2	15.50	11,40	66,10	21,79	1,27	97,13	66,09	—	—	38,10	38,10	101,60
4 <sup>9)</sup>	11.85	6,65	88,30	15,68	2,27	114,30	88,30	—	—	38,10	38,10	101,60
4	14.00	8,38	84,84	19,31	2,27	114,30	84,84	—	—	38,10	38,10	101,60
4-1/2 <sup>9)</sup>	13.75	6,88	100,54	18,27	2,54	127,00	100,54	—	—	38,10	38,10	101,60
4-1/2	16.60	8,56	97,18	22,42	2,54	127,00	97,18	—	—	38,10	38,10	101,60
4-1/2	20.00	10,92	92,46	27,79	2,54	127,00	92,46	—	—	38,10	38,10	101,60