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# International Standard



# 5226

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Materials and equipment for petroleum and natural gas industries — Aluminium alloy drill pipe for oil or natural gas wells

*Matériel et équipement pour les industries du pétrole et du gaz naturel — Tiges de forage en alliage d'aluminium pour puits de pétrole ou de gaz naturel*

**iTeh STANDARD PREVIEW**

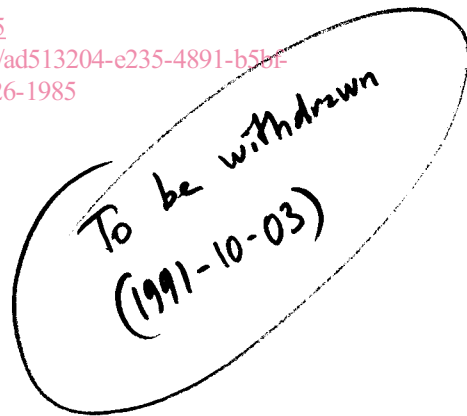
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## Foreword

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.

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 5226 was prepared by Technical Committee ISO/TC 67, *Materials and equipment for petroleum and natural gas industries*.

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# Materials and equipment for petroleum and natural gas industries — Aluminium alloy drill pipe for oil or natural gas wells

## 1 Scope and field of application

This International Standard specifies the characteristics of aluminium alloy drill pipes with screwed-on steel tool joints for use in the drilling of oil and natural gas wells.

## 2 References

ISO 2566, *Steel — Conversion of elongation values*

*Part 1: Carbon and low alloy steels.*

*Part 2: Austenitic steels.*

ISO 3962, *Materials and equipment for petroleum and natural gas industries — Tool joints for steel drill pipe for oil or natural gas wells.*

ISO 6892, *Metallic materials — Tensile testing.*

ISO 8492, *Metallic materials — Tube — Flattening test.*<sup>1)</sup>

## 3 Drill pipe condition

Aluminium alloy drill pipes are manufactured from tubular billets by hot extrusion with a mandrel and they are supplied as

- a) tubular blanks;
- b) threaded tubular blanks;
- c) drill pipes with screwed-on tool joints.

## 4 Data to be given by the purchaser

4.1 When placing orders, the purchaser shall specify the following information:

- a) the reference number of this International Standard;
- b) the overall length of a lot, in metres;
- c) the type of drill pipe and tubular blank:
  - with external thickenings of ends (see figure 1);
  - with internal thickenings of ends (see figure 2);
- d) the size (outside diameter), in millimetres (see table 4);
- e) the wall thickness, in millimetres (see tables 5 and 6);
- f) the length range (see table 3);
- g) the material group (see table 1);
- h) the delivery date;
- j) the shipping instruction and purchaser's requirements;
- k) the delivery type (see clause 3).

4.2 The purchaser shall also state on the order his requirements concerning the following optional stipulations:

- pipe coating;
- type of protective compound.

1) At present at the stage of draft. (Revision of ISO/R 202-1961, ISO/R 955-1969 and ISO/R 1556-1971.)

## 5 Designation

A pipe manufactured in conformity with this International Standard shall be designated by

- the type of its ends;
- the size (outside diameter), in millimetres;
- the wall thickness, in millimetres;
- the material group;
- the length range;
- the reference to this International Standard.

Example:

**Aluminium alloy drill pipe, with external thickenings of ends, 114 × 9, material group 1, range 2, in conformity with ISO 5226**

## 6 Material requirements

6.1 Aluminium alloy drill pipes shall conform to the requirements specified in table 1.

They may be divided into three groups:

- group I: without additional requirements for corrosion and heat resistance;
- group II: with improved corrosion resistance;
- group III: with improved heat resistance.

**Table 1 — Material requirements for aluminium alloy drill pipes**

Characteristic	Unit	Requirements		
		Material group		
		I	II	III
Tensile strength, min. <sup>1)</sup> $R_m$	N/mm <sup>2</sup>	530	345	390
Proof stress, min. <sup>1)</sup> $R_p$	N/mm <sup>2</sup>	460	275	295
Elongation after fracture, min. $A (L_0 = 5,65 \sqrt{S_0})$	%	8	10	12
Corrosion rate, max., in 3,5 % NaCl solution	kg/(m <sup>2</sup> ·s)	—	$1,4 \times 10^{-8}$	—
Flattening test, <sup>2)</sup> maximum distance between plates		0,75 $D$	0,70 $D$	0,70 $D$

1) Any possible change in the mechanical properties of pipe material specified by the manufacturer should be taken into account when pipes of material groups I and II are under operating conditions at a temperature over 120 °C and pipes of material group III over 140 °C.

2)  $D$  = pipe diameter.

6.2 Material for steel tool joints shall conform to the requirements specified in table 2.

**Table 2 — Material requirements for steel tool joints**

Characteristic	Unit	Minimum requirement
Tensile strength, $R_m$	N/mm <sup>2</sup>	380
Proof stress, $R_p$	N/mm <sup>2</sup>	735
Elongation after fracture <sup>1)</sup> $A (L_0 = 5,65 \sqrt{S_0})$	%	12
Relative reduction of area $Z$	%	45
Impact strength, KCU	J/m <sup>2</sup>	$685 \times 10^3$
Brinell hardness	HB	280

1) If other gauge lengths are used, the corresponding elongation values shall be obtained in accordance with ISO 2566. In cases of dispute, the gauge length,  $L_0$ , of  $5,65 \sqrt{S_0}$  shall be used.

## 7 Design and basic dimensions of pipes

### 7.1 Design

Designs of aluminium alloy drill pipes shall correspond to figure 1 for pipes with external thickening of ends and to figure 2 for pipes with internal thickening of ends.

### 7.2 Length

Drill pipe length ranges shall correspond to the requirements specified in table 3.

**Table 3 — Length ranges**

Pipe state at delivery	Length, $L$ m		
	Range 1	Range 2	Range 3
Pipe with screwed-on tool joint	5,5	9,0	12,3
Pipe without tool joint	5,3	8,7	12,0

NOTE — The tolerance for pipes of all three ranges is  $\pm 0,25$  m.

### 7.3 Dimensions of pipes and tool joints

Aluminium alloy drill pipes and steel tool joint diameters shall conform to the dimensions specified in table 4.

Sizes of drill pipes with external and internal thickening of ends shall correspond to the data given in tables 5 and 6, respectively.

### 7.4 Crosswise groove

At any place on the intermediate section between the thickened end and the pipe body, a crosswise groove or collar is allowed, the height or depth of which may not increase or decrease the outside diameter by more than  $\pm \frac{2,5}{5,0}$  mm of the nominal size, but the wall thickness shall remain unreduced at the same location.

**7.5 Straightness**

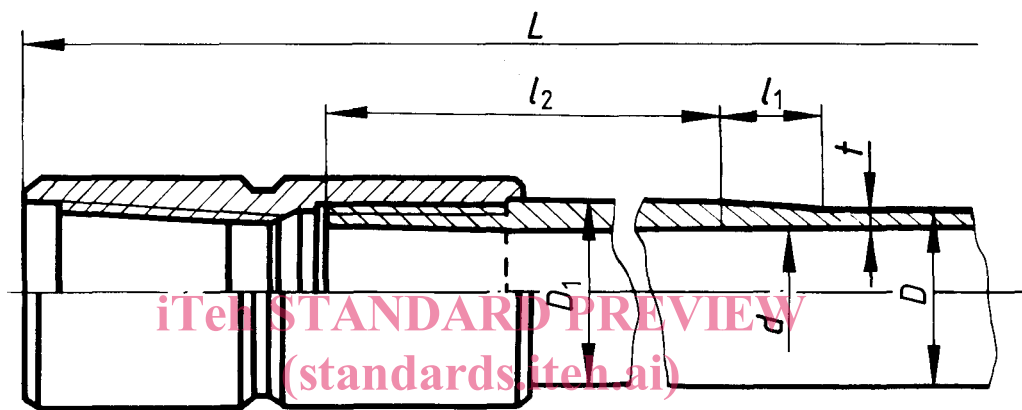
Pipes shall be straight. Permissible curvature of end parts on a length of 1,5 m (excluding external thickened ends) shall not exceed 1,3 mm per metre.

**7.6 Ovality and eccentricity of pipes**

Ovality and eccentricity of pipes shall be within the tolerances on external diameter and wall thickness (see tables 5 and 6).

**7.7 End faces**

If pipe blanks are supplied, deviation from the perpendicular of the end faces of the blanks shall not exceed 1°.



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Figure 1 – Pipe with external thickening of ends

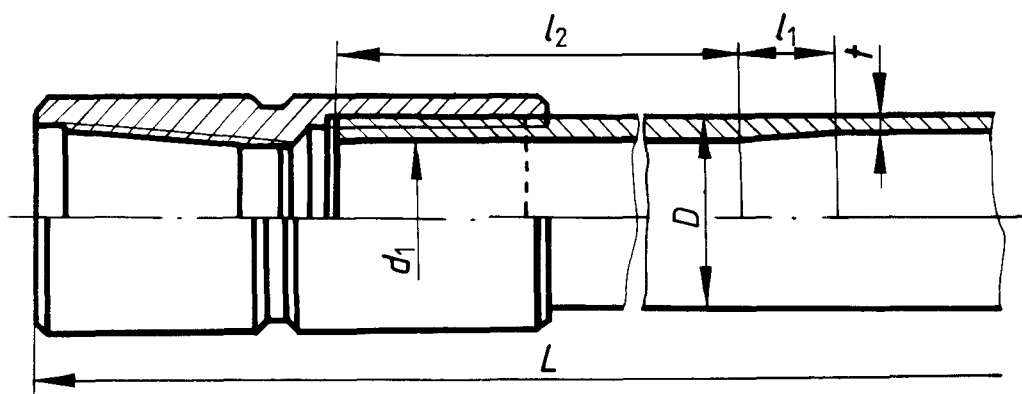


Figure 2 – Pipe with internal thickening of ends

Table 4 — Pipe and tool joint diameters

Dimensions in millimetres

Pipes with external thickening of ends		Pipes with internal thickening of ends	
Drill pipe	Tool joints	Drill pipe	Tool joints
73	108	60	80
89	118	73	90;95
102	146	89	118
114	155	102	118;133
127	178	114	140;146
		127	152;155
		140;146	172;178
		168	197;203

NOTE — Tolerance on outside diameter of all steel tool joints is  $\pm 0,5$  mm.

Table 5 — Drill pipes with external thickening of ends

Dimensions of pipe body					Dimensions of thickened ends					
Outside diameter		Wall thickness		Inside diameter	Outside diameter		Length of transition zone		Length of thickened end	
$D$	tol. %	$t$	tol. mm	$d$	$D_1$	tol. mm	$l_1$	tol. mm	$l_2$	tol. mm
mm		mm		mm	mm		mm		mm	
73	± 1	7	± 0,4	59	84	+ 2,5 - 1,0	450	+ 150 - 100	250	± 50
89		7	± 0,4	75	100					
89		8	± 0,4	73	100					
102		8	± 0,4	86	116					
102		9	± 0,4	84	116					
114		9	± 0,4	96	129					
114		10	± 0,5	94	129	+ 3,0 - 1,2	350	+ 70 - 50		
127		9	± 0,4	109	142					
127		11	± 0,5	105	142					

Table 6 — Drill pipes with internal thickening of ends

Dimensions of pipe body				Dimensions of thickened ends				
Outside diameter		Wall thickness		Inside diameter		Length of transition zone	Length of thickened end	
$D$	tol. %	$t$	tol. mm	$d_1$	tol. mm	$l_1$ min.	$l_2$	tol. mm
mm		mm		mm		mm	mm	
60	± 1	7	± 0,4	36	+ 2,0 - 3,0	40	250	± 50
73		7	± 0,4	47				
89		7	± 0,4	61				
89		8	± 0,4	61				
102		8	± 0,4	74				
102		9	± 0,4	74				
114		9	± 0,4	84	+ 2,5 - 4,0	55	350	+ 75 - 50
114		10	± 0,5	84				
127		9	± 0,4	93				
127		11	± 0,5	93				
140		9	± 0,4	106				
140		11	± 0,5	106				
146		9	± 0,4	112				
146		11	± 0,5	112				
168		9	± 0,4	134				
168		11	± 0,5	134				

## 8 Test methods

**8.1** Each pipe lot shall be inspected and tested at the mill after heat treatment.

**8.2** Not less than 10 % of pipes from each lot shall be subjected to mechanical tests (but not less than one pipe). The types of tests shall be established in accordance with table 1. If any of the test specimens representing a lot of pipe fail to conform to the requirements specified in table 1, the manufacturer may retest double the number of specimens from this lot. If any of the specimens retested fail to conform to the specified requirements, the entire lot shall be rejected.

Testing of drill pipe metal mechanical properties shall be carried out on the specimens cut out from the thickened part of the pipe by non-destructive methods.

The macroscopic structure check shall be made in the macro-templates representing 20 % of each lot.

**8.2.1** Tensile testing shall be carried out in accordance with ISO 6892.

**8.2.2** Pipe flattening shall be carried out in accordance with ISO 8492.

**8.2.3** Testing for hardness as well as flattening shall be carried out at the purchaser's request.

**8.3** When the manufacturer supplies the drill pipes with made-up tool joints, he shall establish the leak-proof testing method.

**8.4** Drill pipe corrosion rate shall not exceed the value specified in table 1, and shall be determined by the weight method. This method is based on the estimation of the material mass loss per time unit in chemical medium from the specimen surface unit. Not less than 5 % of drill pipes of each lot shall be subjected to the corrosion rate test. This test shall be carried out at the purchaser's request, when material for pipes of group II is being chosen.

**8.5** Each pipe and each tool joint shall be inspected.

**8.6** Each lot shall contain pipes of the same size, construction material group and the same heat of alloy.

## 9 Measuring methods

**9.1** The outside diameter of the pipe shall be measured at the middle section of the pipe body in two mutually perpendicular planes and shall be within the tolerances specified in tables 5 and 6.

**9.2** For pipes without tool joints, the outside diameter of the thickened ends shall be measured before threading in any two mutually perpendicular planes at a distance of 50 to 100 mm from the pipe end and shall be within the tolerances specified in tables 5 and 6.

**9.3** Wall thickness may be checked by any non-destructive testing method and shall be within the tolerances specified in tables 5 and 6.

**9.4** Ovality shall be measured in accordance with 9.1. The difference between the maximum and minimum diameters shall not exceed the tolerances specified in tables 5 and 6.

**9.5** The pipe curvature shall be verified against a horizontal plate. The maximum deviation at the distance of 1,5 m from the pipe end shall not exceed the tolerance specified in 7.5.

## 10 Defects

**10.1** The outside and inside pipe surface shall be clean, without cavities, cracks, laminations, blisters, non-metallic inclusions and corrosion pits. Isolated skins, scratches, grooves, dents, mechanical damage and local traces of technological lubricant are permitted provided that their depth remains within the limits of the tolerance for the outside diameter.

**10.2** The depth of a permitted defect on the outside pipe surface shall be determined after slope machining the defective place by a method ensuring visual inspection of the depth until the defect is completely removed. The depth of the defect shall not exceed the tolerances on pipe wall thickness (see tables 5 and 6).

**10.3** Local hammering and repair-welding of defects on the pipe outside surface is not allowed.

**10.4** Upon request and in the presence of the purchaser, the inside pipe surface may be inspected by the manufacturer.

## 11 Pipe and tool joint threads

**11.1** Tool joint threads shall be manufactured in conformity with ISO 3962.

By agreement between manufacturer and purchaser, delivery of pipes with other tool joint threads may be permitted.

**11.2** The shape and dimensions of the thread profile for connecting a tool joint to a pipe shall be established by agreement between manufacturer and purchaser.

## 12 Marking

**12.1** Aluminium alloy drill pipes and steel tool joints manufactured in conformity with this International Standard shall be marked with a stamp. The height of the marking shall be 10 mm and the depth shall be 0,3 to 0,7 mm. Pipes shall be die-stamped on the outside surface of the thickened end, at a distance not exceeding 150 mm from the taper. Markings shall be placed longitudinally on both ends of each pipe.

**12.2** The sequence of marking shall be as follows:

- a) the manufacturer's name or trade mark;
- b) the ISO monogram and reference to this International Standard;
- c) the material group (see 6.1);
- d) the size (outside diameter), in millimetres;
- e) the wall thickness, in millimetres;
- f) the length range;
- g) the serial number of the lot and serial number of the pipe in the lot;
- h) the tool joint type and size.

Left-hand threaded pipes shall be marked with the letter "L".

**12.3** Upon request and in the presence of the purchaser, the aluminium alloy drill pipes can be marked in addition to the die-stamping by paint-stencilling as specified in 12.2. Paint-stencilling shall be located either in the centre part or at any other place and shall be made longitudinally by letters and figures of between 35 and 50 mm. The sequence of paint-stencilled marking shall be the same as in 12.2.

**12.4** Each tool joint (box and pin) shall be provided with a 10 mm band for marking. On the band the following information shall be die-stamped:

- a) the manufacturer's name or trade mark;
- b) the ISO monogram;
- c) the size and lot number;
- d) the thread type.

When tool joints are supplied with a left-hand thread, they shall be provided with an identification band of 5 mm width, spaced 10 mm from the marking band.

## 13 Transport

**13.1** Aluminium alloy drill pipes are shipped in lots. Pipes in each lot shall be of the same diameter, the same wall thickness (or the same size), the same material group, the same length and with the same heat treatment.

**13.2** Each lot shall have a certificate which includes the following information:

- a) the name of the country of the manufacturer;
- b) the manufacturer's name or trade mark;
- c) the material group;
- d) the pipe diameter, wall thickness and length range;
- e) the pipe length (total);
- f) the results of mechanical and technological tests;
- g) the delivery completeness (when pipes are supplied with tool joints, assembled thread direction and tool joint size shall be indicated);
- h) the number of the pipe lot;
- j) the reference to this International Standard.

## 14 Delivery conditions

**14.1** Aluminium alloy drill pipes shall be delivered in accordance with the requirements specified in 8.6.

**14.2** For delivery of threaded pipes or pipes with screwed-on tool joints, threads shall be covered with anticorrosive lubricant and provided with thread protectors properly preventing them from damage during transportation and storage.