

## SLOVENSKI STANDARD oSIST prEN ISO 20312:2008 01-februar-2008

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Petroleum and natural gas industries - Design and operating limits of drill strings with aluminium alloy components (ISO/DIS 20312:2007)

Erdöl- und Erdgasindustrie - Empfohlenes Verfahren für die Auslegung und die Einsatzgrenzen von Bohrsträngen aus Aluminium-Bohrgestängen (ISO/DIS 20312:2007)

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Industries du pétrole et du gaz naturel - Conception et limites d'exploitation des trains de tiges de forage ayant des composants en alliage d'aluminium (ISO/DIS 20312:2007)

Ta slovenski standard je istoveten z: prEN ISO 20312

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75.180.10	Oprema za raziskovanje in odkopavanje	Exploratory and extraction equipment
77.150.10	Aluminijski izdelki	Aluminium products

oSIST prEN ISO 20312:2008

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## EUROPEAN STANDARD NORME EUROPÉENNE EUROPÄISCHE NORM

## DRAFT prEN ISO 20312

October 2007

ICS 75.180.10; 77.150.10

**English Version** 

## Petroleum and natural gas industries - Design and operating limits of drill strings with aluminium alloy components (ISO/DIS 20312:2007)

Industries du pétrole et du gaz naturel - Conception et limites d'exploitation des trains de tiges de forage ayant des composants en alliage d'aluminium (ISO/DIS 20312:2007)

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### Foreword

This document (prEN ISO 20312:2007) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" in collaboration with Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries" the secretariat of which is held by AFNOR.

This document is currently submitted to the parallel Enquiry.

#### **Endorsement notice**

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# Petroleum and natural gas industries — Design and operating limits of drill strings with aluminium alloy components

Industries du pétrole et du gaz naturel — Conception et limites d'exploitation des trains de tiges de forage ayant des composants en alliage d'aluminium

ICS 75.180.10

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### Foreword

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ISO 20312 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures* for petroleum, petrochemical and natural gas industries, Working Group 5.

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# Petroleum and natural gas industries — Design and operating limits of drill strings with aluminium alloy components

#### 1 Scope

This standard shall apply to design and operating limits for the drill strings containing aluminium alloy pipes manufactured in accordance with ISO 15546:2002.

#### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10407-1:—<sup>1)</sup>, Petroleum and natural gas industries — Rotary drilling equipment — Part 1: Drill stem design and operating limits

ISO 10407-2:—<sup>1)</sup>, Petroleum and natural gas industries — Rotary drilling equipment — Part 2: Inspection and classification of drill stem elements IST EN ISO 20312:2011

ISO 10424-1, Petroleum and natural gas industries — Rotary drilling equipment — Part 1: Rotary drill stem elements

ISO 11961, Petroleum and natural gas industries — Steel pipes for use as drill pipes — Specification

ISO 15546:2002, Petroleum and natural gas industries — Aluminium alloy drill pipe

API RP 7G, Recommended Practice for Drill Stem Design and Operating Limits

API RP 7A1, Recommended Practice for Testing of Thread Compounds for Rotary Shouldered Connections

#### 3 Terms, definitions, and abbreviations

#### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1.1

aluminium alloy drill pipe a seamless aluminium alloy drill pipe with tool-joints

#### 3.1.2

box a tool joint part that has internal tool-joint thread

<sup>1)</sup> ISO 10407 current broken into 2 parts, both under development. To be published.

#### 3.1.3

#### buckling

unstable lateral deflection of a drill stem components under compressive axial load

#### 3.1.4

#### corrosion

the adverse chemical alteration or destruction of a metal by air, moisture or chemicals

#### 3.1.5

#### critical buckling load

the load level associated with initiation of drill stem components buckling

#### 3.1.6

#### dogleg

a sharp change of direction in a wellbore

#### 3.1.7

#### dogleg severity

a measure of the amount of change in the inclination and/or direction of a borehole usually expressed in degrees per 30 m interval

#### 3.1.8

drill stem

a complete assembly from the swivel or top drive to the drill bit, that may contain the kelly, drill string, subs, drill collars and other bottomhole assembly (BHA) members such as stabilizers, reamers, junk baskets

NOTE The complete assembly is used to rotate the bit and supply the drilling mud to the drill bit.

#### 3.1.9

#### SIST EN ISO 20312:2011

drill string connected drill pipes with tool joints attached a/48/0217c4c/sist-en-iso-20312-2011

#### 3.1.10

### fatigue crack

a crack resulting from fatigue

#### 3.1.11

heat

the metal melted with one continuous operation of one metal batch

#### 3.1.12

#### helical buckling

buckling in which drill stem components form a helix or spiral shape

#### 3.1.13

#### manufacturer

firm, company or corporation, responsible for making the product

#### 3.1.14

#### new, premium class , class 2 pipes

classification of the pipes worn to a different extent

#### 3.1.15

#### pin

a tool joint part that has external tool-joint thread

#### 3.1.16

#### sinusoidal buckling

buckling of drill stem components in a sinusoidal shape

#### 3.1.17

#### slip area

an area within a small distance along the pipe body from the box end clamped by the pipe slips during the pulling and running operations

#### 3.1.18

tool joint

steel tool joint element for drill pipes consisting of two parts - pin and box

#### 3.2 Abbreviations

ADP	aluminium alloy drill pipe(s)
BHA	bottomhole assembly
HW ADP	heavy weight aluminium drill pipe(s)
HW DP	heavy weight steel drill pipe(s)
OD	outside diameter
ROP	rate of penetration
RPM	revolutions per minute
SDP	steel drill pipe(s) tandards.iteh.ai)
WOB	weight on bit SIST EN ISO 20312:2011

#### 4 Properties of ADP and tool joints tem-iso-20312-2011

#### 4.1 General

Dimensional, mechanical properties of ADP and tool joints are subject to ISO 15546 standard. The pipes may be with external or internal upset ends, and with protector thickening. Separate tables of the chapter include the data on the drill pipes torsional strength, tensile strength, and resistance against internal and external pressure.

#### 4.2 New pipes and tool joints data

The new pipes data shall meet the requirements stipulated:

- in Table 1 for pipes with external upset ends;
- in Table 2 for pipes with internal upset ends.

					Tool joint										
liameter <i>D</i> , mm	ickness, mm	pe mass per ır meter, kg	s gain due to upset, kg	due to protector kening, kg	E	n ID, mm	Thread	oint mass, kg	Mass p inclue protecto to	er 1 linea ding all u or thicken ol joint <sup>a</sup> ,	r metre psets, ling, and kg	Equivalent density of pipe with tool joints <sup>b</sup> , kg/m <sup>3</sup>			
side c	all th	ain p		gain thicl	Ő	imur		o[ loc		Range			Range		
Outs	>	Pi T	Mas	Mass		Mir		Tc	1	2	3	1	2	3	
90	8	5,73	4,65		118	74	NC 38	19,2	9,20	8,09	7,46	4 186	3 879	3 660	
114	10	9,08	11,02		155	94	NC 50	38,6	16,49	13,98	12,78	4 321	4 014	3 786	
129	G	9 4 3	22.61	_	172	110	5 ½ FH	46,0	19,88	16,55	14,66	4 103	3 869	3 686	
120	3	0,70	22,01	20,98	112	110			23,27	18,86	16,35	3 522	3 406	3 312	
133	11	11 72	17.70	h-S'	172	110	5 1⁄2 FH	46.0	21,23	18,20	16,47	4 113	3 847	3 650	
100		11,72	17,70	16,33		110	0 /2111		23,86	19,99	17,79	3 673	3 511	3 385	
140	13	14.41	8,71	(	172	110	5 ½ FH	46.0	22,31	19,79	18,36	4 215	3 892	3 666	
		,	5,7 1	44,34				,.	29,46	24,66	21,93	3 223	3 143	3 081	
147	11	13,06 https:	30,12	-	195	103 atalo	6% FH	65,2	27,59	22,96	20,32	4 162	3 917	3 727	
			/stand	35,65	h.ai/g				33,34	26,88	23,20	3 462	3_359	3 273	
151	13	15 66	24 54	- a'	14876	217c	6% FH	65.2	29,12	24,83	22,39	4 167	3 896	3 693	
		10,00	,	30,42		100			34,03	28,18	24,85	3 584	3 445	3 335	
155	15	18 33	18 79		195	103	6% FH	65.2	30,69	26,75	24,51	4 172	3 877	3 664	
		10,00	10,10	25,00			0/8111	00,2	34,73	29,50	26,53	3 704	3 526	3 391	
164	9	12 18	33 28		203	124	6% FH	66.5	27,48	22,60	19,83	4 157	3 926	3 742	
	Ŭ	12,10	00,20	32,90			0/8111	00,0	32,79	26,22	22,48	3 500	3 396	3 308	
168	11	15.08	27.06		203	124	65⁄4 EH	66.5	29,19	24,69	22,13	4 163	3 901	3 702	
100		10,00	21,00	27,01	200	127	0/8111	00,0	33,55	27,66	24,31	3638	3 492	3 377	
<ul> <li>Value is calculated by Equation B.3 in Annex B.</li> <li>Value is calculated by Equation B.4 in Annex B.</li> </ul>															

#### Table 1 — Dimensions and masses of new drill pipes with external upset ends

4.3 Buoyant weight

The ADP buoyant weight of different length groups in the fluids of different density could be calculated by Equation B.5 of Annex B. The equivalent density of new pipes is given in Table 1. For mass calculation purposes the assumed aluminium alloy density in Tables 1, 2, 5, 6, and 7 is 2,78 g/cm<sup>3</sup>, and the steel density is 7,85 g/cm<sup>3</sup>. In case the alloys of other density are used a correcting factor shall be applied.

EXAMPLE **Objective:** Calculate the weight of 1 m of ADP 147 x 11, 12 m long, with internal upsets in drilling mud with specific gravity 1 200 kg/m<sup>3</sup>.

Solution: According to the Table 2 the mass of 1m of this pipe is 20,71 kg, equivalent density is 3 298 kg/m<sup>3</sup>.

The weight in mud would be

w = 20,71 × 9,81 × (1 – 1 200/3 298) = 129,2 N/m.

						Tool joi	nt																					
diameter <i>D</i> , mm	lickness, mm	ipe mass per ar meter, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to upset, kg	due to protector kening, kg	, mm	m ID, mm	read	oint mass, kg	Mass po incluc protecto too	er 1 linea ling all u or thicker ol joint ª,	ar metre ipsets, ning, and kg	Equivale with	ent densit n tool join kg/m <sup>3</sup>	y of pipe ts <sup>b</sup> ,
all th		ain p line	gain	gain thic	8	nimu	Ч	oj loc		Range		Range																
Outs	M	1 1d	Mass	Mass		Mir		ц	1	2	3	1	2	3														
64	8	3,911	1,42	-	80	34	NC23	9,50	5,42	4,94	4,66	4 024	3 721	3 516														
73	9	5,028	2,22	-	95	27	NC26	14,5	7,40	6,64	6,21	4 171	3 846	3 623														
90	9	6,364	3,00	-	110	40	NC31	19,3	9,55	8,53	7,96	4 214	3 884	3 655														
103	9	7,385	7,17	-	118	73	NC38	19,2	11,16	9,96	9,27	3 840	3 597	3 428														
114	10	9,078	8,43	-	145	70	NC44	34,9	15,48	13,44	12,28	4 304	3 985	3 754														
129 9	٥	9,428	28 13 17	-	155 94	NC50	38.6	17,17	14,70	13,30	4 206	3 923	3 712															
	5		13,17	26,21		- 34		50,0	21,40	17,58	15,41	3 398	3 295	3 213														
129	11	11,331	12,66	2	155	94	NC50	38,6	18,87	16,46	15,10	4 085	3 807	3 607														
147	11	13,059	11 40		170	102	5 1/ EU	52.1	22,62	19,57	17,84	4 395	4 061	3 817														
147 1			11,40	35,65	170	100	5 /2111	55,1	28,37	23,49	20,71	3 530	3 400	3 298														
147	13	15,206	12,74	-	178	103	5 ½ FH	53,1	24,84	21,77	20,02	4 224	3 912	3 689														
147	15	17,284	12,30	ls. <del>it</del> eh	178	103	5 ½ FH	53,1	26,72	23,71	22,00	4 127	_ 3 824	3 611														
170	11	15,267	13,60	<del>-</del> a74	203	124	6 % FH	76,8	28,86	24,53	22,06	4 659	4 296	4 023														
170	13	17 816	15 31	-	203	124	6 % FH	76.8	31,52	27,15	24,67	4 473	4 129	3 876														
170	15	17,010	10,01	44,34	200	124	0 /8111	, 0,0	38,67	32,03	28,24	3 670	3 516	3 395														

Table 2 — Dimensions and masses of new drill pipes with internal upset ends

#### 4.4 Mechanical properties

Г

The mechanical properties of new pipes (tensile loads, torque, internal yield and collapse pressure values) are given in Table 3. The properties correspond to the temperature of 20 °C. The "weak section" for the calculations was the pipe body. The design of ADP provides the strength of "tool joint" and "tool joint to pipe" connection 15 % more than at the "weak section" of the pipe.

The mechanical properties of the premium class pipes are given in Table 4.

The mechanical properties of 2 class pipes are given in Table 5.

#### 4.5 ADP with integral tool joint and heavy weight ADP

ISO 15546 does not cover the ADP with the integral tool joint and heavy weight ADP which are manufactured in the assembled condition with steel tool joints (Figure A.2). Their technical properties are given in Annex A. ADP with integral rotary shouldered connections are used as technological sets in the intervals where the danger of drill string sticking exists. Heavy weight ADP are widely used in BHA to ensure smooth stiffness transition from drill collars to steel drill pipes or as diamagnetic pipes to perform directional survey inside the drill string when drilling directional or vertical wells.