SLOVENSKI STANDARD

oSIST prEN ISO 20312:2008

01-februar-2008

Industrija nafte in zemeljskega plina - Naḷ rtovanje in omejitve uporabe vrtalnih nizov s sestavnimi deli iz aluminijevih zlitin (ISO/DIS 20312:2007)

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)

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**

ICS:

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

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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)

This draft European Standard is submitted to CEN members for parallel enquiry. It has been drawn up by the Technical Committee CEN/TC 12.

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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

The text of ISO/DIS 20312:2007 has been approved by CEN as a prEN ISO 20312:2007 without any modification.

DRAFT INTERNATIONAL STANDARD ISO/DIS 20312

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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

ISO/CEN PARALLEL ENQUIRY

The CEN Secretary-General has advised the ISO Secretary-General that this ISO/DIS covers a subject of interest to European standardization. **In accordance with the ISO-lead mode of collaboration as defined in the Vienna Agreement, consultation on this ISO/DIS has the same effect for CEN members as would a CEN enquiry on a draft European Standard.** Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month FDIS vote in ISO and formal vote in CEN.

In accordance with the provisions of Council Resolution 15/1993 this document is circulated in the English language only.

Conformément aux dispositions de la Résolution du Conseil 15/1993, ce document est distribué en version anglaise seulement.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

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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.

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:—[1)], *Petroleum and natural gas industries — Rotary drilling equipment — Part 1: Drill stem design and operating limits*

ISO 10407-2:—[1)], *Petroleum and natural gas industries — Rotary drilling equipment — Part 2: Inspection and classification of drill stem elements*

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

1) 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
drill string
connected drill pipes with tool joints attached

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)
WOB	weight on bit

4 Properties of ADP and tool joints

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.

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

Outside diameter *D*, mm	Wall thickness, mm	Plain pipe mass per 1 linear meter, kg	Mass gain due to upset, kg	Mass gain due to protector thickening, kg	Tool joint			Tool joint mass, kg	Mass per 1 linear metre including all upsets, protector thickening, and tool joint[a], kg			Equivalent density of pipe with tool joints [b], kg/m^3		
					OD, mm	Minimum ID, mm	Thread		Range			Range		
									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	9	9,43	22,61	–	172	110	5 ½ FH	46,0	19,88	16,55	14,66	4 103	3 869	3 686
				20,98					23,27	18,86	16,35	3 522	3 406	3 312
133	11	11,72	17,70	–	172	110	5 ½ FH	46,0	21,23	18,20	16,47	4 113	3 847	3 650
				16,33					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
				44,34					29,46	24,66	21,93	3 223	3 143	3 081
147	11	13,06	30,12	–	195	103	6⅝ FH	65,2	27,59	22,96	20,32	4 162	3 917	3 727
				35,65					33,34	26,88	23,20	3 462	3 359	3 273
151	13	15,66	24,54	–	195	103	6⅝ FH	65,2	29,12	24,83	22,39	4 167	3 896	3 693
				30,42					34,03	28,18	24,85	3 584	3 445	3 335
155	15	18,33	18,79	–	195	103	6⅝ FH	65,2	30,69	26,75	24,51	4 172	3 877	3 664
				25,00					34,73	29,50	26,53	3 704	3 526	3 391
164	9	12,18	33,28	–	203	124	6⅝ FH	66,5	27,48	22,60	19,83	4 157	3 926	3 742
				32,90					32,79	26,22	22,48	3 500	3 396	3 308
168	11	15,08	27,06	–	203	124	6⅝ FH	66,5	29,19	24,69	22,13	4 163	3 901	3 702
				27,01					33,55	27,66	24,31	3638	3 492	3 377

[a] Value is calculated by Equation B.3 in Annex B.

[b] Value is calculated by Equation B.4 in Annex B.

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^3, and the steel density is 7,85 g/cm^3. 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^3.

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

The weight in mud would be

$$w = 20{,}71 \times 9{,}81 \times (1 - 1\,200/3\,298) = 129{,}2 \text{ N/m}.$$

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

Outside diameter *D*, mm	Wall thickness, mm	Plain pipe mass per 1 linear meter, kg	Mass gain due to upset, kg	Mass gain due to protector thickening, kg	Tool joint			Tool joint mass, kg	Mass per 1 linear metre including all upsets, protector thickening, and tool joint [a], kg			Equivalent density of pipe with tool joints [b], kg/m^3		
					OD, mm	Minimum ID, mm	Thread		Range			Range		
									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	9,428	13,17	–	155	94	NC50	38,6	17,17	14,70	13,30	4 206	3 923	3 712
				26,21					21,40	17,58	15,41	3 398	3 295	3 213
129	11	11,331	12,66	–	155	94	NC50	38,6	18,87	16,46	15,10	4 085	3 807	3 607
147	11	13,059	11,40	–	178	103	5 ½ FH	53,1	22,62	19,57	17,84	4 395	4 061	3 817
				35,65					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	–	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	–	203	124	6 ⅝ FH	76,8	28,86	24,53	22,06	4 659	4 296	4 023
170	13	17,816	15,31	–	203	124	6 ⅝ FH	76,8	31,52	27,15	24,67	4 473	4 129	3 876
				44,34					38,67	32,03	28,24	3 670	3 516	3 395

4.4 Mechanical properties

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.