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Petroleum and natural gas industries — Rotary drilling equipment —

Part 1: Rotary drill stem elements

Industries du pétrole et du gaz naturel — Équipements de forage rotary —

Partie 1: Éléments de forage rotary

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10424-1 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment*.

ISO 10424 consists of the following parts, under the general title *Petroleum and natural gas industries — Rotary drilling equipment*:

— *Part 1: Rotary drill stem elements*

— *Part 2: Threading and gauging of rotary shouldered thread connections*

Introduction

The function of this part of ISO 10424 is to define the design and the mechanical properties of the material required for rotary drill stem elements. It also defines the testing required to verify compliance with these requirements. As rotary drill stem elements are very mobile, moving from rig to rig, design control is an important element required to ensure the interchangeability and performance of product manufactured by different sources.

A major portion of this part of ISO 10424 is based upon API Spec 7, 40th edition, November 2001. However, API Spec 7 does not define the nondestructive testing requirements of materials used to manufacture the drill stem components covered by this part of ISO 10424. This part of ISO 10424 does address these requirements.

Users of this part of ISO 10424 should be aware that further or differing requirements may be needed for individual applications. This part of ISO 10424 is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this part of ISO 10424 and provide details.

In this part of ISO 10424, certain ISO and non-ISO standards provide the same technical result for a particular provision, however there is a market need to retain the traditional non-ISO reference.

In the running text the provision is written in the form "..... in accordance with ISO xxx.

NOTE For the purposes of this provision, non-ISO Ref yyy is equivalent to ISO xxx."

Application of a non-ISO reference cited in this manner will lead to the same results as the use of the preceding ISO reference. These documents are thus considered interchangeable in practice. In recognition of the migration of global standardization towards the use of ISO standards, it is intended that references to these alternative documents be removed at the time of the first full revision of this part of ISO 10424.

Petroleum and natural gas industries — Rotary drilling equipment —

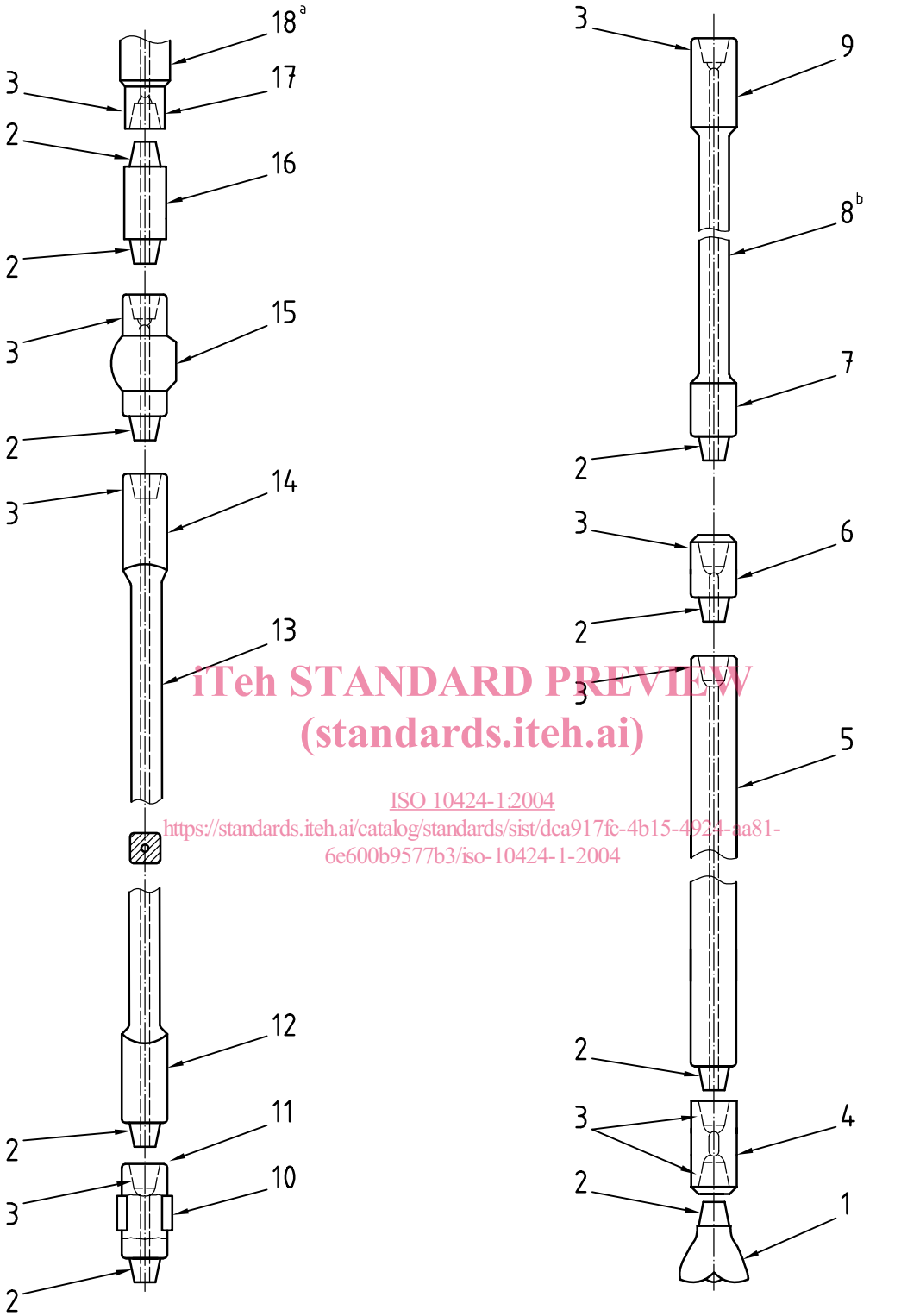
Part 1: Rotary drill stem elements

1 Scope

This part of ISO 10424 specifies requirements for the following drill stem elements: upper and lower kelly valves; square and hexagonal kellys; drill stem subs; standard steel and non-magnetic drill collars; drilling and coring bits.

This part of 10424 is not applicable to drill pipe and tool joints, rotary shouldered connection designs, thread gauging practice, or grand master, reference master and working gauges.

A typical drill stem assembly to which this part of 10424 is applicable is shown in Figure 1.



a) Upper section of assembly

b) Lower section of assembly

Figure 1 — Typical drill stem assembly

Key

1	bit	7	pin tool joint	13	kelly drive section
2	rotary pin connection	8	drill pipe	14	upper kelly upset
3	rotary box connection	9	box tool joint	15	upper kelly valve
4	bit sub	10	protector rubber	16	swivel sub
5	drill collar	11	lower kelly valve or kelly saver sub	17	swivel stem
6	crossover sub	12	lower kelly upset	18	swivel

[a] Requirements on swivels can be found in ISO 13535.

[b] Requirements on drill pipe with weld-on tool joints can be found in ISO 11961.

NOTE 1 For the purposes of the provision in footnote a, API Specs 8A and 8C are equivalent to ISO 13535.

NOTE 2 For the purposes of the provision in footnote b, API Specs 5D and 7 are equivalent to ISO 11961.

NOTE 3 All connections between lower kelly upset and the bit are RH.

NOTE 4 All connections between upper kelly upset and swivel are LH.

Figure 1 — Typical drill stem assembly (*continued*)

2 Conformance

2.1 Units of measurement

In this International Standard, data are expressed in both the International System (SI) of units and the United States Customary (USC) system of units. For a specific order item, it is intended that only one system of units be used, without combining data expressed in the other system.

Products manufactured to specifications expressed in either of these unit systems shall be considered equivalent and totally interchangeable. Consequently, compliance with the requirements of this International Standard as expressed in one system provides compliance with requirements in the other system.

For data expressed in the SI, a comma is used as the decimal separator and a space as the thousands separator. For data expressed in the USC system, a dot is used as the decimal separator and a space as the thousands separator.

Data within the text of this International Standard are expressed in SI units followed by data in USC units in parentheses.

2.2 Tables and figures

Separate tables for data expressed in SI units and in USC units are given. The tables containing data in SI units are included in the text and the tables containing data in USC units are given in Annex A. For a specific order item, only one unit system shall be used.

Figures are contained in the text of the clause concerning the particular product, and express data in both SI and USC units.

3 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 148, *Steel — Charpy impact test (V notch)*

ISO 3452, *Non-destructive testing — Penetrant inspection — General principles*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

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

ISO 9934-1, *Non-destructive testing — Magnetic particle testing — Part 1: General principles*

ISO 9712, *Non-destructive testing — Qualification and certification of personnel*

ISO 13665, *Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube body for the detection of surface imperfections*

ISO 15156-1, *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials*

ISO 15156-2, *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low alloy steels, and the use of cast irons*

ISO 15156-3, *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production — Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys*

API[1] RP 7G, *Drill Stem Design and Operating Limits*

API Spec 7, *Rotary Drill Stem Elements*

ASTM[2] A 262, *Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels*

ASTM A 434, *Standard Specification for Steel Bars, Alloy, Hot-Wrought or Cold-Finished, Quenched and Tempered*

ASTM E 587, *Standard Practice for Ultrasonic Angle-Beam Examination by the Contact Method*

1) American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005, USA

2) American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428, USA

4 Terms, definitions, symbols and abbreviated terms

4.1 Terms and definitions

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

4.1.1
amplitude
vertical height of the A-scan received signal, measured from base to peak or peak to peak

4.1.2
A-scan display
ultrasonic instrument display in which the received signal is displayed as a vertical height or "pip" from the horizontal-sweep time trace, while the horizontal distance between two signals represents the material distance for time of travel between the two conditions causing the signals

4.1.3
back reflection
signal received from the back surface of a surface test object

4.1.4
bevel diameter
outer diameter of the contact face of the rotary shouldered connection

4.1.5
bit sub
sub, usually with two box connections, that is used to connect the bit to the drill stem

4.1.6
box connection
threaded connection on oilfield tubular goods (OCTG) that has internal (female) threads

4.1.7
bending strength ratio
BSR
ratio of the section modulus of a rotary shouldered box at the point in the box where the pin ends when made up, to the section modulus of the rotary shouldered pin at the last engaged thread

4.1.8
calibration system
documented system of gauge calibration and control

4.1.9
cold working
plastic deformation of the thread roots of a rotary shouldered connection, of radii and of cylindrical sections at a temperature low enough to ensure or cause permanent strain of the metal

4.1.10
decarburization
loss of carbon from the surface of a ferrous alloy as a result of heating in a medium that reacts with the carbon at the surface

4.1.11
depth prove-up
act of grinding a narrow notch across a surface-breaking indication until the bottom of the indication is located and then measuring the depth of the indication with a depth gauge for comparison to acceptance criteria

4.1.12
drift
gauge used to check minimum internal diameter of drill stem components

4.1.13
drill collar
thick-walled pipe used to provide stiffness and concentration of mass at or near the bit

4.1.14
drill pipe
length of tube, usually steel, to which special threaded connections called tool joints are attached

4.1.15
forge, verb
⟨hammer⟩ plastically deform metal, usually hot, into desired shapes by the use of compressive force, with or without dies

4.1.16
forging, noun
⟨product⟩ shaped metal part formed by the forging method

4.1.17
full-depth thread
thread in which the thread root lies on the minor cone of an external thread or on the major cone of an internal thread

4.1.18
gauge point
plane perpendicular to the thread axis in API rotary shouldered connections

NOTE The gauge point is located 15,9 mm (0.625 in) from the shoulder of the product pin.

4.1.19
gas-tight
capable of holding gas without leaking under the specified pressure for the specified length of time

4.1.20
heat, noun
metal produced by a single cycle of a batch melting process

4.1.21
H_2S trim
all components, except external valve body, meeting the H_2S service requirements of ISO 15156-2 and ISO 15156-3

NOTE For the purposes of this provision, NACE MR0175 is equivalent to ISO 15156–2 and ISO 15156–3.

4.1.22
kelly
square or hexagonally shaped steel pipe connecting the swivel to the drill pipe that moves through the rotary table and transmits torque to the drill stem

4.1.23
kelly saver sub
short rotary sub that is made up onto the bottom of the kelly to protect the pin end of the kelly from wear during make-up and break-out operations

4.1.24
label
dimensionless designation for the size and style of a rotary shouldered connection

4.1.25
length of box thread
LBT
length of threads in the box measured from the make-up shoulder to the intersection of the non-pressure flank and crest of the last thread with full thread depth

4.1.26
lot
pieces of steel, with the same nominal dimensions and from a single heat, which are subsequently heat-treated as part of the same continuous operation (or batch)

4.1.27
low-stress steel stamps
steel stamps that do not contain any sharp protrusions on the marking face

4.1.28
lower kelly valve
kelly cock
essentially full-opening valve installed immediately below the kelly, with outside diameter equal to the tool joint outside diameter, that can be closed to remove the kelly under pressure and can be stripped in the hole for snubbing operations

4.1.29
make-up shoulder
sealing shoulder on a rotary shouldered connection

4.1.30
non-pressure flank – box
thread flank closest to the make-up shoulder where no axial load is induced from make-up of the connection or from tensile load on the drill stem member

4.1.31
non-pressure flank – pin
thread flank farthest from the make-up shoulder where no axial load is induced from make-up of the connection or from tensile load on the drill stem member

4.1.32
out-of-roundness
difference between the maximum and minimum diameters of the bar or tube, measured in the same cross-section, and not including surface finish tolerances outlined in 8.1.4

4.1.33
pin end
external (male) threads of a threaded connection

4.1.34
process of quenching
hardening of a ferrous alloy by austenitizing and then cooling rapidly enough so that some or all of the austenite transforms to martensite

4.1.35
process of tempering
reheating a quench-hardened or normalized ferrous alloy to a temperature below the transformation range and then cooling to soften and remove stress

4.1.36
reference dimension
dimension that is a result of two or more other dimensions

4.1.37
rotary shouldered connection
connection used on drill stem elements, which has coarse, tapered threads and sealing shoulders

4.1.38
stress-relief features
modification performed on rotary shouldered connections by removing the unengaged threads on the pin or box to make the joint more flexible and to reduce the likelihood of fatigue-cracking in highly stressed areas

4.1.39
sub
short drill stem members with different rotary shouldered connections at each end for the purposes of joining unlike members of the drill stem

4.1.40
swivel
device at the top of the drill stem that permits simultaneous circulation and rotation

4.1.41
tensile strength
maximum tensile stress that a material is capable of sustaining that is calculated from the maximum load during a tensile test carried to rupture and the original cross-sectional area of the specimen

4.1.42
tensile test
mechanical test used to determine the behaviour of material under axial loading

4.1.43
test pressure
pressure above working pressure used to demonstrate structural integrity of a pressure vessel

4.1.44
thread form
thread profile in an axial plane for a length of one pitch

4.1.45
tolerance
amount of variation permitted

4.1.46
tool joint
heavy coupling element for drill pipe having coarse, tapered threads and sealing shoulders

4.1.47
upper kelly valve
kelly cock
valve immediately above the kelly that can be closed to confine pressures inside the drill stem

4.1.48
working pressure
pressure to which a particular piece of equipment is subjected during normal operation

4.1.49
working temperature
temperature to which a particular piece of equipment is subjected during normal operation

4.2 Symbols and abbreviated terms

D	outside diameter
D_{BP}	diameter baffle plate recess
D_c	distance across corners, forged kellys
D_{cc}	distance across corners, machined kellys
D_F	bevel diameter
D_{FL}	distance across flats on kellys
D_{FR}	diameter float valve recess
D_E	diameter elevator groove
D_L	outside diameter lift shoulder
D_{LR}	outside diameter, kelly lower upset
D_P	elevator recess diameter
D_R	outside diameter, reduced section
D_S	diameter slip groove
D_U	outside diameter, upper kelly upper upset
d	inside diameter
d_b	inside bevel
L	overall length
L_D	length kelly drive section
L_{FV}	length float valve assembly
L_G	minimum length kelly sleeve gauge
L_L	lower upset length kellys
L_R	depth of float valve recess
L_U	upper upset length kellys
l_E	elevator groove recess depth
l_S	slip recess groove depth
R	radius