INTERNATIONAL STANDARD

ISO 11960

Third edition
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Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells

Industries du pétrole et du gaz naturel — Tubes d'acier utilisés comme cuvelage ou tubes de production dans les puits

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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 11960 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 5, *Casing, tubing and drill pipe*.

This third edition cancels and replaces the second edition (ISO 11960:2001), which has been technically revised. It also incorporates the Technical Corrigendum ISO 11960:2001/Cor.1:2002.

It is the intent of TC 67 that the second and third editions of ISO 11960 both be applicable, at the option of the purchaser (as defined in 4.1.35), for a period of six months from the first day of the calendar quarter immediately following the date of publication of this third edition, after which period the second edition will no longer be applicable.

Introduction

This International Standard is based on API 5CT (Specification for Casing and Tubing).

Users of this International Standard should be aware that further or differing requirements may be needed for individual applications. This International Standard 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 International Standard and provide details.

This International Standard includes requirements of various nature. These are identified by the use of certain verbal forms:

— 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.

Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells

1 Scope

1.1 This International Standard specifies the technical delivery conditions for steel pipes (casing, tubing, plain-end casing liners and pup joints), coupling stock and accessories and establishes requirements for three Product Specification Levels (PSL-1, PSL-2, PSL-3). The requirements for PSL-1 are the basis of this International Standard. The requirements that define different levels of standard technical requirements for PSL-2 and PSL-3, for all Grades except H-40 and L-80 9Cr, are contained in Annex H.

For pipes covered by this International Standard, the sizes, masses and wall thicknesses as well as grades and applicable end-finishes are listed in Tables C.1 to C.3 and Tables E.1 to E.3.

By agreement between the purchaser and manufacturer, this International Standard can also be applied to other plain-end pipe sizes and wall thicknesses.

This International Standard is applicable to the following connections in accordance with API Spec 5B:

— short round thread casing (STC);

— long round thread casing (LC);

— buttress thread casing (BC);

— extreme-line casing (XC);

— non-upset tubing (NU);

— external upset tubing (EU);

— integral joint tubing (IJ).

For such connections, this International Standard specifies the technical delivery conditions for couplings and thread protection. Supplementary requirements that may optionally be agreed for enhanced leak resistance connections are given in Annex A.11 (SR22).

This International Standard can also be applied to tubulars with connections not covered by ISO/API standards.

1.2 The four groups of products to which this International Standard is applicable include the following grades of pipe:

— Group 1: All casing and tubing in Grades H, J, K and N;

— Group 2: All casing and tubing in Grades C, L, M and T;

— Group 3: All casing and tubing in Grade P;

— Group 4: All casing in Grade Q.

1.3 Casing sizes larger than Label 1: 4-1/2 but smaller than Label 1: 10-3/4 may be specified by the purchaser to be used in tubing service, see Tables C.1, C.24, C.30 and C.31 or Tables E.1, E.24, E.30 and E.31.

1.4 Supplementary requirements that may optionally be agreed between purchaser and manufacturer for non-destructive examination, coupling blanks, upset casing, electric-welded casing, impact testing, seal ring couplings and certificates are given in Annex A.

1.5 This International Standard is not applicable to threading requirements.

NOTE Dimensional requirements on threads and thread gauges, stipulations on gauging practice, gauge specifications, as well as instruments and methods for inspection of threads are given in API Spec 5B.

2 Conformance

2.1 Normative references

In the interests of world-wide application of this International Standard, ISO/TC 67 has decided, after detailed technical analysis, that certain of the normative documents listed in Clause 3 and prepared by ISO/TC 67 or other ISO Technical Committee are interchangeable in the context of the relevant requirement with the relevant document prepared by the American Petroleum Institute (API), the American Society for Testing and Materials (ASTM) or the American National Standards Institute (ANSI). These latter documents are cited in the running text following the ISO reference and preceded by “or”, for example “ISO XXXX or API YYYY”. Application of an alternative normative document cited in this manner will lead to technical results different from the use of the preceding ISO reference. However, both results are acceptable and these documents are thus considered interchangeable in practice.

2.2 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 expressed 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 (on the line) is used as the decimal separator and a space as the thousands separator.

In the text, data in SI units are followed by data in USC units in parentheses.

Separate tables for data expressed in SI units and USC units are given in Annex C and Annex E respectively.

Figures are contained in Annex D 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 31-0, *Quantities and units — Part 0: General principles*

ISO 643, *Steels — Micrographic determination of the apparent grain size*

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

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1:Test method (Scales A, B, C, D, E, F, G, H, K, N, T)*

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

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

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 9304, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Eddy current testing for the detection of imperfections*

ISO 9305, *Seamless steel tubes for pressure purposes — Full peripheral ultrasonic testing for the detection of transverse imperfections*

ISO 9402, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Full peripheral magnetic transducer/flux leakage testing of ferromagnetic steel tubes for the detection of longitudinal imperfections*

ISO 9598, *Seamless steel tubes for pressure purposes — Full peripheral magnetic transducer/flux leakage testing of ferromagnetic steel tubes for the detection of transverse imperfections*

ISO 9764, *Electric resistance and induction welded steel tubes for pressure purposes — Ultrasonic testing of the weld seam for the detection of longitudinal imperfections*

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

ISO 10400, *Petroleum and natural gas industries — Formulae and calculation for casing, tubing, drill pipe and line pipe properties*

ISO 11484, *Steel tubes for pressure purposes — Qualification and certification of non-destructive testing (NDT) 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 13678, *Petroleum and natural gas industries — Evaluation and testing of thread compounds for use with casing, tubing and line pipe*

ANSI-NACE TM0177:1996, *Laboratory testing of metals for resistance to sulfide stress cracking at ambient temperature in H_2S environment*

API Bull 5C2, *Bulletin on performance properties of casing, tubing and drill pipe*

API Bull 5C3, *Bulletin on formulas and calculations for casing, tubing, drill pipe and line pipe properties* (plus Supplement 1)

API Spec 5B, *Specification for threading, gauging and thread inspection of casing, tubing and line pipe threads*

API Std 5T1, *Imperfection terminology*

ASNT SNT-TC-1A:1984, *Recommended practice, personnel qualification and certification in non destructive testing*

ASTM A370, *Standard test methods and definitions for mechanical testing of steel products*

ASTM A751, *Standard test methods, practices and terminology for chemical analysis of steel products*

ASTM A941, *Terminology relating to steel, stainless steel, related alloys and ferroalloys*

ASTM B117, *Standard practice for operating salt spray (fog) apparatus*

ASTM E4, *Standard practices for force verification of testing machines*

ASTM E10, *Standard test method for Brinell hardness of metallic materials*

ASTM E18, *Standard test methods for Rockwell hardness and Rockwell superficial hardness of metallic materials*

ASTM E23, *Standard test methods for notched bar impact testing of metallic materials*

ASTM E29, *Standard practice for using significant digits in test data to determine conformance with specifications*

ASTM E83, *Standard practice for verification and classification of extensometer system*

ASTM E112, *Standard test methods for determining average grain size*

ASTM E213, *Standard practice for ultrasonic examination of metal pipe and tubing*

ASTM E273, *Standard practice for ultrasonic examination of the weld zone of welded pipe and tubing*

ASTM E309, *Standard practice for eddy-current examination of steel tubular products using magnetic saturation*

ASTM E570, *Standard practice for flux leakage examination of ferromagnetic steel tubular products*

ASTM E709, *Standard guide for magnetic particle examination*

IADC/SPE 11396, B.A. Dale, M.C. Moyer, T.W. Sampson, *A Test Program for the Evaluation of Oilfield Thread Protectors*, IADC/SPE Drilling Conference, New Orleans, LA, 20-23 February 1983

MIL-STD-810c, *Military Environmental Test Methods*, March 10, 1975

4 Terms, definitions, symbols and abbreviated terms

4.1 Terms and definitions

For the purposes of this document, the terms and definitions in ASTM A941 for heat treatment operations and the following apply.

4.1.1
accessory material
seamless standard casing or tubing, or seamless thick-wall tubes or mechanical tubes, or bar stock or hot forgings used for the manufacture of accessories

4.1.2
API threads
threads as specified in API Spec 5B

4.1.3
carload
quantity of pipe loaded on a railway car for shipment from the pipe-making facilities

4.1.4
casing
pipe run from the surface and intended to line the walls of a drilled well

4.1.5
casing and tubing accessory
one-piece tubular section used in a pipe string to provide mechanical and pressure integrity within the pipe string and facilitate the performance of some other function required of that pipe string

EXAMPLES Crossover connectors, swages, nipples, flow couplings, blast joints, etc.

NOTE Accessories exclude the other tubular products specifically defined in this International Standard or products included in other ISO (API) specifications.

4.1.6
connection
threaded assembly of tubular components

4.1.7
controlled cooling
cooling from an elevated temperature in a pre-determined manner to avoid hardening, cracking or internal damage, or to produce a desired microstructure or mechanical properties

4.1.8
coupling
internally threaded cylinder for joining two lengths of threaded pipe

4.1.9
coupling blank
unthreaded material used to produce an individual coupling

4.1.10
coupling stock
seamless thick-wall tube or mechanical tube used for the manufacture of coupling blanks

4.1.11
defect
imperfection of sufficient magnitude to warrant rejection of the product based on criteria defined in this International Standard

4.1.12
electric-welded pipe
pipe having one longitudinal seam formed by electric-resistance or electric-induction welding, without the addition of filler metal, wherein the edges to be welded are mechanically pressed together and the heat for welding is generated by the resistance to flow of electric current

4.1.13
handling tight
sufficiently tight that the coupling cannot be removed except by the use of a wrench

4.1.14
heat
metal produced by a single cycle of a batch melting process

4.1.15
heat analysis
chemical analysis representative of a heat as reported by the metal producer

4.1.16
imperfection
discontinuity in the product wall or on the product surface that can be detected by a NDE method included in Table C.62 or Table E.62 of this International Standard

4.1.17
inspection
process of measuring, examining, testing, gauging or otherwise comparing a unit of product with the applicable requirements

4.1.18
inspection lot
definite quantity of product manufactured under conditions that are considered uniform for the attribute to be inspected

4.1.19
inspection lot sample
one or more units of product selected from an inspection lot to represent that inspection lot

4.1.20
inspection lot size
number of units of product in an inspection lot

4.1.21
interrupted quenching
quenching in which the pipe being quenched is removed from the quenching medium while the pipe is at a temperature substantially higher than that of the quenching medium

4.1.22
label 1
dimensionless designation for the size or specified outside diameter that may be used when ordering pipe

4.1.23
label 2
dimensionless designation for the mass per unit length that may be used when ordering pipe

4.1.24
length
piece of pipe that may be plain-end, threaded, or threaded and coupled, that is in accordance with the range requirements in Table C.30 or Table E.30 of this International Standard

4.1.25
linear imperfection
imperfection which includes, but is not limited to, seams, laps, cracks, plug scores, cuts and gouges

NOTE See API Std 5T1.

4.1.26
manufacturer
one or more of the following, depending on the context: pipe mill; processor; threader; coupling manufacturer, pup-joint manufacturer; accessory manufacturer

NOTE See Clause 14.

4.1.27
non-linear imperfection
imperfection which includes, but is not limited to, pits and round-bottom die stamping

NOTE See API Std 5T1.

4.1.28
pipe
casing, tubing, plain-end casing liners and pup joints as a group

4.1.29
pipe mill
firm, company or corporation that operates pipe-making facilities

4.1.30
plain-end casing liner
casing provided unthreaded and with a wall thickness often greater than that specified for J55

4.1.31
processor
firm, company or corporation that operates facilities capable of heat-treating pipe made by a pipe mill

4.1.32
product
pipe, coupling, accessory, coupling stock or coupling blank, either individually or collectively as applicable

4.1.33
pup joint
casing, tubing or plain-end casing liner of length shorter than Range 1

4.1.34
pup-joint material
standard casing or tubing, or thick-wall tubes or mechanical tubes, or bar stock used for the manufacture of pup joints

4.1.35
purchaser
party responsible for both the definition of requirements for a product order and for payment for that order

4.1.36
quench crack
crack in steel resulting from stresses produced during the transformation from austenite to martensite

NOTE This transformation is accompanied by an increase in volume.

4.1.37
seamless pipe
wrought steel tubular product made without a weld seam

NOTE It is manufactured by hot-working steel, and if necessary, by subsequently cold-working or heat-treating, or a combination of these operations, to produce the desired shape, dimensions and properties.

4.1.38
skelp
hot-rolled steel strip used for manufacturing EW pipe

4.1.39
special end-finish
threads with thread form and features, manufacturing specifications, dimensions, connection make-up and performance properties which are beyond the scope of this International Standard