INTERNATIONAL STANDARD

ISO 15590-2

First edition
2003-12-15

Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems —

Part 2: Fittings

Industries du pétrole et du gaz naturel — Coudes d'induction, raccords et brides pour systèmes de transport par conduites —

Partie 2: Raccords

Reference number
ISO 15590-2:2003(E)

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Published in Switzerland

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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 15590-2 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 2, *Pipeline transportation systems*.

ISO 15590 consists of the following parts, under the general title *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems*:

— *Part 1: Induction bends*

— *Part 2: Fittings*

The following part is under preparation:

— *Part 3: Flanges*

Introduction

Users of this part of ISO 15590 should be aware that further or differing requirements may be needed for individual applications. This part of ISO 15590 is not intended to inhibit a manufacturer from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This can be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the manufacturer should identify any variations from this part of ISO 15590 and provide details.

Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems —

Part 2: Fittings

1 Scope

This part of ISO 15590 specifies the technical delivery conditions for unalloyed or low-alloy steel seamless and welded pipeline fittings for use in pipeline transportation systems for the petroleum and natural gas industries as defined in ISO 13623.

This part of ISO 15590 is applicable to welding-end fittings such as elbows, caps, tees, single or multiple extruded headers, reducers, and transition sections made from seamless and welded pipe of unalloyed or low-alloy steels.

This part of ISO 15590 specifies three classes of fitting corresponding to increasing quality requirements in accordance with the technical delivery conditions of ISO 3183 for pipe as indicated in Table 1.

Table 1 — Fitting class and corresponding pipe standard

Fitting class	Corresponding pipe standard
Class A	ISO 3183-1
Class B	ISO 3183-2
Class C	ISO 3183-3

This part of ISO 15590 is not applicable to the selection of the fitting class.

This part of ISO 15590 is not applicable to the materials for, or the attachment of, factory-welded extensions.

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 148 (all parts), *Steel — Charpy impact test (V-notch)*

ISO 377:1997, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 783, *Metallic materials — Tensile testing at elevated temperature*

ISO 2566-1, *Steel – Conversion of elongation values — Part 1: Carbon and low alloy steels*

ISO 3183-1, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 1: Pipes of requirement class A*

ISO 3183-2, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 2: Pipes of requirement class B*

ISO 3183-3, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 3: Pipes of requirement class C*

ISO 3834-2, *Quality requirements for welding — Fusion welding of metallic materials — Part 2: Comprehensive quality requirements*

ISO 4885, *Ferrous products — Heat treatments — Vocabulary*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

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

ISO 7438, *Metallic materials — Bend test*

ISO/TR 7705:1991, *Guidelines for specifying Charpy V-notch impact prescriptions in steel specifications*

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

ISO 10474, *Steel and steel products — Inspection documents*

ISO 11496, *Seamless and welded steel tubes for pressure purposes — Ultrasonic testing of tube ends for the detection of laminar imperfections*

ISO 12095, *Seamless and welded steel tubes for pressure purposes — Liquid penetrant testing*

ISO 12096, *Submerged arc-welded steel tubes for pressure purposes — Radiographic testing of the weld seam for the detection of imperfections*

ISO 13623, *Petroleum and natural gas industries — Pipeline transportation systems*

ISO 13664, *Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube ends for the detection of laminar imperfections*

ASME[1] B16.9, *Factory-made wrought butt welding fittings*

ASME B31.8, *Gas transmission and distribution piping systems*

ASME IX, *Boiler and pressure vessel code, Section IX — Welding and brazing procedures, welders, brazers, and welding and brazing operators*

ASTM[2] E 112, *Standard test methods for determining average grain size*

ASTM E 709, *Standard guide for magnetic particle examination*

EN 287-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

EN 288-3, *Specification and approval of welding procedures for metallic materials — Part 3: Welding procedure tests for the arc welding of steels*

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1) American Society of Mechanical Engineers, 345 East 47th Street, NY 10017-2392, USA

2) American Society for Testing and Materials, 100 Bar Harbor Drive, West Conshohocken, PA 19428-2959, USA

MSS[3] SP-75, *Specification for high test wrought butt welding fittings*

EFC Publication 16:1995[4], *Guidelines on materials requirements for carbon and low alloy steels for H_2S containing environments in oil and gas production*

3 Terms and definitions

For the purposes of this part of ISO 15590 the terms and definitions given in ISO 4885 and the following apply.

3.1
by agreement
agreed between manufacturer and purchaser

[ISO 15590-1:2001]

3.2
extrados
outer curved section of the elbow

NOTE Adapted from ISO 15590-1:2001.

3.3
heat, noun
batch of steel prepared in one steel-making process

NOTE Adapted from ISO 15590-1:2001.

3.4
intrados
inner curved section of the elbow

NOTE Adapted from ISO 15590-1:2001.

3.5
manufacturing procedure specification
MPS
document which specifies the process control parameters and the acceptance criteria to be applied for all manufacturing, inspection and testing activities performed during fitting manufacture

3.6
tangent
straight section at the ends of the fitting

NOTE Adapted from ISO 15590-1:2001.

3.7
test unit
fitting or test piece of the same designation, starting material wall thickness, heat, manufacturing procedure specification, and heat treatment condition

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3) Manufacturers Standardization Society of the Valve & Fittings Industry, 127 Park Street, N.E., Vienna, Virginia 22180, USA

4) European Federation of Corrosion, c/o The Institute of Materials, 1 Carlton House Terrace, London SW1Y 5DB, United Kingdom

4 Symbols and abbreviated terms

A_o	original cross-sectional area of the parallel length of a tensile test specimen
D	outside diameter
D_p	specified outside diameter of matching pipe
D_n	minor outside diameter of a conical reducer or reducing tee at any point, n, under consideration, measured perpendicular to the longitudinal axis
E	factor used to calculate t_i (see A.1)
f	factor used to calculate proof test pressure (see Table B.1)
P_{cm}	crack measurement parameter (see Table 4)
p	design pressure
p_p	numerical value of the computed proof pressure
R_m	tensile strength
$R_{m,\ red}$	allowable tensile strength of a reducer
$R_{t0,5}$	yield strength for 0,5 % total elongation
R_{smys}	specified minimum yield strength
$T_{d,\ min}$	minimum design temperature specified by the purchaser
t	nominal wall thickness
t_D	wall thickness of thicker component for joints of unequal thickness (see Figure 1)
t_i	minimum wall thickness required in the intrados
t_p	nominal wall thickness of matching pipe
t_n	specified wall thickness of reducers and reducing tees at diameter D_n
α	included angle of a conical reducer
ρ_o	radius of curvature of the external contoured portion of the outlet of a tee

CE	carbon equivalent (see Table 4)
CTOD	crack tip opening displacement
DN	nominal size
HIC	hydrogen-induced cracking
MT	magnetic particle testing
NDT	non-destructive testing
PT	liquid penetrant testing
RT	radiographic testing
SMYS	specified minimum yield strength
SSC	sulfide stress-cracking
UT	ultrasonic testing

5 Designation

Designation of fittings shall take the form:

ISO 15590-2 YY xxx-Z,

where

— YY is a textual description of the type of fitting, corresponding to one of the following: EL for elbow, TE for tee, CA for cap, CR for concentric reducer, ER for eccentric reducer and NR for conical reducer, preceeded by the size designation (e.g. “DN 600 EL” is a DN 600 elbow);

— xxx is the specified minimum yield strength requirement in MPa;

— Z is the suffix A or B or C, to identify the fitting class for use in non-sour service, or the suffix CS to identify class C fittings for use in sour-service conditions.

6 Pressure rating and design

6.1 General

The capability of the fitting to withstand internal pressure shall equal or exceed that of the matching pipe. The verification of the capability shall be made by calculation and/or proof testing. The calculations shall be made in accordance with Annex A. The proof test procedure shall be as defined in Annex B. Additional requirements on strength design verifications, such as resistance to internal pressure under special load cases in accordance with ISO 13623, shall be indicated at the time of enquiry or order.

The design calculations and/or results of proof testing shall be available for review at the manufacturer’s facility.

If the SMYS of the fitting material is less than that of the matching pipe, the minimum thickness of the fitting end shall be increased such that the product of its thickness times its SMYS shall at least equal the product of the specified wall thickness and the SMYS of the matching pipe, in accordance with MSS SP-75.

6.2 Tees and headers

Outlet branches in tees and headers manufactured from seam-welded pipe shall be positioned diametrically opposite the longitudinal weld. When this positioning is not possible, the location shall be decided by agreement.

The design and welding for the attachment of guide bars of barred tees shall be decided by agreement prior to manufacture of the tee.

6.3 Extruded outlet headers

Extruded outlet headers shall be designed to comply with ASME B31.8.

7 Information to be supplied by the purchaser

7.1 Principal information

The purchaser shall provide the following information in the order given below:

a) fitting designation;

b) required fitting dimensions, including

   1) nominal outside diameters,

   2) minimum wall thicknesses at the welding ends,

   3) radius and type of radius (e.g. long-radius),

   4) the angle (for elbows);

NOTE Guidance on specific dimensions to specify is given in ISO 3545-3.

c) end-preparation details;

d) whether the purchaser wishes to approve the MPS prior to commencement of manufacturing.

7.2 Supplementary information

If applicable, the purchaser shall specify the following supplementary information:

a) minimum design temperature;

b) maximum design temperature;

c) maximum wall thickness;

d) special dimensional requirements;

e) requirements for supplementary inspection and testing;

f) requirements for gauging and other measurements of dimensions where different from this part of ISO 15590;

g) pipeline design standard or design factors if different from ISO 13623;

h) pipeline operating conditions;

i) mechanical property requirements at the maximum design temperature;

j) requirements for proof, burst, or hydrostatic testing;

k) activities for witnessing and approval by purchaser;

l) coating or painting requirements;

m) marking requirements where different from this part of ISO 15590;

n) packaging and shipping instructions;

o) third-party inspection organization;

p) ISO 10474 standard designation of inspection document required;