INTERNATIONAL STANDARD

**ISO 15590-3**

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

## Part 3: Flanges



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

*Partie 3: Brides*



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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 15590-3 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*

— *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 3: Flanges

## 1 Scope

This part of ISO 15590 applies to weldneck and blind flanges (full face, raised face, and RTJ groove) as well as anchor, swivel-ring flanges and orifice flanges.

This part of ISO 15590 specifies the technical requirements for carbon steel and low-alloy steel forged flanges for use in pipeline transportation systems for the petroleum and natural gas industries as defined in ISO 13623.

This part of ISO 15590 designates those categories of flanges that meet the industry's need to match ISO 3183 pipe. These flanges are for normal and low-temperature service and include supplementary requirements where required for sour service.



Materials for, or the attachment of, factory-welded extensions, bolting materials, gaskets, slip-on flanges or flanged fittings are not covered by this part of ISO 15590.



This part of ISO 15590 is not applicable to integrally cast or forged flanges for valves, pumps or other equipment.

This part of ISO 15590 does not cover the selection of the flange category or pressure class. Sizes and pressure classes listed in ISO 7005-1 and applicable to this part of ISO 15590 are as follows:

— DN 10 (NPS 1/2) to DN 1500 (NPS 60);

— PN 20 (class 150), PN 50 (class 300), PN 100 (class 600), PN 150 (class 900), PN 250 (class 1500), PN 420 (class 2500).

## 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 148-1, *Metallic material —- Charpy pendulum impact test — Part 1: Test method*

ISO 377, *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 4885, *Ferrous products — Heat treatments — Vocabulary*

ISO 6507-1:1997, *Metallic materials — Vickers hardness test — Part 1: Test method*

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

ISO 7005-1:1992, *Metallic flanges — Part 1: Steel flanges*

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

ISO 9327-1, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions — Part 1: General requirements*

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

ISO 10474:1991, *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 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*

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

ISO 15156-2:2003, *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 15590-1:2001, *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems — Part 1: Induction bends*

ISO 15590-2, *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems — Part 2: Fittings*

ASME Boiler and Pressure Vessel Code; Section VIII Division 1, *Rules for Construction of Pressure Vessels*

ASME B16.5, *Pipe Flanges and Flanged Fittings — NPS 1/2 through 24*

ASME B16.36[1)], *Orifice Flanges*

ASME B16.47, *Large Diameter Steel Flange —— NPS 26 through NPS 60*

ASME B31.3, *Process piping*

ASTM A 370-03a[1)], *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM E 112-96e3, *Standard Test Methods for Determining Average Grain Size*

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

MSS SP 44[2], 1996 *Steel Pipeline Flanges*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4885 and the following apply.

**3.1**
**ANSI rating class**
numerical pressure design class defined in ASME B16.5 and used for reference purposes

NOTE The ANSI rating class is designated by the word “Class” followed by a number.

[ISO 14313:1999][1]

**3.2**
**by agreement**
agreed between manufacturer and purchaser

[ISO 14313:1999][1]

**3.3**
**heat**
batch of steel prepared in one steel-making operation

[ISO 15590-1:2001]



**3.4**
**imperfection**
irregularity in the wall or on the surface detectable by methods described in this part of ISO 15590



**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 flange manufacture

NOTE Adapted from ISO 15590-2.

**3.6**
**matching pipe**
specified pipe grade and thickness to which the flange will be attached

**3.7**
**pressure class**
numerical pressure design class expressed in accordance with either the nominal pressure (PN) class or the ANSI rating class

NOTE In this part of ISO 15590, the pressure class is stated by the PN class followed by the ANSI rating class between brackets.

[ISO 14313:1999][1]

2) Manufacturer’s Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia 22180, USA

## 4 Symbols and abbreviated terms

| | |
|---|---|
| $A_o$ | original cross-sectional area of the parallel length of a test specimen |
| CE | carbon equivalent |
| DN | nominal diameter |
| HIC | hydrogen-induced cracking |
| HV | Vickers hardness |
| ID | inside diameter |
| L | low-temperature service |
| LS | low-temperature sour service |
| MPS | manufacturing procedure specification |
| MT | magnetic particle testing |
| N | normal service |
| NDT | non-destructive testing |
| NPS | nominal pipe size |
| NS | normal sour service |
| PN | nominal pressure |
| PT | liquid penetrant testing |
| $R_m$ | tensile strength |
| RTJ | ring type joint |
| S | sour service |
| SMTS | specified minimum tensile strength |
| SMYS | specified minimum yield strength |
| SSC | sulfide stress cracking |
| $t$ | specified wall thickness at the welding ends for flanges |
| $T_{d\ min}$ | minimum design temperature |
| UT | ultrasonic testing |



## 5 Designation of flanges

Flanges shall be designated as specified in Table 1.

**Table 1 — Flange designations**

| Non-sour service | | Sour service | |
|---|---|---|---|
| **Temperature**, $T_{d\ min}$ °C | **Flange designation** | **Temperature**, $T_{d\ min}$ °C | **Flange designation** |
| $\geqslant 0$ | (N) | $\geqslant 0$ | (NS) |
| $< 0$ | (L) | $< 0$ | (LS) |

Flanges with a minimum design temperature lower than 0 °C shall demonstrate proven notch toughness in accordance with Clause 9.

Flanges intended for sour service shall be so specified by the purchaser and meet the applicable requirements of Clause 9.

## 6 Pressure class and design

The flange shall be capable of withstanding an internal pressure equal to the working pressure at the temperature range required. Maximum pressures for the various pressure classes against temperature are shown in Table 2.

**Table 2 — Maximum pressures as a function of temperature**

| Temperature °C | PN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 | | 50 | | 100 | | 150 | | 250 | | 420 | |
| | Class | | | | | | | | | | | |
| | 150 | | 300 | | 600 | | 900 | | 1500 | | 2500 | |
| | MPa | (bar) | MPa | (bar) | MPa | (bar) | MPa | (bar) | MPa | (bar) | MPa | (bar) |
| −30 to 120 | 1,96 | (19,6) | 5,11 | (51,1) | 10,2 | (102) | 15,3 | (153) | 25,5 | (255) | 42,6 | (426) |
| 150 | 1,9 | (19) | 4,93 | (49,3) | 9,86 | (98,6) | 14,8 | (148) | 22,6 | (226) | 37,7 | (377) |
| 175 | 1,83 | (18,3) | 4,75 | (47,5) | 9,51 | (95,1) | 14,3 | (143) | 22,2 | (222) | 34,1 | (341) |
| 200 | 1,76 | (17,6) | 4,59 | (45,9) | 9,17 | (91,7) | 13,8 | (138) | 21,9 | (219) | 36,5 | (365) |
| 250 | 1,7 | (17) | 4,41 | (44,1) | 8,86 | (88,6) | 13,3 | (133) | 22,5 | (225) | 35,5 | (355) |
| For any temperature below 30 °C, the rating shall be no greater than the rating shown for −30 °C.<br>For intermediate temperatures, linear interpolation should be used.<br>Ratings of flanges for temperatures greater than those given shall be by agreement. | | | | | | | | | | | | |



If there are any deviations from the flange dimensions specified in ISO 7005-1, pressure-containment calculations shall be made in accordance with an agreed pressure-vessel design standard such as ASME Section VIII, Division 1.

The design calculations shall be available for review.

For pipeline applications, the design criteria shall be in accordance with ISO 7005-1:1992, Annex F.

NOTE External loads or moments are not covered by this part of ISO 15590. However, swivels and anchor flanges can experience external loads and can be designed using the equivalent pressure method.

## 7 Information to be supplied by the purchaser

### 7.1 Principal information

The following information shall be provided:

a) flange designation, size and class;

b) quantity of flanges;