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**Petroleum and natural gas  
industries — Corrosion resistant alloy  
clad bends and fittings for pipeline  
transportation system —**

**Part 2:  
Clad fittings**

*Industries du pétrole et du gaz naturel — Coudes et raccords  
recouverts d'alliage résistant à la corrosion pour système de transport  
par conduites —*

*Partie 2: Raccords recouverts*



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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*, Subcommittee SC 2, *Pipeline transportation systems*.

A list of all parts in the ISO 24139 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).



# Petroleum and natural gas industries — Corrosion resistant alloy clad bends and fittings for pipeline transportation system —

## Part 2: Clad fittings

### 1 Scope

This document specifies the technical delivery conditions regarding design, geometric dimensions, materials, manufacturing procedures, inspection methods, non-destructive testing, marking, package and storage for factory-made, seamless and welded, corrosion resistant alloy (CRA) clad fittings for use in pipeline transportation systems for the petroleum and natural gas industries as defined in ISO 13623.

This document is applicable to CRA clad fittings for use in transportation or process pipelines transporting corrosive media-containing single-phase or multi-phase fluid such as oil, gas and water for the petroleum and natural gas industries. It can also be used as reference in other fields.

The clad fittings specified in this document include clad elbows, clad reducers, clad tees and clad caps.

Two technical delivery conditions classes for clad fittings are designated. Class B provides a standard quality level for clad fittings and Class S provides technical requirements for sour-service conditions.

Fabricated laterals, fabricated lap joint stub ends and other fittings employing circumferential or intersection welds are considered as pipe fabrication and are outside the scope of this document.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3183:2019, *Petroleum and natural gas industries — Steel pipe for pipeline transportation systems*

ISO 3651-1:1998, *Determination of resistance to intergranular corrosion of stainless steels — Part 1: Austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in nitric acid medium by measurement of loss in mass (Huey test)*

ISO 3651-2:1998, *Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid*

ISO 6507 (all parts), *Metallic materials — Vickers hardness test*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

ISO 7438, *Metallic materials — Bend test*

ISO 7539-2, *Corrosion of metals and alloys — Stress corrosion testing — Part 2: Preparation and use of bent-beam specimens*

ISO 8407, *Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens*

ISO 8501-1:2007, *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 9400:1990, *Nickel-based alloys — Determination of resistance to intergranular corrosion*

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

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

ISO 10893-4, *Non-destructive testing of steel tubes — Part 4: Liquid penetrant inspection of seamless and welded steel tubes for the detection of surface imperfections*

ISO 10893-5, *Non-destructive testing of steel tubes — Part 5: Magnetic particle inspection of seamless and welded ferromagnetic steel tubes for the detection of surface imperfections*

ISO 10893-6, *Non-destructive testing of steel tubes — Part 6: Radiographic testing of the weld seam of welded steel tubes for the detection of imperfections*

ISO 10893-8, *Non-destructive testing of steel tubes — Part 8: Automated ultrasonic testing of seamless and welded steel tubes for the detection of laminar imperfections*

ISO 10893-9, *Non-destructive testing of steel tubes — Part 9: Automated ultrasonic testing for the detection of laminar imperfections in strip/plate used for the manufacture of welded steel tubes*

ISO 10893-10, *Non-destructive testing of steel tubes — Part 10: Automated full peripheral ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of longitudinal and/or transverse imperfections*

ISO 10893-11, *Non-destructive testing of steel tubes — Part 11: Automated ultrasonic testing of the weld seam of welded steel tubes for the detection of longitudinal and/or transverse imperfections*

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

ISO 14250, *Steel — Metallographic characterization of duplex grain size and distributions*

ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials*

ISO 15156-1, *Petroleum and natural gas industries — Materials for use in H<sub>2</sub>S-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<sub>2</sub>S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low-alloy steels, and the use of cast irons*

ISO 15156-3:2020, *Petroleum and natural gas industries — Materials for use in H<sub>2</sub>S-containing environments in oil and gas production — Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys*

ISO 15590-1:2018, *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems — Part 1: Induction bends*

ISO 15590-2:2021, *Petroleum and natural gas industries — Factory bends, fittings and flanges for pipeline transportation systems — Part 2: Fittings*

ISO 15614-7, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 7: Overlay welding*

ISO 15614-8, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 8: Welding of tubes to tube-plate joints*

ISO 17405, *Non-destructive testing — Ultrasonic testing — Technique of testing claddings produced by welding, rolling and explosion*



ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*

ISO 80000-1:2009, *Quantities and units — Part 1: General*

ASME BPVC Section II - Materials Part C, *Specifications for welding rods, electrodes, and filler metals*

ASME BPVC Section IX *Qualification standard for welding, brazing, and fusing procedures; welders; brazers; and welding, brazing, and fusing operators*

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

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

ASME B31.4, *Pipeline transportation systems for liquids and NDT slurries*

ASNT SNT-TC-1A, *Recommended practice No. SNT-TC-1A: Personnel qualification and certification in non-destructive testing*

ASTM A262-15, *Standard practices for detecting susceptibility to intergranular attack in austenitic stainless steels*

ASTM A263-12, *Standard specification for stainless Chromium steel-clad plate*

ASTM A264-12, *Standard specification for stainless Chromium-Nickel steel-clad plate*

ASTM A265-12, *Standard specification for Nickel and Nickel-base alloy-clad steel plate*

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

ASTM A435, *Standard Specification for straight-beam ultrasonic examination of steel plates*

ASTM A578/A578M-17, *Standard specification for straight-beam ultrasonic examination of rolled steel plates for special applications*

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

ASTM A923-14, *Standard test methods for detecting detrimental intermetallic phase in duplex austenitic/ferritic stainless steels*

ASTM E3, *Standard guide for preparation of metallographic specimens*

ASTM E92, *Standard test methods for Vickers hardness and Knoop hardness of metallic materials*

ASTM E165, *Standard test method for liquid penetrant examination*

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

ASTM E340, *Standard practice for macroetching metals and alloys*

ASTM E353, *Standard test methods for chemical analysis of stainless, heat-resisting, maraging, and other similar Chromium-Nickel-Iron alloys*

ASTM E562, *Standard test method for determining volume fraction by systematic manual point count*

ASTM E709, *Standard guide for magnetic particle testing*

ASTM G1, *Standard practice for preparing, cleaning, and evaluating corrosion test specimens*

ASTM G28-02, *Standard test methods for detecting susceptibility to intergranular corrosion in wrought, Nickel-rich, Chromium-bearing alloys*

ASTM G39, *Standard practice for preparation and use of bent-beam stress-corrosion test specimens*

ASTM G111, *Standard guide for corrosion tests in high temperature or high pressure environment, or both*

MSS SP-75, *High-strength, wrought, butt-welding fittings*

NACE TM0177, *Standard test method — Laboratory testing of metals for resistance to sulfide stress cracking and stress corrosion cracking in H<sub>2</sub>S environments*

NACE TM0284, *Standard test method — Evaluation of pipeline and pressure vessel steels for resistance to hydrogen-induced cracking*

### 3 Terms, definitions, symbols and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15590-2:2021 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

##### 3.1.1

##### **as agreed**

as achieving consensus upon by the manufacturer and purchaser, and specified in the purchase order

##### 3.1.2

##### **backing steel**

substrate of the clad plate, clad pipe or clad fittings withstanding mechanical load or pressure, and made of carbon steel or low alloy steel

##### 3.1.3

##### **clad layer**

layer of the corrosion resistant alloy metallurgically bonded to the surface of the backing steel of clad plate, clad pipe or clad fittings

Note 1 to entry: Metallurgically bonded corrosion resistant alloy (CRA) layer is to be produced by hot roll bonding, weld overlaying, explosion cladding, coextruding or some other process that produces the atomic diffusion interface between CRA and carbon steel.

##### 3.1.4

##### **corrosion resistant alloy**

##### **CRA**

alloy such as stainless steel and nickel-based alloy intended to be resistant to general and localized corrosion of oilfield environments that are corrosive to carbon steels

[SOURCE: ISO 15156-1:2020, 3.6, modified — "such as stainless steel and nickel-based alloy" has been added.]

##### 3.1.5

##### **if agreed**

as prescribed, or more stringent than is prescribed, if achieved consensus by the manufacturer and the purchaser and specified in the purchase order

##### 3.1.6

##### **manufacturer**

firm, company or corporation responsible for making and marking the product in accordance with specific requirements

Note 1 to entry: The specific requirements are addressed in this document.