~~ISO/TC 67/SC 6~~

Date: 2023-~~02-09~~06-17

ISO/FDIS 13703-2:2023-(E)

ISO/TC 67/SC 6/WG 5

Secretariat: AFNOR

Oil and gas industries including lower carbon energy — Piping systems on offshore platforms and onshore plants — Part 2: Materials

Industries pétrolières et gazières, y compris les énergies à faible émission de carbone — Conception et installation des systèmes de tuyauterie sur les plates-formes de production en mer et les installations à terre — Partie 2: Matériels

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Published in Switzerland

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Foreword

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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~~document 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~~www.iso.org/directives).

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

For an explanation ~~on~~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 the following URL: www.iso.org/iso/foreword.html~~), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, ~~*Materials, equipment*~~*Oil* *and* ~~*offshore structures for petroleum, petrochemical and natural*~~ *gas industries* *including lower carbon energy*, Subcommittee SC 6, ~~*Processing*~~*Process* *equipment* ~~*and*~~*, piping, systems, and related safety*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC- 12, ~~*Materials, equipment and offshore structures for petroleum, petrochemical and natural*~~ *Oil and gas industries including lower carbon energy*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 13703-2, together with ISO 13703-1 and ISO 13703-3, cancels and replaces ISO- 13703:2000, which has been technically revised. It also incorporates the Technical Corrigendum ISO- 13703:2000/Cor.1:2002.

The main changes compared to the previous edition are as follows:

~~— This document is new (no previous revision to compare against) which contains a selection of standardized material datasheets for commonly used materials.~~

— deletion of the installation and quality control requirements in Clause 10;

— deletion of former Annex C as requirements are addressed in ASME B31.3;

— addition of material data sheets.

A list of all parts in the ISO 13703 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.

Introduction

Requirements are defined in material datasheets and element datasheets, which can be used for the specification and procurement of materials for piping systems. Common fabrication, welding, inspection, examination and testing requirements of piping systems are covered by ISO 13703-3.

Local, national or regional regulations can also affect the specification of piping materials.

Oil and gas industries including lower carbon energy — Piping systems on offshore platforms and onshore plants — Part 2: Materials

1 Scope

This document provides a set of common supplementary requirements for the most frequently used materials in upstream oil and gas piping systems ~~designed according to ISO 13703-1.~~

This document is applicable to offshore and onshore production facilities, processing and gas liquefaction plants. The materials covered in this document are intended to be used in the following piping systems services:

— category D, category M, normal and high pressure, according to ASME B31.3 ~~where supplemented by ISO 13703-1~~;

— sour environments as defined in the ISO 15156 series.

NOTE ~~-~~ For the purposes of this document, ANSI/NACE MR0175 is equivalent to the ISO 15156 series, and ANSI/NACE MR0103 is equivalent to ISO 17945.

This document does not provide guidelines for material selection. The selection of suitable materials for a specific service including any necessary additional material requirements remains the responsibility of the end user.

This document does not cover requirements related to:

— onshore refining and natural gas processing systems. Requirements related to sulfide stress cracking (SSC) in corrosive petroleum refining environments included in ISO 17945 ~~are not covered in this document~~.

— non-metallic piping systems according to ASME B31.3-2022 chapter VII or the ISO 14692 ~~(all parts);~~series;

— marine piping systems, e.g. ballasting piping system, covered by classification rules;

— subsea production systems;

— downhole equipment;

— transportation pipeline systems, including flowlines, designed in accordance with a recognized pipeline design code.

Common requirements related to manufacture, inspection and procurement of piping and valve parts are included in Annex A and Annex B, providing material datasheets and element datasheets, respectively. These material and element datasheets can be applied for applications other than piping systems, e.g. pressure vessels and pumps based upon assessment of the end user and conformance with the selected design code for the relevant equipment. This document is not intended to limit the use of alternative materials or grades within a referenced material standard. Where the use of alternative materials/grades

are considered appropriate, the end user is responsible for specifying any additional requirements necessary to meet the design code or specification.

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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 ~~148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*~~

~~ISO~~ 3452~~,~~ (all parts), *Non-destructive testing — Penetrant testing*

~~ISO 3878, *Hardmetals — Vickers hardness test*~~

~~ISO~~ ISO 4499-~~-~~2, *Hardmetals — Metallographic determination of microstructure — Part 2: Measurement of WC grain size*

ISO 4499-~~-~~4, *Hardmetals ~~-~~— Metallographic determination of microstructure — Part 4: Characterisation of porosity, carbon defects and eta-phase content*

ISO 4624, *Paints and varnishes — Pull-off test for adhesion*

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

ISO 9606, *Qualification testing of welders — Fusion welding*

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

ISO 10684, *Fasteners — Hot dip galvanized coatings*

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 11970, *Specification and qualification of welding procedures for production welding of steel castings*

~~ISO 13703-1, *Petroleum and natural gas industries — Piping systems on offshore production platforms and onshore plants — Part 1: Design*~~

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

ISO 15156 ~~series,~~(all parts), *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

~~ISO 15608, *Welding — Guidelines for a metallic materials grouping system*~~

~~ISO 15614~~ ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 15614-~~-~~5, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 5: Arc welding of titanium, zirconium and their alloys*

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

ISO- 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints*

ISO- 17781, *Petroleum, petrochemical and natural gas industries — Test methods for quality control of microstructure of ferritic/austenitic (duplex) stainless steels*

ISO- 17782, *Petroleum, petrochemical and natural gas industries — Scheme for conformity assessment of manufacturers of special materials*

ISO- 27509, *Petroleum and natural gas industries — Compact flanged connections with IX seal ring*

ISO- 28079, *Hardmetals — Palmqvist toughness test*

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

ANSI/MSS SP-55, *Quality standard for steel castings for valves, flanges, fittings, and other piping components - visual method for evaluation of surface irregularities*

ANSI/NACE TM0284, *Evaluation of pipeline and pressure vessel steels for resistance to hydrogen-induced cracking*

ANSI/NACE MR0175, *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

API RP 934-A, *Materials and fabrication of 2 ~~¼~~1/4 Cr-1Mo, 2 ~~¼~~1/4 Cr-1Mo ~~¼~~1/4 v, 3Cr-1Mo, and 3Cr-1Mo-1/4 V steel heavy wall pressure vessels for high-temperature, high pressure Hydrogen service*

API RP 934-C, *Materials and fabrication of 1 ~~¼~~1/4 Cr ~~½~~-1/2 Mo steel heavy wall pressure vessels for high-pressure Hydrogen service operating at or below 825 degrees F (440 degrees C)*

API Spec 5L, 46th edition, *Specification for line pipe*

API Std 6ACRA, *Age-hardened Nickel-based alloys for oil and gas drilling and production equipment*

ASME B16.20, *Metallic gaskets for pipe flanges*

ASME B16.34, *Valves – Flanged, threaded and welding end*

ASME B31.3-2022, *Process piping*

ASME Boiler and pressure vessel code (BPVC), Section V: *Nondestructive examination*

ASME Boiler and pressure vessel code (BPVC), Section VIII, Division 1: *Rules for construction of pressure vessels*

ASME Boiler and pressure vessel code (BPVC), Section VIII, Division 2: *Alternative rules*

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ASME Boiler and pressure vessel code (BPVC), Section VIII, Division 3: *Alternative rules for high pressure vessels*

ASME Boiler and pressure vessel code (BPVC), Section IX: *Welding and brazing qualifications*

ASTM A20/A20M-20, *Standard specification for general requirements for steel plates for pressure vessels*

ASTM A29/A29M, *Standard specification for general requirements for steel bars, Carbon and alloy, hot-wrought*

ASTM A105/A105M, *Standard specification for Carbon steel forgings for piping applications*

ASTM A106/A106M, *Standard specification for seamless Carbon steel pipe for high-temperature service*

ASTM A182/A182M-23, *Standard specification for forged or rolled alloy and stainless Steel pipe flanges, forged fittings, and valves and parts for high-temperature service*

ASTM A193/~~193M~~A193M, *Standard specification for alloy-steel and stainless steel bolting for high temperature or high pressure service and other special purpose applications*

ASTM A194/A194M, *Standard specification for Carbon steel, alloy steel, and stainless steel nuts for bolts for high pressure or high temperature service, or both*

ASTM A203/A203M, *Standard specification for pressure vessel plates, alloy steel, Nickel*

ASTM A216/A216M-21, *Standard specification for steel castings, Carbon, suitable for fusion welding, for high-temperature service*

ASTM A217/217M-22, *Standard Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service*

ASTM A234/A234M, *Standard specification for piping fittings of wrought Carbon steel and alloy steel for moderate and high temperature service*

ASTM A240/A240M, *Standard specification for Chromium and Chromium-Nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications*

ASTM A269/A269M-22, *Standard specification for seamless and welded austenitic stainless steel tubing for general service*

ASTM A276/A276M, *Standard specification for stainless steel bars and shapes*

ASTM A312/A312M-22a, *Standard specification for seamless, welded, and heavily cold worked austenitic stainless steel pipes*

ASTM A320/A320M, *Standard specification for alloy-steel and stainless steel bolting for low-temperature service*

ASTM A333/A333M, *Standard specification for seamless and welded steel pipe for low-temperature service and other applications with required notch toughness*

ASTM A334/~~334M~~A334M, Standard specification for seamless and welded Carbon and alloy-steel tubes for low-temperature service

ASTM A335/A335M-22, *Standard specification for seamless Ferritic alloy-steel pipe for high-temperature service*

ASTM A350/A350M-23, *Standard specification for Carbon and low-alloy steel forgings, requiring notch toughness testing for piping components*

~~ASTM A351~~ ASTMA351/A351M- 18e1, *Standard specification for castings, austenitic, for pressure-containing parts*

ASTM A352/A352M, *Standard specification for steel castings, ferritic and martensitic, for pressure-containing parts, suitable for low-temperature service*

ASTM A358/A358M-19, *Standard specification for electric-fusion-welded austenitic Chromium-Nickel stainless steel pipe for high-temperature service and general applications*

ASTM A363, *Standard specification for Zinc-coated (galvanized) steel overhead ground wire strand*

ASTM A370-22, *Standard test methods and definitions for mechanical testing of steel products*

ASTM A387/~~387M~~A387M-17A, *Standard specification for pressure vessel plates, alloy steel, Chromium-Molybdenum*

ASTM A388/A388M, *Standard practice for ultrasonic examination of steel forgings*

ASTM A403/A403M-22B, *Standard specification for wrought austenitic stainless steel piping fittings*

ASTM A420/A420M, *Standard specification for piping fittings of wrought Carbon steel and alloy steel for low-temperature service*

~~ASTM A450/A450M, *Standard specification for general requirements for Carbon and low alloy steel tubes*~~

ASTM A453/A453M, *Standard specification for high-temperature bolting, with expansion coefficients comparable to austenitic stainless steels*

ASTM A479/A479M, *Standard specification for stainless steel bars and shapes for use in boilers and other pressure vessels*

ASTM A484/A484M, *Standard specification for general requirements for stainless steel bars, billets, and forgings*

ASTM A488/A488M, *Standard practice for steel castings, welding, qualifications of procedures and personnel*

ASTM A494/A494M, *Standard specification for castings, Nickel and Nickel alloy*

ASTM A508/A508M, *Standard specification for quenched and tempered vacuum-treated Carbon and alloy steel forgings for pressure vessels*

ASTM A516/A516M, *Standard specification for pressure vessel plates, Carbon steel, for moderate- and lower-temperature service*

ASTM A564/A564M, *Standard specification for hot-rolled and cold-finished age-hardening stainless steel bars and shapes*

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

ASTM A671/A671M, *Standard specification for electric-fusion-welded steel pipe for atmospheric and lower temperatures*

ASTM A672/A672M, *Standard specification for electric-fusion-welded steel pipe for high-pressure service at moderate temperatures*

ASTM A691/A691M-19, *standard specification for Carbon and alloy steel pipe, electric-fusion-welded for high-pressure service at high temperatures*

ASTM A694/A694M, *Standard specification for Carbon and alloy steel forgings for pipe flanges, fittings, valves, and parts for high-pressure transmission service*

ASTM A696, *Standard specification for steel bars, Carbon, hot-wrought or cold-finished, special quality, for pressure piping components*

ASTM A703/A703M-20, *standard specification for steel castings, creep-strength enhanced ferritic alloy, for pressure-containing parts, suitable for high temperature service*

ASTM A705/A705M, *Standard specification for age-hardening stainless steel forgings*

ASTM A739, *Standard specification for steel bars, alloy, hot-wrought, for elevated temperature or pressure-containing parts, or both*

ASTM A781/A781M, *Standard specification for castings, steel and alloy, common requirements, for general industrial use*

ASTM A788/A788M, *Standard specification for steel forgings, general requirements*

ASTM A789/A789M, *Standard specification for seamless and welded ferritic/austenitic stainless steel tubing for general service*

ASTM A790/A790M, *Standard specification for seamless and welded ferritic/austenitic stainless steel pipe*

ASTM A815/A815M, *Standard specification for wrought ferritic, ferritic/austenitic, and martensitic stainless steel piping fittings*

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ASTM A860/A860M, *Standard specification for wrought high-strength ferritic steel butt-welding fittings*

ASTM A928/A928M, *Standard specification for ferritic/austenitic (duplex) stainless steel pipe electric fusion welded with addition of filler metal*

ASTM A957/A957M, *Standard specification for investment castings, steel and alloy, common requirements, for general industrial use*

ASTM A960/A960M-20, *Standard specification for common requirements for wrought steel piping fittings*

ASTM A961/A961M-23, *Standard specification for common requirements for steel flanges, forged fittings, valves, and parts for piping applications*

ASTM A962/A962M-23, *Standard specification for common requirements for bolting intended for use at any temperature from cryogenic to the creep range*

ASTM A966/A966M, *Standard practice for magnetic particle examination of steel forgings using alternating current*

ASTM A985/A985M-21, *Standard specification for steel investment castings general requirements, for pressure-containing parts*

ASTM A988/A988M-19, *Standard specification for hot isostatically-pressed stainless steel flanges, fittings, valves, and parts for high temperature service*

ASTM A995/995M, *Standard specification for castings, austenitic-ferritic (duplex) stainless steel, for pressure-containing parts*

ASTM A1058, *Standard Test Methods for Mechanical Testing of Steel Products — Metric*

ASTM A1080/A1080M, *Standard practice for hot isostatic pressing of steel, stainless steel, and related alloy castings*

ASTM A1082/A1082M-16R21, *Standard specification for high strength precipitation hardening and duplex stainless steel bolting for special purpose applications*

ASTM B124/B124M, *Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes*

ASTM B148, *Standard specification for Aluminum-Bronze sand castings*

ASTM B150/150M, *Standard Specification for Aluminum Bronze Rod, Bar, and Shapes*

ASTM B151/B151M, *Standard specification for Copper-Nickel-Zinc alloy (Nickel Silver) and Copper-Nickel rod and bar*

ASTM B171/B171M, *Standard specification for Copper-alloy plate and sheet for pressure vessels, condensers, and heat exchangers*

ASTM B265, *Standard specification for Titanium and Titanium alloy strip, sheet, and plate*

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ASTM B338, *Standard specification for seamless and welded Titanium and Titanium alloy tubes for condensers and heat exchangers*

ASTM B348, *Standard specification for Titanium and Titanium alloy bars and billets*

ASTM B363, *Standard specification for seamless and welded unalloyed Titanium and Titanium alloy welding fittings*

ASTM B366/B366M, *Standard specification for factory-made wrought Nickel and Nickel alloy fittings*

ASTM B367, *Standard specification for Titanium and Titanium alloy castings*

ASTM B381, *Standard specification for Titanium and Titanium alloy forgings*

ASTM B423, *Standard Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy Seamless Pipe and Tube*

ASTM B424, *Standard Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloys Plate, Sheet, and Strip*

ASTM B425, *Standard Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloys Rod and Bar*

ASTM B443, *Standard specification for Nickel-Chromium-Molybdenum-Columbium alloy and Nickel-Chromium-Molybdenum-Silicon alloy plate, sheet, and strip*

ASTM B444, *Standard specification for Nickel-Chromium-Molybdenum-Columbium alloys (UNS N06625 and UNS N06852) and Nickel-Chromium-Molybdenum-Silicon alloy (UNS N06219) pipe and tube*

ASTM B446, *Standard specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten alloy (UNS N06650) rod and bar*

ASTM B499, *Standard test method for measurement of coating thicknesses by the magnetic method: nonmagnetic coatings on magnetic basis metals*

ASTM B564-22, *Standard specification for Nickel alloy forgings*

ASTM B571, *Standard practice for qualitative adhesion testing of metallic coatings*

ASTM B578, *Standard test method for microhardness of electroplated coatings*

ASTM B602, *Standard test method for attribute sampling of metallic and inorganic coatings*

ASTM B637, *Standard specification for precipitation-hardening and cold worked Nickel alloy bars, forgings, and forging stock for moderate or high temperature service*

ASTM B705, *Standard specification for Nickel-alloy (UNS N06625, N06219 and N08825) welded pipe*

ASTM B733-22, *Standard specification for autocatalytic (electroless) Nickel-Phosphorus coatings on metal*

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