



SLOVENSKI STANDARD
oSIST prEN ISO 13703-3:2020
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Industrija za predelavo nafte in zemeljskega plina - Cevni sistemi na plavajočih proizvodnih objektih in kopenskih obratih - 3. del: Izdelava (ISO/DIS 13703-3:2020)

Petroleum and natural gas industries - Piping systems on offshore production platforms and onshore plants - Part 3: Fabrication (ISO/DIS 13703-3:2020)

Erdöl- und Erdgasindustrie - Rohrleitungssysteme auf Offshore-Förderplattformen und Onshore-Anlagen - Teil 3: Herstellung (ISO/DIS 13703-3:2020)

Industries du pétrole et du gaz naturel - Conception et installation des systèmes de tuyauterie sur les plates-formes de production en mer et les installations à terre - Partie 3: Fabrication (ISO/DIS 13703-3:2020)

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ICS:

75.180.10	Oprema za raziskovanje, vrtanje in odkopavanje	Exploratory, drilling and extraction equipment
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Petroleum and natural gas industries — Piping systems on offshore production platforms and onshore plants —

Part 3: Fabrication

Partie 3: Fabrication

ICS: 75.180.10

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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).

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).

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.

This document was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

This edition cancels and replaces part of ISO 13703:2000, which has been technically revised and split in three parts.

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

- deletion of the installation and quality control requirements of [Clause 10](#);
- deletion of Annex C as requirements are addressed in ASME B31.3:2018.

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.

ISO/DIS 13703-3:2020(E)**Introduction**

The aim of this document is to establish common requirements for the fabrication, welding, inspection, examination and testing of new, metallic process piping systems designed in accordance with the requirements of ISO 13703-1, and using bulk piping materials in accordance with ISO 13703-2.

This document makes normative reference to ASME B31.3:2018 as the base code for process piping. Alternative codes to ASME B31.3:2018 exist for the fabrication, welding, inspection, examination and testing of process piping systems along with the potential need to comply with local or national regulatory/jurisdictional requirements. The user of this document is expected to assess the implications arising from local or national regulatory/jurisdictional requirements in implementing the requirements herein, including the need to specify additional requirements to those stated. ASME B31.3:2018, Appendix N provides guidance on its use internationally, and specifically its use within the European Union for which additional requirements to those specified in ASME B31.3:2018 will be necessary to meet the requirements of Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment (PED).

This document is not intended to inhibit a user from accepting alternative fabrication, welding, examination or testing solutions for the individual application. This can be particularly appropriate where there is innovative or developing technology. Where an alternative to the requirements in this document is offered, the user is expected to review the implications in meeting the performance requirements within this document.

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Petroleum and natural gas industries — Piping systems on offshore production platforms and onshore plants —

Part 3: Fabrication

1 Scope

This document defines requirements for the fabrication, welding, inspection, examination and testing of new, metallic piping systems up to 69 000 kPa (ga) maximum, within temperature range limits for the materials meeting the requirements of ASME B31.3:2018, on fixed and floating offshore production facilities and onshore production, processing and gas liquefaction plants.

This document is applicable to all pressure retaining components and any non-pressure retaining component, such as a pipe support, welded directly to a pressure retaining component.

This document is not applicable to:

- marine-related piping systems, e.g. ballasting piping systems, systems covered by classification societies;
- metallic tubing with a maximum wall thickness of 6,0 mm and internal diameter of 50,8 mm, used for subsea umbilical systems;

NOTE 1 Reference can be made to ISO 13628-5 or API Spec 17E for welding and examination of these components.

- piping systems with corrosion resistant cladding (either integrally clad or mechanically lined) or weld overlay, including buttering and associated dissimilar welds;

NOTE 2 Reference can be made to DNVGL-RP-B204 for welding and examination of these systems.

- refractory alloys (with exception of CP titanium Grade 1 (UNS R50250) or Grade 2 (UNS R50400));
- non-metallic piping assemblies;
- transportation pipeline systems, including flowlines, designed in accordance with a recognized pipeline design code.

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

ISO 8249, *Welding — Determination of Ferrite Number (FN) in austenitic and duplex ferritic-austenitic Cr-Ni stainless steel weld metals*

ISO 9051-1, *Destructive tests on welds in metallic materials — Hardness testing — Part 1: Hardness test on arc welded joints*

ISO 9606 (all parts), *Qualification testing of welders — Fusion welding*

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- ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*
- ISO 10474, *Steel and steel products — Inspection documents*
- ISO 11666:2018, *Non-destructive testing of welds — Ultrasonic testing — Acceptance levels*
- ISO 11699-1, *Non-destructive testing — Industrial radiographic film — Part 1: Classification of film systems for industrial radiography*
- ISO 14175, *Welding consumables — Gases and gas mixtures for fusion welding and allied processes*
- ISO 14344, *Welding consumables — Procurement of filler materials and fluxes*
- ISO 14731, *Welding coordination — Tasks and responsibilities*
- ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials*
- ISO 15156-2, *Petroleum and natural gas industries — Materials for use in H₂S 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, *Petroleum and natural gas industries — Materials for use in H₂S containing environments in oil and gas production — Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys*
- ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*
- 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 15614-6, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 6: Arc and gas welding of copper and its alloys*
- ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*
- ISO 17636-2, *Non-destructive testing of welds — Radiographic testing — Part 2: X- and gamma-ray techniques with digital detectors*
- ISO 17781:2017, *Petroleum, petrochemical and natural gas industries — Test methods for quality control of microstructure of ferritic/austenitic (duplex) stainless steels*
- ISO 18265, *Metallic materials — Conversion of hardness values*
- ISO 22825, *Non-destructive testing of welds — Ultrasonic testing — Testing of welds in austenitic steels and nickel-based alloys*
- ANSI Z49.1, *Safety in Welding, Cutting and Allied Processes*
- API RP 686, *Machinery Installation and Installation Design*
- ASME B31.3:2018, *Process Piping*
- ASME Boiler and Pressure Vessel Code, Section II, Materials, Part C:2019, *Specifications for welding rods, electrodes, and filler metals*
- ASME Boiler and Pressure Vessel Code, Section V:2019, *Non Destructive Testing*
- ASME Boiler and Pressure Vessel Code, Section IX:2019, *Welding and Brazing Qualifications*
- ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel*

ASNT SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*

ASTM A380, *Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems*

ASTM E140, *Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness*

ASTM E1815, *Standard Test Method for Classification of Film Systems for Industrial Radiography*

ASTM G48, *Standard Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution*

AWS A4.2M, *Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel*

AWS D10.10, *Recommended Practices for Local Heating of Welds in Piping and Tubing*

EN 10204, *Metallic products — Types of inspection documents*

PFI ES-3, *Fabricating Tolerances*

3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

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

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

3.1

alkaline service

service environments containing alkaline compounds such as amines, caustic, carbonates

3.2

bolted connection

connection using flanges in accordance with ASME B16.5 or ASME B16.47, compact flanges in accordance with ISO 27509 or proprietary mechanical clamped connectors with reduced weight and metal-to-metal sealing

3.3

carbon equivalent

numerical value for a steel's composition that represents the contribution of the relevant elements to the hydrogen cracking susceptibility of steel

Note 1 to entry: The carbon equivalent is based on:

$$CE = \% C + \left(\frac{\% Mn}{6} \right) + \left(\frac{\% Cr + \% Mo + \% V}{5} \right) + \left(\frac{\% Ni + \% Cu}{15} \right)$$

where all mass fractions are expressed in percent.

ISO/DIS 13703-3:2020(E)**3.4****closure weld**

final weld connecting piping systems, assemblies or sub-assemblies that have been successfully leak tested, but that itself is not subject to leak testing

Note 1 to entry: Closure welds include any welds made after leak or tightness testing, such as seal welds to threaded connections, or repair welds made in the event of a leak that are not subject to further leak test, if approved by owner.

Note 2 to entry: Closure welds are often also described as 'golden welds'.

3.5**computerised imaging technique**

manual or encoded ultrasonic examination technique with capability for computer processed display or analysis and display of ultrasonic data to provide two or three dimensional surfaces

Note 1 to entry: For the purposes of this document, computerised imaging techniques can include PAUT, TOFD, FMC/TFM.

3.6**confined space**

space that is substantially but not necessarily entirely enclosed, and where serious injury can occur from hazardous substances or conditions within the space or nearby (e.g. lack of oxygen)

Note 1 to entry: Confined space includes access into the internal bore of pipes to install, inspect and remove internal backing gas dams, and during cleaning, flushing, leak and tightness testing activities.

3.7**controlled hydrogen welding process** (standards.iteh.ai)

welding process capable of depositing weld metal with a maximum diffusible hydrogen content of 5 ml/100 g deposited metal

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3.8**critical bolted connection**

bolted connection defined in the engineering design as critical based on service environment, pressure class, bolt diameter and/or meeting defined minimum bolt stress criteria

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3.9**cryogenic service**

service environments with a minimum design temperature lower than $-104\text{ }^{\circ}\text{C}$

3.10**extrados**

outer curved portion of a bend

3.11**fabricator**

organization responsible for the fabrication, welding, examination and testing of piping systems including any externally provided products or services

Note 1 to entry: For the purposes of this document, "fabricator" is considered interchangeable with "manufacturer", "erector", "employer" or "purchaser" where these terms are used in referenced documents.

3.12**fibre elongation**

elongation during bending or forming calculated as 100 r/R expressed as percentage

Note 1 to entry: Fibre elongation can be determined by physical measurement or calculation.

3.13**heat input**

energy introduced into the weld region during welding per unit run length as calculated in accordance with ASME Boiler and Pressure Vessel Code, Section IX :2019 for the specific welding process

3.14**high alloyed stainless steel**

austenitic stainless steel typically having $PREN \geq 40$ or $[\% Ni + 2 (\% Mo)] > 30$ where $\% Mo > 2$, where all mass fractions are expressed as percent

EXAMPLE SS type 6Mo or SS type 565.

3.15**intrados**

inner curved portion of a bend

3.16**leak testing**

application of a pressure load greater than the design load to demonstrate the integrity of a piping assembly to safely withstand the design load

Note 1 to entry: Leak testing is also referred to as “hydrostatic leak testing” or “pneumatic leak testing”, or combination thereof, as defined in ASME B31.3:2018.

3.17**lot**

all welds completed by all welders, and accepted by visual examination on any one day, unless otherwise defined in the engineering design

[SOURCE: PFI ES48]

3.18**low sulphur oil**

heating oil with maximum sulphur content of 1 000 ppm

3.19**nephelometric turbidity units**

measurement of water turbidity

3.20**owner**

person, partnership, organization or business ultimately responsible for design, construction, operation, and maintenance of a facility

[SOURCE: ASME B31.3:2018]

3.21**pitting resistance equivalent number**

number indicating the resistance of stainless steels to pitting corrosion and related to chemical composition

Note 1 to entry: PREN is calculated from one of the following formulas:

$$PREN = \% Cr + 3,3 \% Mo + 16 \% N$$

$$PREN = \% Cr + 3,3 \% (Mo + 0,5W) + 16 \% N$$

where all mass fractions are expressed as percent.

Note 2 to entry: All PREN limits are absolute limits based upon the heat analysis. The calculated value shall not be rounded.

ISO/DIS 13703-3:2020(E)**3.22****sour service**

service environments that contain sufficient H₂S to cause cracking of materials by the mechanisms addressed in ISO 15156-2 or ISO 15156-3

Note 1 to entry: For the purpose of this document, NACE MR0175-2 and NACE MR0175-3 are equivalent to ISO 15156-2 and ISO 15156-3, respectively.

3.23**stainless steel 300-series**

austenitic stainless steel with at least 16 % Cr (mass fraction) and 8 % Ni (mass fraction) possibly with other elements added to secure special properties

Note 1 to entry: Low carbon grades are typically used where welding is required.

EXAMPLE UNS S30400, UNS S30403, UNS S31600, UNS S31603.

3.24**stainless steel type 22 Cr duplex**

ferritic/austenitic stainless steel alloys with $30,0 < PREN < 40,0$ and $Cr \geq 19$ % (mass fraction)

EXAMPLE UNS S31803, UNS S32205.

3.25**stainless steel type 25Cr duplex**

ferritic/austenitic stainless steel alloys with $40,0 \leq PREN < 48,0$

Note 1 to entry: This alloy is often referred to as "super duplex".

EXAMPLE UNS S32505, UNS S32550, UNS S32750, UNS S32760, UNS S39274, UNS S39277.

3.26**stainless steel type 6Mo**

austenitic stainless steel with $PREN \geq 40$ and a nominal Mo alloying content of 6 % (mass fraction) and nickel alloys with Mo content in the range 6 % to 8 % (mass fraction)

EXAMPLE UNS S31254, UNS N08367, UNS N08926.

3.27**stainless steel type 565**

manganese austenitic stainless steel with Mn content in the range 4 % to 12 % (mass fraction) and $PREN \geq 40$

EXAMPLE UNS S34565.

3.28**tangent**

straight section at the end of a bend

3.29**tightness testing**

application of a pressure differential to a piping assembly to detect leakage paths or rates

Note 1 to entry: Tightness testing includes testing of mechanically completed piping systems as part of pre-commissioning activities, and sensitive leak tests as defined in ASME B31.3:2018.

3.30**transition zone**

areas of the start and stop points of induction heating, which include material that extends from the unheated mother pipe to the material that has been heated to the full bending temperature

3.31**waveform controlled welding process**

welding process modification of the voltage and/or current wave shape to control characteristics such as droplet shape, penetration, wetting, bead shape or transfer mode(s)

[SOURCE: ASME Boiler and Pressure Vessel Code, Section IX:2019]

4 Symbols and abbreviated terms**4.1 Symbols**

<i>D</i>	nominal pipe diameter, expressed in millimetres
<i>HBW</i>	heated band width, expressed in millimetres
<i>L</i>	length, expressed in millimetres
<i>R</i>	nominal bending radius to centreline of pipe, expressed in millimetres
<i>r</i>	nominal outside radius of the pipe, expressed in millimetres
<i>t</i>	nominal material thickness at the weld, expressed in millimetres
<i>U_g</i>	Geometric unsharpness

4.2 Abbreviated terms (standards.iteh.ai)

AWS	American Welding Society
aMDEA	activated MDEA
CE	carbon equivalent
CIT	computerised imaging technique
CMTR	certified material test report
CP	commercially pure (in relation to titanium materials)
CRA	corrosion resistant alloy
CSWIP	certification scheme for weldment inspection personnel
CWEng	certified welding engineer
DGA	di-glycol amine
DIPA	di-iso propyl amine
ECA	engineering critical assessment
EWE	European welding engineer
EWf	European Welding Federation
FCAW-G	flux cored arc welding – gas shielded
FCAW-S	flux cored arc welding – self shielded