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Oil and gas industries including lower carbon energy — Tertiary outfitting structures

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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~~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).

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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 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, *Oil and gas industries including lower carbon energy*, in collaboration with Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 8, *Ship design*.

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

~~The purpose of this document for tertiary structure items is to provide a uniform reference when tertiary structure is designed and constructed in offshore oil & gas projects.~~ This document aims to reduce the number and variations in requirements to the minimum necessary to reflect a common and global best practice based upon existing standards and requirements. In addition, standard inventory for shapes and dimensions referred to as specifications are proposed in this document. Exemptions where requirements in common standards for tertiary items applied in offshore oil & gas projects are not met in this document are clearly stated.

The main benefits of more standardized tertiary items are expected to be reduced delivery time, more streamlined and efficient engineering, and construction as well as improved cross use of tertiary items between projects. A risk-based approach has been used when defining the proposed requirements and recommendations. The underpinning factors for determining the proposed conditions are to provide an acceptable safety level for people in combination with cost efficient solutions for implementing the requirements.

Material requirements are addressed in Clause 6 for carbon steel and Clause 7 for aluminium.

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Oil and gas industries including lower carbon energy — Tertiary outfitting structures

1 Scope

~~The purpose of this~~ This document ~~provides a uniform reference~~ provides a uniform reference for tertiary structure items ~~is to provide a uniform reference when~~ when a tertiary structure is designed and constructed in offshore oil ~~& and~~ gas projects. This document covers topside systems for fixed or floating offshore projects not covered by class requirements. This document can be applicable for hull systems and onshore projects when there is consent from relevant stakeholders. ~~This document does not provide with class rules from classification societies. For verification of conformity with class rules, it is best to use the respective class rules from class societies.~~

This document provides requirements ~~to on~~ dimensions of the items but does not include requirements ~~to on~~ clearances with other structures.

~~Material requirements are addressed in Chapter 6 for carbon steel and Chapter 7 for Aluminium, and requirements are specified in Annex F and Annex G.~~

The following tertiary outfitting designs for equipment items are covered in this document:

- handrails;
- safety gate;
- stairs;
- spiral stairs;
- vertical ladder;
- grating;
- maintenance hole (manhole);
- connection method.

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.

~~ASTM A36 Standard Specification for Carbon Structural Steel~~

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~~ASTM A53 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless~~

~~ASTM A106 Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service~~

~~ASTM A333 Standard Specification for Seamless and Welded Steel Pipe for Low Temperature Service and Other Applications with Required Notch Toughness~~

~~ASTM A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products~~

~~ASTM A500 Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes~~

~~ASTM A572 Standard Specification for High Strength Low Alloy Columbium Vanadium Structural Steel~~

~~ASTM B209, Standard Specification for Aluminium and Aluminium Alloy Sheet and Plate~~

~~API 5L, API Specification 5L~~

~~AWS D1.1, Structural Welding — Steel~~

~~AWS QC1, Specification for AWS Certification of Welding Inspectors~~

~~EN 485-1, Aluminium and aluminium alloys — Sheet, strip and plate Part 1: Technical conditions for inspection and delivery~~

~~EN485-2, Aluminium and aluminium alloys — Sheet, strip and plate Part 2: Mechanical properties~~

~~EN 10025-2 Technical delivery conditions for non alloy structural steels~~

~~EN10025-3 Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels~~

~~EN 10204, Metallic products — Types of inspection documents.~~

~~EN10210-1 Hot finished structural hollow sections of non alloy and fine grain steels — Part 2: Tolerances, dimensions and sectional properties~~
~~EN10219-1 Cold formed welded structural hollow sections of non alloy and fine grain steels. Technical delivery requirements~~

~~IACS W11 Normal and higher strength hull structural steels~~

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

~~ISO 898-1, Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread~~

~~ISO 898-2, Fasteners — Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes~~

~~ISO 898-3, Mechanical properties of fasteners made of carbon steel and alloy steel — Part 3: Flat washers with specified property classes~~

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

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~~ISO 3834-2, Quality requirements for fusion welding of metallic materials — Part 1: Criteria for the selection of the appropriate level of 2: Comprehensive quality requirements~~

ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

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

~~ISO 9606 1, Qualification testing of welders — Fusion welding — Part 1: Steels~~

~~ISO 9606 2, Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys~~

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

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

ISO 14122-2, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

~~ISO-ISO 14122-4, Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders~~

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

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

~~ISO 15609-ISO 15609-1, Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding~~

~~EN 485 (all parts), Aluminium and aluminium alloys — Sheet, strip and plate~~

~~EN 10025-2, Technical delivery conditions for non-alloy structural steels~~

~~EN 10025-3, Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels~~

~~EN 10204, Metallic products – Types of inspection documents~~

~~EN 10210-1, Hot finished structural hollow sections of non-alloy and fine grain steels — Part 2: Tolerances, dimensions and sectional properties~~

~~EN 10219-1, Cold formed welded structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements~~

~~ASTM A36, Standard Specification for Carbon Structural Steel~~

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[ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless](#)

[ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service](#)

[ASTM A333, Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness](#)

[ASTM A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products](#)

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[ASTM A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel](#)

[ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate](#)

[API 5L, API Specification 5L](#)

[AWS D1.1, Structural Welding - Steel](#)

[AWS QC1, Specification for AWS Certification of Welding Inspectors](#)

[IACS W11, Normal and higher strength hull structural steels](#)

JIS G3101, Rolled steels for general structure

JIS G3106, Rolled steels for welded structure

JIS G3444, Carbon steel tubes for general structure

JIS G3454, Carbon steel pipes for pressure service

DNV rule Part 2 Material

[ASNT SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing](#)

3 Terms, definitions and abbreviated terms

3.1 Terms and definition

For the purposes of this document, the following terms and definitions 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 Terms and definition

3.1.1

handrail

device for protection against accidental fall sideways ~~with manned~~ within crewed areas which stairs/step ladders or landings, platforms and walkways may be equipped with

3.1.2

guard-rail

device for protection against accidental fall sideways with all areas

3.1.3

spiral stair

a stair ~~describing~~forming a helix around a central column

3.1.4

AR

as-rolled

AR

rolling at high temperature followed by air cooling

Note 1 to entry: The rolling finishing temperature and reduction are typically in the austenite recrystallization region and above the normalizing temperature; but, they possibly are not able to be accurately controlled resulting in variable grain sizes and, hence, variable mechanical properties.

3.1.5

NR

normalizing rolling

NR

controlled rolling procedure where the final rolling temperature is controlled within the same temperature range as for conventional furnace normalizing

Note 1 to entry: Normalizing rolling is typically followed by air cooling. The primary grain control and refining mechanism is the recrystallization of austenite following each rolling pass in the normalizing temperature range.

3.1.6

TM

thermo-mechanically controlled process

TM

rolling procedure in which both rolling temperatures and reduction ratios and, when used, accelerated cooling conditions (AcC) are controlled

Note 1 to entry: It is characterized by high deformation ratios per rolling pass in the austenite non-recrystallization range close to the Ar3 temperature; it perhaps involves rolling in the austenite-ferrite dual phase temperature region below Ar3. After the final pass, either air cooling or accelerated cooling, excluding quenching, is used. The primary grain size and microstructural control ~~if~~of the fine ~~grained~~grain structure is obtained when ~~the~~ highly deformed austenite ~~is transformed~~transforms during cooling, typically into typically ferrite, pearlite, bainite, etc. during cooling.

3.1.7

N

normalizing

N

separate heat treatment after rolling involving automatizing and air cooling to produce a fine-grained ferrite-pearlite microstructure

3.1.8

~~Tertiary~~ **tertiary outfitting members**

~~Tertiary outfitting members are defined as members and attachments which are~~ not essential to the main stability and strength of the structure

3.1.9

~~quenching and tempering.~~

~~QT~~

~~Quenching (Q) is a heat treatment process in which the steel is heated to an appropriate temperature above A_{c3} , followed by cooling at a rate sufficient for the formation of typically a martensitic or bainite microstructure. Quenched steels are typically hard and brittle.~~

~~Tempering (T) is reheating of the steel to a temperature below A_{c1} . Tempering improves the ductility and toughness of quenched materials through microstructural changes, but reduces the hardness and strength. Furthermore, the quenching process results in material internal stress which is to some extent released/reduced by the subsequent tempering.~~

Note 1 to entry: This term is used to describe members and attachments.

3.2 Abbreviated terms

ANSI	American National Standards Institute
API	American Petroleum Institute
AS	Australian Standard
ASSM	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
BS	British Standards
Eq. (CEV)	Carbon equivalent
CS	Carbon carbon equivalent
DC	Design Class <u>design class</u>
EN	European standards
ERW	Electric Resistance Welded
HSE	Health, Safety & Environment
ISO	International Standards Organization
JIS	Japanese Industrial Standards
MDS	Material Data Sheet <u>material data sheet</u>
NDT	Non-Destructive Testing <u>non-destructive testing</u>
NMA	Norwegian Maritime Authority
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NORSOK	Norsk Søkels Konkuranseposisjon
LC	Load Case <u>load case</u>

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OSHA	Occupational Safety and Health Administration
Pcm	Parameterparameter of weld crack susceptibility of base metal
PSApWPS	Petroleum Safety Authority Norwaypreliminary welding procedure specification
QCP	Manufacturer'smanufacturer's quality control plan
SMYS	Specified Minimum Yield Strengthspecified minimum yield strength
SQL	Steel Quality Levelsteel quality level
SUS	Steel Use Stainlesssteel use stainless
ULS	Ultimate Limit Stateultimate limit state
USCGWPQR	United States Coast Guardwelding procedure qualification record
WPQT	welding procedure qualification testing

4 Requirements and specifications clause for steel outfitting

4.1 General

This document ~~has been developed in the~~ focuses on three layerslayers, i.e. requirements, specifications and practical drawings, as shown in Figure 1, considering operational safety and construction efficiency. The requirements ~~were developed~~ are based on major international standards and requirements applied for steel tertiary items in offshore oil and gas projects.

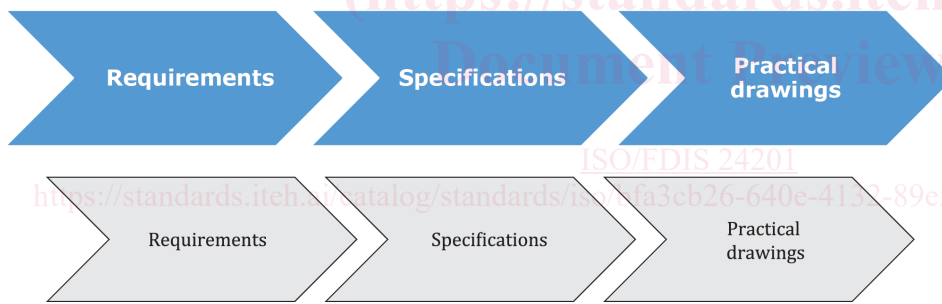


Figure 1 — Three layers

The specifications ~~were developed~~ are based on requirements and industrial practice. The specified dimensions (specifications) provided in this document are based on either centre-to-centre (e.g. central axis from one rail to next rail) or centre-to-platform edge (e.g. central axis in rail to floor, wall or ceiling) ~~as per industry~~ according to industrial practice.

The carbon steel grades for tertiary items shall be selected ~~from~~ MDS ~~number~~ numbers CS301 to CS308 in Annex F.

The practical drawings for fabrication ~~were developed~~ are based on the specifications and fabricator's practice. These drawings can be used during the construction phase, eliminating the need to develop shop drawings from scratch. The practical drawings are given in Annex B.

4.2 Handrails

4.2.1 General

The design of the handrail shall comply with the requirements in Table 1, and the specifications should be consistently applied ~~to maintain consistency of specifications.~~

Table 1 — Specification and requirements for handrails

Parameter	Specification	Requirement(s)	Comments and limitations
Height (a)	— 1 100 mm (centre-to-platform distance)	— Min. 1 100 mm (top of handrail-to-platform distance)	
Height on stair (b)	— 1 000 mm (centre-to-platform distance)	— Min. 1 000 mm (top of handrail-to-platform distance)	Deviation with ANSI/ASSE A1264.1: 34 in —max.to 38 in (863 mm to 965 mm)
Vertical opening (c)	— Max. 380 mm (centre-to-centre distance) — Max. 230 mm for lowest course (centre-to-edge distance)	— Max. 380 mm — Max. 230 mm for lowest course	
Intermediate knee rail	— Two (2) knee rails	— Min. 2 knee rails	
Diameter and thickness (d)	— 48 mm / 4 mm (top rail) — 34 mm / 4 mm (knee rails) — 48 mm / 6 mm (vertical stanchion)	— Min. 25 mm to max. 50 mm	Deviation with ANSI/ASSE A1264.1: 1,25 in to 2 in (32 mm to 51 mm)
Distance between vertical stanchions (e)	— Max. 1 500 mm (centre-to-centre distance)	— Max. 1 500 mm	
Height of toe-plate (f)	— 100 mm	— Min. 100 mm	
Thickness of toe plate (g)	— 8 mm	— 6 mm to 10 mm	