International Standard

ISO 24201

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

*Industries du pétrole et du gaz, y compris les énergies à faible teneur en carbone — Structures d'équipement tertiaire*



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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 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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This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*.

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

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.

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

## 1 Scope

This document provides a uniform reference for tertiary structure items 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 class rules from classification societies.

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

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

— handrails;

— safety gate;

— stairs;

— spiral stairs;

— vertical ladder;

— grating;

— access 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.

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*

ISO 3834-2, *Quality requirements for fusion welding of metallic materials — Part 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 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 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 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

EN 485, *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*

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 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

# 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**
**handrail**
device for protection against accidental fall sideways 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**
stair forming a helix around a central column



**3.1.4**
**AR**
as-rolled
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
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
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 of the fine grain structure is obtained when highly deformed austenite transforms during cooling, typically into typically ferrite, pearlite, bainite, etc.

**3.1.7**
**N**
normalizing
separate heat treatment after rolling involving automatizing and air cooling to produce a fine-grained ferrite-pearlite microstructure

**3.1.8**
**tertiary outfitting**
not essential to the main stability and strength of the structure

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

## 3.2 Abbreviated terms

| | |
|---|---|
| CS | carbon equivalent |
| DC | design class |
| MDS | material data sheet |
| NDT | non-destructive testing |
| LC | load case |
| Pcm | parameter of weld crack susceptibility of base metal |
| pWPS | preliminary welding procedure specification |
| QCP | manufacturer's quality control plan |
| SMYS | specified minimum yield strength |
| SQL | steel quality level |
| SUS | steel use stainless |
| ULS | ultimate limit state |
| WPQR | welding procedure qualification record |
| WPQT | welding procedure qualification testing |



# 4 Requirements and specifications for steel outfitting

## 4.1 General

This document focuses on three layers, i.e. requirements, specifications and practical drawings, as shown in Figure 1, considering operational safety and construction efficiency. The requirements 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 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) according to industrial practice.

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

The practical drawings for fabrication 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.

**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 to 38 in (863 mm to 965 mm) |
| **Vertical opening (*c*)** | — Max. 380 mm (centre-to-centre distance)<br>— Max. 230 mm for lowest course (centre-to-edge distance) | — Max. 380 mm<br>— 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)<br>— 34 mm / 4 mm (knee rails)<br>— 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 | |
| **Vertical opening (gap) between toe plate and floor level (*h*)** | — Max. 10 mm | — Max. 10 mm | Deviation with ANSI/ASSE A1264.1: Max. 0,25 in (6 mm) |
| **Horizontal opening (gap) between toe plates (*i*)** | — Max. 10 mm | — Continuous type (or max. 10 mm) | |
| **Radius of rounding (*j*)** | — 150 R | — 150 R | The radius is measured based on the centreline of the handrail. |

**Table 1** *(continued)*

| Parameter | Specification | Requirement(s) | Comments and limitations |
|---|---|---|---|
| **Length of end segment from vertical stanchion (*k*)** | — 350 mm | — Max. 600 mm | |
| **Space between two segments (*m*)** | — Rounding type<br>— 77 mm (space)<br>— 125 mm (centre-to-centre distance) | — 75 mm to 120 mm (no rounding)<br>— 75 mm to 100 mm (rounding) | |
| **Sharp edges** | — Not allowed | — Not allowed | |
| **Material** | — Tubular type | | |

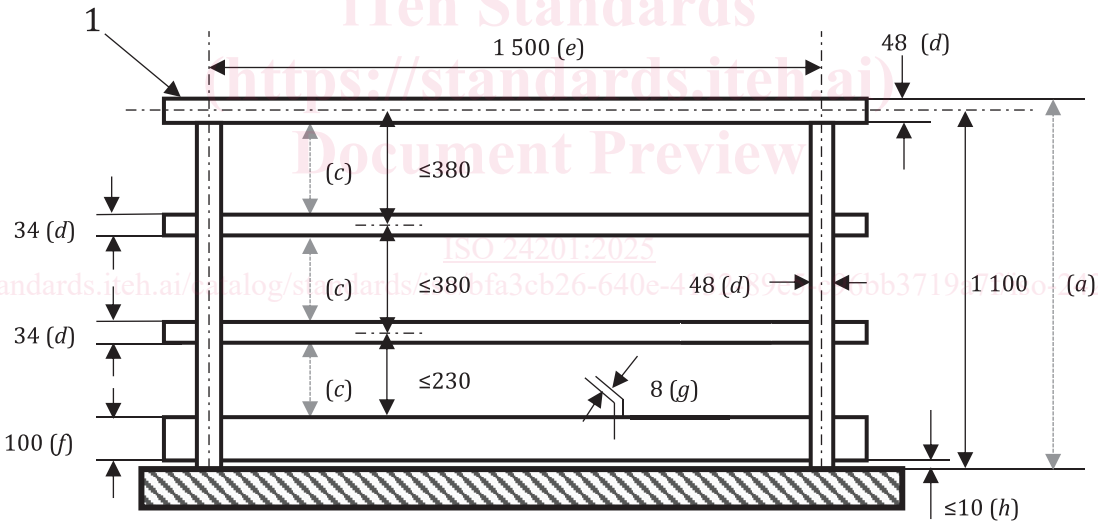
### 4.2.2 General requirements

The specification for typical handrails on floor or platforms is presented in Figure 2. The diameter of top rail and intermediate knee rails are defined based upon specifications for electric resistance welded (ERW) pipes.

Top rails of major egress routes shall be continuous. Although continuous type is preferred also for other areas, dis-continuous type can be applied if required to ensure structural integrity, maintainability and ease of construction.

All pipe ends shall be sealed.

Dimension in millimetres






**Key**

1 tubular type
*a* height
*c* vertical opening
*d* diameter and thickness
*e* distance between vertical stanchions
*f* height of toe-plate
*g* thickness of toe plate
*h* vertical opening (gap) between toe plate and floor level

**Figure 2 — Specifications for handrails**

All handrails at deck corner edges shall be inter-connected.