



International
Standard

ISO 19901-3

**Oil and gas industries including
lower carbon energy — Specific
requirements for offshore
structures —**

**Part 3:
Topsides structure**

*Industries du pétrole et du gaz, y compris les énergies à faible
teneur en carbone — Exigences spécifiques relatives aux
structures en mer —*

Partie 3: Structures Top Sides

**Third edition
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Contents

Page

Foreword	vii
Introduction	x
1 Scope	1
2 Normative references	2
3 Terms and definitions	3
4 Symbols and abbreviated terms	5
4.1 Symbols	5
4.2 Abbreviated terms	6
5 Overall requirements	7
5.1 Conceptual design	7
5.2 Codes and standards	7
5.2.1 Limit states and allowable stress philosophies	7
5.2.2 Use of national building standards	8
5.3 Deck elevation	8
5.4 Exposure level	8
5.5 Operational requirements	9
5.5.1 Functional requirements	9
5.5.2 Spillage and containment	9
5.6 Design physical environmental conditions	9
5.7 Critical structure	9
5.8 Assessment of existing topsides structure	10
5.9 Reuse of topsides structure	10
5.10 Repairs, modifications and refurbishment	10
6 Design requirements	11
6.1 General	11
6.2 Design/assessment situations	11
6.3 Material selection	11
6.4 Structural interfaces	11
6.5 Design for serviceability	11
6.5.1 Serviceability limits	11
6.5.2 Vibrations	12
6.5.3 Deflections	13
6.6 Design for strength	14
6.7 Design for fatigue	14
6.8 Robustness	14
6.8.1 General	14
6.8.2 Ductility	14
6.9 Confirmation of execution of design requirements	15
6.10 Corrosion control	15
6.11 Design for fabrication and inspection	16
6.12 Design for loadout, transportation and installation	16
6.13 Design for structural integrity management	17
6.14 Design for decommissioning, removal and disposal	17
6.14.1 General	17
6.14.2 Structural releases	17
6.14.3 Lifting appurtenances	17
6.14.4 Heavy lift and set-down operations	17
7 Actions and analysis methods	18
7.1 General	18
7.2 In-service actions	19
7.3 Action factors	20
7.3.1 Design actions for operational design/assessment situations in still water	20

7.3.2	Design actions for operational design/assessment situations with operating environmental actions	20
7.3.3	Design actions for extreme design/assessment situations	21
7.4	Vortex-induced vibrations	21
7.5	Indirect actions and resulting forces (action effects)	21
7.6	Metocean and ice actions	22
7.6.1	Wave, current and ice actions	22
7.6.2	Wind actions	23
7.6.3	Cold regions effects	24
7.7	Seismic actions	24
7.7.1	General	24
7.7.2	Minimum lateral acceleration	24
7.7.3	Equipment and appurtenances	24
7.8	Actions during fabrication, loadout, transportation, and installation	25
7.9	Actions arising from accidental events	25
7.9.1	General	25
7.9.2	Structural design for fire hazard	27
7.9.3	Structural design for explosion hazard	28
7.9.4	Explosion and fire interaction	32
7.9.5	Cryogenic spill	33
7.9.6	Actions due to vessel collision	33
7.9.7	Actions due to dropped and swinging objects and projectiles	33
7.9.8	Actions due to loss of buoyancy	33
7.9.9	Actions due to topsides acceleration	34
7.10	Other actions	34
7.10.1	Drilling	34
7.10.2	Conductors	35
7.10.3	Risers	36
7.10.4	Caissons	36
7.10.5	Maintenance, mechanical handling and lifting aids	36
7.10.6	Bridge supports	36
8	Strength and resistance of structural components	37
8.1	Correspondence factor K_c	37
8.2	Design of cylindrical tubular sections	37
8.3	Design of non-cylindrical sections	37
8.3.1	Rolled and welded non-circular prismatic members	37
8.3.2	Plate girder	38
8.3.3	Box girder	38
8.3.4	Stiffened plate components and stressed skin structures	38
8.4	Connections	39
8.4.1	General	39
8.4.2	Restraint and shrinkage	39
8.4.3	Bolted connections	39
8.5	Castings and forgings	43
8.6	Design for structural stability	43
9	Limit state verification	44
9.1	Limit state verification approach	44
9.2	Limit state verification for fire and explosion events	45
9.3	Approaches for limit state verification for fire and explosion events	45
9.4	Risk and risk targets	46
9.5	Limit state verification for fire and explosion events by semi-probabilistic approach	48
9.5.1	DL limit state verification	48
9.5.2	NC limit state verification	48
9.5.3	Representative values of accidental actions	49
10	Structural systems	49
10.1	Topsides design	49
10.1.1	General	49

ISO 19901-3:2024(en)

10.1.2	Topsides on concrete substructures.....	49
10.1.3	Topsides on floating structures.....	50
10.1.4	Equipment supports.....	50
10.2	Topsides structure design models.....	50
10.2.1	General.....	50
10.2.2	Substructure model for topsides design.....	51
10.2.3	Topsides model for topsides design.....	51
10.2.4	Modelling for design of equipment and piping supports.....	52
10.3	Substructure interface.....	52
10.3.1	Responsibility.....	52
10.3.2	Strength design.....	52
10.3.3	Fatigue design.....	52
10.4	Flare towers, booms, vents and similar structure.....	52
10.5	Helicopter landing facilities (helidecks).....	53
10.5.1	General.....	53
10.5.2	Construction.....	54
10.5.3	Helideck design verification.....	54
10.5.4	Reassessment of existing helidecks.....	58
10.6	Crane support structure and crane boom rest.....	59
10.6.1	General.....	59
10.6.2	Design requirements.....	59
10.6.3	Static design.....	60
10.6.4	Fatigue design.....	62
10.6.5	Seismic/Earthquake design.....	63
10.6.6	Dynamic design.....	63
10.6.7	Fabrication.....	64
10.6.8	Crane boom rest design.....	64
10.7	Derrick equipment set.....	64
10.8	Bridges.....	65
10.9	Bridge bearings.....	65
10.10	Anti-vibration mountings for modules and major equipment skids.....	66
10.11	System interface assumptions.....	66
10.12	Fire protection systems.....	66
10.13	Penetrations.....	67
10.14	Difficult-to-inspect areas.....	67
10.15	Drainage.....	67
10.16	Strength reduction due to heat.....	67
10.17	Walkways, laydown areas and equipment maintenance.....	67
10.18	Muster areas and lifeboat stations.....	68
11	Materials.....	68
11.1	General.....	68
11.2	Carbon steel.....	69
11.3	Stainless steel.....	74
11.3.1	General.....	74
11.3.2	Types of stainless steel.....	74
11.3.3	Material properties.....	75
11.4	Aluminium alloys.....	75
11.4.1	General.....	75
11.4.2	Types of aluminium.....	75
11.4.3	Material properties.....	75
11.4.4	Thermite sparking.....	76
11.5	Fibre-reinforced polymers (FRP).....	76
11.6	Timber.....	76
12	Fabrication, quality control, quality assurance and documentation.....	77
12.1	Assembly.....	77
12.1.1	General.....	77
12.1.2	Grating.....	77
12.1.3	Landing and stairways.....	77

ISO 19901-3:2024(en)

12.1.4	Temporary attachments.....	77
12.2	Welding.....	77
12.3	Fabrication inspection.....	78
12.4	Quality control, quality assurance and documentation.....	78
12.5	Corrosion protection.....	78
12.5.1	Coatings.....	78
12.5.2	Under deck areas.....	78
12.5.3	Dissimilar materials.....	78
12.6	In-service inspection, monitoring and maintenance of corrosion control.....	79
13	Loadout, transportation and installation.....	79
14	In-service inspection and structural integrity management.....	79
14.1	General.....	79
14.2	Requirements applying to topsides structures.....	79
14.2.1	Corrosion protection systems.....	79
14.2.2	Critical structures.....	79
14.2.3	Control of hot work (e.g. welding and cutting).....	79
14.2.4	Accidental events and incidents.....	80
14.2.5	Change control.....	80
Annex A (informative) Additional information and guidance.....		81
Annex B (informative) Example calculation of correspondence factor.....		141
Bibliography.....		147

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Document Preview

ISO 19901-3:2024

<https://standards.iteh.ai/catalog/standards/iso/63e1105e-bfe1-4959-8bce-58ae864b79e8/iso-19901-3-2024>

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 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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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*, Subcommittee SC 7, *Offshore structures*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Oil and gas industries including lower carbon energy*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 19901-3:2014), which has been technically revised.

The main changes are as follows:

- alignment of terminology with that of ISO 19900;
- a rational re-arrangement of the clauses content and numbering;
- adoption with modifications of IOGP supplementary requirements (S-631-04);
- ‘national or regional codes’ and ‘national or regional building codes’ have been replaced by ‘national building standards’ throughout the whole document;
- ‘supporting structure’ has been replaced by ‘substructure’ and definition of ‘substructure’ has been added to [Clause 3](#);
- ‘wave, wind and current’ has been replaced by ‘metocean’;
- ‘design assessment/situations’ has replaced ‘design situations’ according to ISO 19900;
- [5.2.1](#) has been updated distinguishing between ASD (Allowable strength design) associated to ANSI/AISC 360-22 and WSD (Working stress design) associated to AISC 335-89 and API RP 2A-WSD. Further guidance is provided for floating structures where the hull is typically designed using the WSD method. In [5.2.2](#) guidance on the application of K_c is given in case of WSD method.
- [subclause 5.7](#) on critical structures has been added;

ISO 19901-3:2024(en)

- in [6.5.2.4](#) the frequency range to avoid structural resonance has been changed according to NORSOK N-004:2022, F-2-9-6;
- [Table 2](#) has been updated with the introduction of ‘restricted access for inspection, maintenance and repair’ partial damage factors and reduction in case of full accessibility (with reference to ISO 19904-1, NORSOK N-004,^[32] Reference [\[30\]](#) and DNV-OS-C101^[31]). Guidance in case of dissimilar materials has been added;
- subclause [6.8.2](#) on ductility has been introduced, adapted from NORSOK N-004:2022, 7.2;
- addition of [Table A.1](#) with typical minimum values for local, primary and global design of operational actions (Q);
- subclause [7.3](#) has been re-ordered and updated;
- subclause [7.5](#) has been renamed ‘Indirect actions and resulting forces’ and updated according to the modifications and assumptions in [10.1](#) and [10.2](#);
- wind actions, [7.6.2](#) and [A.7.6.2](#), introduction of national building standards for the evaluation of the representative wind actions; alignment with ISO 19900 and ISO 19901-1 and addition of more guidance;
- alignment of minimum lateral acceleration for seismic ([7.7.2](#) and [A.7.7.2](#)) with ANSI/API RP 2TOP^[82].
- all sources of topsides accelerations collected ([7.9.9](#) and [A.7.9.9](#)) and aligned;
- technical review of the accidental events ([7.9](#) and [A.7.9](#)), with introduction of risk-informed and reliability-based approaches for fire and explosion in addition to the default semi-probabilistic approach;
- K_c correspondence factor ([8.1](#) and [A.8.1](#)) defined according to an equivalent reliability procedure for ANSI/AISC 360-22,^[12] CSA-S16:19^[14] and EN 1993-1-1^[13];
- bolted connection ([8.4.3](#) and [A.8.4.3](#)) have been modified according to IOGP supplementary specification S-631-04;
- [8.5](#) has been renamed as ‘Castings and forgings’, adding references to forgings;
- addition of [8.6](#) and [A.8.6](#) on design for structural stability in alignment with ANSI/API RP 2TOP^[82] and based on ANSI/AISC 360-22^[12] and EN 1993-1-1^[13] criteria;
- addition of [Clause 9](#) dedicated to the description of the limit state verification approaches including risk-informed and reliability-based approaches for fire and explosion ([9.2](#), [9.3](#), [A.9.2](#) and [A.9.3](#)) in addition to the default semi-probabilistic approach;
- in [10.2.1](#), an alternative method (method b) for the analysis of the topsides structures has been introduced with further guidance in [A.10.2.1](#). The associated [6.4](#), [7.5](#), [7.8](#) and [10.1](#) and [A.6.4](#), [A.7.5](#), [A.7.8](#) and [A.10.1](#) have been updated accordingly;
- helicopter landing facilities ([10.5](#)) updated according to CAP 437^[21] for emergency landing and addition of design load combinations ([Table 7](#)) adapted from NORSOK N-004:2022, Table F.5.^[32] Deletion of the previous Table A.5;
- crane support structure clauses, [10.6](#) and [A.10.6](#) have been reviewed. Crane support structure is to be designed according to API Spec 2C or EN 13852-1 and additional provisions reported. The simplified fatigue method has been aligned with ANSI/API RP 2TOP^[82];
- [Table 9](#) adapted with modifications from NORSOK N-004:2022, Table F.1^[32] and addition of some example figures for DC;
- former 12.1 to 12.3.5 have been deleted and moved to ISO 19902:2020, Clause 18.
- in [12.2](#) Welding requirements have been reviewed;
- in [12.5](#) provisions for dissimilar materials have been added, adapted from NORSOK N-004:2022, F.4.4;

ISO 19901-3:2024(en)

- the previous Clause 12 and A.12 “Corrosion control” in ISO 19901-3:2014 has been removed because it is now included in ISO 19902:2020; in [Clause 14](#), reference to ISO 19901-9 has been added and the previous Clause 14 in ISO 19901-3:2014 on “Topsides structure default inspection scope” has been removed, being now covered by ISO 19901-9; in [Clause 14](#) and [A.14](#), the subclauses [14.2.2](#) and [A.14.2.2](#) on “Critical structures” have been added;
- in [Annex B](#), updated example of K_c calculations by utilization ratio for ISO 19902 and ANSI/AISC 360-22^[12].
- removal of former Annex C. K_c is now reported as normative value in Table 4 for ANSI/AISC 360-22^[12], CSA-S16:19^[14] and EN 1993-1-1^[13].

A list of all parts in the ISO 19901 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.

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Introduction

The International Standards on offshore structures prepared by TC 67 (i.e. ISO 19900, the ISO 19901 series, ISO 19902, ISO 19903, ISO 19904-1, ISO 19905-1, ISO 19905-3 and ISO 19906) constitute a common basis covering those aspects that address design requirements and assessments of all offshore structures used by the petroleum and natural gas industries including lower carbon energy worldwide. Through their application, the intention is to achieve reliability levels appropriate for manned and unmanned offshore structures, whatever the type of structure and the nature or combination of the materials used.

It is important to recognize that structural integrity is an overall concept comprising models for describing actions, structural analyses, design rules, safety elements, workmanship, quality control procedures and national requirements, all of which are mutually dependent. The modification of one aspect of design in isolation can disturb the balance of reliability inherent in the overall concept or structural system. The implications involved in modifications, therefore, need to be considered in relation to the overall reliability of all offshore structural systems.

The International Standards on offshore structures prepared by TC 67 are intended to provide wide latitude in the choice of structural configurations, materials and techniques, without hindering innovation. Sound engineering judgement is therefore necessary in the use of these International Standards.

This document has been prepared for those structural components of offshore platforms which are above the wave zone and are not part of the substructure or of the hull.

Historically, the design of structural components in topsides has been performed to national building standards for onshore structures, modified in accordance with experience within the offshore industry, or to relevant parts of classification society rules. While this document permits use of national building standards, and indeed remains dependent on them for the formulation of component resistance equations, it provides modifications that result in a more consistent level of component safety between substructures and topsides structures.

In some aspects, the requirements for topsides structures are the same as, or similar to, those for fixed steel structures; in such cases, reference is made to ISO 19902, with modifications where necessary. [Annex A](#) provides background to, and guidance on, the use of this document.

[Annex B](#) provides an example of the use of national building standards for onshore structures in conjunction with this document.

Oil and gas industries including lower carbon energy — Specific requirements for offshore structures —

Part 3: Topsides structure

1 Scope

This document provides requirements, guidance and information for the design and fabrication of topsides structure for offshore structures, including in-service, pre-service and post-service conditions.

The actions on topsides structure and the action effects in structural components are derived from this document, where necessary in combination with other International Standards in the ISO 19901 series (e.g. ISO 19901-1 for wind actions - see [7.6.2](#), ISO 19901-2 for seismic actions - see [7.7](#)) and ISO 19902 for fatigue design (see [6.7](#)).

This document is applicable to the following:

- topsides of fixed offshore structures;
- discrete structural units placed on the hull structures of floating offshore structures and mobile offshore units;
- topsides of arctic offshore structures, excluding winterization (see ISO 19906).

If any part of the topsides structure forms part of the primary structure of the overall structural system which resists global platform actions, the requirements of this document are supplemented with applicable requirements in ISO 19902, ISO 19903, ISO 19904-1, ISO 19905-1, ISO 19905-3 and ISO 19906.

For those parts of floating offshore structures and mobile offshore units that are chosen to be governed by the rules of a recognized classification society, the corresponding class rules supersede the associated requirements of this document.

This document also addresses prevention, control and assessment of fire, explosions and other accidental events.

The fire and explosion provisions of this document can be applied to those parts of the hulls of floating structures and mobile offshore units that contain hydrocarbon processing, piping or storage.

NOTE Requirements for structural integrity management are presented in ISO 19901-9.

This document applies to structural components including the following:

- primary and secondary structure in decks, module support frames and modules;
- flare structures;
- crane pedestal and other crane support arrangements;
- helicopter landing decks (helidecks);
- permanent bridges between separate offshore structures;
- masts, towers and booms on offshore structures.

This document provides requirements for selecting and using a national building standard with a correspondence factor for determining the resistance of rolled and welded non-circular prismatic components and their connections.

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.

API Spec 2C, *Offshore Pedestal-mounted Cranes*

API Spec 2SC, *Manufacture of Structural Steel Castings for Primary Offshore Applications*

API Spec 2SF, *Manufacturer of Structural Steel Forgings for Primary Offshore Applications*, 1 edition, August 2013, reaffirmed 2020

ASTM F2329/F2329M, *Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners*

ASTM F3125/F3125M, *Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 Mpa and 1 040 Mpa Minimum Tensile Strength*

EEMUA PUB NO 176, *Specification for structural castings for use offshore*

EN 13852-1, *Cranes — Offshore cranes — Part 1: General-purpose offshore cranes*

EN 1993-1-8, *Eurocode 3: Design of steel structures – Part 1-8: Design of joints*

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 2631-1, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*

ISO 2631-2, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz)*

ISO 10684, *Fasteners — Hot dip galvanized coatings*

ISO 13702, *Petroleum and natural gas industries — Control and mitigation of fires and explosions on offshore production installations — Requirements and guidelines*

ISO 17776, *Petroleum and natural gas industries — Offshore production installations — Major accident hazard management during the design of new installations*

ISO 19900, *Petroleum and natural gas industries — General requirements for offshore structures*

ISO 19901-1, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 1: Metocean design and operating considerations*

ISO 19901-2, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 2: Seismic design procedures and criteria*

ISO 19901-6, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 6: Marine operations*

ISO 19901-9, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 9: Structural integrity management*

ISO 19902, *Petroleum and natural gas industries — Fixed steel offshore structures*

ISO 19903, *Petroleum and natural gas industries — Concrete offshore structures*

ISO 19904-1, *Petroleum and natural gas industries — Floating offshore structures — Part 1: Ship-shaped, semi-submersible, spar and shallow-draught cylindrical structures*

ISO 19905-1, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 1: Jack-ups*

ISO 19905-3, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 3: Floating units*

ISO 19906, *Petroleum and natural gas industries — Arctic offshore structures*

ISO 20088-1, *Determination of the resistance to cryogenic spillage of insulation materials — Part 1: Liquid phase*

ISO 20088-2, *Determination of the resistance to cryogenic spill of insulation materials — Part 2: Vapour exposure*

ISO 20088-3, *Determination of the resistance to cryogenic spillage of insulation materials — Part 3: Jet release*

ISO 22899-1, *Determination of the resistance to jet fires of passive fire protection materials — Part 1: General requirements*

ISO 834-1, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

NORSOK M-122, *Cast structural steel, rev. 2, October 2012*

NORSOK M-123, *Forged structural steel, rev. 2, October 2012*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19900 and ISO 19902 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

active fire protection

equipment, systems, and methods which, following initiation, can be used to control, mitigate, and extinguish fires

[SOURCE: ISO 13702:2015, 3.1.3]

3.2

caisson

appurtenance used for abstracting water from the sea or as a drain

3.3

critical structure

structural components, forming parts of the topsides structure, that provide support to safety and environmental critical elements (SECE), loss of which can cause specific life-safety, environmental or business consequences

Note 1 to entry: [Subclause 5.7](#) provides details and examples.

Note 2 to entry: Critical structure also includes structures which support safety and environmental critical elements (SECE) previously termed safety-critical elements (SCE), see ISO 19901-9:2019, 9.4 and A.9.4.

Note 3 to entry: SECE includes all relevant equipment and systems.

3.4

endurance period

time estimated for evacuation as defined by the Emergency Evacuation Rescue Analysis (EERA)

Note 1 to entry: The endurance period is specified in the basis of design.

3.5

major accident

MA

hazardous event that results in

- multiple fatalities or severe injuries; or
- extensive damage to structure, installation or plant; or
- large-scale impact on the environment (e.g. persistent and severe environmental damage that can lead to loss of commercial or recreational use, loss of natural resources over a wide area or severe environmental damage that will require extensive measures to restore beneficial uses of the environment)

Note 1 to entry: In this document, a major accident is the realization of a major accident hazard.

[SOURCE: ISO 17776:2016, 3.1.12, modified — Note 2 to entry deleted.]

3.6

passive fire protection

PFP

coating or cladding arrangement or free-standing system which, in the event of fire, provides thermal protection to restrict the rate at which heat is transmitted to the object or area being protected

[SOURCE: ISO 13702:2015, 3.1.36]

3.7

risk curve

probability of consequences exceeding a defined limit during a reference period

3.8

substructure

structure supporting the topsides

Note 1 to entry: The substructure can take many forms including fixed steel (see ISO 19902), concrete (see ISO 19903), floating (see ISO 19904-1 and ISO 19905-3), jack-up (see ISO 19905-1), or the various forms of arctic structures (see ISO 19906).

3.9

ideal hinge

pinned connection

idealisation by which no moments are transferred

Note 1 to entry: Plastic strain in an ideal hinge is typically a fraction of a percent.