

ISO 19901-3:2024-01 (E)

Oil and gas industries including lower carbon energy - Specific requirements for offshore structures - Part 3: Topsides structure

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

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

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