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Petroleum and natural gas industries - Fixed steel offshore structures (ISO 19902:2020)

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN ISO 19902:2020 (E)

Contents	Page
European foreword.....	3

European foreword

This document (EN ISO 19902:2020) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries" in collaboration with Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries" the secretariat of which is held by NEN.

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*Industries du pétrole et du gaz naturel — Structures en mer fixes
en acier*



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Contents

Page

Foreword.....	xiv
Introduction.....	xvii
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Symbols	10
5 Abbreviated terms	14
6 Overall considerations.....	16
6.1 Types of fixed steel offshore structure.....	16
6.1.1 General.....	16
6.1.2 Jackets	16
6.1.3 Towers.....	17
6.1.4 Jack-ups.....	17
6.2 Planning.....	18
6.2.1 General	18
6.2.2 Hazards	18
6.2.3 Designing for hazards	19
6.2.4 Design situations and criteria.....	19
6.2.5 Design for inspection and maintenance.....	19
6.2.6 Foundations and active geological processes	20
6.2.7 Regulations.....	20
6.3 Service and operational considerations	20
6.3.1 General considerations	20
6.3.2 Water depth.....	20
6.3.3 Structural configuration	20
6.3.4 Access and auxiliary systems.....	21
6.4 Safety considerations.....	21
6.5 Environmental considerations.....	21
6.5.1 General	21
6.5.2 Selecting design metocean parameters and action factors.....	22
6.6 Exposure levels	22
6.7 Assessment of existing structures.....	23
6.8 Structure reuse	23
7 General design requirements.....	23
7.1 General.....	23
7.2 Material properties for steel.....	24
7.3 Incorporating limit states	24
7.4 Determining design situations	24
7.5 Structural modelling and analysis	25
7.6 Design for pre-service and removal situations	25
7.7 Design for the in-place situation.....	25
7.8 Determination of component resistances.....	25
7.8.1 General	25
7.8.2 Physical testing to derive resistances.....	26
7.8.3 Resistances derived from computer simulations validated by physical testing.....	26

ISO 19902:2020(E)

7.8.4	Resistances derived from computer simulations validated against design formulae.....	26
7.8.5	Resistances derived from unvalidated computer simulations	26
7.9	Strength and stability checks	26
7.9.1	Action and resistance factors	26
7.9.2	Strength and stability equations	26
7.9.3	Unfactored actions	27
7.10	Robustness.....	27
7.10.1	General	27
7.10.2	Damage tolerance	27
7.11	Reserve strength.....	28
7.11.1	New structures.....	28
7.11.2	Existing structures	29
7.12	Indirect actions.....	29
7.13	Structural reliability analysis.....	29
8	Actions for pre-service and removal situations.....	30
8.1	General.....	30
8.1.1	Coverage.....	30
8.1.2	Design situations.....	30
8.1.3	Actions	30
8.2	General requirements.....	31
8.2.1	Weight control	31
8.2.2	Dynamic effects.....	31
8.2.3	Action effects	31
8.3	Onshore lifting.....	33
8.3.1	General	33
8.3.2	Dynamic effects.....	33
8.3.3	Effect of tolerances	34
8.3.4	Multi-crane lift	34
8.3.5	Local factor.....	34
8.3.6	Member and joint strengths.....	35
8.3.7	Lifting attachments	35
8.3.8	Slings, shackles and fittings	36
8.4	Fabrication.....	36
8.5	Loadout.....	36
8.5.1	Direct lift	36
8.5.2	Horizontal movement onto vessel	36
8.5.3	Self-floating structures	37
8.6	Transportation	37
8.6.1	General	37
8.6.2	Metoccean conditions.....	37
8.6.3	Determination of actions	37
8.6.4	Other considerations.....	38
8.7	Installation.....	38
8.7.1	Lifted structures.....	38
8.7.2	Launched structures.....	38
8.7.3	Crane assisted uprighting of structures	38
8.7.4	Submergence pressures	38
8.7.5	Member flooding.....	39
8.7.6	Actions on the foundation during installation	39
9	Actions for in-place situations.....	39
9.1	General	39
9.2	Permanent actions (<i>G</i>) and variable actions (<i>Q</i>).....	40

9.2.1	Permanent action 1, G_1	40
9.2.2	Permanent action 2, G_2	40
9.2.3	Variable action 1, Q_1	40
9.2.4	Variable action 2, Q_2	41
9.2.5	Unintentional flooding	41
9.2.6	Position and range of permanent and variable actions	41
9.2.7	Carry down factors.....	41
9.2.8	Representation of actions from topsides.....	41
9.2.9	Weight control.....	41
9.3	Extreme metocean actions.....	42
9.3.1	General.....	42
9.3.2	Notation	42
9.4	Extreme quasi-static action due to wind, waves and current (E_e).....	42
9.4.1	Procedure for determining E_e	42
9.4.2	Direction of extreme wind, waves and current.....	43
9.4.3	Extreme global actions.....	44
9.4.4	Extreme local actions and action effects.....	44
9.4.5	Vortex induced vibrations (VIV).....	45
9.5	Extreme quasi-static action caused by waves only (E_{we}) or by waves and currents (E_{wce}).....	45
9.5.1	Procedure for determining E_{we} and E_{wce}	45
9.5.2	Models for hydrodynamic actions.....	46
9.5.3	Hydrodynamic models for appurtenances	50
9.6	Actions caused by current.....	50
9.7	Actions caused by wind	51
9.7.1	General.....	51
9.7.2	Determining actions caused by wind.....	51
9.7.3	Wind actions determined from models	52
9.8	Equivalent quasi-static action representing dynamic response caused by extreme wave conditions	52
9.8.1	General.....	52
9.8.2	Equivalent quasi-static action (D_e) representing the dynamic response.....	53
9.8.3	Global dynamic analysis in waves.....	53
9.9	Factored actions	55
9.9.1	General.....	55
9.9.2	Factored permanent and variable actions.....	55
9.9.3	Factored extreme metocean action	55
9.10	Design situations.....	56
9.10.1	General considerations on the ultimate limit state.....	56
9.10.2	Demonstrating sufficient RSR under metocean actions.....	56
9.10.3	Partial factor design format	57
9.11	Local hydrodynamic actions	58
10	Accidental and abnormal situations.....	59
10.1	General.....	59
10.1.1	Treatment of ALS events.....	59
10.1.2	Accidental events	60
10.1.3	Abnormal environmental events.....	60
10.2	Vessel collisions.....	60
10.2.1	General.....	60
10.2.2	Collision events.....	61
10.2.3	Collision process.....	61

ISO 19902:2020(E)

10.3	Dropped objects	61
10.4	Fires and explosions	62
10.5	Abnormal environmental actions.....	62
10.6	Assessment of structures following damage	63
11	Seismic design considerations	63
11.1	General	63
11.2	Seismic design procedure.....	63
11.3	Seismic reserve capacity factor	64
11.4	Recommendations for ductile design.....	64
11.5	ELE requirements	66
11.5.1	Partial action factors	66
11.5.2	ELE structural and foundation modelling.....	66
11.6	ALE requirements.....	67
11.6.1	General	67
11.6.2	ALE structural and foundation modelling.....	68
11.6.3	Non-linear static pushover analysis.....	68
11.6.4	Time-history analysis.....	70
12	Structural modelling and analysis	70
12.1	Purpose of analysis	70
12.2	Analysis principles	71
12.2.1	Extent of analysis	71
12.2.2	Calculation methods	71
12.3	Modelling	71
12.3.1	General	71
12.3.2	Level of accuracy	71
12.3.3	Geometrical definition for framed structures.....	72
12.3.4	Modelling of material properties.....	75
12.3.5	Topsides structure modelling	75
12.3.6	Appurtenances.....	75
12.3.7	Soil-structure interaction	76
12.3.8	Other support conditions.....	77
12.3.9	Local analysis structural models.....	77
12.3.10	Actions	78
12.3.11	Mass simulation.....	78
12.3.12	Damping.....	79
12.4	Analysis requirements.....	79
12.4.1	General	79
12.4.2	Fabrication	81
12.4.3	Other pre-service and removal situations.....	81
12.4.4	In-place situations	84
12.5	Types of analysis	86
12.5.1	Natural frequency analysis.....	86
12.5.2	Dynamically responding structures.....	86
12.5.3	Static and quasi-static linear analysis	86
12.5.4	Static ultimate strength analysis.....	87
12.5.5	Dynamic linear analysis	87
12.5.6	Dynamic ultimate strength analysis	87
12.6	Non-linear analysis	88
12.6.1	General	88
12.6.2	Geometry modelling	88
12.6.3	Component strength	89
12.6.4	Models for member strength.....	89
12.6.5	Models for joint strength.....	89

12.6.6	Ductility limits	89
12.6.7	Yield strength of structural steel	90
12.6.8	Models for foundation strength	90
12.6.9	Investigating non-linear behaviour	90
13	Strength of tubular members	91
13.1	General	91
13.2	Tubular members subjected to tension, compression, bending, shear, torsion or hydrostatic pressure	93
13.2.1	General	93
13.2.2	Axial tension	93
13.2.3	Axial compression	94
13.2.4	Bending	95
13.2.5	Shear	97
13.2.6	Hydrostatic pressure	98
13.3	Tubular members subjected to combined forces without hydrostatic pressure	101
13.3.1	General	101
13.3.2	Axial tension and bending	101
13.3.3	Axial compression and bending	102
13.3.4	Axial tension or compression, bending, shear and torsion	103
13.3.5	Piles	105
13.4	Tubular members subjected to combined forces with hydrostatic pressure	105
13.4.1	General	105
13.4.2	Axial tension, bending and hydrostatic pressure	106
13.4.3	Axial compression, bending and hydrostatic pressure	107
13.4.4	Axial tension or compression, bending, hydrostatic pressure, shear and torsion	108
13.5	Effective lengths and moment reduction factors	108
13.6	Conical transitions	110
13.6.1	General	110
13.6.2	Design stresses	110
13.6.3	Strength requirements without external hydrostatic pressure	113
13.6.4	Strength requirements with external hydrostatic pressure	118
13.6.5	Ring design	118
13.7	Dented tubular members	121
13.7.1	General	121
13.7.2	Dented tubular members subjected to tension, compression, bending or shear	121
13.7.3	Dented tubular members subjected to combined forces	126
13.8	Corroded tubular members	129
13.9	Grouted tubular members	129
13.9.1	General	129
13.9.2	Grouted tubular members subjected to tension, compression or bending	129
13.9.3	Grouted tubular members subjected to combined forces	133
14	Strength of tubular joints	134
14.1	General	134
14.2	Design considerations	135
14.2.1	Materials	135
14.2.2	Design forces and joint flexibility	136
14.2.3	Minimum joint strength	136
14.2.4	Weld strength	136
14.2.5	Joint classification	136
14.2.6	Detailing practice	139

ISO 19902:2020(E)

14.3	Simple tubular joints.....	142
14.3.1	General	142
14.3.2	Basic joint strength	143
14.3.3	Strength factor, Q_u	144
14.3.4	Chord force factor, Q_f	145
14.3.5	Effect of chord can length on joint strength	146
14.3.6	Strength check	147
14.4	Overlapping joints.....	148
14.5	Grouted joints	148
14.6	Ring stiffened joints.....	149
14.7	Other joint types	149
14.8	Damaged joints.....	149
14.9	Non-circular joints	150
14.10	Cast joints	150
15	Strength and fatigue resistance of other structural components.....	150
15.1	Grouted connections	150
15.1.1	General	150
15.1.2	Detailing requirements	152
15.1.3	Axial force.....	152
15.1.4	Reaction force from horizontal shear force and bending moment in piles.....	152
15.1.5	Interface transfer stress.....	153
15.1.6	Interface transfer strength.....	154
15.1.7	Strength check	157
15.1.8	Fatigue assessment	157
15.2	Mechanical connections	158
15.2.1	Types of mechanical connectors	158
15.2.2	Design requirements	158
15.2.3	Actions and forces on the connector.....	159
15.2.4	Resistance of the connector	159
15.2.5	Strength criteria.....	159
15.2.6	Fatigue criteria	160
15.2.7	Stress analysis validation	160
15.2.8	Threaded fasteners.....	161
15.2.9	Swaged connections.....	162
15.3	Clamps for strengthening and repair	163
15.3.1	General	163
15.3.2	Split sleeve clamps	163
15.3.3	Prestressed clamps	163
15.3.4	Forces on clamps.....	164
15.3.5	Clamp design	164
15.3.6	General requirements for bolted clamps.....	166
15.3.7	Bolting considerations.....	167
16	Fatigue.....	167
16.1	General	167
16.1.1	Applicability.....	167
16.1.2	The fatigue process	167
16.1.3	Fatigue assessment by analysis using $S-N$ data	167
16.1.4	Fatigue assessment by analysis using fracture mechanics methods	168
16.1.5	Fatigue assessment by other methods.....	168
16.2	General requirements.....	168
16.2.1	Applicability.....	168
16.2.2	Fatigue crack initiation and crack propagation	169

16.2.3	Sources of variable stresses causing fatigue	169
16.2.4	Service life and fatigue life.....	169
16.2.5	The nature of fatigue damage	170
16.2.6	Characterization of the stress range data governing fatigue	170
16.2.7	The long-term stress range history	170
16.2.8	Partial action and resistance factors.....	171
16.2.9	Fatigue resistance	171
16.2.10	Fatigue damage calculation	171
16.2.11	Weld improvement techniques.....	171
16.3	Description of the long-term wave environment	172
16.3.1	General.....	172
16.3.2	Wave scatter diagram.....	172
16.3.3	Mean wave directions.....	172
16.3.4	Wave frequency spectra	173
16.3.5	Wave directional spreading function.....	173
16.3.6	Periodic waves	173
16.3.7	Long-term distribution of individual wave heights.....	173
16.3.8	Current.....	173
16.3.9	Wind.....	173
16.3.10	Water depth.....	174
16.3.11	Marine growth	174
16.4	Performing the global stress analyses.....	174
16.4.1	General.....	174
16.4.2	Actions caused by waves.....	175
16.4.3	Quasi-static analyses.....	176
16.4.4	Dynamic analyses.....	176
16.5	Characterization of the stress range data governing fatigue	177
16.6	The long-term local stress range history.....	178
16.6.1	General	178
16.6.2	Probabilistic determination using spectral analysis methods.....	179
16.6.3	Deterministic determination using individual periodic waves	179
16.6.4	Approximate determination using simplified methods.....	180
16.7	Determining the long-term stress range distribution by spectral analysis.....	180
16.7.1	General.....	180
16.7.2	Stress transfer functions.....	181
16.7.3	Short-term stress range statistics	182
16.7.4	Long-term stress range statistics	182
16.8	Determining the long-term stress range distribution by deterministic analysis....	184
16.8.1	General.....	184
16.8.2	Wave height selection.....	184
16.8.3	Wave period selection	184
16.8.4	Long-term stress range distribution	184
16.9	Determining the long-term stress range distribution by approximate methods....	184
16.10	Geometric stress ranges	185
16.10.1	General.....	185
16.10.2	Stress concentration factors for tubular joints	185
16.10.3	Geometric stress ranges for other fatigue sensitive locations.....	186
16.11	Fatigue resistance of the material.....	187
16.11.1	Basic S-N curves.....	187
16.11.2	High strength steel.....	188
16.11.3	Cast joints.....	188
16.11.4	Thickness effect	188
16.12	Fatigue assessment.....	189
16.12.1	Cumulative damage and fatigue life	189

ISO 19902:2020(E)

16.12.2	Fatigue damage design factors.....	190
16.12.3	Local experience factor.....	190
16.13	Other causes of fatigue damage than wave action.....	190
16.13.1	General	190
16.13.2	Vortex induced vibrations	191
16.13.3	Wind induced vibrations.....	191
16.13.4	Transportation	191
16.13.5	Installation	191
16.13.6	Risers.....	191
16.14	Further design considerations.....	192
16.14.1	General	192
16.14.2	Conductors, caissons and risers	192
16.14.3	Miscellaneous non-load carrying attachments.....	192
16.14.4	Miscellaneous load carrying attachments	192
16.14.5	Conical transitions.....	192
16.14.6	Members in the splash zone.....	192
16.14.7	Topsides structure	193
16.14.8	Inspection strategy.....	193
16.15	Fracture mechanics methods	193
16.15.1	General	193
16.15.2	Fracture assessment.....	194
16.15.3	Fatigue crack growth law	194
16.15.4	Stress intensity factors	195
16.15.5	Fatigue stress ranges	195
16.15.6	Castings.....	195
16.16	Fatigue performance improvement of existing components	195
17	Foundation design	195
17.1	General	195
17.2	Design of pile foundations.....	196
17.3	Pile wall thickness.....	198
17.3.1	General	198
17.3.2	Pile stresses	198
17.3.3	Pile design checks.....	198
17.3.4	Check for design situation due to weight of hammer during hammer placement	198
17.3.5	Stresses during driving.....	199
17.3.6	Minimum wall thickness	200
17.3.7	Allowance for underdrive and overdrive.....	200
17.3.8	Driving shoe.....	200
17.3.9	Driving head	200
17.4	Length of pile sections	200
17.5	Shallow foundations	201
17.5.1	General	201
17.5.2	Stability of shallow foundations.....	202
18	Corrosion control	202
18.1	General	202
18.2	Corrosion zones and environmental parameters affecting corrosivity	202
18.3	Forms of corrosion, associated corrosion rates and corrosion damage	203
18.4	Design of corrosion control.....	204
18.4.1	General	204
18.4.2	Considerations in design of corrosion control.....	204
18.4.3	Coatings, linings and wrappings.....	204
18.4.4	Cathodic protection.....	205

18.4.5	Corrosion resistant materials.....	208
18.4.6	Corrosion allowance	208
18.5	Fabrication and installation of corrosion control	209
18.5.1	General.....	209
18.5.2	Coatings and linings	209
18.5.3	Cathodic protection	209
18.5.4	Corrosion resistant materials.....	209
18.6	In-service inspection, monitoring and maintenance of corrosion control	209
18.6.1	General.....	209
18.6.2	Coatings and linings	210
18.6.3	Cathodic protection	210
18.6.4	Corrosion resistant materials.....	211
19	Materials.....	211
19.1	General.....	211
19.2	Lowest anticipated service temperature.....	212
19.3	Chemical composition	212
19.3.1	General.....	212
19.3.2	Carbon equivalent.....	212
19.3.3	Modified carbon equivalent	213
19.4	Strength, toughness and other considerations	213
19.4.1	Yield strength	213
19.4.2	Toughness.....	213
19.4.3	Other considerations	214
19.5	Material category approach	214
19.5.1	Steel selection philosophy	214
19.5.2	Material characterization.....	214
19.5.3	Material selection criteria.....	214
19.5.4	Selection process.....	215
19.5.5	Steel strength groups.....	216
19.5.6	Toughness class	216
19.5.7	Applicable steels.....	217
19.6	Design class approach	217
19.6.1	General.....	217
19.6.2	DC component classification	218
19.6.3	Materials.....	218
19.6.4	Applicable steels.....	221
19.7	Cement grout	221
19.7.1	Grout materials	221
19.7.2	Onshore grout trial	221
19.7.3	Offshore grout trial.....	222
19.7.4	Offshore quality control.....	222
20	Welding, weld inspection and fabrication.....	222
20.1	General.....	222
20.2	Welding.....	223
20.2.1	Selected generic welding and fabrication standards	223
20.2.2	Weld metal and HAZ properties.....	225
20.2.3	Tubular T-, Y- and K-joints.....	229
20.3	Inspection	229
20.4	Fabrication	229
20.4.1	General.....	229
20.4.2	Weld requirements.....	230
20.4.3	Forming.....	232
20.4.4	Fabrication tolerances.....	232

ISO 19902:2020(E)

	20.4.5	Grouted connections.....	233
21		Quality control, quality assurance and documentation.....	233
	21.1	General.....	233
	21.2	Quality management system.....	234
	21.3	Quality control plan.....	235
	21.3.1	General.....	235
	21.3.2	Inspector qualifications.....	235
	21.3.3	NDT personnel qualifications.....	235
	21.3.4	Inspection of materials.....	235
	21.3.5	Inspection of fabrication.....	236
	21.3.6	Inspection of welding.....	236
	21.4	Documentation.....	236
	21.4.1	General.....	236
	21.4.2	Calculations.....	237
	21.4.3	Weight and centre of gravity reports.....	237
	21.4.4	Fabrication inspection documentation.....	237
	21.5	Drawings and specifications.....	237
22		Loadout, transportation and installation.....	238
	22.1	General.....	238
	22.1.1	Planning.....	238
	22.1.2	Records and documentation.....	239
	22.1.3	Actions and required resistance.....	239
	22.1.4	Temporary bracing and rigging.....	239
	22.2	Loadout and transportation.....	239
	22.2.1	General.....	239
	22.2.2	Loadout.....	239
	22.2.3	Cargo and launch vessels.....	240
	22.2.4	Towing vessels.....	240
	22.2.5	Actions on the platform components.....	241
	22.2.6	Buoyancy and flooding systems.....	241
	22.3	Transfer of the structure from the transport vessel into the water.....	241
	22.3.1	General.....	241
	22.3.2	Lifting operations.....	241
	22.3.3	Launching.....	242
	22.4	Placement on the sea floor and assembly of the structure.....	242
	22.4.1	General.....	242
	22.4.2	Safety of navigation.....	243
	22.4.3	Stationkeeping.....	243
	22.4.4	Positioning of the structure.....	243
	22.5	Pile installation.....	244
	22.5.1	General.....	244
	22.5.2	Stabbing guides.....	244
	22.5.3	Lifting methods.....	244
	22.5.4	Field welds.....	245
	22.5.5	Driveability studies.....	245
	22.5.6	Drilled and grouted piles.....	245
	22.5.7	Grouting pile-to-sleeve connections and grouted repairs.....	245
	22.5.8	Pile installation records.....	245
	22.6	Installation of conductors.....	245
	22.7	Topsides installation.....	245
	22.7.1	General.....	245
	22.7.2	Alignment and tolerances.....	246
	22.7.3	Securing topsides.....	246

22.8	Grounding of installation welding equipment	246
22.8.1	General	246
22.8.2	Welding equipment	246
22.8.3	Monitoring remote ground efficiency	246
Annex A (informative)	Additional information and guidance	247
Annex B (normative)	Weld CTOD testing procedures	497
Annex C (informative)	Material category approach	502
Annex D (informative)	Design class approach	508
Annex E (informative)	Welding and weld inspection requirements — Material category approach	512
Annex F (informative)	Welding and weld inspection requirements – Design class approach ...	516
Annex G (normative)	Fabrication tolerances	523
Annex H (informative)	Regional information	538
Bibliography		544

ISO 19902:2020(E)

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 7, *Offshore structures*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*.

This second edition cancels and replaces the first edition (ISO 19902:2007), which has been technically revised. It also incorporates the Amendment ISO 19902:2007/Amd.1:2013. The main changes compared to the previous edition are as follows:

- duplication of symbols has largely been eliminated (see Clause 4);
- use of metocean versus environmental has been rationalized. Metocean now refers to wind, wave and current actions only while environmental encompasses metocean, ice and seismic;
- high strength steel: applicable specified minimum yield strength increased to 800 MPa but only with respect to non-material requirements;
- hazards and designing for hazards moved from 10.1.1 and 10.1.2, respectively, to 6.2.2 and 6.2.3, respectively;
- deck elevation (6.3.3.2) expanded to include air gap plus need to consider crest levels 15 % higher than calculated values;
- exposure levels (6.6) are addressed in ISO 19900 so text modified accordingly;

- damage tolerance now more appropriately addressed in 7.10.2 rather than 10.1.6.1;
- reserve strength ratio (7.11.1): detailed procedure introduced because of general lack of adequate, appropriate documentation;
- structural reliability analysis (7.13): text reordered and supplemented by text from completely rewritten A.9.9.3.3;
- onshore lifting (8.3): because offshore lifting is now addressed in ISO 19901-6, the text and tabulated information on DAFs have been modified accordingly;
- multi-crane lifts (8.3.4): for consistency with ISO 19901-6, now considered in place of dual lifts;
- gravity load partial action factors for extreme conditions reduced from 1.1 to 1.0 (Table 9.10-1 and Table 8.2-1);
- clarified that for abnormal design situations, verification is required even if wave-in-deck events do not occur to ensure that the appropriate robustness requirement is realized;
- ELE structural and foundation modelling: new first paragraph added in response to questions to Seismic Panel (responsible for ISO 19901-2) regarding the appropriate weight of personnel to consider during an event;
- tubular member diameter to thickness ratio non-dimensionalized (13.1);
- shear and torsion now included in all tubular member strength formulae including those addressing hydrostatic pressure;
- tubular member strength formulae for combined axial and bending loading now of cosine interaction form instead of previously adopted linear interaction;
- formulae (13.6-2) and (13.6-3) relating to conical transitions corrected;
- tubular joint strength formulae nearly all changed through adoption of the API RP 2A-WSD 21st Edition Supplement 2 (October 2005) tubular joint formulae supplemented by some limited non-linear FEA;
- grouted connections: pile outer diameter limited (15.1.5.2);
- use of HSS in fatigue applications: warning re possible hydrogen embrittlement when yield strength exceeds 700 MPa (16.11.2);
- fatigue damage design factors: effect of considering life cycle (16.12.2);
- Clause 17: detailed pile design requirements moved to ISO 19901-4 so no longer addressed;
- Clause 19: expanded to include more detailed requirements for Design class approach;
- Clause 20: expanded to include more detailed requirements for Design class approach;
- Clause 21: some requirements for Design class approach added to Tables 21.2-1 and 21.4-1 (previously 21.7-1);
- particular standards identified for NDT personnel qualification (21.3.3);
- Clause 21: existing 21.4 to 21.6 moved to ISO 19901-6;

ISO 19902:2020(E)

- Clause 22: reference to ISO 19901-6 added where appropriate. Requirements for flotation (22.3.2.4) and crane barges (22.3.2.5) combined (22.3.3.4);
- Clauses 23 to 25 (and A.23 to A.25) deleted because ISO 19901-9 *Structural integrity management* approved;
- Annex A modified to accommodate above changes to normative text as appropriate;
- Table C.1: extra strength groups for chord cans and padeyes;
- Table C.4 enlarged considerably;
- Annex D completely rewritten;
- E.3: 100 % CVI now required for all welding;
- Annex F: substantially rewritten and expanded. Now important to consider whether LAST is $\geq -10^{\circ}\text{C}$ or $< -10^{\circ}\text{C}$;
- new Table F.5 and Figure F.1 similar to existing requirements in Table D.3 and Figure D.1, now deleted from Annex D;
- new Table F.6 addressing subsea structures whereas Table F.5 only concerns jacket structures;
- minimum RSR requirement added for North West Europe (H.2.3.1);
- H.3.3.2 Canadian welding references revised;
- US Customary units have been deleted;
- a number of figures have been corrected.

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 International Standards on offshore structures prepared by TC 67/SC 7 (i.e. ISO 19900, the ISO 19901 series, ISO 19902, ISO 19903, ISO 19904-1, the ISO 19905 series, 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 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.

These documents applicable to the various types of offshore structure are intended to provide wide latitude in the choice of structural configurations, materials and techniques without hindering innovation. Sound engineering judgment is therefore crucial in the use of these documents.

Annex A provides background to and guidance on the use of this document and should be read in conjunction with the main body of this document. The clause numbering in Annex A is the same as in the normative text to facilitate cross-referencing.

Materials, welding and weld inspection requirements can be based either on a “material category” or on a “design class” approach, as discussed in Clauses 19 and 20. If the material category approach is used, see the corresponding provisions of Annexes C and E; if the design class approach is used, see the corresponding provisions of Annexes D and F.

Annex G gives requirements on fabrication tolerances.

Regional information on the application of the document to certain specific offshore areas is provided in Annex H.

To meet certain needs of industry for linking software to specific elements in this document, a special numbering system has been permitted for figures, tables, formulae and bibliographic references.

Petroleum and natural gas industries — Fixed steel offshore structures

1 Scope

This document specifies requirements and provides recommendations applicable to the following types of fixed steel offshore structures for the petroleum and natural gas industries:

- caissons, free-standing and braced;
- jackets;
- monotowers;
- towers.

In addition, it is applicable to compliant bottom founded structures, steel gravity structures, jack-ups, other bottom founded structures and other structures related to offshore structures (such as underwater oil storage tanks, bridges and connecting structures).

This document contains requirements for planning and engineering of the design, fabrication, transportation and installation of new structures as well as, if relevant, their future removal.

NOTE 1 Specific requirements for the design of fixed steel offshore structures in arctic environments are presented in ISO 19906.

NOTE 2 Requirements for topsides structures are presented in ISO 19901-3; for marine operations in, ISO 19901-6; for structural integrity management, in ISO 19901-9 and for the site-specific assessment of jack-ups, in ISO 19905-1.

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

ISO 10414-1, *Petroleum and natural gas industries — Field testing of drilling fluids — Part 1: Water-based fluids*

ISO 12135, *Metallic materials — Unified method of test for the determination of quasistatic fracture toughness*

ISO 15653, *Metallic materials — Method of test for the determination of quasistatic fracture toughness of welds*

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

ISO 19902:2020(E)

ISO 19901-1, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 1: Meticulous 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 19901-3, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 3: Topsides structure*

ISO 19901-4, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 4: Geotechnical and foundation design considerations*

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

ISO 19901-8, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 8: Marine soil investigations*

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

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

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

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