

E DIN EN ISO 19905-1:2022-03 (E)

Erscheinungsdatum: 2022-02-04

Petroleum and natural gas industries - Site-specific assessment of mobile offshore units - Part 1: Jack-ups (ISO/DIS 19905-1:2022); English version prEN ISO 19905-1:2022

Contents	Page
Foreword.....	x
Introduction.....	xiii
1 Scope.....	1
2 Normative references.....	2
3 Terms and definitions	2
4 Symbols and abbreviated terms	16
4.1 Symbols.....	16
4.2 Abbreviated terms.....	18
5 Overall considerations	19
5.1 General.....	19
5.1.1 Interaction with ISO 19905-4	19
5.1.2 Competency	20
5.1.3 Planning.....	20
5.1.4 Assessment situations and associated criteria	20
5.1.5 Reporting	20
5.1.6 Regulations.....	20
5.1.7 Classification of unit.....	20
5.2 Assessment approach	21
5.3 Selection of assessment situations	23
5.4 Determination of assessment situations.....	24
5.4.1 General.....	24
5.4.2 Reaction point and foundation fixity	24
5.4.3 Extreme storm event approach angle.....	24
5.4.4 Weights and centre of gravity.....	24
5.4.5 Hull elevation	25
5.4.6 Leg length reserve.....	25
5.4.7 Adjacent structures.....	25
5.4.8 Other.....	25
5.5 Exposure levels	25
5.5.1 Determination of exposure level.....	25
5.5.2 Exposure level L1	25
5.5.3 Exposure level L2	26
5.5.4 Exposure level L3	26
5.5.5 Exposure level for earthquake	26
5.6 Analytical tools	26
6 Data to assemble for each site	27
6.1 Applicability.....	27
6.2 Jack-up data.....	27
6.3 Site and operational data	27
6.4 Metocean data	28
6.5 Geophysical and geotechnical data.....	29
6.6 Earthquake data	29
6.7 Ice data.....	29

7	Actions.....	29
7.1	Applicability	29
7.2	General.....	30
7.3	Metoccean actions.....	30
7.3.1	General.....	30
7.3.2	Hydrodynamic model.....	30
7.3.3	Wave and current actions	31
7.3.4	Wind actions	31
7.4	Functional actions.....	31
7.5	Displacement dependent effects	31
7.6	Dynamic effects.....	32
7.7	Earthquakes	32
7.8	Ice actions	32
7.9	Other actions.....	32
8	Structural modelling.....	32
8.1	Applicability	32
8.2	Overall considerations	32
8.2.1	General.....	32
8.2.2	Modelling philosophy.....	32
8.2.3	Levels of FE modelling.....	33
8.3	Modelling the leg	33
8.3.1	General.....	33
8.3.2	Detailed leg.....	33
8.3.3	Equivalent leg (stick model)	33
8.3.4	Combination of detailed and equivalent leg.....	33
8.3.5	Stiffness adjustment.....	34
8.3.6	Leg inclination.....	34
8.4	Modelling the hull	34
8.4.1	General.....	34
8.4.2	Detailed hull model	34
8.4.3	Equivalent hull model	34
8.5	Modelling the leg-to-hull connection	34
8.5.1	General.....	34
8.5.2	Guide systems.....	34
8.5.3	Elevating system.....	34
8.5.4	Fixation system.....	35
8.5.5	Shock pad — floating jacking systems.....	35
8.5.6	Jackcase and associated bracing.....	35
8.6	Modelling the spudcan and foundation.....	35
8.6.1	Spudcan structure.....	35
8.6.2	Seabed reaction point.....	35
8.6.3	Foundation modelling	35
8.7	Mass modelling	36
8.8	Application of actions.....	36
8.8.1	Assessment actions.....	36
8.8.2	Functional actions due to fixed load and variable load.....	38
8.8.3	Hull sagging.....	38
8.8.4	Metoccean actions.....	39
8.8.5	Inertial actions.....	39
8.8.6	Large displacement effects	39
8.8.7	Conductor actions	39
8.8.8	Earthquake actions.....	39

8.8.9	Ice actions	39
9	Foundations	39
9.1	Applicability	39
9.2	General	40
9.3	Geotechnical analysis of independent leg foundations	40
9.3.1	Foundation modelling and assessment	40
9.3.2	Leg penetration during preloading	41
9.3.3	Yield interaction	41
9.3.4	Foundation stiffnesses	42
9.3.5	Vertical-horizontal foundation capacity envelopes	42
9.3.6	Acceptance checks	43
9.4	Other considerations	44
9.4.1	Skirted spudcans	44
9.4.2	Hard sloping strata	45
9.4.3	Footprint considerations	45
9.4.4	Leaning instability	45
9.4.5	Leg extraction difficulties	45
9.4.6	Cyclic mobility, liquefaction and liquefaction-induced lateral flow	45
9.4.7	Scour	46
9.4.8	Spudcan interaction with adjacent infrastructure	46
9.4.9	Geohazards	46
9.4.10	Carbonate material	46
10	Structural response	46
10.1	Applicability	46
10.2	General considerations	47
10.3	Types of analyses and associated methods	47
10.4	Common parameters	48
10.4.1	General	48
10.4.2	Natural periods and affecting factors	48
10.4.3	Damping	49
10.4.4	Foundations	49
10.4.5	Storm excitation	50
10.5	Storm analysis	50
10.5.1	General	50
10.5.2	Two-stage deterministic storm analysis	50
10.5.3	Stochastic storm analysis	52
10.5.4	Initial leg inclination	52
10.5.5	Limit state checks	52
10.6	Fatigue analysis	53
10.7	Earthquake analysis	53
10.8	Ice	54
10.8.1	General	54
10.8.2	ULS	54
10.8.3	ALS	55
10.8.4	Assessments in the area types	55
10.8.5	Additional factors to be considered for arctic and cold regions	55
10.9	Accidental situations	55
10.10	Alternative analysis methods	55
10.10.1	Ultimate strength analysis	55
10.10.2	Methodology	56
11	Long-term applications	56

11.1	Applicability.....	56
11.2	Assessment data	56
11.3	Special requirements.....	57
11.3.1	Fatigue assessment.....	57
11.3.2	Weight control.....	57
11.3.3	Corrosion protection	57
11.3.4	Marine growth.....	57
11.3.5	Foundations	57
11.4	Survey requirements	57
12	Structural strength	58
12.1	Applicability.....	58
12.1.1	General.....	58
12.1.2	Truss type legs	58
12.1.3	Other leg types	58
12.1.4	Fixation system and/or elevating system	59
12.1.5	Spudcan strength including connection to the leg	59
12.1.6	Overview of the assessment procedure.....	59
12.2	Classification of member cross-sections	59
12.2.1	Member types.....	59
12.2.2	Material yield strength.....	59
12.2.3	Classification definitions	59
12.3	Section properties of non-circular prismatic members.....	60
12.3.1	General.....	60
12.3.2	Plastic and compact sections	60
12.3.3	Semi-compact sections.....	60
12.3.4	Slender sections.....	61
12.3.5	Cross-section properties for the assessment.....	61
12.4	Effects of axial force on bending moment	61
12.5	Strength of tubular members	61
12.6	Strength of non-circular prismatic members	61
12.7	Assessment of joints.....	62
13	Acceptance criteria.....	62
13.1	Applicability.....	62
13.1.1	General.....	62
13.1.2	Ultimate limit states.....	62
13.1.3	Serviceability and accidental limit states.....	63
13.1.4	Fatigue limit states	63
13.2	General formulation of the assessment check.....	63
13.3	Leg strength assessment.....	64
13.4	Spudcan strength assessment	64
13.5	Holding system strength assessment.....	64
13.6	Hull elevation assessment	64
13.7	Leg length reserve assessment.....	65
13.8	Overturning stability assessment	65
13.9	Foundation integrity assessment.....	66
13.9.1	Foundation capacity check	66
13.9.2	Displacement check	67
13.10	Interaction with adjacent infrastructure	67
13.11	Temperatures.....	67
Annex A (informative)	Additional information and guidance.....	68
A.1	Scope.....	68

A.2	Normative references.....	68
A.3	Terms and definitions	68
A.4	Symbols.....	68
A.4.1	Symbols used in A.1.....	68
A.4.2	Symbols used in A.2.....	68
A.4.3	Symbols used in A.3.....	68
A.4.4	Symbols used in A.4.....	68
A.4.5	Symbols used in A.5.....	68
A.4.6	Symbols used in A.6.....	68
A.4.7	Symbols used in A.7.....	70
A.4.8	Symbols used in A.8.....	72
A.4.9	Symbols used in A.9.....	72
A.4.10	Symbols used in A.10.....	76
A.4.11	Symbols used in A.11.....	77
A.4.12	Symbols used in A.12.....	77
A.5	Overall considerations.....	81
A.6	Data assembled for each site	81
A.6.1	Scope.....	81
A.6.2	Jack-up data.....	81
A.6.3	Site data	81
A.6.4	Metocean data	81
A.6.5	Geophysical and geotechnical data.....	91
A.6.6	Earthquake data	95
A.6.7	Ice data.....	95
A.7	Actions.....	95
A.7.1	Applicability.....	95
A.7.2	General.....	95
A.7.3	Metocean actions.....	95
A.7.4	Functional actions.....	115
A.7.5	Displacement dependent actions.....	116
A.7.6	Dynamic effects.....	116
A.7.7	Earthquakes	116
A.7.8	Ice actions	116
A.7.9	Other actions.....	116
A.8	Structural modelling.....	117
A.8.1	Applicability.....	117
A.8.2	Overall considerations.....	117
A.8.3	Modelling the leg	120
A.8.4	Modelling the hull	124
A.8.5	Modelling the leg-to-hull connection.....	124
A.8.6	Modelling the spudcan and foundation	134
A.8.7	Mass modelling	135
A.8.8	Application of actions	135
A.9	Foundations	140
A.9.1	Applicability.....	140
A.9.2	General.....	140
A.9.3	Geotechnical analysis of independent leg foundations.....	140
A.9.4	Other considerations.....	197
A.10	Structural response.....	206
A.10.1	Applicability.....	206
A.10.2	General considerations.....	206
A.10.3	Types of analyses and associated methods	206

A.10.4	Common parameters	207
A.10.5	Storm analysis	218
A.10.6	Fatigue analysis	232
A.10.7	Earthquake analysis.....	232
A.10.8	Ice.....	235
A.10.9	Accidental situations	238
A.10.10	Alternative analysis methods	239
A.11	Long-term applications.....	239
A.11.1	Applicability.....	239
A.11.2	Assessment data	239
A.11.3	Special requirements.....	240
A.11.4	Survey requirements	244
A.12	Structural strength	245
A.12.1	Applicability.....	245
A.12.2	Classification of member cross-sections	246
A.12.3	Section properties of non-circular prismatic members.....	254
A.12.4	Effects of axial force on bending moment	260
A.12.5	Strength of tubular members	264
A.12.6	Strength of non-circular prismatic members	271
A.12.7	Assessment of joints.....	288
A.13	Acceptance checks	289
Annex B (normative) Summary of partial action and partial resistance factors.....		290
Annex C (informative) Additional information on structural modelling and response analysis		292
C.1	Guidance on 8.5 — Modelling the leg-to-hull connections.....	292
C.2	Guidance on A.10.5.3.4 — Methods for determining the MPME	293
C.2.1	Guidance on the first method of Table A.10.5-1 — Fitting Weibull distributions to the results of a number of time domain simulations to determine responses at the required probability level and average the results.....	293
C.2.2	Guidance on the second method of Table A.10.5-1: Fitting Gumbel distribution to histogram of absolute maximum responses from a number of time domain simulations to determine responses at required probability level.....	295
C.2.3	Guidance on the third method of Table A.10.5-1 — Application of Winterstein's Hermite polynomial method to the results of time domain simulation(s)	297
C.2.4	Guidance on the fourth method of Table A.10.5-1: Application of drag-inertia method to determine the base shear and overturning moment DAF from time domain simulation.....	299
Annex D (informative) Foundations — Recommendations for the acquisition of site-specific geotechnical data		302
Annex E (informative) Foundations — Additional information and alternative approaches		309
E.1	Guidance on A.9.3.2.2: Penetration in clays — Bearing capacity factors of Houlsby and Martin	309
E.2	Guidance on A.9.3.2.4 — Penetration in silica sands	316
E.3	Guidance on A.9.3.2.6.4 — Punch-through — Sand overlying clay — Further details on alternate methods.....	318
E.4	Calculated foundation capacities approach	322
E.4.1	General.....	322
E.4.2	Background	322
E.4.3	Suitable spudcan geometries.....	323
E.4.4	Criterion for use of calculated foundation capacities.....	325
E.4.5	Soil strength parameters.....	327

E.4.6	Calculated foundation yield surface and fixity.....	327
E.4.7	Bearing capacity check.....	328
E.4.8	Sliding capacity check.....	328
E.4.9	Spudcan-to-leg connection and spudcan structural integrity checks.....	329
E.4.10	Precautions and considerations when adopting calculated foundation capacities	329
E.5	Example of simplified free-field liquefaction assessment calculation method.....	331
E.5.1	General.....	331
E.5.2	Calculation of CRR based on shear wave velocity.....	332
E.5.3	Calculation of the CRR based on CPT data.....	332
E.5.4	CSR calculation.....	333
E.5.5	Ratio of CRR and CSR.....	334
Annex F (informative)	Informative annex on Clause A.12 — Structural strength	335
F.1	Guidance on A.12.6.2.4 — Axial compressive column buckling strength.....	335
F.2	Guidance on A.12.6.3.2 — Interaction formula approach — Determination of η	336
F.3	Guidance on A.12.6.3.3 — Interaction surface approach	337
Annex G (informative)	Contents list for typical site-specific assessment report	cccxlix
Annex H (informative)	Regional information.....	ccclvi
H.1	General.....	ccclvi
H.2	Norway	ccclvi
H.2.1	Description of region	ccclvi
H.2.2	Regulatory framework.....	ccclvi
H.2.3	Technical requirements	ccclvi
H.2.4	Technical commentary.....	ccclviii
H.2.5	Additional national requirements	ccclviii
H.3	US Gulf of Mexico	ccclviii
H.3.1	Description of region	ccclviii
H.3.2	Regulatory framework.....	ccclx
H.3.3	Metoccean conditions.....	ccclx
Bibliography		ccclxiv