ISO 19905-1:2023-10 (E)

Oil and gas industries including lower carbon energy - Site-specific assessment of mobile offshore units - Part 1: Jack-ups: elevated at a site

Contents

Page

Foreword viii

Introduction xi

1 Scope 1

2 Normative references 1

3 Terms and definitions 2

4 Symbols and abbreviated terms 15
4.1 Symbols 15
4.1.1 General 15
4.1.2 Symbols used in A.6 17
4.1.3 Symbols used in A.7 19
4.1.4 Symbols used in A.8 21
4.1.5 Symbols used in A.9 and Annex E 22
4.1.6 Symbols used in A.10 25
4.1.7 Symbols used in A.11 26
4.1.8 Symbols used in A.12 27
4.2 Abbreviated terms 31

5 Overall considerations 32
5.1 General 32
5.1.2 Competency 33
5.1.3 Planning 33
5.1.4 Assessment situations and associated criteria 33
5.1.5 Reporting 33
5.1.6 Regulations 33
5.1.7 Classification of unit 34
5.2 Assessment approach 34
5.3 Selection of assessment situations 36
5.4 Determination of assessment situations 37
5.4.1 General 37
5.4.2 Reaction point and foundation fixity 37
5.4.3 Extreme storm event approach angle 37
5.4.4 Weights and centre of gravity 37
5.4.5 Hull elevation 37
5.4.6 Leg length reserve 38
5.4.7 Adjacent structures 38
5.4.8 Other 38
5.5 Exposure levels 38
5.5.1 Determination of exposure level 38
5.5.2 Exposure level L1 38
5.5.3 Exposure level L2 38
5.5.4 Exposure level L3 39
5.5.5 Exposure level for earthquake 39
5.6 Analytical tools 39

6 Data to assemble for each site 39
6.1 Applicability 39
6.2 Jack-up data 39
6.3 Site and operational data 40
6.4 Metocean data 40

6.5 Geophysical and geotechnical data ... 41
6.6 Earthquake data ... 42
6.7 Ice data ... 42
7 Actions ... 42
7.1 Applicability ... 42
7.2 General ... 42
7.3 Metocean actions ... 43
7.3.1 General ... 43
7.3.2 Hydrodynamic model ... 43
7.3.3 Wave and current actions ... 43
7.3.4 Wind actions ... 43
7.4 Functional actions ... 44
7.5 Displacement dependent effects ... 44
7.6 Dynamic effects ... 44
7.7 Earthquakes ... 44
7.8 Ice actions ... 44
7.9 Other actions ... 44
8 Structural modelling ... 44
8.1 Applicability ... 44
8.2 Overall considerations ... 45
8.2.1 General ... 45
8.2.2 Modelling philosophy ... 45
8.2.3 Levels of FE modelling ... 45
8.3 Modelling the leg ... 46
8.3.1 General ... 46
8.3.2 Detailed leg ... 46
8.3.3 Equivalent leg (stick model) ... 46
8.3.4 Combination of detailed and equivalent leg ... 46
8.3.5 Stiffness adjustment ... 46
8.3.6 Leg inclination ... 46
8.4 Modelling the hull ... 46
8.4.1 General ... 46
8.4.2 Detailed hull model ... 46
8.4.3 Equivalent hull model ... 46
8.5 Modelling the leg-to-hull connection ... 47
8.5.1 General ... 47
8.5.2 Guide systems ... 47
8.5.3 Elevating system ... 47
8.5.4 Fixation system ... 47
8.5.5 Shock pad — floating jacking systems ... 47
8.5.6 Jackcase and associated bracing ... 47
8.6 Modelling the spudcan and foundation ... 47
8.6.1 Spudcan structure ... 47
8.6.2 Seabed reaction point ... 47
8.6.3 Foundation modelling ... 48
8.7 Mass modelling ... 48
8.8 Application of actions ... 49
8.8.1 Assessment actions ... 49
8.8.2 Functional actions due to fixed load and variable load ... 50
8.8.3 Hull sagging ... 51
8.8.4 Metocean actions ... 51
8.8.5 Inertial actions ... 51
8.8.6 Large displacement effects ... 51
8.8.7 Conductor actions ... 51

8.8.8 Earthquake actions 51
8.8.9 Ice actions 51

9 Foundations 52
9.1 Applicability 52
9.2 General 52
9.3 Geotechnical analysis of independent leg foundations 52
9.3.1 Foundation modelling and assessment 52
9.3.2 Leg penetration during preloading 53
9.3.3 Yield interaction 54
9.3.4 Foundation stiffnesses 54
9.3.5 Vertical-horizontal foundation capacity envelopes 54
9.3.6 Acceptance checks 55
9.4 Other considerations 56
9.4.1 Skirted spudcans 56
9.4.2 Hard sloping strata 57
9.4.3 Footprint considerations 57
9.4.4 Leaning instability 57
9.4.5 Leg extraction difficulties 57
9.4.6 Cyclic mobility, liquefaction and liquefaction-induced lateral flow 57
9.4.7 Scour 58
9.4.8 Spudcan interaction with adjacent infrastructure 58
9.4.9 Geohazards 58
9.4.10 Carbonate material 58

10 Structural response 58
10.1 Applicability 58
10.2 General considerations 59
10.3 Types of analyses and associated methods 59
10.4 Common parameters 60
10.4.1 General 60
10.4.2 Natural periods and related considerations 60
10.4.3 Damping 61
10.4.4 Foundations 61
10.4.5 Storm excitation 61
10.5 Storm analysis 61
10.5.1 General 61
10.5.2 Two-stage deterministic storm analysis 62
10.5.3 Stochastic storm analysis 63
10.5.4 Initial leg inclination 64
10.5.5 Limit state checks 64
10.6 Fatigue analysis 64
10.7 Earthquake analysis 64
10.8 Ice 66
10.8.1 General 66
10.8.2 ULS 66
10.8.3 ALS 66
10.8.4 Assessments in the area types 67
10.8.5 Additional factors for arctic and cold regions 67
10.9 Accidental situations 67
10.10 Alternative analysis methods 67
10.10.1 Ultimate strength analysis 67
10.10.2 Methodology 67

11 Long-term applications 68
11.1 Applicability 68
11.2 Assessment data 68

11.3 Special requirements 68
11.3.1 Fatigue assessment 68
11.3.2 Weight control 68
11.3.3 Corrosion protection 69
11.3.4 Marine growth 69
11.3.5 Foundations 69
11.4 Survey requirements 69

12 Structural strength 69
12.1 Applicability 69
12.1.1 General 69
12.1.2 Truss type legs 70
12.1.3 Other leg types 70
12.1.4 Fixation system and/or elevating system 70
12.1.5 Spudcan strength including connection to the leg 70
12.1.6 Overview of the assessment procedure 71
12.2 Classification of member cross-sections 71
12.2.1 Member types 71
12.2.2 Material yield strength 71
12.2.3 Classification definitions 71
12.3 Section properties of non-circular prismatic members 72
12.3.1 General 72
12.3.2 Plastic and compact sections 72
12.3.3 Semi-compact sections 72
12.3.4 Slender sections 72
12.3.5 Cross-section properties for the assessment 72
12.4 Effects of axial force on bending moment 73
12.5 Strength of tubular members 73
12.6 Strength of non-circular prismatic members 73
12.7 Assessment of joints 73

13 Acceptance criteria 73
13.1 Applicability 73
13.1.1 General 73
13.1.2 Ultimate limit states 74
13.1.3 Serviceability and accidental limit states 74
13.1.4 Fatigue limit states 74
13.2 General formulation of the assessment check 74
13.3 Leg strength assessment 75
13.4 Holding system strength assessment 76
13.5 Spudcan strength assessment 76
13.6 Hull elevation assessment 76
13.7 Leg length reserve assessment 76
13.8 Overturning stability assessment 77
13.9 Foundation integrity assessment 78
13.9.1 Foundation capacity check 78
13.10 Displacement check 79
13.11 Interaction with adjacent infrastructure 79
13.12 Temperatures 79

Annex A (informative) Additional information and guidance 80

Annex B (normative) Summary of partial action and partial resistance factors 283

Annex C (informative) Additional information on structural modelling and response analysis 285

Annex D (informative) Foundations — Recommendations for the acquisition of site-specific geotechnical data **295**

Annex E (informative) Foundations — Additional information and alternative approaches **301**

Annex F (informative) Guidance on Clause A.12 — Structural strength **328**

Annex G (informative) Contents list for typical site-specific assessment report **342**

Annex H (informative) Regional information **349**

Bibliography **358**