INTERNATIONAL STANDARD

ISO 29400

Second edition
2020-05

Ships and marine technology — Offshore wind energy — Port and marine operations

Navires et technologie maritime — Énergie éolienne offshore — Opérations portuaires et maritimes

This document is a preview generated by EVS

Reference number
ISO 29400:2020(E)

© ISO 2020

This document is a preview generated by EVS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

 © ISO 2020 – All rights reserved

Contents

Page

Foreword ... **xi**
Introduction ... **xii**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **2**
4 Symbols and abbreviated terms ... **25**
4.1 Symbols ... 25
4.2 Abbreviated terms ... 29
5 General considerations ... **32**
5.1 Introduction ... 32
5.1.1 General ... 32
5.1.2 Safety requirements ... 33
5.2 Jurisdiction ... 34
5.2.1 Introduction ... 34
5.2.2 Safety of life at sea ... 34
5.2.3 Environment ... 35
5.3 HSSE plan ... 35
5.4 Risk management ... 35
5.4.1 Introduction ... 35
5.4.2 Techniques to evaluate risks ... 36
5.5 Job safety analysis ... 36
5.6 Environmental impact study ... 37
5.7 Manning, qualifications, job and safety training ... 37
5.8 Daily progress and incident reporting ... 37
5.9 Personnel tracking ... 38
5.10 Approval by national authorities ... 38
6 Organization, documentation and planning ... **38**
6.1 Introduction ... 38
6.2 Organization and communication ... 39
6.2.1 Project organization ... 39
6.2.2 Operational organization ... 39
6.3 Quality assurance and administrative procedures ... 40
6.4 Technical procedures ... 40
6.5 Technical documentation ... 41
6.5.1 Document numbering system ... 41
6.5.2 RAMS for port and marine operations ... 41
6.5.3 Operational schedule/programme ... 42
6.5.4 Contingency philosophy ... 43
6.5.5 Contingency planning and emergency procedures ... 43
6.5.6 Emergency response coordination plan ... 44
6.5.7 As-built documentation/Post construction file ... 45
6.5.8 Standards for data transfer to CAD systems ... 46
6.6 Certification and documentation ... 48
6.6.1 Introduction ... 48
6.6.2 Required or recommended documentation ... 49
6.7 Marine warranty survey ... 49
6.7.1 Introduction ... 49
6.7.2 Role of the marine warranty surveyor ... 49
6.7.3 MWS scope of work ... 50
6.7.4 Certificate of approval ... 50
6.8 Systems and equipment ... 51
6.8.1 Introduction ... 51

This document is a preview generated by EVS

© ISO 2020 – All rights reserved

6.8.2 Marine vessels ... 51
6.8.3 Major equipment ... 51

7 Metocean requirements ... 51
7.1 Introduction ... 51
7.2 Weather-restricted/weather-unrestricted operations ... 52
7.2.1 Weather-restricted operations ... 52
7.2.2 Weather-unrestricted operations ... 52
7.3 Metocean conditions ... 52
7.3.1 Wind ... 52
7.3.2 Wave, wave period and swell conditions ... 53
7.3.3 Current ... 53
7.3.4 Other metocean factors ... 53
7.3.5 Temperature ... 54
7.3.6 Marine growth ... 54
7.4 Metocean criteria ... 54
7.4.1 Design criteria and operational limits ... 54
7.4.2 Return periods ... 55
7.4.3 Vessel response-based analysis ... 55
7.4.4 Probability distributions of sea state parameters ... 55
7.5 Operational duration, contingency and weather window ... 55
7.5.1 Planned operational duration ... 55
7.5.2 Weather window and contingency ... 56
7.5.3 Point of no return ... 56
7.5.4 Forecasted and monitored operational limits, metocean reduction factor ... 57
7.6 Weather forecasts ... 58
7.6.1 Introduction ... 58
7.6.2 Forecast parameters ... 58
7.7 On-site monitoring ... 58

8 Onshore transport and nearshore transport ... 59
8.1 Introduction ... 59
8.2 Structural integrity calculations ... 59
8.3 Transport by road ... 59
8.4 Transport via inland waterways ... 59
8.5 Transport via nearshore waterways ... 60
8.6 Transport via railways ... 60
8.7 Transport frames and equipment ... 60

9 Intermediate storage areas ... 60
9.1 Introduction ... 60
9.2 Infrastructure requirements ... 61
9.2.1 Load bearing ... 61
9.2.2 Surface ... 61
9.3 Storage frames and equipment ... 61
9.4 Requirements of components for storage ... 62
9.5 Protection of components against environmental conditions ... 62
9.6 Structural integrity calculations ... 62
9.6.1 Introduction ... 62
9.6.2 Vortex shedding ... 62
9.7 Security measures ... 63

10 Pre-assembly ... 63
10.1 Introduction ... 63
10.2 Pre-assembly area requirements ... 63
10.3 Pre-assembly activities ... 63
10.4 Pre-assembly equipment ... 64
10.5 Structural integrity calculations ... 64
10.6 Vortex shedding ... 64
10.7 Security measures ... 64

This document is a preview generated by EVS

 © ISO 2020 – All rights reserved

11 Port activities **64**
11.1 Introduction 64
11.2 Accessibility of harbour areas 64
11.2.1 Water access 64
11.2.2 Inland access 65
11.3 Storage areas of quayside 65
11.4 Security measures 65
11.5 Quayside requirements 65
11.6 Port subsea soil requirements for jacking activities 65
12 Weight control **66**
12.1 Introduction 66
12.2 Weight control classes 67
12.3 Weight and CoG constraints 67
12.4 Weight control monitoring 67
12.5 Dimensional control 68
12.6 Serial items 68
12.7 Weight determinations 68
13 Stability **68**
13.1 Introduction 68
13.2 General requirements 69
13.3 Stability calculations 69
13.4 Intact stability 70
13.4.1 Introduction 70
13.4.2 Intact stability criteria 71
13.5 Damage stability 72
13.5.1 Introduction 72
13.5.2 Damage stability criteria 74
13.6 Single-barge transports 75
13.7 Multi-barge transports 75
13.8 Classed vessels 76
13.9 Self-floating structures 76
13.9.1 Introduction 76
13.9.2 Intact and damage stability 76
13.9.3 Upending and installation of self-floating and launched structures 77
13.10 Loadout operations 78
13.11 Watertight integrity and temporary closures 79
13.12 Inclining tests 79
14 Ballasting operations **80**
14.1 Introduction 80
14.2 Ballast calculations for different stages 81
14.3 In ballast system 81
14.3.1 Operational aspects 81
14.3.2 Other operational considerations 82
14.4 Protection against damage and deterioration 82
14.4.1 Introduction 82
14.4.2 Freezing 83
14.5 Prevention of progressive flooding in damage condition 83
14.6 Control and indicating systems 83
14.7 Pumps 84
14.7.1 Introduction 84
14.7.2 Specification and layout 84
14.7.3 Pump performance curves and functional limitations 84
14.8 Valve arrangements 84
14.9 Vent systems 85
14.10 Air cushion system capacity 85
14.11 System testing 85

This document is a preview generated by EVS

© ISO 2020 – All rights reserved

15 Loadout **85**
15.1 Introduction 85
15.2 Categories of loadout 86
15.2.1 Introduction 86
15.2.2 Design: structural analysis during all loadout phases 87
15.2.3 Loadout planning 87
15.2.4 Cargo weight details and CoG information 87
15.2.5 Deck loading plan 88
15.3 Structure being loaded 88
15.4 Site and quay 88
15.5 Barge 89
15.6 Link beams, skidways and skidshoes 89
15.7 Moorings 89
15.7.1 Weather-restricted operation 89
15.7.2 Temporary mooring system 90
15.8 Grounded loadouts 90
15.9 Pumping and ballasting 91
15.9.1 Pump capacity 91
15.9.2 Recommended pump capacity 91
15.10 Loadouts by trailers, SPMTs or hydraulic skidshoes 92
15.10.1 Introduction 92
15.10.2 Structural capacity 92
15.10.3 Load equalization and stability 93
15.10.4 Vertical alignment 93
15.10.5 Skidshoes 93
15.11 Propulsion system design, redundancy and back-up 93
15.11.1 Propulsion system 93
15.11.2 Redundancy and recommendations 94
15.12 Float-on onto submersible barges or vessels 95
15.13 Lifted loadouts 96
15.14 Horizontal loadouts 97
15.15 Barge reinstatement and sea fastenings 97
15.16 Tugs 98
15.17 Management and organization 98
15.18 Loadout manual 98
15.19 Operating manual 98

16 Transportation **100**
16.1 Introduction 100
16.2 General considerations 100
16.2.1 Manned tows 100
16.2.2 Unmanned tows 101
16.2.3 Navigation lights, signals and day shapes 101
16.2.4 Contingency 101
16.2.5 Motion responses 101
16.2.6 Verification of the transported object 101
16.2.7 Structural analysis during all transport phases 101
16.2.8 Transport planning 102
16.3 Weather routeing and forecasting 102
16.4 Ports of shelter, shelter areas, holding areas 102
16.5 Inspections during the towage or voyage 103
16.6 Responsibility 103
16.7 Hazardous materials 103
16.8 Ballast water 104
16.9 Restricted depths, heights and manoeuvrability 104
16.10 Under-keel clearances 104
16.11 Air draught 105
16.12 Channel width 105
16.13 Survey requirements 105

This document is a preview generated by EVS

 © ISO 2020 – All rights reserved

16.14 Towline pull required, fleet composition and towing arrangement 106
16.14.1 Towline pull required 106
16.14.2 Towing fleet 107
16.14.3 Towing arrangement 107
16.14.4 Towline length 108
16.15 Tow out from dry dock 108
16.15.1 Introduction 108
16.15.2 Under-keel clearance 108
16.15.3 Side clearances 108
16.15.4 Air cushion/air pressure 108
16.15.5 Capacity of winching and towing arrangements 109
16.15.6 Positioning systems 109
16.15.7 Survey requirements 109
16.16 Inshore tow 109
16.16.1 Tow route and towing clearances 109
16.16.2 Positioning systems 110
16.17 Transport onboard a vessel/Offshore tow 110
16.17.1 Vessel selection 110
16.17.2 Stability 110
16.17.3 Sea fastening 110
16.17.4 Vortex shedding 112
16.17.5 Navigation systems 112
16.18 Transport manual 112

17 Temporary mooring and stationkeeping for marine operations 113
17.1 Introduction 113
17.2 Environmental criteria 113
17.3 Determination of mooring response 114
17.3.1 Analysis methods 114
17.3.2 General considerations on the mooring design 114
17.4 Sizing of mooring lines 115
17.4.1 General considerations 115
17.4.2 Line tension limits and design safety factors 115
17.4.3 Particular mooring conditions 116
17.5 Sizing of anchors 116
17.6 Sizing of attachments 117
17.7 Sizing of mooring line components 117
17.8 Clearances under extreme conditions 117
17.9 Clearances during positioning 118
17.10 Tensioning of moorings 118
17.11 Other stationkeeping means 118
17.11.1 Introduction 118
17.11.2 DP systems 119
17.11.3 Purpose-built mooring arrangements 119
17.11.4 Use of tugs 119
17.12 System for common reference stations 119

18 Offshore installation operations 120
18.1 Introduction 120
18.1.1 Foundation 120
18.1.2 Transition piece 120
18.1.3 Wind turbine generator 120
18.1.4 Offshore substation/Offshore accommodation platforms 120
18.1.5 Installation plan 120
18.1.6 Cargo weight details and CoG information 123
18.2 Installation site 123
18.2.1 Sea floor survey 123
18.2.2 Soil survey 124
18.2.3 Soil preparation 124

This document is a preview generated by EVS

© ISO 2020 – All rights reserved

18.2.4 Site charts 124
18.2.5 Unexploded ordnance (UXO) 125
18.3 Systems and equipment 127
18.3.1 Introduction 127
18.3.2 Vessels 127
18.3.3 Equipment 127
18.3.4 Position reference system 128
18.3.5 Ballast systems 128
18.3.6 Transport vessel interface with marine equipment 128
18.4 Positioning of vessels 128
18.5 Site reference system 129
18.6 Geotechnical site-specific assessment for jack-up operations 129
18.6.1 Introduction 129
18.6.2 Required soil investigations 129
18.6.3 Penetration analysis, punch-through and horizontal-vertical-interaction 130
18.7 Vessel operation manual 132
18.8 Jack-up preloading procedure 133
18.9 Ballasting 133
18.10 Lifted installations 133
18.10.1 Introduction 133
18.10.2 Installation of liftable jackets 133
18.10.3 Installation of templates for piles 134
18.10.4 Installation of piles 134
18.10.5 Installation of transition pieces 134
18.10.6 Installation of GBS 134
18.10.7 Transfer of items from a barge to the deck of a crane vessel/jack-up vessel 135
18.10.8 Installation of towers 135
18.10.9 Installation of WTG including nacelle, hub and blades 135
18.10.10 Installation of topsides of offshore substations/accommodation platforms 135
18.10.11 Operational aspects 135
18.10.12 Operational control parameters 136
18.11 Lowering by ballasting 136
18.11.1 Introduction 136
18.11.2 Operational aspects 136
18.11.3 Operational control parameters 136
18.12 Precise positioning on the sea floor by active and passive means 137
18.12.1 Introduction 137
18.12.2 Operational design aspects 137
18.12.3 Operational control parameters 137
18.13 Skirt penetration 138
18.13.1 Introduction 138
18.13.2 Gravity penetration 138
18.13.3 Suction penetration 138
18.13.4 Operational design aspects 138
18.13.5 Operational control parameters 138
18.14 Pile installation 139
18.14.1 Introduction 139
18.14.2 Operational design aspects 139
18.14.3 Operational control parameters 140
18.15 Grouting 140
18.15.1 Introduction 140
18.15.2 Grouting of pile/transition piece structure 140
18.15.3 Underbase grouting of pile/jacket structure 141
18.15.4 Operational design aspects 141
18.15.5 Preparations 141

This document is a preview generated by EVS

© ISO 2020 – All rights reserved

18.15.6 Operational control parameters ... 142
18.16 Bolted connections of foundation ... 142
18.17 Welding of piles/foundation to topsides ... 142
18.18 Noise mitigation measures ... 142
18.19 Crew transfer to and from installation units ... 143
18.20 Offshore completion ... 143
18.20.1 Introduction ... 143
18.20.2 ROV inspection ... 143
18.20.3 Removal of temporary equipment ... 144
18.20.4 Scour protection ... 144
18.20.5 Final inspection ... 144
18.21 Project execution manual ... 144

19 Design and operation of lifting equipment ... 145
19.1 Introduction ... 145
19.2 Rigging geometry ... 147
19.3 Actions and action effects ... 147
19.4 Weight contingency factors ... 149
19.5 Dynamic amplification factors (DAFs) ... 150
19.5.1 Introduction ... 150
19.5.2 Lifts by a crane ... 150
19.5.3 Offshore lifts by cranes on two or more vessels ... 152
19.6 Representative hook load ... 152
19.6.1 One-hook lifts by a single crane ... 152
19.6.2 Two-hook lifts by two cranes ... 152
19.7 Representative lift weight per lift point ... 153
19.7.1 One-hook lifts ... 153
19.7.2 Two-hook lifts ... 153
19.8 Representative forces on a lift point ... 154
19.8.1 Representative vertical force ... 154
19.8.2 Representative force in line with the sling direction ... 155
19.8.3 Representative lateral force ... 155
19.9 Representative force for slings and grommets ... 156
19.10 Design values of actions and action effects ... 156
19.11 Strengths of slings, grommets and shackles ... 158
19.11.1 Steel cable slings ... 158
19.11.2 Fibre rope slings and fibre rope grommets ... 158
19.11.3 Working load limits and design strengths of fibre slings and grommets ... 159
19.11.4 Working load limit and design strength of shackles ... 160
19.12 Design verifications ... 160
19.12.1 Allowable hook load ... 160
19.12.2 Slings and grommets ... 161
19.12.3 Lift points and their attachment to the structure and supporting members ... 163
19.13 Lift point design ... 164
19.13.1 Introduction ... 164
19.13.2 Sling ovalization ... 164
19.13.3 Plate rolling direction and direction of loading ... 164
19.13.4 Pinholes ... 164
19.13.5 Cast padears and welded trunnions ... 165
19.13.6 Cheek plates ... 165
19.13.7 Padeyes ... 165
19.14 Clearances ... 165
19.14.1 Introduction ... 165
19.14.2 Clearances around lifted objects ... 166
19.14.3 Clearances around crane vessel ... 166
19.14.4 Clearances around jack-up crane vessel ... 167
19.14.5 Clearances around mooring lines and anchors of crane vessels ... 167
19.14.6 Clearances around array cable zones ... 168
19.14.7 Clearances around spud-can positions of jack-up vessels ... 168

This document is a preview generated by EVS

© ISO 2020 – All rights reserved

19.15 Bumpers and guides ... 168
19.15.1 Introduction ... 168
19.15.2 Object movements ... 168
19.15.3 Position of bumpers and guides ... 168
19.15.4 Bumper and guide loads ... 169
19.15.5 Design considerations ... 169
19.16 Heave compensated lifts ... 170
19.17 Lifts using DP ... 170
19.18 Practical considerations ... 170
19.18.1 Access ... 170
19.18.2 Design of seafastening ... 170
19.18.3 Equipment ... 170
19.18.4 Slings ... 171
19.19 Certification requirements for lifting equipment ... 171
19.19.1 Standard lifting equipment ... 171
19.19.2 Custom-made lifting equipment ... 171
19.19.3 Recertification of lifting equipment ... 172

20 Laying, burial, jointing, and repair of sub-sea cables ... 172
20.1 Introduction ... 172
20.2 Planning and design ... 172
20.2.1 Cable dimensions and handling parameters ... 172
20.2.2 Seafloor survey — Specifically cable route corridors between turbines and substation(s) ... 173
20.2.3 Vessel suitability ... 175
20.2.4 Cable storage and cable handling equipment ... 177
20.2.5 Navigation equipment — Positioning and control of vessel/cable interface ... 177
20.3 Cable loadout and offshore transfer ... 178
20.3.1 Introduction ... 178
20.3.2 Handling and lifting ... 178
20.3.3 Loadout by reeling, spooling, winding and coiling ... 178
20.3.4 Lifted loadout and offshore transfer ... 180
20.4 Cable laying ... 180
20.4.1 Introduction ... 180
20.4.2 Cable pull-in procedures ... 181
20.4.3 Laying ... 182
20.5 Cable protection ... 182
20.5.1 Introduction ... 182
20.5.2 Cable burial ... 182
20.5.3 Non-burial cable protection ... 183
20.6 Cable crossings ... 185
20.7 Landfalls ... 185
20.8 Cable jointing and repair ... 185
20.9 As-built survey ... 186
20.10 Cable integrity check ... 186
20.11 Cable installation manual ... 186

21 Construction management ... 186
21.1 Introduction ... 186
21.2 Marine coordination ... 187
21.3 Harbour coordination ... 188
21.4 Guard vessel ... 188
21.5 Reporting ... 188
21.6 Personnel tracking ... 188

Annex A (informative) **Additional information and guidance ... 189**

Bibliography ... 203

This document is a preview generated by EVS

 © ISO 2020 – All rights reserved

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 8, *Ships and marine technology*.

This second edition cancels and replaces the first edition (ISO 29400:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clause 3: terms and definitions revised; new entries inserted;

— Clause 7, “Metocean requirements”: fully revised;

— Clause 20, “Cable loadout and offshore transfer”: new subclause added;

— revisions made throughout most other clauses;

— Annex A: revised.

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.

This document is a preview generated by EVS

© ISO 2020 – All rights reserved

Introduction

This document applicable to the offshore wind industry constitutes a comprehensive and common basis covering port and marine operations of all offshore structures installed and maintained by the offshore wind industries worldwide. Through its application, the intention is to achieve reliability levels appropriate for offshore wind farm components, whatever the type of structure and the nature or combination of materials used.

It is important to recognize that during port and marine operations the structural integrity of the component is an overall concept comprising models for describing actions, structural analysis, 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. It is necessary, therefore, to consider the implications involved in modifications in relation to the overall reliability of structures in offshore wind farms.

This document applicable to offshore wind farms is intended to provide a wide latitude in the choice of structural configuration, material and techniques without hindering innovation. Sound engineering judgment is, therefore, necessary in the use of this document.

This document was developed to provide comprehensive requirements and guidance for the planning, engineering and safe execution of port and marine operations for all types of offshore wind farm components including cable-laying and burial operations and installation and operation of floating turbines moored to the seabed.

Port operations for installation of components of offshore wind farms cover all component transport to the ports, whether marine or via inland waterways, any intermediate storage, as well as preassembly activities at the ports until placing the components close to any quayside for subsequent marine operations to start.

Marine operations for offshore wind farm structures cover loadout from the quayside, offshore transportation and installation phases when the structure is at risk from the marine environment including any marine logistics during offshore commissioning works, operation and maintenance, component exchange, repair operations and decommissioning or redeployment.

This document describes the principles of, and provides requirements and guidance for, port and marine operations associated with foundations, substructures, WTG, cables and topsides installed in offshore wind farms, from the point of view of planning, engineering, construction and documentation. Alternative requirements, methods and provisions can fulfil the intention of this document and may be applied, provided it can be demonstrated that they achieve at least the same level of assurance and reliability. The overall objective of this document is to ensure that port and marine operations are conducted within defined and recognized safety and reliability levels, wherever they are performed. Additional standards, codes and guidelines should also be taken into account, where applicable. Special attention should be paid to national regulations governing the area in which the port and marine operations are performed.

It is not the intent of this document to govern the design of structures, systems and components used in port and marine operations, beyond the principles given. Recognized codes and standards are normally accepted as the basis for the detailed design and the fabrication requirements of such components.

Annex A provides some background and some additional information to the main body of the document and it is intended that it be read in conjunction with the main body of the document.

This document is based on ISO 19901-6 while adapting it extensively to the specific requirements of the offshore wind industry.

NOTE Port and marine operations of offshore wind farms are covered in local, national and international regulations.

This document is a preview generated by EVS

 © ISO 2020 – All rights reserved

Ships and marine technology — Offshore wind energy — Port and marine operations

This document is a preview generated by EVS

1 Scope

This document provides comprehensive requirements and guidance for the planning and engineering of port and marine operations of offshore wind farms, encompassing all documents and works related to such operations, e.g. the design and analysis of the components, systems, equipment and procedures required to perform port and marine operations, as well as the methods or procedures developed to carry them out safely.

This document is intended to be comprehensive, covering all relevant information related to port and marine operations necessary for loadout, offshore transport, installation, offshore commissioning works, operation and maintenance, component exchange, repair operations and decommissioning or redeployment of offshore wind farms.

This document is applicable to port and marine operations for offshore structures including:

— lattice structure foundations made from steel;

— concrete gravity base structures (GBS);

— piled steel foundation or mixed steel and concrete foundation structures;

— subsea templates and similar temporary structures or installation aids;

— steel or mixed material towers, nacelles and blades forming part of the wind turbine generators (WTG);

— floating turbines moored to the seabed;

— self-elevating offshore units for offshore substations or offshore accommodations platforms;

— launching systems at sea from quay side or onshore;

— array cables within the wind farms as well as export cables connecting the wind farm to the grid.

This document is also applicable to modifications of existing structures, e.g. installation of additional modules, exchange of components or decommissioning, and to marine operations during the service life of the windfarm related to the technical maintenance works.

It is not applicable to the following operations:

— construction activities, e.g. in a fabrication yard onshore, where there is no exposure to the marine environment;

— road transport onshore;

— diving.

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 undated references, the latest edition of the referenced document (including any amendments) applies.

© ISO 2020 – All rights reserved

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

ISO 19901-7, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 7: Stationkeeping systems for floating offshore structures and mobile offshore units)*

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

IMCA LR 008, M 179, *Guidance on the Manufacture and Safe Use of Cable Laid Slings and Grommets*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
action
external load applied to the *structure* (3.153) (direct action) or an imposed deformation or acceleration (indirect action)

Note 1 to entry: An imposed deformation can be caused by fabrication tolerances, settlement, temperature change or moisture variation.

Note 2 to entry: An earthquake typically generates imposed accelerations.

[SOURCE: ISO 19904-1:2006, 3.5]

3.2
action effect
effect of *actions* (3.1) on structural components

EXAMPLE Internal forces, moments, stresses, strains, rigid body motions or elastic deformations.

[SOURCE: ISO 19904-1:2006, 3.5]

3.3
adverse weather
meteorological and oceanographic conditions which can affect people, operations, equipment or facilities, to such an extent that precautionary measures must be taken to safeguard the facility to maintain a safe system of work

Note 1 to entry: Adverse weather includes, snow, ice, hail, lightning, heavy rain, high wind, low cloud base, poor visibility, severe sea states and strong *currents* (3.32). Weather conditions can change quickly and the effects of short-term variations such as wind gusts must be considered.

3.4
air cushion
air pumped into underbase compartments of the *structure* (3.153)

Note 1 to entry: An air cushion is normally applied in order to reduce the draught and increase the freeboard and/or to alter the structural loading.

[SOURCE: ISO 19903:2006, 3.10, modified - Note 1 to entry has been slightly reworded for clarity.]

This document is a preview generated by EVS

© ISO 2020 – All rights reserved