

E DIN EN ISO 19901-8:2022-02 (E)

Erscheinungsdatum: 2022-01-07

Petroleum and natural gas industries - Specific requirements for offshore structures - Part 8: Marine soil investigations (ISO/DIS 19901-8:2021); English version prEN ISO 19901-8:2021

Contents		Page
1	Scope	1
2	Normative references	2
3	Terms and definitions.....	2
4	Symbols, units and abbreviated terms	6
4.1	Symbols	6
4.2	Units.....	7
4.3	Abbreviated terms	7
5	Objectives, planning and requirements	9
5.1	Objectives	9
5.2	Planning	10
5.2.1	Sequence of activities.....	10
5.2.2	Integrated geoscience studies.....	12
5.3	Scope of work and development of project specifications	12
5.4	Health, safety and environmental requirements for marine operations.....	13
5.4.1	General	13
5.4.2	Investigation vessel	13
5.4.3	Hazardous substances and acoustic noise.....	14
5.4.4	Shallow gas.....	14
5.5	Other requirements	15
5.5.1	Operational requirements	15
5.5.2	Quality requirements	15
5.5.3	Specific considerations for unconventional soils	15
6	Deployment of investigation equipment.....	16
6.1	Non-drilling mode deployment	16
6.2	Drilling mode deployment	16
6.2.1	General	16
6.2.2	Vessel drilling	17
6.2.3	Seafloor drilling.....	17
6.3	Accuracy of vertical depth measurements	17
6.3.1	General	17
6.3.2	Factors affecting the accuracy of vertical depth measurements.....	18
6.3.3	Depth accuracy classes	18
6.4	Horizontal positioning.....	19
6.5	Interaction of investigation equipment with the upper seabed.....	19
7	Drilling and logging.....	19
7.1	General	19
7.2	Project-specific drilling requirements	20
7.3	Drilling objectives and selection of drilling equipment and procedures.....	20
7.4	Drilling operations plan.....	21
7.5	Recording of drilling parameters	21
7.6	Borehole geophysical logging	22
7.6.1	General	22
7.6.2	Reporting of results	22

8	<i>In situ</i> testing	23
8.1	General	23
8.2	General requirements for the documentation of <i>in situ</i> tests	23
8.3	Cone penetration test.....	24
8.3.1	General.....	24
8.3.2	Equipment	24
8.3.3	Test procedures	25
8.3.4	Procedures for testing offshore	27
8.3.5	Presentation of test results and reporting.....	29
8.4	Pore pressure dissipation test	30
8.4.1	General.....	30
8.4.2	Equipment	31
8.4.3	Test procedure	31
8.4.4	Presentation of results.....	31
8.5	Ball and T-bar penetration tests.....	32
8.5.1	General.....	32
8.5.2	Equipment	34
8.5.3	Ball and T-bar conformity assessment.....	34
8.5.4	Test procedures to be followed offshore.....	34
8.5.5	Presentation of test results and reporting.....	35
8.6	Seismic cone penetration test.....	36
8.6.1	General.....	36
8.6.2	Equipment	37
8.6.3	Test procedures	37
8.6.4	Presentation of results.....	38
8.7	Other <i>in situ</i> tests	38
8.7.1	General.....	38
8.7.2	Documentation requirements.....	39
9	Sampling	39
9.1	Purpose and objectives of sampling.....	39
9.2	Sampling systems.....	39
9.3	Selection of samplers.....	40
9.3.1	General.....	40
9.3.2	Drilling mode samplers	41
9.3.3	Non-drilling mode samplers	42
9.4	Sample recovery considerations	43
9.5	Handling, transport and storage of samples	44
9.5.1	General.....	44
9.5.2	Offshore sample handling.....	44
9.5.3	Offshore storage	45
9.5.4	Onshore transport, handling and storage.....	46
10	Laboratory testing	46
10.1	General.....	46
10.2	Project specifications.....	46
10.3	Presentation of laboratory test results.....	47
10.4	Instrumentation, calibration and data acquisition.....	47
10.5	Preparation of soil specimens for testing	48
10.5.1	Minimum sample size and specimen dimensions	48
10.5.2	Preparation of disturbed samples and soil batching	48
10.5.3	Preparation of undisturbed specimens (fine-grained soils).....	48
10.5.4	Laboratory-prepared compacted and reconstituted specimens	49
10.5.5	Preparation of remoulded samples.....	51
10.6	Evaluation of intact sample quality	51
11	Reporting	52
11.1	Definition of reporting requirements.....	52

11.2	Presentation of field operations and factual data	52
11.3	Data interpretation and soil parameters	53
Annex A	(informative) Additional information and guidance.....	55
A.1	Scope	55
A.2	Normative references	55
A.3	Terms and definitions	55
A.4	Symbols, units and abbreviated terms	55
A.5	Objectives, planning and requirements	55
A.5.1	Objectives	55
A.5.2	Planning	55
A.5.3	Scope of work	60
A.5.4	Health, safety and environmental requirements for marine operations.....	60
A.5.5	Other requirements	65
A.6	Deployment of investigation equipment.....	67
A.6.1	Non-drilling mode deployment	67
A.6.2	Drilling mode deployment	67
A.6.3	Accuracy of vertical depth measurements	67
A.6.4	Horizontal positioning.....	73
A.6.5	Interaction of investigation equipment with the seafloor.....	73
A.7	Drilling and logging.....	74
A.7.1	General	74
A.7.2	Project-specific drilling requirements	74
A.7.3	Drilling objectives and selection of drilling equipment and procedures.....	74
A.7.4	Drilling operations plan	78
A.7.5	Recording of drilling parameters	78
A.7.6	Borehole geophysical logging	78
A.8	<i>In situ</i> testing.....	81
A.8.1	General	81
A.8.2	General requirements for the documentation of <i>in situ</i> tests.....	81
A.8.3	Cone penetration test.....	81
A.8.4	Pore pressure dissipation test.....	85
A.8.5	Ball and T-bar penetration test	85
A.8.6	Seismic cone penetration test	85
A.8.7	Other <i>in situ</i> tests	87
A.9	Sampling	88
A.9.1	Purpose and objectives of sampling	88
A.9.2	Sampling systems	88
A.9.3	Selection of samplers	88
A.9.4	Sample recovery considerations.....	94
A.9.5	Handling, transport and storage of samples.....	94
A.10	Laboratory testing.....	97
A.10.1	General	97
A.10.2	Project specifications	97
A.10.3	Presentation of laboratory test results	97
A.10.4	Instrumentation, calibration and data acquisition	97
A.10.5	Preparation of soil specimens for testing.....	97
A.10.6	Evaluation of intact sample quality.....	97
A.11	Reporting.....	97
A.11.1	Definition of reporting requirements	97
A.11.2	Presentation of field operations and factual data	98
A.11.3	Data interpretation and soil parameters.....	100

Annex B (normative) Procedures for calibration and verification of cone penetrometers	103
B.1 Environment and preparation	103
B.2 Measuring intervals for calibration	103
B.3 Symbols	104
B.4 Cone resistance and sleeve friction calibration	105
B.4.1 General	105
B.4.2 Test method	105
B.4.3 Assessment of calibration uncertainty	107
B.4.4 Calibration results	109
B.5 Calibration of pore pressure sensor	110
B.5.1 General	110
B.5.2 Test method	110
B.5.3 Assessment of calibration uncertainty	111
B.5.4 Test results	112
B.6 Determination of cone and friction sleeve dimensions	112
B.6.1 General	112
B.6.2 Test method	112
B.6.3 Assessment of dimensional uncertainty	113
B.6.4 Test results	114
B.7 Calibration of a cone penetrometer for inclination	115
B.7.1 General	115
B.7.2 Test method	115
B.7.3 Inclination uncertainty	115
B.7.4 Test results	116
B.8 Verification of a cone penetrometer for temperature influence	116
B.8.1 General	116
B.8.2 Test method	117
B.8.3 Test results	117
B.9 Verification of a cone penetrometer for bending influence	119
B.9.1 General	119
B.9.2 Test method	119
B.9.3 Test results	119
Annex C (informative) Calibration certificate for cone penetrometer	120
C.1 General	120
C.2 Example calibration report	120
Annex D (informative) Laboratory testing	128
D.1 General	128
D.2 Classification and index tests	128
D.2.1 Soil identification and description	128
D.2.2 Soil classification	128
D.2.3 Sample photograph	128
D.2.4 Non-destructive sampling logging	129
D.2.5 Water content	129
D.2.6 Liquid and plastic limits	129
D.2.7 Bulk density of soil or soil unit weight	129
D.2.8 Particle density of soil	130
D.2.9 Maximum and minimum index densities	130
D.2.10 Particle size distribution	130
D.2.11 Angularity	131
D.2.12 Organic content	131
D.2.13 Carbonate content	131
D.2.14 Soluble salt content	132

D.2.15	Undrained shear strength index tests.....	132
D.2.16	Soil sensitivity.....	136
D.2.17	Needle penetration resistance.....	136
D.3	One-dimensional consolidation.....	136
D.3.1	General.....	136
D.3.2	Incremental loading oedometer tests.....	137
D.3.3	Continuous loading oedometer tests.....	138
D.3.4	Dismounting the specimen.....	138
D.3.5	Determination of horizontal stress.....	139
D.3.6	Presentation of results.....	139
D.4	Consolidated triaxial tests.....	139
D.4.1	General.....	139
D.4.2	Test apparatus.....	140
D.4.3	Preparation of triaxial test specimens.....	143
D.4.4	Saturation.....	143
D.4.5	Consolidation.....	144
D.4.6	Static shearing.....	145
D.4.7	Cyclic testing.....	146
D.4.8	Dismounting the specimen.....	146
D.4.9	Presentation of test results.....	147
D.5	Direct shear tests.....	148
D.5.1	General.....	148
D.5.2	Direct simple shear.....	148
D.5.3	Ring shear.....	154
D.5.4	Direct shear box.....	157
D.6	Resonant column.....	157
D.6.1	General.....	157
D.6.2	Test procedure.....	158
D.6.3	Presentation of test results.....	158
D.7	Test for shear wave velocity and initial shear modulus using bender elements.....	159
D.8	Thixotropy.....	159
D.9	Permeability.....	160
D.10	Thermal conductivity and volumetric heat capacity tests.....	161
D.11	Geological and geochemical tests.....	161
D.11.1	General.....	161
D.11.2	Visual description.....	161
D.11.3	Mineralogical analysis.....	161
D.11.4	Amino acid chronology.....	162
D.11.5	Stable oxygen isotope analysis.....	162
D.11.6	Gas in sediment samples.....	162
D.11.7	Age determination (¹⁴ C dating).....	162
D.11.8	Paleontological analyses.....	162
D.11.9	Soil corrosiveness.....	162
D.12	Rock testing.....	162
D.13	Other laboratory tests.....	163
	Bibliography.....	165