

E DIN EN ISO 15551:2022-07 (E)

Erscheinungsdatum: 2022-05-27

Petroleum and natural gas industries - Drilling and production equipment - Electric submersible pump systems for artificial lift (ISO/DIS 15551:2022); English version prEN ISO 15551:2022

Inhalt/Contents

Seite/Page

Nationales Vorwort.....	3
Nationaler Anhang NA (informativ) Begriffe und Abkürzungen.....	5
3 Begriffe	5
4 Symbole und Abkürzungen.....	19
Nationaler Anhang NB (informativ) Literaturhinweise	22
Foreword.....	viii
Introduction	ix
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Symbols and abbreviated terms	14
5 Functional specification	17
5.1 General.....	17
5.2 Component type.....	17
5.3 Functional requirements	17
5.3.1 General.....	17
5.3.2 Application parameters.....	17
5.3.3 Environmental compatibility.....	19
5.3.4 Compatibility with related well equipment and services	20
5.4 User/purchaser selections	21
5.4.1 General.....	21
5.4.2 Design validation.....	21
5.4.3 Component functional evaluation	21
5.4.4 Quality grades	22
5.4.5 Shipping, handling and storage.....	22
5.4.6 Operator's manual	22
5.4.7 Subcomponent condition classifications in manufacture of components.....	22
5.4.8 Additional documentation or requirements	22
6 Technical specification	22
6.1 General.....	22
6.2 Design criteria.....	23
6.2.1 General.....	23
6.2.2 Design documentation.....	23
6.2.3 Materials.....	23
6.2.4 Dimensional information.....	26
6.2.5 Component and assembled system design verification.....	26
6.2.6 Component design validation	27
6.2.7 Component functional evaluation requirements.....	27
6.2.8 Assembled system functional evaluation.....	27

6.2.9	Design changes.....	27
6.3	Technical specification — All components	27
6.3.1	Technical characteristics	27
6.3.2	Performance rating.....	27
6.4	Technical specification — Bolt-on discharge	28
6.4.1	General.....	28
6.4.2	Technical characteristics for the discharge.....	28
6.4.3	Performance ratings.....	28
6.4.4	Scaling of design validation.....	28
6.5	Technical specification — Pump and gas handler	28
6.5.1	General.....	28
6.5.2	Technical characteristics for the pump and gas handler	28
6.5.3	Performance ratings.....	28
6.5.4	Scaling of design validation.....	29
6.6	Technical specification — Bolt-on intake.....	29
6.6.1	General.....	29
6.6.2	Technical characteristics for the bolt-on intake	29
6.6.3	Performance ratings	29
6.6.4	Scaling of design validation.....	29
6.7	Technical specification — Mechanical gas separators	29
6.7.1	General.....	29
6.7.2	Technical characteristics.....	29
6.7.3	Performance ratings	29
6.7.4	Scaling of design validation.....	29
6.8	Technical specification — Seal chamber sections.....	29
6.8.1	General.....	29
6.8.2	Technical characteristics.....	30
6.8.3	Performance ratings	30
6.8.4	Scaling of design validation.....	30
6.8.5	Horsepower requirement.....	30
6.9	Technical specification – Motors	30
6.9.1	General.....	30
6.9.2	Technical characteristics.....	30
6.9.3	Performance ratings	30
6.9.4	Scaling of design validation.....	31
6.10	Technical specifications — Power and motor lead extension cable.....	31
6.10.1	General.....	31
6.10.2	Technical characteristics.....	31
6.10.3	Performance ratings	31
6.10.4	Scaling of design validation.....	31
6.11	Technical specifications — Pothead	31
6.11.1	General.....	31
6.11.2	Technical characteristics.....	31
6.11.3	Performance ratings	32
6.11.4	Scaling of design validation.....	32
6.12	Assembled ESP system – Additional requirements	32
6.12.1	General.....	32
6.12.2	Technical characteristics.....	32
6.12.3	System capabilities.....	32
6.13	Technical specification response guideline – ESP components	33
7	Supplier's/manufacturer's requirements.....	34
7.1	General.....	34
7.2	Documented information	34
7.2.1	General.....	34
7.2.2	Delivery documentation	34
7.2.3	Operator's manual	34
7.2.4	Certificate of conformance	35

7.2.5	Component data sheet	35
7.3	Component identification.....	38
7.3.1	Permanent identification.....	38
7.3.2	Semi-permanent identification.....	38
7.4	Quality	39
7.4.1	General.....	39
7.4.2	Quality grade requirements.....	39
7.5	Raw materials	40
7.6	Additional processes applied to components.....	40
7.6.1	Documentation	40
7.6.2	Coatings and surface treatments	41
7.6.3	Welding.....	41
7.7	Traceability.....	41
7.8	Calibration systems	41
7.9	Examination and inspection.....	42
7.9.1	General.....	42
7.9.2	Weld	42
7.9.3	Component and subcomponent dimensional inspection.....	43
7.9.4	Construction features.....	44
7.10	Manufacturing non-conformance	44
7.11	Component functional testing	44
8	Repair/redress	45
9	Shipping, handling and storage.....	45
9.1	General.....	45
9.2	Storage.....	45
10	Subcomponent condition classifications in manufacture of components.....	45
Annex A (normative) Design validation performance rating requirements by component		46
A.1	General.....	46
A.2	Design validation grades.....	46
A.2.1	General	46
A.3	Method for determining performance ratings.....	48
A.3.1	For all components	48
A.3.2	Bolt-on discharge	51
A.3.3	Pump and gas handler	51
A.3.4	Bolt-on intake.....	56
A.3.5	Mechanical gas separator	56
A.3.6	Seal chamber section.....	58
A.3.7	Motor	61
A.3.8	Power and motor lead extension cable.....	64
A.3.9	Pothead	68
Annex B (normative) Requirements for determining performance capabilities as an assembled system		73
B.1	General.....	73
B.2	Method for determining system capabilities.....	73
B.2.1	Axial strength and bending tensile load	73
B.2.2	Surface temperature rating.....	73
B.2.3	Amperage rating for the assembled ESP system	73
B.2.4	Dog leg severity limits for the assembled ESP system	73
B.2.5	Deviation limits for the assembled ESP system.....	74
B.2.6	Minimum, maximum and differential operating environment temperature capability for the ESP assembly	74
B.2.7	Maximum pressurization and depressurization rates	74
B.2.8	Power requirements	74
B.2.9	Assembled ESP system motor fluid percentage utilization of each seal chamber contraction capacity	74

B.2.10 Minimum operating speed for assembled system	75
B.2.11 Maximum operating speed for assembled system.....	75
Annex C (normative) Functional evaluation: single component	76
C.1 General.....	76
C.2 Terms and definitions.....	76
C.3 Bolt-on discharge head	77
C.4 Pump and gas handler	77
C.5 Bolt-on intake.....	78
C.6 Mechanical gas separator	78
C.7 Seal chamber section	79
C.8 Motors	80
C.8.1 Functional evaluation	80
C.8.2 Electrical functional testing procedure	81
C.9 Cable and MLE.....	81
C.9.1 Functional evaluation	81
C.9.2 Insulation AC discharge test.....	82
C.10 Measuring shaft runout.....	83
C.10.1 General.....	83
C.10.2 Procedure.....	83
Annex D (normative) Cable reference information	84
D.1 General.....	84
D.2 Metric conductors	84
D.2.1 Conductor properties.....	84
D.2.2 Metric cable conductor dimension table	84
D.2.3 Metric conductor resistance tables.....	84
D.3 AWG conductors	85
D.3.1 AWG conductor dimensions.....	85
D.3.2 AWG copper conductor resistance	86
D.3.3 Resistance and temperature for copper AWG conductors	87
D.3.4 Conductor resistance testing	88
D.4 Other conductor configurations.....	89
Annex E (informative) Functional evaluation guideline — Assembled ESP system	90
E.1 General.....	90
E.2 Mechanical compatibility test.....	90
E.3 Stack-up test	90
E.4 System integration test.....	91
E.4.1 General.....	91
E.4.2 Assembled ESP system functional evaluation grade.....	91
E.4.3 Requirements.....	91
E.4.4 SIT procedure.....	92
E.4.5 Analysis after SIT	93
E.5 Power test	93
E.6 Calculating ESP system efficiency.....	94
Annex F (informative) Establishing recommended operating range of ESP system	95
F.1 General.....	95
F.2 Considerations for ROR.....	95
F.2.1 Axial thrust forces.....	95
F.2.2 Flow and pressure limits.....	95
F.2.3 Power limits.....	95
F.2.4 Shape of head/flow rate curve	95
Annex G (informative) Example of user's/purchaser's ESP functional specification form...	96
Annex H (informative) Considerations for use of three-phase low and medium voltage adjustable speed drives for ESP applications.....	100

H.1 General.....	100
H.2 Terms and definitions.....	100
H.3 Design and selection considerations	100
H.4 Input power	101
H.5 Output power to ESP	102
H.6 Accuracy of measurement	102
H.7 Control functions.....	102
H.8 Minimum input and output functionality.....	103
H.9 Protective functions	104
H.10 ASD information to be provided to user/purchaser.....	104
Annex I (informative) Analysis after ESP use.....	106
I.1 General.....	106
I.2 Terms and definitions.....	106
I.3 Documentation immediately after ESP failure is detected.....	107
I.4 Evidence collection during pull and wellsite dismantle.....	107
I.4.1 General.....	107
I.4.2 Recommended pull observations	108
I.4.3 Recommended observations from well site disassembly	109
I.4.4 ESP component dismantle	110
I.5 Failure cause analysis	113
I.5.1 General.....	113
I.5.2 Reason for pull	113
I.5.3 Primary failed item.....	114
I.5.4 Failure descriptor	115
I.5.5 Failure causes.....	116
Annex J (informative) Downhole monitoring of ESP assembly.....	118
J.1 General.....	118
J.2 Downhole gauge typical parameters	118
Annex K (informative) Information on permanent magnet motors for ESP applications..	120
K.1 General.....	120
K.2 Design and selection considerations	120
Annex L (informative) User guide.....	122
L.1 General.....	122
L.2 Document structure.....	122
L.3 Process categories.....	123
L.3.1 General.....	123
L.3.2 Functional specifications (Clause 5)	124
L.3.3 Technical specification (Clause 6).....	124
L.3.4 Supplier's/manufacturer's requirements (Clause 7).....	124
L.4 Process flow chart.....	125
Bibliography.....	126