ISO 15551-1:2015-05 (E)

Petroleum and natural gas industries - Drilling and production equipment - Part 1: Electric submersible pump systems for artificial lift

Contents

Page

Foreword vi

Introduction vii

1 Scope 1

2 Normative references 1

3 Terms and definitions 2

4 Symbols and abbreviated terms 13

5 Functional specification 16
5.1 General 16
5.2 Component type 16
5.3 Functional requirements 16
5.3.1 General 16
5.3.2 Application parameters 16
5.3.3 Environmental compatibility 18
5.3.4 Compatibility with related well equipment and services 19
5.4 User/purchaser selections 20
5.4.1 General 20
5.4.2 Design validation 20
5.4.3 Component functional evaluation 20
5.4.4 Quality grades 20
5.4.5 Shipping, handling, and storage 21
5.4.6 Additional documentation or requirements 21

6 Technical specification 21
6.1 General 21
6.2 Design criteria 22
6.2.1 General 22
6.2.2 Design documentation 22
6.2.3 Materials 22
6.2.4 Dimensional information 25
6.2.5 Component and assembled system design verification 26
6.2.6 Component design validation 26
6.2.7 Component functional evaluation requirements 26
6.2.8 Assembled system functional evaluation 26
6.2.9 Design changes 26
6.3 Technical specification -- All components 26
6.3.1 Technical characteristics 26
6.3.2 Performance rating 27
6.4 Technical specification -- Bolt-on discharge 27
6.4.1 General 27
6.4.2 Technical characteristics for the discharge 27
6.4.3 Performance ratings 27
6.4.4 Scaling of design validation 27
6.5 Technical specification -- Pump and gas handler 27
6.5.1 General 27
6.5.2 Technical characteristics for the pump and gas handler 27

6.5.3 Performance ratings 28
6.5.4 Scaling of design validation 28
6.6 Technical specification -- Bolt-on intake 28
6.6.1 General 28
6.6.2 Technical characteristics for the intake 28
6.6.3 Performance ratings 28
6.6.4 Scaling of design validation 28
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 29
6.8.3 Performance ratings 29
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 32
6.11.1 General 32
6.11.2 Technical characteristics 32
6.11.3 Performance ratings 32
6.11.4 Scaling of design validation 32
6.12 Assembled ESP system 32
6.12.1 General 32
6.12.2 Technical characteristics 33
6.12.3 System capabilities 33

7 Supplier/manufacturer requirements 34
7.1 General 34
7.2 Documentation and data control 34
7.2.1 General 34
7.2.2 Delivery documentation 34
7.2.3 Operator's manual 35
7.2.4 Certificate of compliance 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 41
7.6.1 Documentation 41
7.6.2 Coatings and surface treatments 41
7.6.3 Welding 41
7.6.4 Heat treating 41
7.7 Traceability 41
7.8 Calibration systems 42
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 43
7.10 Manufacturing non-conformance 44
7.11 Component functional testing 44

8 Repair/redress 44

9 Shipping, handling, and storage 44
9.1 General 44
9.2 Storage 45

Annex A (normative) Design validation performance rating requirements by component 46

Annex B (normative) Requirements for determining performance ratings as an assembled system 74

Annex C (normative) Functional evaluation: single component 77

Annex D (normative) Cable reference information 85

Annex E (informative) Functional evaluation guideline -- Assembled ESP system 91

Annex F (informative) Establishing recommended operating range (ROR) of ESP system 93

Annex G (informative) Example user/purchaser ESP functional specification form 95

Annex H (informative) Considerations for use of 3-phase low and medium voltage adjustable speed drives for ESP applications 99

Annex I (informative) Analysis after ESP use 105

Annex J (informative) Downhole monitoring of ESP assembly 117

Annex K (informative) Information on permanent magnet motors for ESP applications 119

Bibliography 121