ISO/TS 12835:2022-03 (E)

Qualification of casing connections for thermal wells

Contents

Page

Foreword ... **vi**

Introduction ... **vii**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 Abbreviated terms and symbols ... **5**
4.1 Abbreviated terms ... 5
4.2 Symbols ... 6

5 Program overview ... **7**
5.1 Illustrations of selected definitions ... 7
5.2 Program flowchart ... 7

6 Overview and fundamental assumptions ... **8**
6.1 General ... 8
6.2 Main features ... 8
6.2.1 Purpose ... 8
6.2.2 Applicability to service conditions ... 9
6.2.3 Rationale for development ... 9
6.2.4 Subject of evaluation ... 9
6.2.5 Application severity levels ... 9
6.3 Assessment philosophy and principles ... 10
6.3.1 Fundamental principles ... 10
6.3.2 Conservative evaluation procedure ... 11
6.3.3 Mandatory and optional tasks ... 11
6.3.4 Use of analysis and physical testing ... 12
6.3.5 Performance measures ... 12
6.3.6 Assessment criteria ... 12
6.3.7 Task outcomes — data categories ... 13
6.3.8 Prior evaluation data ... 13
6.3.9 Treatment of confidential design information ... 13
6.3.10 Interpretation of evaluation results ... 14
6.3.11 Avoiding perception of conflict of interest ... 14
6.4 Evaluation variables ... 14
6.4.1 Connection loading ... 14
6.4.2 Impacts of contributing variables ... 14
6.4.3 Pin-box interferences and tapers ... 16
6.4.4 Material yield strength ... 16
6.5 Evaluation procedure ... 17
6.5.1 Safety standards ... 17
6.5.2 Seepage assessment — random variations ... 17
6.5.3 Seepage rate thresholds ... 17
6.5.4 Seal isolation ... 18
6.5.5 Dope entrapment ... 18
6.5.6 Thermal cycle test — bake-out and hold durations ... 18
6.5.7 Pressure and temperature loading in thermal cycle test and analysis ... 19
6.5.8 Dependence of material strength on temperature ... 19
6.6 Scope of reporting ... 20

7 Program roles and proprietary design information ... **20**

7.1 Program execution roles 20
7.2 Proprietary connection design information 20

8 Conformance requirements 21
8.1 Conformant evaluation program 21
8.2 Program non-conformances 21
8.3 Performance acceptance 22
8.4 Conformance of results from previous evaluations 22
8.5 Use of data from previous evaluations 22
8.6 Conformance to lower ASLs 23

9 Application severity levels 23
9.1 Thermal well load path 23
9.2 Temperature as controlling parameter 25
9.3 Specifications for application severity levels 26
9.4 Selection of application severity level 27

10 Program blocks and tasks 27
10.1 Evaluation procedure overview 27
10.2 Critical path tasks 31

11 Program specifications 32
11.1 Task overview 32
11.2 Identification of program roles 32
11.3 Identification of candidate connection 33
11.4 Program options 34
11.5 Data from prior evaluations 35

12 Determination of biased test population 35
12.1 Task overview 35
12.2 Initial material property characterization 36
12.2.1 Task description, definitions, methods 36
12.2.2 Testing conditions and scope 37
12.2.3 Procedure for tensile tests 39
12.2.4 Interpretation and processing of tensile test results 40
12.3 Specimen configuration analysis 45
12.3.1 Task description 45
12.3.2 Modelling and reporting requirements 46
12.3.3 Nominal reference case 47
12.3.4 Worst-case geometry configurations 48
12.3.5 Seal taper analysis 50
12.3.6 Impacts of material property variations 51
12.3.7 Make-up torque for sealability tests 54
12.3.8 Test versus production specimens 56

13 Specimen procurement 56
13.1 Task overview 56
13.2 Specimen pipe procurement 57
13.3 Material property verification 57
13.3.1 Task description 57
13.3.2 Specimens for tensile verification tests 57
13.3.3 Scope of tensile verification tests 58
13.3.4 Coefficient of thermal expansion verification test 59
13.4 Test specimen machining and gauging 60
13.4.1 General requirements 60
13.4.2 Specimen naming convention 60
13.4.3 Specimen length and length-reference requirements 61
13.4.4 Geometrical configurations 62
13.4.5 Mother pipe for specimens 62
13.4.6 Specimen machining tolerances 63
13.5 Markings 65
13.6 Specimen geometry verification 65
13.6.1 Gauging inspection scope 65
13.6.2 Inspection extent – example cases 66
13.6.3 Geometry inspection guidelines 66
13.7 Procurement and quality control of connection interfacial components 67

13.8 Specimen handling and storage 67
13.8.1 Handling recommendations 67
13.8.2 Treatment of damaged specimens 68

14 Full-scale physical tests and supplementary analyses 68
14.1 Task overview 68
14.2 Full-scale tests - general requirements 69
14.2.1 Ambient temperature at test site 69
14.2.2 Calibration of instrumentation 69
14.2.3 Disabling of secondary seals 70
14.2.4 Seepage measurement and rate definitions 70
14.2.5 Load application rates 72
14.2.6 Excluded connections 72
14.3 Galling resistance test 73
14.3.1 Task description 73
14.3.2 Rationale and objectives 74
14.3.3 Make-break specimens 74
14.3.4 Scope of galling resistance test 74
14.3.5 Set-up and instrumentation 75
14.3.6 Test procedure 76
14.3.7 Performance assessment 77
14.3.8 Reporting 78
14.4 Thermal cycle test 78
14.4.1 Task description 78
14.4.2 Rationale and objectives 78
14.4.3 Thermal cycle specimens 79
14.4.4 Scope of thermal cycle test 79
14.4.5 Mechanical strain compensations 82
14.4.6 Set-up and instrumentation 85
14.4.7 Test procedure 91
14.4.8 Performance assessment 96
14.4.9 Selection of cycled specimens for bend test and limit-strain test 97
14.4.10 Reporting 97
14.5 Bending evaluation 97
14.6 Limit-strain test 98
14.6.1 Task description 98
14.6.2 Rationale and objectives 98
14.6.3 Limit-strain specimens 99
14.6.4 Mandatory test description 99
14.6.5 Set-up and instrumentation 101
14.6.6 Mandatory test procedure 103
14.6.7 Performance assessment 108
14.6.8 Reporting 108
14.7 As-tested configuration analysis 108

15 Evaluation and inspection reports 108
15.1 Reporting deliverables 108
15.2 Reporting scope and contents 109
15.3 Reporting templates 113

Annex A (informative) **FEA modelling guidelines 114**

Annex B (informative) **Derivations of formulae - Strain compensation factors 124**

Annex C (informative) **Program role assignments and responsibilities 133**

Annex D (informative) **Optional program selections, tasks, and procedures 140**

Bibliography 163