ISO 24817:2026-09 (E)

Oil and gas industries including lower carbon energy - Composite repairs for piping - Qualification and design, installation, testing and integrity management

Contents

Page

Foreword vi

Introduction viii

1 Scope 1

2 Normative references 1

3 Terms and definitions 2

4 Symbols and abbreviated terms 7
4.1 Symbols 7
4.2 Abbreviated terms 10

5 Applications 11

6 Summary of key issues 13
6.1 General 13
6.2 Repair system qualification 13
6.3 Enquiry stage 13
6.4 Design of repair 13
6.4.1 General 13
6.4.2 Type A and Type B design cases 14
6.5 Installer training 15
6.6 Installation of repair 16
6.7 Ongoing integrity management of the repaired system 16

7 Qualification 16
7.1 Repair system qualification data 16
7.2 Re-qualification of the repair system 18
7.2.1 Overview 18
7.2.2 For Type A defect repairs 18
7.2.3 For Type B defect repairs 18

8 Repair feasibility assessment 18
8.1 General 18
8.2 Repair class 20
8.3 Required data 20
8.3.1 Background 20
8.3.2 Original equipment design data 20
8.3.3 Maintenance and operational histories 21
8.3.4 Service condition data 21

9 Design methodology 21
9.1 Design lifetime and initial service life 21
9.2 Environmental compatibility 22
9.3 Design temperature effects 23
9.4 Cyclic loading 24
9.5 Determination of design strains 24
9.5.1 General 24
9.5.2 Design strains based on default allowable strains 25

9.5.3 Design strains based on performance testing ... 25
9.6 Determination of equivalent load and equivalent pressure ... 25
9.7 Design of repairs for Type A defects ... 26
9.7.1 General ... 26
9.7.2 Design limited by substrate allowable stress ... 26
9.7.3 Design limited by composite laminate design strain, substrate shares loads ... 27
9.7.4 Design limited by composite laminate design strain, composite laminate carries all loads ... 28
9.8 Design of repairs for Type B defects ... 28
9.8.1 General ... 28

9.8.2 Determination of service factor, fleak ... 29
9.8.3 Circular or near-circular defects ... 29
9.8.4 Slot-type defects in the circumferential direction ... 29
9.8.5 Slot-type defects in the axial direction ... 30
9.9 External loads ... 31
9.10 Other defects (with assessments based on substrate stress) ... 31
9.11 Repair of other components ... 32
9.12 Axial extent of repair ... 33
9.12.1 General ... 33
9.12.2 Patches ... 34
9.13 Calculation of the composite laminate thickness, td ... 34
9.14 Confirmation that composite laminate thickness is within acceptable limits ... 34
9.14.1 General ... 34
9.14.2 Maximum acceptable value of td ... 35
9.14.3 Maximum allowable design pressure for tees or nozzles ... 35
9.14.4 Potential for repair disbonding ... 35
9.15 Calculation of total repair length ... 36
9.16 Design output ... 36
9.17 Optional design considerations ... 36
9.17.1 Fire performance ... 36
9.17.2 Cathodic disbonding ... 37
9.17.3 Electrical conductivity ... 37
9.17.4 Fretting type defects ... 37
9.17.5 Delamination or blister type defects ... 37
9.17.6 Clamps and other repair systems ... 37

10 Installation ... 38
10.1 Storage conditions ... 38
10.2 Documentation prior to repair application ... 38
10.2.1 Method statement ... 38
10.2.2 Work pack ... 39
10.3 Installer and supervisor qualifications ... 40
10.4 Installation procedure ... 40
10.5 Repair completion documentation ... 41
10.6 Live repairs ... 42
10.7 Repair of clamps, piping components, tanks, or vessels ... 43
10.8 Environmental considerations ... 43
10.9 Repair of defects within the repair system ... 43

11 Ongoing integrity management ... 43
11.1 General ... 43
11.2 Record keeping ... 44
11.3 In-service inspection ... 44
11.4 Allowable defects for the repair system ... 45
11.5 Repair system maintenance and remedial options ... 48
11.5.1 Overview ... 48
11.5.2 Substrate adjacent to the repair ... 49
11.5.3 Repairs to Type A defects ... 49
11.5.4 Repairs to Type B defects ... 49
11.5.5 Repair system ... 49
11.6 Repair lifetime considerations ... 50

11.6.1 Periodic review 50
11.6.2 Lifetime reduction 51
11.6.3 Lifetime extension 51
11.7 Modifications 51

12 System testing 51

13 Decommissioning 52

Annex A (informative) Design data sheet 53

Annex B (normative) Qualification data 56

Annex C (normative) Short-term pipe spool survival test 61

Annex D (normative) Measurement of LCL for through-wall defect calculation 63

Annex E (normative) Measurement of performance test data 68

Annex F (normative) Measurement of impact performance 70

Annex G (normative) Measurement of the degradation factor 71

Annex H (normative) Qualification of repair systems for other defects (with assessments based on substrate stress) 73

Annex I (informative) Guidance on the selection of the appropriate defect size and geometry for through-wall defects (Type B defect) 76

Annex J (normative) Installer qualification 89

Annex K (normative) Installation requirements and guidance 92

Annex L (informative) Design considerations 95

Annex M (informative) Management of the integrity of composite repair systems to piping and vessels 102

Bibliography 106