

ISO 21809-3:2016-03 (E)

Petroleum and natural gas industries - External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 3: Field joint coatings

Contents		Page
Foreword		ix
Introduction		x
1	Scope	1
2	Normative references	1
3	Terms and definitions	4
4	Symbols and abbreviated terms	6
4.1	Symbols	6
4.2	Abbreviated terms	7
5	General requirements	8
5.1	Responsibility of the end user	8
5.2	Rounding	8
5.3	Compliance, testing and quality	8
6	Information to be supplied by the purchaser	8
6.1	General information	8
6.2	Additional information	8
7	Application procedures and qualification	9
7.1	Application procedure specification (APS)	9
7.2	Coating materials	10
7.3	Procedure qualification trial (PQT)	10
7.4	Pre-production trial (PPT)	11
7.5	Qualification of coating and inspection personnel	12
7.6	Production testing and inspection	12
7.7	Inspection documents and traceability	12
8	Classification of field joint coatings	12
9	General requirements for surface preparation, coating application, testing and repair	13
9.1	Surface preparation	13
9.1.1	General	13
9.1.2	Preparation of the steel substrate	14
9.1.3	Preparation of the adjacent plant-applied coating	15
9.2	Application of the coating	15
9.3	Visual inspection of the applied coating	15
9.4	Testing of the field joint coating	16
9.5	Repairs	16
9.6	Verification, handling and storage of coating materials	16
10	Hot-applied bituminous tape coatings	16
10.1	Coating identification	16
10.2	Description of the coatings	16
10.3	Surface preparation	16
10.4	Coating application	16
10.4.1	General	16

10.4.2	Application of the primer	16
10.4.3	Application of the bituminous tapes	17
10.4.4	Overlap	17
10.5	Testing of the applied coatings	17
10.5.1	General	17
10.5.2	Thickness	17
10.5.3	Holiday detection	18
10.5.4	Impact resistance	18
10.5.5	Indentation resistance	18
10.5.6	Specific electrical insulation resistance	18
10.5.7	Cathodic disbondment	18
10.5.8	Peel strength to pipe surface and plant coating	18
10.5.9	Hot-water immersion test	18
10.5.10	Lap shear strength	18
11	Petrolatum and wax-based tape coatings	22
11.1	Coating identification	22
11.2	Description of the coatings	22
11.2.1	Petrolatum tapes (Type 11A)	22
11.2.2	Wax-based tapes (Type 11B)	22
11.3	Surface preparation	22
11.4	Coating application	22
11.4.1	General	22
11.4.2	Application of the primer	22
11.4.3	Application of petrolatum or wax-based tapes	23
11.4.4	Overlap	23
11.5	Testing of the applied coatings	23
11.5.1	General	23
11.5.2	Thickness	23
11.5.3	Holiday detection	23
11.5.4	Impact resistance	23
11.5.5	Indentation resistance	24
11.5.6	Specific electrical insulation resistance	24
11.5.7	Cathodic disbondment	24
11.5.8	Peel strength to pipe surface and plant coating	24
11.5.9	Hot-water immersion test	24
11.5.10	Drip resistance	24
12	Cold-applied polymeric tape coatings	26
12.1	Coating identification	26
12.2	Description of the coatings	26
12.3	Surface preparation	26
12.4	Coating application	26
12.4.1	General	26
12.4.2	Application of the primer	26
12.4.3	Application of polymeric tapes	26
12.4.4	Overlap	27
12.5	Testing of the applied coatings	27
12.5.1	General	27
12.5.2	Thickness	27
12.5.3	Holiday detection	27
12.5.4	Impact resistance	27
12.5.5	Indentation resistance	27
12.5.6	Cathodic disbondment	28
12.5.7	Peel strength between tape layers of polymeric tapes	28
12.5.8	Peel strength to pipe surface and plant coating	28
12.5.9	Hot-water immersion test	28
12.5.10	Lap shear strength	28
12.5.11	Thermal ageing resistance	28
13	Non-crystallinelow-viscositypolyolefinbasedcoatings	29

13.1	Coating identification	29
13.2	Description of the coatings	30
13.3	Surface preparation	30
13.4	Application of the coatings	31
13.4.1	General	31
13.4.2	Overlap	31
13.5	Testing of the applied coating	31
13.5.1	General	31
13.5.2	Thickness	31
13.5.3	Holiday detection	31
13.5.4	Impact resistance	32
13.5.5	Indentation resistance	32
13.5.6	Specific electrical insulation resistance	32
13.5.7	Cathodic disbondment resistance	32
13.5.8	Peel strength between layers of outer wrap	32
13.5.9	Adhesion to pipe surface and plant coating	32
13.5.10	Thermal ageing resistance	33
13.5.11	Resistance to lap shear	33
13.5.12	Hot-water immersion test	33
13.5.13	Glass transition and crystallization temperatures	33
13.5.14	Drip resistance	33
14	Coatings based on heat-shrinkable materials	37
14.1	Coating identification	37
14.2	Description of the coatings	37
14.2.1	General	37
14.2.2	Type 14A	37
14.2.3	Types 14B, 14C and 14D	37
14.3	Surface preparation	38
14.4	Application of the coatings	38
14.4.1	General	38
14.4.2	Application of the primer	38
14.4.3	Application of heat-shrinkable materials	38
14.4.4	Overlap	39
14.5	Testing of the applied coatings	39
14.5.1	General	39
14.5.2	Thickness	39
14.5.3	Holiday detection	39
14.5.4	Peel strength	40
14.5.5	Cathodic disbondment	40
14.5.6	Hot-water immersion test	40
14.5.7	Impact resistance	40
14.5.8	Indentation resistance	40
14.5.9	Lap shear strength	40
14.5.10	Thermal ageing resistance and thermal stability	40
14.5.11	Bursting strength	40
14.5.12	Oxidation induction time	41
15	Hot-applied microcrystalline wax coatings	45
15.1	Coating identification	45
15.2	Description of the coating	45
15.3	Surface preparation	45
15.4	Application of the coating	45
15.4.1	General	45
15.4.2	Application of the microcrystalline wax	45
15.4.3	Application of the outer wrap	46
15.4.4	Application of wax top coat	46
15.5	Testing of the applied coatings	46
15.5.1	General	46
15.5.2	Thickness	46
15.5.3	Holiday detection	46
15.5.4	Adhesion	46

15.5.5	Hardness	46
16	Elastomeric coatings	48
16.1	Coating identification	48
16.2	Description of the coatings	48
16.3	Surface preparation	48
16.4	Application of the coatings	48
16.4.1	General	48
16.4.2	In situ vulcanization method	48
16.4.3	Ambient-cure adhesive method	49
16.5	Testing of the applied coatings	49
16.5.1	General	49
16.5.2	Visual appearance	49
16.5.3	Coating thickness	49
16.5.4	Holiday detection	49
16.5.5	Hardness	49
16.5.6	Adhesion	49
16.5.7	Hot-water immersion test	50
16.5.8	Cathodic disbondment	50
16.5.9	Density	50
16.5.10	Rheometer curve -- Oscillating disc	50
16.5.11	Tensile strength	50
16.5.12	Elongation at break	50
16.5.13	Tear strength	50
16.5.14	Electrical volume resistivity	50
16.5.15	Ozone resistance	51
16.5.16	Resistance to seawater	51
17	Fusion-bonded epoxy (FBE) powder coatings	53
17.1	Coating identification	53
17.2	Description of the coatings	53
17.3	Surface preparation	53
17.4	Application of the coatings	54
17.4.1	General	54
17.4.2	Transport and storage of epoxy powder	54
17.4.3	Heating	54
17.4.4	Application of epoxy powder	54
17.5	Testing of the applied coatings	55
17.5.1	General	55
17.5.2	Visual appearance	55
17.5.3	Thickness	55
17.5.4	Holiday detection	55
17.5.5	Adhesion	55
17.5.6	Degree of cure	55
17.5.7	Impact resistance	55
17.5.8	Cathodic disbondment	55
17.5.9	Hot-water immersion test	56
17.5.10	Flexibility	56
18	Liquid-applied coatings	56
18.1	Coating identification	56
18.2	Description of the coatings	56
18.2.1	Liquid epoxy -- 18A	56
18.2.2	Liquid polyurethane -- 18B	56
18.2.3	Fibre reinforced epoxy -- 18C	56
18.2.4	Fibre reinforced vinyl ester -- 18D	56
18.2.5	Cast polyurethane -- 18E	57
18.3	Surface preparation	57
18.4	Application of the coatings	57
18.4.1	General	57
18.4.2	Heating	57
18.4.3	Liquid coatings application	57

18.5	Testing of the applied coatings	58
18.5.1	General	58
18.5.2	Thickness	58
18.5.3	Holiday detection	58
18.5.4	Adhesion	58
18.5.5	Impact resistance	58
18.5.6	Hardness	58
18.5.7	Cathodic disbondment	58
18.5.8	Hot-water immersion test	59
18.5.9	Flexibility	59
18.5.10	Indentation resistance	59
18.5.11	Specific electrical insulation resistance	59
18.5.12	Compressive strength	59
18.5.13	Electrical volume resistivity	59
18.5.14	Water absorption	59
19	Hot-applied polyolefin-based coatings	62
19.1	Coating identification	62
19.2	Description of the coatings	62
19.2.1	Flame-sprayed polypropylene -- Type 19A	62
19.2.2	Hot-applied polypropylene tapes/sheets -- Type 19B	62
19.2.3	Injection-moulded polypropylene -- Type 19C	63
19.2.4	Flame-sprayed polyethylene -- Type 19D	63
19.2.5	Hot-applied polyethylene tapes/sheets -- Type 19E	63
19.2.6	Thickness of the epoxy primer	63
19.3	Surface preparation	64
19.4	Application of the coating	64
19.4.1	General	64
19.4.2	Heating	64
19.4.3	Application of the epoxy layer	64
19.4.4	Application of the chemically modified PP or PE	65
19.4.5	Application of the polyolefin top coat	65
19.5	Testing of the applied coatings	65
19.5.1	General	65
19.5.2	Thickness	66
19.5.3	Holiday detection	66
19.5.4	Peel strength	66
19.5.5	Adhesion to plant coating	66
19.5.6	Hot-water immersion test	66
19.5.7	Degree of cure	66
19.5.8	Cathodic disbondment	66
19.5.9	Impact resistance	67
19.5.10	Indentation resistance	67
19.5.11	Oxidation induction time	67
19.5.12	Flexibility	67
20	Thermal spray aluminium (TSA) coatings	70
20.1	Coating identification	70
20.2	Description of the coating	70
20.3	Qualification	70
20.4	Surface preparation	71
20.5	Application of the coating	71
20.5.1	General	71
20.5.2	Aluminium	71
20.5.3	Sealer	71
20.6	Testing of the applied coating	71
20.6.1	General	71
20.6.2	Visual inspection	72
20.6.3	TSA porosity	72
20.6.4	Coating thickness	72
20.6.5	Bend test	72
20.6.6	Pull-off adhesion test	72

20.6.7	Sealer penetration	72
Annex A (normative)	Test programmes for procedure qualification trials (PQT), pre- production trials (PPT) or production testing	74
Annex B (normative)	Inspection of thickness	79
Annex C (normative)	Holiday detection test	80
Annex D (normative)	Impact test	81
Annex E (normative)	Indentation test	83
Annex F (normative)	Specific electrical insulation resistance	85
Annex G (normative)	Cathodic disbondment test	87
Annex H (normative)	Peel strength test	93
Annex I (normative)	Hot water immersion test	99
Annex J (normative)	Lap shear strength	102
Annex K (normative)	Drip resistance	105
Annex L (normative)	Peel strength between layers	106
Annex M (normative)	Thermal ageing resistance	109
Annex N (normative)	Thermal stability test (Hot air ageing)	114
Annex O (normative)	Bursting strength of reinforced backing	115
Annex P (normative)	Thermal analysis of epoxy power and cured coating film (FBE)	116
Annex Q (normative)	Adhesion test -- Resistance to removal	120
	Bibliography	122