

DIN EN ISO 21809-3



ICS 23.040.10; 75.200; 87.040

Ersatz für
DIN EN ISO 21809-3:2016-08

**Erdöl- und Erdgasindustrie –
Umhüllungen für erd- und wasserverlegte Rohrleitungen in
Transportsystemen –
Teil 3: Nachumhüllung der Schweißverbindungen (ISO 21809-3:2016 +
Amd 1:2020);
Englische Fassung EN ISO 21809-3:2016 + A1:2020**

Petroleum and natural gas industries –
External coatings for buried or submerged pipelines used in pipeline transportation systems –
Part 3: Field joint coatings (ISO 21809-3:2016 + Amd 1:2020);
English version EN ISO 21809-3:2016 + A1:2020

Industries du pétrole et du gaz naturel –
Revêtements externes des conduites enterrées ou immergées utilisées dans les systèmes de
transport par conduites –
Partie 3: Revêtements des joints soudés sur site (ISO 21809-3:2016 + Amd 1:2020);
Version anglaise EN ISO 21809-3:2016 + A1:2020

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DIN-Normenausschuss Erdöl- und Erdgasgewinnung (NÖG)
DIN-Normenausschuss Gastechnik (NAGas)
DIN-Normenausschuss Materialprüfung (NMP)

Nationales Vorwort

Dieses Dokument (EN ISO 21809-3:2020-09) wurde vom Technischen Komitee ISO/TC 67 „Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 459 „ECISS — Europäisches Komitee für Eisen- und Stahlnormung“ erarbeitet, dessen Sekretariat von AFNOR (Frankreich) gehalten wird.

Das zuständige nationale Normungsgremium ist der Arbeitsausschuss NA 109-00-02 AA „Fernleitungssysteme — Spiegelausschuss zu ISO/TC 67/SC 2“ im DIN-Normenausschuss Erdöl- und Erdgasgewinnung (NÖG).

Diese Europäische Norm enthält unter Berücksichtigung des DIN-Präsidialbeschlusses 1/2004 nur die englische Originalfassung der ISO Norm.

Dieses Dokument enthält die Änderung 1, angenommen von CEN am 2020-03-06.

Für die in diesem Dokument zitierten Dokumente wird im Folgenden auf die entsprechenden deutschen Dokumente hingewiesen:

ISO 34-1	siehe	DIN ISO 34-1
ISO 62	siehe	DIN EN ISO 62
ISO 527-1	siehe	DIN EN ISO 527-1
ISO 572-2	siehe	DIN EN ISO 527-2
ISO 572-3	siehe	DIN EN ISO 527-3
ISO 868	siehe	DIN EN ISO 868
ISO 1431-1	siehe	DIN ISO 1431-1
ISO 1523	siehe	DIN EN ISO 1523
ISO 1817	siehe	DIN ISO 1817
ISO 2178	siehe	DIN EN ISO 2178
ISO 2808	siehe	DIN EN ISO 2808
ISO 2811-1	siehe	DIN EN ISO 2811-1
ISO 3251	siehe	DIN EN ISO 3251
ISO 4593	siehe	DIN ISO 4593
ISO 4624	siehe	DIN EN ISO 4624
ISO 4625-1	siehe	DIN EN ISO 4625-1
ISO 7619-1	siehe	DIN ISO 7619-1
ISO 8501-1	siehe	DIN EN ISO 8501-1
ISO 8501-3	siehe	DIN EN ISO 8501-3
ISO 8502-3	siehe	DIN EN ISO 8502-3
ISO 8502-6	siehe	DIN EN ISO 8502-6
ISO 8502-9	siehe	DIN EN ISO 8502-9
ISO 8503-1	siehe	DIN EN ISO 8503-1
ISO 8503-2	siehe	DIN EN ISO 8503-2
ISO 8503-3	siehe	DIN EN ISO 8503-3
ISO 8503-4	siehe	DIN EN ISO 8503-4
ISO 8503-5	siehe	DIN EN ISO 8503-5
ISO 8504-2	siehe	DIN EN ISO 8504-2
ISO 8504-3	siehe	DIN EN ISO 8504-3
ISO 11124 (all parts)	siehe	DIN EN ISO 11124 (alle Teile)
ISO 11126 (all parts)	siehe	DIN EN ISO 11126 (alle Teile)
ISO 11357-1	siehe	DIN EN ISO 11357-1
ISO 11357-2	siehe	DIN EN ISO 11357-2
ISO 11357-3	siehe	DIN EN ISO 11357-3

ISO 11357-6	siehe	DIN EN ISO 11357-6
ISO 21809-2	siehe	DIN EN ISO 21809-2
ISO/IEC 17025	siehe	DIN EN ISO/IEC 17025
ISO/TS 29001	siehe	DIN CEN ISO/TS 29001 (DIN SPEC 91241)

Aktuelle Informationen zu diesem Dokument können über die Internetseiten von DIN (www.din.de) durch eine Suche nach der Dokumentennummer aufgerufen werden.

Änderungen

Gegenüber DIN EN ISO 21809-3:2016-08 wurden folgende Änderungen vorgenommen:

- a) Tabelle 1 modifiziert;
- b) Abschnitt 12 wurde inhaltlich umgearbeitet.

Frühere Ausgaben

DIN EN ISO 21809-3: 2016-08

Nationaler Anhang NA (informativ)

Begriffe

Die Benummerung der folgenden Begriffe ist identisch mit der Benummerung in der englischen Fassung.

3 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

3.1

Spezifikation des Umhüllungsverfahrens

APS

(en: application procedure specification)

Dokument, welches das Verfahren, die Methode, Ausrüstung und Werkzeuge zum Aufbringen der Umhüllung beschreibt

3.2

Beschichter

(en: applicator)

Unternehmen, welches Umhüllungen nach diesem Teil der ISO 21809 herstellt

3.3

Charge

(en: batch)

Menge des Materials in einem kontinuierlichen Fertigungsprozess mit Rohstoffen aus gleicher Herkunft und gleichbleibender Qualität

3.4

Chargenzeugnis

(en: batch certificate)

Analysenzertifikat der Charge des Herstellers

3.5

Haftvermittler

(en: bonding agent)

Material, welches als ein Film auf die grundierte Metalloberfläche aufgebracht wird, um die Haftung der nachfolgenden Umhüllung sicherzustellen

3.6

Prüfbescheinigung

(en: inspection document)

Dokument nach ISO 10474:2013 (oder EN 10204:2004), welches die Einhaltung der Anforderungen der Bestellung bestätigt

3.7

Umhüller

(en: coating operative)

Person, welche die Oberflächenvorbereitung und Aufbringung der Umhüllung ausführt

3.8**Rückschnitt**

(en: cutback)

zu Verbindungszwecken (z. B. Schweißen) verbleibende unbeschichtete/nicht umhüllte Rohrenden

3.9**Kunde**

(en: end user)

Unternehmen als Auftraggeber oder als Rohrleitungsbetreiber

3.10**Nachumhüllungsbereich**

(en: field joint area)

nicht umhüllter Verbindungsbereich durch Rohrkürzungen, Rückschnitte oder Schweißnähte, die vor Ort geschweißt werden

3.11**Umhüllungsfehlstelle**

(en: holiday)

Fehler in der Umhüllung, die elektrische Leitfähigkeit aufweist, wenn sie einer bestimmten Spannung ausgesetzt wird

3.12**Prüf- und Testplan****ITP**

(en: inspection and testing plan)

Dokument, welches die Abfolge der Prüfungen und Tests, einschließlich Prüfmitteln und Verfahren zusammenfasst

3.13**Prüfer**

(en: inspector)

Endbenutzer und/oder Käufer, der für einen oder mehrere der in diesem Teil der ISO 21809 festgelegten Prüfungen verantwortlich ist

3.14**Bandlage**

(en: layer of tape)

Einzelbandwicklung ohne Überlappung

Anmerkung1 zum Begriff: Wicklungen eines Bandes mit 50% Überdeckung bilden eine zweilagige Umhüllung

3.15**Hersteller**

(en: manufacturer)

Unternehmen, welches das Umhüllungsmaterial herstellt

3.16**maximale Einsatztemperatur der Nachumhüllung** $T_{\max}$

(en: maximum service temperature of field joint coating)

maximale dauerhafte Temperatur, welcher die Nachumhüllung während des Betriebs standhält

3.17

maximale und minimale der Planung zugrunde gelegte Temperatur der Rohrleitung

(en: maximum and minimum design temperature of pipeline)

maximale und minimale Temperatur, für welche die Rohrleitungen geplant worden ist

3.18

minimale Einsatztemperatur der Nachumhüllung

(en: minimum service temperature of field joint coating)

minimale Temperatur, welcher die Nachumhüllung während des Betriebs und Aufbringung standhält

3.19

Überlappung

(en: overlap)

Bereich, in dem sich Nachumhüllung und Werksumhüllung überschneiden

3.20

Rohrleitung

(en: pipeline)

Einrichtung zum Durchleiten von flüssigen Medien einschließlich Rohr, Molchschleusen, Komponenten und Zubehör und Absperrarmaturen

[QUELLE: ISO 13623]

3.21

Rohrleitungssystem

(en: pipeline system)

Rohrleitungen mit dazugehörigen Anlagenteilen wie Verdichter- oder Pumpstationen, Leitstellen, Mess- und Regelstationen, Speichersysteme, Überwachungs- und Datenverarbeitungssysteme (SCADA), Sicherheitssysteme, Korrosionsschutz-Systeme sowie weitere Einrichtungen oder Gebäude, welche zum Transport von Flüssigkeiten verwendet werden

[QUELLE: ISO 13623]

3.22

Vorfertigungs-Prozess

PPT

(en: pre-production-trail)

Aufbringung der Nachumhüllung und Inspektion/Prüfung ihrer Eigenschaften, um zu bestätigen, dass der APS die Fähigkeit hat, die Nachumhüllung mit der geforderten Qualität auf der Baustelle unmittelbar vor Ausführungsbeginn auszuführen.

3.23

Grundierung

(en: primer)

Material, welches als ein Film auf den Untergrund (Metall-und / oder Werksumhüllung) aufgebracht wird, um die Haftung der nachfolgenden Umhüllung sicherzustellen

3.24

Vorfertigungs-Qualitätssicherungsprüfung

PQT

(en: procedure qualification trial)

Aufbringen einer Nachumhüllung und anschließende Inspektion/Prüfung der geforderten Eigenschaften, um sicherzustellen, dass die APS erfüllt wird, durchgeführt nach den Vorgaben des Herstellers oder einer abgestimmten Ausführung/Lokalität

3.25

Besteller

(en: purchaser)

Unternehmen, welches für die Festlegung der Bestellanforderungen verantwortlich ist

3.26

Wickelschlauch

Schrumpfschlauch

(en: wraparound sleeve)

Hülle, welche die Nachumhüllungsstelle des Stahlrohrs umschließt

Nationaler Anhang NB (informativ)

Literaturhinweise

DIN CEN ISO/TS 29001 (DIN SPEC 91241), *Erdöl-, petrochemische und Erdgasindustrie — Sektorspezifische Qualitätsmanagementsysteme — Anforderungen an Hersteller- und Serviceorganisationen*

DIN EN ISO 62, *Kunststoffe — Bestimmung der Wasseraufnahme*

DIN EN ISO 527-1, *Kunststoffe — Bestimmung der Zugeigenschaften — Teil 1: Allgemeine Grundsätze*

DIN EN ISO 527-2, *Kunststoffe — Bestimmung der Zugeigenschaften — Teil 2: Prüfbedingungen für Form- und Extrusionsmassen*

DIN EN ISO 527-3, *Kunststoffe — Bestimmung der Zugeigenschaften — Teil 3: Prüfbedingungen für Folien und Tafeln*

DIN EN ISO 868, *Kunststoffe und Hartgummi — Bestimmung der Eindruckhärte mit einem Durometer (Shore-Härte)*

DIN EN ISO 1523, *Bestimmung des Flammpunktes — Gleichgewichtsverfahren mit geschlossenem Tiegel*

DIN EN ISO 2178, *Nichtmagnetische Überzüge auf magnetischen Grundmetallen — Messen der Schichtdicke — Magnetverfahren*

DIN EN ISO 2808, *Beschichtungsstoffe — Bestimmung der Schichtdicke*

DIN EN ISO 2811-1, *Beschichtungsstoffe — Bestimmung der Dichte — Teil 1: Pyknometer-Verfahren*

DIN EN ISO 3251, *Beschichtungsstoffe und Kunststoffe — Bestimmung des Gehaltes an nichtflüchtigen Anteilen*

DIN EN ISO 4624, *Beschichtungsstoffe — Abreißversuch zur Bestimmung der Haftfestigkeit*

DIN EN ISO 4625-1, *Bindemittel für Beschichtungsstoffe — Bestimmung der Erweichungstemperatur — Teil 1: Verfahren mit Ring und Kugel*

DIN EN ISO 8501-1, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Visuelle Beurteilung der Oberflächenreinheit — Teil 1: Rostgrade und Oberflächenvorbereitungsgrade von unbeschichteten Stahloberflächen und Stahloberflächen nach ganzflächigem Entfernen vorhandener Beschichtungen*

DIN EN ISO 8501-3, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Visuelle Beurteilung der Oberflächenreinheit — Teil 3: Vorbereitungsgrade von Schweißnähten, Kanten und anderen Flächen mit Oberflächenunregelmäßigkeiten*

DIN EN ISO 8502-3, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Prüfungen zum Beurteilen der Oberflächenreinheit — Teil 3: Beurteilung von Staub auf für das Beschichten vorbereiteten Stahloberflächen (Klebeband-Verfahren)*

DIN EN ISO 8502-6, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Prüfungen zum Beurteilen der Oberflächenreinheit — Teil 6: Lösen von wasserlöslichen Verunreinigungen zur Analyse — Bresle-Verfahren*

DIN EN ISO 8502-9, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Prüfungen zum Beurteilen der Oberflächenreinheit — Teil 9: Feldverfahren zum Bestimmen von wasserlöslichen Salzen durch Leitfähigkeitsmessung*

DIN EN ISO 8503-1, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Rauheitskenngrößen von gestrahlten Stahloberflächen — Teil 1: Anforderungen und Begriffe für ISO-Rauheitsvergleichsmuster zur Beurteilung gestrahlter Oberflächen*

DIN EN ISO 8503-2, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Rauheitskenngrößen von gestrahlten Stahloberflächen — Teil 2: Verfahren zur Prüfung der Rauheit von gestrahltem Stahl — Vergleichsmusterverfahren*

DIN EN ISO 8503-3, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Rauheitskenngrößen von gestrahlten Stahloberflächen — Teil 3: Verfahren zur Kalibrierung von ISO-Rauheitsvergleichsmustern und zur Bestimmung der Rauheit — Mikroskopverfahren*

DIN EN ISO 8503-4, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Rauheitskenngrößen von gestrahlten Stahloberflächen — Teil 4: Verfahren zur Kalibrierung von ISO-Rauheitsvergleichsmustern und zur Bestimmung der Rauheit — Tastschnittverfahren*

DIN EN ISO 8503-5, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Rauheitskenngrößen von gestrahlten Stahloberflächen — Teil 5: Abdruckverfahren zum Bestimmen der Rauheit*

DIN EN ISO 8504-2, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Verfahren für die Oberflächenvorbereitung — Teil 2: Strahlen*

DIN EN ISO 8504-3, *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Verfahren für die Oberflächenvorbereitung — Teil 3: Reinigen mit Handwerkzeugen und mit maschinell angetriebenen Werkzeugen*

DIN EN ISO 11124 (alle Teile), *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Anforderungen an metallische Strahlmittel*

DIN EN ISO 11126 (alle Teile), *Vorbereitung von Stahloberflächen vor dem Auftragen von Beschichtungsstoffen — Anforderungen an nichtmetallische Strahlmittel*

DIN EN ISO 11357-1, *Kunststoffe — Dynamische Differenz-Thermoanalyse (DSC) — Teil 1: Allgemeine Grundlagen*

DIN EN ISO 11357-2, *Kunststoffe — Dynamische Differenz-Thermoanalyse (DSC) — Teil 2: Bestimmung der Glasübergangstemperatur und Glasübergangsstufenhöhe*

DIN EN ISO 11357-3, *Kunststoffe — Dynamische Differenz-Thermoanalyse (DSC) — Teil 3: Bestimmung der Schmelz- und Kristallisationstemperatur und der Schmelz- und Kristallisationsenthalpie*

DIN EN ISO 11357-6, *Kunststoffe — Dynamische Differenz-Thermoanalyse (DSC) — Teil 6: Bestimmung der Oxidations-Induktionszeit (isothermische OIT) und Oxidations-Induktionstemperatur (dynamische OIT)*

DIN EN ISO 21809-2, *Erdöl und Erdgasindustrie — Umhüllungen für erd- und wasserverlegte Rohrleitungen in Transportsystemen — Teil 2: Einsicht-Epoxipulverbeschichtungen*

DIN EN ISO/IEC 17025, *Allgemeine Anforderungen an die Kompetenz von Prüf- und Kalibrierlaboratorien*

DIN ISO 34-1, *Elastomere oder thermoplastische Elastomere — Bestimmung des Weiterreißwiderstandes — Teil 1: Streifen-, winkel- und bogenförmige Probekörper*

DIN ISO 1431-1, *Elastomere oder thermoplastische Elastomere — Widerstand gegen Ozonrissbildung — Teil 1: Statische und dynamische Dehnungsprüfung*

DIN ISO 1817, *Elastomere oder thermoplastische Elastomere — Bestimmung des Verhaltens gegenüber Flüssigkeiten*

DIN ISO 4593, *Prüfung von Kunststoff-Folien — Bestimmung der Dicke durch mechanische Abtastung*

DIN ISO 7619-1, *Elastomere oder thermoplastische Elastomere — Bestimmung der Eindringhärte — Teil 1: Durometer-Verfahren (Shore-Härte)*

English Version

**Petroleum and natural gas industries - External coatings
for buried or submerged pipelines used in pipeline
transportation systems - Part 3: Field joint coatings
(ISO 21809-3:2016)**

Industries du pétrole et du gaz naturel - Revêtements
externes des conduites enterrées ou immergées
utilisées dans les systèmes de transport par conduites -
Partie 3: Revêtements des joints soudés sur site
(ISO 21809-3:2016)

Erdöl- und Erdgasindustrie - Umhüllungen für erd- und
wasserverlegte Rohrleitungen in Transportsystemen -
Teil 3: Nachumhüllungen der Schweißverbindungen -
(ISO 21809-3:2016)

This European Standard was approved by CEN on 17 March 2016.

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European foreword

This document (EN ISO 21809-3:2016) has been prepared by Technical Committee ISO/TC 67 “Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries” in collaboration with Technical Committee ECISS/TC 110 “Steel tubes, and iron and steel fittings” the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2016, and conflicting national standards shall be withdrawn at the latest by September 2016.

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Endorsement notice

The text of ISO 21809-3:2016 has been approved by CEN as EN ISO 21809-3:2016 without any modification.

English Version

**Petroleum and natural gas industries - External coatings
for buried or submerged pipelines used in pipeline
transportation systems - Part 3: Field joint coatings -
Amendment 1: Introduction of mesh-backed coating
systems (ISO 21809-3:2016/Amd 1:2020)**

Industries du pétrole et du gaz naturel - Revêtements
externes des conduites enterrées ou immergées
utilisées dans les systèmes de transport par conduites -
Partie 3: Revêtements des joints soudés sur site -
Amendement 1: Introduction de systèmes de
revêtement à support maillé (ISO 21809-3:2016/Amd 1:2020)

Erdöl- und Erdgasindustrie - Umhüllungen für erd- und
wasserverlegte Rohrleitungen in Transportsystemen -
Teil 3: Nachumhüllung der Schweißverbindungen -
Änderung 1 (ISO 21809-3:2016/Amd 1:2020)

This amendment A1 modifies the European Standard EN ISO 21809-3:2016; it was approved by CEN on 6 March 2020.

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European foreword

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This Amendment to the European Standard EN ISO 21809-3:2016 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2020, and conflicting national standards shall be withdrawn at the latest by October 2020.

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Endorsement notice

The text of ISO 21809-3:2016/Amd 1:2020 has been approved by CEN as EN ISO 21809-3:2016/A1:2020 without any modification.

**Petroleum and natural gas
industries — External coatings for
buried or submerged pipelines used
in pipeline transportation systems —**

**Part 3:
Field joint coatings**

**AMENDMENT 1: Introduction of mesh-
backed coating systems**

*Industries du pétrole et du gaz naturel — Revêtements externes
des conduites enterrées ou immergées utilisées dans les systèmes de
transport par conduites —*

Partie 3: Revêtements des joints soudés sur site

*AMENDEMENT 1: Introduction de systèmes de revêtement à
support maillé*





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Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems —

Part 3: Field joint coatings

AMENDMENT 1: Introduction of mesh-backed coating systems

Clause 8, Table 1

Replace the following row:

Clause	Code	Type of field joint coating
12	12	Cold-applied polymeric tape coatings

with

Clause	Code	Type of field joint coating
12	12A	Cold-applied tape coatings with a polymeric continuous backing
	12B	Cold-applied tape coatings with a polymeric mesh backing

Clause 12

Replace text with the following:

12 Cold-applied polymeric tape coatings

12.1 Coating identification

Cold-applied polymeric tape coatings (FJC Types 12A or 12B) shall be identified in the APS in accordance with Table 2 and shall meet the requirements of Table 10. Data sheets for the coating materials shall be in accordance with Table 4 (primer) and Table 5 (tape).

Application instructions shall be provided by the manufacturer in accordance with Table 6.

12.2 Description of the coatings

12.2.1 Cold-applied tape coatings with a polymeric continuous backing (Type 12A)

Cold-applied tape coatings with a polymeric continuous backing consist of several layers of one or more continuous polymeric tapes, with or without a primer.

This coating type can be further subdivided into the following:

- **12A-1:** with a $T_{\max}$ not greater than 50 °C;
- **12A-2:** with a $T_{\max}$ not greater than 80 °C;
- **12A-3:** with a $T_{\max}$ not greater than 120 °C.

The $T_{\max}$ shall be stated in brackets, e.g. FJC Type 12A-1(30) or FJC Type 12A-1(50).

A $T_{\max}$ higher than 120 °C can be agreed as long as the requirements of Table 10 are met.

12.2.2 Cold-applied tape coatings with a polymeric mesh backing (Type 12B)

Cold-applied tape coatings with a polymeric mesh backing consist of a single layer or multiple layers of one or more mesh-backed tapes, with or without a primer.

The mesh-backed tape shall be composed of rubber or polymeric based adhesive and a supporting woven fabric backing.

This coating type can be further subdivided into the following:

- **12B-1:** with a $T_{\max}$ not greater than 50 °C;
- **12B-2:** with a $T_{\max}$ not greater than 80 °C;

The $T_{\max}$ shall be stated in brackets, e.g. FJC Type 12B-1(30) or FJC Type 12B-1(50).

A $T_{\max}$ higher than 80 °C can be agreed as long as the requirements of Table 10 are met.

12.3 Surface preparation

Surface preparation shall be carried out in accordance with the APS. The edges of the plant coating shall be bevelled and the plant coating shall be roughened for the minimum length according to the overlap on the plant coating (12.4.4).

The area to be coated shall be cleaned by abrasive blast-cleaning as described in ISO 8504-2 to a minimum grade Sa 2 according to ISO 8501-1. The profile/roughness shall be in accordance with the manufacturer's application instructions.

For FJC Type 12A-1 and Type 12-B, surface preparation can be achieved by power tool cleaning as described in ISO 8504-3 to a minimum grade St 3 according to ISO 8501-1, by agreement of the end user.

Dust contamination shall be grade 3 or better, measured in accordance with ISO 8502-3.

12.4 Coating application

12.4.1 General

Application of the coating, including the primer if applicable, shall be carried out in accordance with the APS.

12.4.2 Application of the primer

If applicable, application of the primer shall be carried out in accordance with the APS.

12.4.3 Application of polymeric tapes with continuous or mesh backing

Application shall be carried out in accordance with the APS.

As a general guide, the following application procedure shall be followed.

- Prepare the surface according to the approved method.
- Apply a thin coat of compatible primer (if any); allow the primer to dry.
- Spirally wrap the area being coated with tapes of an adequate width, employing the right overlap and using sufficient tension to ensure a complete conformability of the coating. Any tenting effect shall be prevented. A manual application tool should be used to achieve these goals.

A single piece of wrapping wide enough to cover the required area may be used in certain circumstances (in particular, for offshore installation on a conventional barge).

12.4.4 Overlaps

The minimum tape overlap shall be in accordance with Table 7, or the manufacturer's required overlap (Table 6) if greater.

The overlap of tape on plant-applied coating shall be in accordance with the manufacturer's application instructions (Table 6) and shall be at least 50 mm.

12.5 Testing of the applied coatings

12.5.1 General

The tests in 12.5.2 to 12.5.11 shall be carried out for production quality control, and for PQT and PPT if required.

12.5.2 Thickness

The nominal thickness is the calculated sum of the thickness of all the layers of the coating before application. The minimum thickness of the coating on the body of the joint shall be not less than 90 % of the nominal value or as otherwise agreed to by the purchaser.

Unless otherwise agreed with the purchaser, the minimum thickness on the weld cap shall be not less than 0,6 mm.

NOTE The coating thickness on the weld cap is normally less than on the body because some of the polymeric adhesive flows from the weld cap to the body, both during and after the application. This is necessary to prevent voids in the coating and is not detrimental to the corrosion protection.

The coating thickness shall be measured using the method given in Annex B.

12.5.3 Holiday detection

The entire surface of the coated joint shall be checked for holidays or other discontinuities according to the method defined in Annex C.

The voltage of the holiday detector shall be set at the following values:

- 5 kV/mm + 5 kV at a maximum of 25 kV for cold-applied polymeric continuous tape coatings (Type 12A)
- 5 kV/mm at a maximum of 15 kV for cold-applied polymeric mesh-backed tape coatings (Type 12B).

Holidays shall be repaired in accordance with the APS.

12.5.4 Impact resistance

The impact resistance shall be measured using the method given in Annex D and shall meet the requirements of Table 10.

12.5.5 Indentation resistance

The indentation resistance shall be measured using the method given in Annex E and shall meet the requirements of Table 10.

12.5.6 Cathodic disbondment

The cathodic disbondment shall be measured using the method given in Annex G.

The cathodic disbondment after 28 days at 23 °C shall meet the requirements of Table 10. A test duration of 48 h instead of 28 days can be used for PPT provided that the test temperature is increased to 65 °C and a comparison of results is performed during PQT.

The maximum cathodic disbondment after 28 days at maximum service temperature shall meet the requirements of Table 10. It shall be agreed between the end user and the applicator for Type 12A.

12.5.7 Peel strength between tape layers

The peel strength between tape layers shall be measured using the method given in Annex L and shall meet the requirements of Table 10.

12.5.8 Peel strength to pipe surface and plant coating

Unless specified otherwise by the manufacturer, the minimum waiting period between application of the coating and the peel strength test shall be 120 h. This waiting period may be reduced to 24 h. However, if this test fails, it shall be carried out again after a waiting period of 120 h.

The peel strength shall be measured using the methods given in Annex H and shall meet the requirements of Table 10. The method given in H.1 shall be used for PQT. The method given in H.2 can be used for PPT and production testing.

Failure shall not occur at the interface between steel and adhesive, nor between adhesive and polyolefin or mesh backing, except for coatings with a peeling strength 50 % higher than the values listed in Table 10.

12.5.9 Hot-water immersion test

A hot-water immersion test shall be carried out in accordance with Annex I with a duration of 28 days, the test temperature being the maximum service temperature of the joint coating, limited as specified in Annex I.

The peel strength after the hot-water immersion test shall be measured using the method given in H.1 and shall meet the requirements of Table 10.

12.5.10 Lap shear strength

The lap shear strength resistance shall be measured using the method given in Annex J and shall meet the requirements of Table 10.

12.5.11 Thermal ageing resistance

The thermal ageing resistance shall be measured using the method given in Annex M and shall meet the requirements of Table 10.

Table 10 — Requirements for Type 12A (Polymeric continuous tapes) and Type 12B (Polymeric mesh-backed tapes)

Property	Test temp.	Unit	Type 12A-1 ($T_{\max} \leq 50\text{ °C}$)	Type 12A-2 ($T_{\max} \leq 80\text{ °C}$)	Type 12A-3 ($T_{\max} \leq 120\text{ °C}$)	Type 12B-1 ($T_{\max} \leq 50\text{ °C}$)	Type 12B-2 ($T_{\max} \leq 80\text{ °C}$)	Test method	
Thickness	—	mm	≥0,9 × nominal value						Annex B
Holiday detection: no holiday at:	—	—	5 kV/mm + 5 kV, max. 25 kV			5 kV/mm, max. 15 kV		Annex C	
Impact resistance	23 °C	J/mm	≥4			≥1,25		Annex D	
Indentation resistance, pressure	23 °C and	N/mm ²	10,0	1,0	1,0	0,1	0,1	Annex E	
— Residual thickness	$T_{\max}$	mm	≥0,6	≥0,6	≥0,6	≥0,6	≥0,6		
Cathodic disbondment resistance 28 days	23 °C $T_{\max}$	mm mm	≤15 a	≤15 a	≤15 a	≤10 ≤15	≤5 ≤10	Annex G	
Peel strength between tape layers								Annex L	
^a By agreement after qualification.									
^b The test is considered passed when the tape leaves a film of adhesive on the substrate.									

Table 10 (continued)

Property	Test temp.	Unit	Type 12A-1 ($T_{\max} \leq 50\text{ °C}$)	Type 12A-2 ($T_{\max} \leq 80\text{ °C}$)	Type 12A-3 ($T_{\max} \leq 120\text{ °C}$)	Type 12B-1 ($T_{\max} \leq 50\text{ °C}$)	Type 12B-2 ($T_{\max} \leq 80\text{ °C}$)	Test method		
— inner/inner	23 °C	N/mm	≥1,50	≥1,50	≥2,00	≥1,50	≥1,00			
— outer/inner	23 °C	N/mm	≥1,50	≥1,50	≥1,50	n.a.	n.a.			
— inner/inner, outer/inner	$T_{\max}$	N/mm	≥0,20	b	b	b	b			
— outer/outer	23 °C	N/mm	≥0,20	≥0,20	≥0,80	n.a.	n.a.			
— outer/outer	$T_{\max}$	N/mm	≥0,20	b	b	n.a.	n.a.			
Peel strength								Annex H		
— to steel surface	23 °C	N/mm	≥1,00	≥1,00	≥1,00	≥0,2	≥1,50			
— to steel surface	$T_{\max}$	N/mm	≥0,10	b	b	≥0,04	b			
— to plant coating	23 °C	N/mm	≥0,40	≥0,40	≥0,40	≥0,40	≥1,50			
— to plant coating	$T_{\max}$	N/mm	≥0,04	b	b	≥0,04	b			
— to plant coating after 28-day hot-water immersion test at $T_{\max}$	23 °C	N/mm	≥0,40	≥0,40	≥0,40	≥0,40	≥0,80	Annex I		
— to steel surface after 28-day hot-water immersion test at $T_{\max}$	23 °C	N/mm	≥0,40	≥0,40	≥0,40	≥0,40	b	Annex I		
Lap shear strength	23 °C	N/mm ²	≥0,050	≥0,050	≥0,100	≥0,050	≥0,100	Annex J		
	$T_{\max}$	N/mm ²	≥0,050	≥0,020	b	≥0,010	≥0,020			
Thermal ageing resistance	—	—						Annex M		
Ratio of:										
— elongation at break						$1,25 \geq E_{100}/E_0 \geq 0,75$ $E_{100}/E_{70} \geq 0,8$	a		a	a
— peel strength between tape layers						$P'_{100}/P'_0 \geq 0,75$ $P'_{100}/P'_{70} \geq 0,8$	a		a	a
— peel strength to pipe surface			$P_{100}/P_0 \geq 0,75$ $P_{100}/P_{70} \geq 0,8$		a	a	a			
^a By agreement after qualification.										
^b The test is considered passed when the tape leaves a film of adhesive on the substrate.										

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

*Industries du pétrole et du gaz naturel — Revêtements externes
des conduites enterrées ou immergées utilisées dans les systèmes de
transport par conduites —*

Partie 3: Revêtements des joints soudés sur site





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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-crystalline low-viscosity polyolefin based coatings.....	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	<i>In situ</i> 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 powder and cured coating film (FBE)	116
Annex Q (normative) Adhesion test — Resistance to removal	120
Bibliography	122

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 2, *Pipeline transportation systems*.

This second edition cancels and replaces the first edition (ISO 21809-3:2008), which has been technically revised. It also incorporates the Amendment ISO 21809-3:2008/Amd 1:2011.

ISO 21809 consists of the following parts, under the general title *Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems*:

- *Part 1: Polyolefin coatings (3-layer PE and 3-layer PP)*
- *Part 2: Single layer fusion-bonded epoxy coatings*
- *Part 3: Field joint coatings*
- *Part 4: Polyethylene coatings (2-layer PE)*
- *Part 5: External concrete coatings*

Multilayer fusion bonded epoxy coatings is to form the subject of future part 6.

Coating repairs on rehabilitation is to form the subject of future part 11.

Introduction

Users of this part of ISO 21809 are to be aware that further or differing requirements can be needed for individual applications. This part of ISO 21809 is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This can be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the vendor is to identify any variations from this part of ISO 21809 and provide details.

Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems —

Part 3: Field joint coatings

1 Scope

This part of ISO 21809 specifies requirements for field joint coating of seamless or welded steel pipes for buried and submerged sections of pipeline transportation systems used in the petroleum, petrochemical and natural gas industries as defined in ISO 13623. This part of ISO 21809 specifies the qualification, application and testing of the corrosion protection coatings applied to steel surfaces left bare after the joining of pipes and fittings (components) by welding.

This part of ISO 21809 defines and codifies in Table 1 the different types of field joint coatings for pipelines.

This part of ISO 21809 does not address requirements for additional mechanical protection, for thermal insulation or for joint infills of concrete weight-coated pipes.

NOTE Field joints of pipes and fittings coated in accordance with this part of ISO 21809 are considered suitable for further protection by means of cathodic protection.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 34-1, *Rubber, vulcanized or thermoplastic — Determination of tear strength — Part 1: Trouser, angle and crescent test pieces*

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 62, *Plastics — Determination of water absorption*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 1523, *Determination of flash point — Closed cup equilibrium method*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 2781, *Rubber, vulcanized or thermoplastic — Determination of density*

ISO 2808, *Paints and varnishes — Determination of film thickness*

ISO 2811-1, *Paints and varnishes — Determination of density — Part 1: Pyknometer method*

ISO 3251, *Paints, varnishes and plastics — Determination of non-volatile-matter content*

ISO 3303-1, *Rubber- or plastics-coated fabrics — Determination of bursting strength — Part 1: Steel-ball method*

ISO 3417, *Rubber — Measurement of vulcanization characteristics with the oscillating disc curemeter*

ISO 3801, *Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area*

ISO 4591, *Plastics — Film and sheeting — Determination of average thickness of a sample, and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness)*

ISO 4593, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*

ISO 4624, *Paint and varnishes — Pull-off test for adhesion*

ISO 4625-1, *Binders for paints and varnishes — Determination of softening point — Part 1: Ring-and-ball method*

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

ISO 7619-1, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 1: Durometer method (Shore hardness)*

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 8501-3, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, edges and other areas with surface imperfections.*

ISO 8502-3, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)*

ISO 8502-6, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 6: Extraction of soluble contaminants for analysis — The Bresle method*

ISO 8502-9, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 9: Field method for conductometric determination of water-soluble salts*

ISO 8503-1, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces*

ISO 8503-2, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel — Comparator procedure*

ISO 8503-4, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile — Stylus instrument procedure*

ISO 8503-5, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 5: Replica tape method for the determination of the surface profile*

ISO 8504-2, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 2: Abrasive blast-cleaning*

ISO 8504-3, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 3: Hand- and power-tool cleaning*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 11124 (all parts), *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives*

ISO 11126 (all parts), *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives*

ISO 11357-1, *Plastics — Differential scanning calorimetry (DSC) — Part 1: General principles*

ISO 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature and glass transition step height*

ISO 11357-3, *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ISO 13623, *Petroleum and natural gas industries — Pipeline transportation systems*

ISO 21809-2, *Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems — Part 2: Single layer fusion-bonded epoxy coatings*

ISO 80000-1:2009, *Quantities and units — Part 1: General*

EN 10204, *Metallic products — Types of inspection documents*

ASTM D70¹⁾, *Standard Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)*

ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*

ASTM D127, *Standard Test Method for Drop Melting Point of Petroleum Wax, Including Petrolatum*

ASTM D149, *Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies*

ASTM D257, *Standard Test Methods for DC Resistance or Conductance of Insulating Materials*

ASTM D695, *Standard Test Method for Compressive Properties of Rigid Plastics*

ASTM D937, *Standard Test Method for Cone Penetration of Petrolatum*

ASTM D938, *Standard Test Method for Congealing Point of Petroleum Waxes, Including Petrolatum*

ASTM D1000, *Standard Test Methods for Pressure — Sensitive Adhesive — Coated Tapes Used for Electrical and Electronic Applications*

1) American Society for Testing and Materials, 100 Harbour Drive, West Conshohocken, PA 19380-2959, USA

ASTM D1141, *Standard Practice for the Preparation of Substitute Ocean Water*

ASTM D1321, *Standard Test Method for Needle Penetration of Petroleum Waxes*

ASTM D2084, *Standard Test Method for Rubber Property — Vulcanization Using Oscillating Disk Cure Meter*

ASTM D4285, *Standard Test Method for Indicating Oil or Water in Compressed Air*

ASTM D4541, *Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers*

AWS C2.25/C2.25M²⁾, *Specification for Thermal Spray Feedstock Solid and Composite Wire and Ceramic Rods*

SSPC-SP1³⁾, *Surface preparation specification No.1 — Solvent cleaning*

SSPC CS 23.00, *Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminium, Zinc and Their Alloys and Composites for the Corrosion Protection of Steel*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 application procedure specification APS

document describing procedures, methods, equipment and tools used for field joint coating application

3.2 applicator

company that undertakes the coating application in accordance with the provisions of this part of ISO 21809

3.3 batch

quantity of material produced in a continuous manufacturing operation using raw materials of the same source and grade

3.4 batch certificate

certificate of analysis issued by the manufacturer for a given batch

3.5 bonding agent

material applied as a film to the primed steel surface in order to ensure adhesion of the subsequent protective coating

3.6 inspection document

document issued in accordance with ISO 10474 (or EN 10204) stating compliance with the requirements given in the purchase order

3.7 coating operative

individual undertaking coating activity on the work site, including surface preparation

3.8 cutback

length of pipe left uncoated at each end for joining purposes (e.g. welding)

2) America Welding Society, 550 N.W. Le Jeune Road, Miami, Florida 33126, USA.

3) The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656, USA.

3.9

end user

company that owns and/or operates the pipeline system

3.10

field joint area

uncoated area that results when two pipe sections or a pipe section and a fitting with coating cutbacks are assembled by welding in the field

3.11

holiday

coating discontinuity that exhibits electrical conductivity when exposed to a specific voltage

3.12

inspection and testing plan

ITP

document providing an overview of the sequence of inspections and tests, including resources and procedures

3.13

inspector

end user and/or purchaser's representative responsible for one or more of the inspections specified in this part of ISO 21809

3.14

layer of tape

single wrap of tape without overlap

Note 1 to entry: Wrapping of a tape with 50 % overlap constitutes a two-layer coating.

3.15

manufacturer

company responsible for the manufacture of coating material

3.16

maximum service temperature of field joint coating

$T_{\max}$

maximum continuous temperature that the field joint coating can resist during operation

3.17

maximum and minimum design temperature of pipeline

maximum and minimum operating temperature for which the pipeline has been designed

3.18

minimum service temperature of field joint coating

minimum temperature that the field joint coating can resist during operation and installation

3.19

overlap

length of the field joint coating over the plant-applied coating including the coating bevel

3.20

pipeline

those facilities through which fluids are conveyed, including pipe, pig traps, components and appurtenances, up to and including the isolating valves

[SOURCE: ISO 13623]

3.21

pipeline system

pipeline with compressor or pump stations, pressure control stations, flow control stations, metering, tankage, supervisory control and data acquisition system (SCADA), safety systems, corrosion protection systems, and any other equipment, facility or building used in the transportation of fluids

[SOURCE: ISO 13623]

3.22

pre-production trial

PPT

application of coating and inspection/testing of its properties immediately prior to start of production, to confirm that the APS is able to produce field joint coatings with the specified properties

3.23

primer

material applied as a film on substrate (steel and/or plant coating) to ensure adhesion of the subsequent protective coating

3.24

procedure qualification trial

PQT

application of a field joint coating and subsequent inspection/testing of its properties, to confirm that the APS is able to produce a coating with the specified properties, carried out at the premises of the applicator or any other agreed location

3.25

purchaser

company responsible for providing the product order requirements

3.26

wraparound sleeve

sleeve wrapped circumferentially around the steel pipe area being coated

4 Symbols and abbreviated terms

4.1 Symbols

c	bursting strength without heat ageing
B_{70}	bursting strength after heat ageing for 70 days
B_{100}	bursting strength after heat ageing for 100 days
C	percentage of conversion of FBE coating
ΔH	exothermic heat of reaction
ΔT_g	variation of glass transition temperature between two or more successive thermal analysis scans
E_0	elongation at break without heat ageing
E_{70}	elongation at break after heat ageing for 70 days
E_{100}	elongation at break after heat ageing for 100 days
P_0	peel strength to pipe surface without heat ageing

P_{70}	peel strength to pipe surface after heat ageing for 70 days
P_{100}	peel strength to pipe surface after heat ageing for 100 days
P'_0	peel strength between layers without heat ageing
P'_{70}	peel strength between layers after heat ageing for 70 days
P'_{100}	peel strength between layers after heat ageing for 100 days
R_S	specific electrical resistance of a coating
R_{S70}	specific electrical resistance after 70 days
R_{S100}	specific electrical resistance after 100 days
$T_{\max}$	maximum service temperature of field joint coating

4.2 Abbreviated terms

APS	application procedure specification
DFT	dry film thickness
DSC	differential scanning calorimetry
EP	epoxy
EPDM	ethylene propylene diene monomer
FBE	fusion-bonded epoxy
FJC	field joint coating
HSS	heat-shrink sleeve
ITP	inspection and testing plan
MSDS	material safety data sheet
PE	polyethylene
PP	polypropylene
PPT	pre-production trial
PQT	procedure qualification trial
PU	polyurethane
PVC	polyvinylchloride
TSA	thermal spray aluminium
2LPE	two-layer polyethylene coating
3LPE	three-layer polyethylene coating
3LPP	three-layer polypropylene coating

5 General requirements

5.1 Responsibility of the end user

The end user shall be responsible for making or approving the appropriate selection of the FJC in accordance with the specified service conditions. He shall validate the information to be supplied by the purchaser as listed in Clause 6.

5.2 Rounding

Unless otherwise stated in this part of ISO 21809, to determine conformance with the specified requirements, observed or calculated values shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with ISO 80000-1:2009, Annex B, Rule A.

NOTE For the purposes of this provision, the rounding method of ASTM E29 is equivalent to ISO 80000-1:2009, Annex B, Rule A.

5.3 Compliance, testing and quality

Systems for quality and environmental management, and good laboratory practices, should be applied to assist compliance with the requirements of this part of ISO 21809.

NOTE 1 ISO/TS 29001 gives sector-specific guidance on quality management systems

NOTE 2 ISO 14001 gives guidance on the selection and use of an environmental management system.

NOTE 3 ISO/IEC 17025 gives guidance for testing laboratories.

6 Information to be supplied by the purchaser

6.1 General information

The purchase order shall include the following information:

- designation of this part of ISO 21809;
- type of field joint coating system in accordance with Table 1;
- minimum and maximum thickness of the field joint coating (if applicable);
- minimum and maximum design temperature of the pipeline;
- cutback length (or length of the field joint being coated), including tolerances;
- pipe material/grade;
- pipe nominal outer diameter and wall thickness;
- plant-applied coating system, including thickness;
- number of field joints to be coated;
- type and frequency of inspection document in accordance with ISO 10474 or EN 10204 (see 7.7).

6.2 Additional information

The purchase order shall specify which of the following provisions apply for the specific order item:

- permissible field joint coating repairs (see 9.5);

- acceptable level of soluble salts (see 9.1.2.2);
- any special requirement with regard to FJC overall thickness and/or thickness of individual layers (see 10.5.2, 11.5.2, 12.5.2, 13.5.2, 16.5.3, 17.5.3, 18.5.2, 19.5.2);
- overlap on the parent (i.e. “plant-applied”) coating or detailed drawing of the field joint coating with dimensional tolerances (see 17.5.3);
- requirements for traceability and marking;
- requirements for documentation and schedule of supply of documentation (see 7.7);
- qualification of the applicator’s personnel who apply and/or inspect the coating (see 7.5);
- purchaser’s approval of the application procedure specification (APS) (see 7.1);
- use of specific proprietary coating materials (see 7.2);
- procedure qualification trial (PQT) (see 7.3);
- pre-production trial (PPT) (see 7.4);
- subsequent coating (or infill) being applied;
- temperature range during installation;
- method of installation of the pipeline;
- time constraints for application and number and dimensions of working stations, if relevant;
- specific testing conditions and minimum requirements when applicable (e.g. cathodic disbondment or flexibility) (see 17.5.8, 17.5.10, etc.).

7 Application procedures and qualification

7.1 Application procedure specification (APS)

The applicator shall prepare an APS to be approved by the end user and/or purchaser prior to the start of production and prior to any agreed PQT and/or PPT (see 7.3 and 7.4). The responsibilities shall be clearly defined between all parties. Once approved, the APS shall not be changed without prior written authorization of the parties.

The APS shall include the following:

- identification of the coating;
- manufacturer’s instructions for application, including the acceptable temperature range during installation;
- preparation of steel surface and plant-applied coating, including inspection (see 9.1);
- data sheets defining coating and abrasive blasting material properties, including all health and safety data (see 7.2 and 9.1.2.2);
- maximum service temperature, $T_{\max}$, of field joint coating;
- receipt, handling and storage of coating and abrasive blasting materials (see 7.2 and 9.1.2.2);
- coating application procedure, tools and equipment;
- overlap (with tolerances) of FJC over plant coating (a drawing should be considered for certain types of FJC);

- time required for coating application;
- inspection and testing of applied FJC;
- repair and testing of defective FJC;
- stripping of defective FJC;
- marking, traceability and documentation.

The APS shall cover all items associated with quality control as defined in this part of ISO 21809 and any agreed options for the specific FJC.

All coating work, testing and inspection shall be carried out according to the APS.

7.2 Coating materials

The applicator shall provide the data sheets specified in Clauses 10 to 20 for each coating material from the manufacturer.

In addition to the coating-material data sheets, the applicator shall provide the following information from the manufacturer:

- batch certificates certifying that the coating materials delivered meet the coating characteristics as set forth in the coating data sheets;
- any agreed optional requirements, if applied according to the manufacturer's instructions;
- packaging, transport and storage requirements of coating materials;
- range of application conditions including minimum and maximum application temperatures (for materials and substrate) and relative humidity;
- material safety data sheet (MSDS).

Marking on each shipment of coating materials shall contain the following information:

- manufacturer's name;
- name and complete identification of material, including plant of origin;
- reference to applicable coating-material standards, if any;
- production batch number;
- mass/size;
- date of production;
- expiry date.

7.3 Procedure qualification trial (PQT)

If specified by the purchaser or otherwise required by this part of ISO 21809, the APS shall be qualified by a PQT. Test methods and frequencies for PQT are specified in Annex A. Acceptance criteria are given in the relevant clauses referred to in Annex A.

The applicator may request the manufacturer(s) to assist during the PQT to ensure the correct use of the coating material(s) and to train applicator personnel.

PQT may be carried out independently of any project. In this case, representative pipes having the diameter, thickness and plant-coating as agreed upon between manufacturer, applicator, end user and purchaser, if any, shall be used.

For a PQT related to a specific project, tests shall be carried out on test zones distributed along a pipe coated with the actual plant-applied coating. The length of the test zones shall be equivalent to the field joint coating length. The test points shall be defined in the PQT programme.

If not present, a circumferential cap weld shall be added at the centre of each of the test zones to simulate the field weld.

If heating of the area to be coated is specified in the APS, it shall be demonstrated that there is no visual detrimental effect such as blistering or disbondment of the plant-applied coating.

All tools and equipment (e.g. for induction heating, abrasive blasting, coating application and inspection) being used for PQT shall be of the same type as those being used for the actual field joint coating.

Unless otherwise specified, at least three test zones shall be coated.

Coating repairs and stripping of defective FJC shall be included in PQT if they are allowed.

The time for coating application during PQT shall be consistent with the estimated field joint coating time in the field. Any significant differences in the PQT environment compared to actual production conditions should be considered, e.g. number of work stations, lifting equipment.

For pipelines that experience deformations above 0,3 % during handling or installation (e.g. reeling), the PQT shall include relevant tests carried out after pipe deformation. The test temperature shall be at least 5 °C below minimum deformation temperature.

The applicator shall submit a complete report of the qualification test results to the purchaser for approval.

7.4 Pre-production trial (PPT)

If specified by the purchaser or otherwise required by this part of ISO 21809, a PPT shall be performed on site to verify the following:

- surface condition and adhesion of the plant-applied coating on steel in the vicinity of the cut-backs;
- field joint coating materials;
- application procedure;
- equipment being used for surface preparation and coating application;
- heating equipment (when used);
- application of the coating system;
- qualification of the coating operatives and purchaser's inspectors that will actually be used in the field;
- properties of the applied FJC.

The above shall comply with the requirements of this part of ISO 21809 and the results of any previous PQT.

Test methods and frequencies for PPT are specified in Annex A. Acceptance criteria are given in the relevant clauses to which reference is made in Annex A.

The PPT shall be carried out in presence of the end user and/or purchaser (or their representative) at the start of operations when equipment and personnel are mobilized on site. The PPT shall be performed on the first joints to be coated or, if agreed, on a dummy pipe.

The applicator shall submit a complete report of the tests containing the values and other results obtained in the PPT.

7.5 Qualification of coating and inspection personnel

The coating operatives shall be qualified to undertake the coating application procedure and repair work. The qualification may be obtained by demonstration during PQT, during PPT, through a certification organization or as agreed with the end user.

The applicator shall request the manufacturer of the coating material(s) and equipment to provide technical assistance to the coating operatives if necessary.

Inspectors and applicator personnel carrying out the coating inspection shall be trained and qualified. Proof of successful qualification shall be documented.

7.6 Production testing and inspection

The applicator shall perform inspection and testing during production in accordance with an ITP to verify the surface preparation, coating application and the specified properties of the applied FJC.

The ITP shall be prepared by the applicator and shall be approved by the purchaser prior to the start of the coating work and prior to the start of any PQT and/or PPT. The ITP shall identify all inspection activities and tests, their frequency and the relevant inspection authorities.

Test methods and frequencies are specified in Annex A. Acceptance criteria are given in the relevant clauses to which reference is made in Annex A.

7.7 Inspection documents and traceability

The inspection documents shall be in accordance with ISO 10474 or EN 10204. The type of certificate of compliance shall be defined in the purchase order.

FJC reports shall identify each field joint by a unique number for identification purposes and shall record the material batch number for traceability. Test results shall be linked to the field joint number or repair on which they were performed. Records shall be maintained on a shift and daily basis and shall be available for inspection by the purchaser and/or end user.

The inspection documents signed by the applicator (and the inspector, if applicable) shall be transmitted to the purchaser at a frequency defined in the purchase order. Cumulative production records shall be maintained daily.

8 Classification of field joint coatings

The FJC types covered by this part of ISO 21809 are classified in Table 1.

Table 1 — FJC types

Clause	Code	Type of field joint coating
10	10	Hot-applied bituminous tape coatings
11	11A	Petrolatum tape coatings
	11B	Wax-based tape coatings
12	12	Cold-applied polymeric tape coatings
13	13A	Non-crystalline low-viscosity polyolefin based coatings with polymeric tape outer wrap
	13B	Non-crystalline low-viscosity polyolefin based coatings with heat shrinkable material outer wrap

Table 1 (continued)

Clause	Code	Type of field joint coating
14	14A	Coatings based on heat-shrinkable materials, polyethylene-base, applied without primer
	14B	Coatings based on heat-shrinkable materials, polyethylene-based, applied over a liquid epoxy, fusion-bonded epoxy, or other compatible primer layer
	14C	Coatings based on heat-shrinkable materials, polyolefin-based, with reinforced backing (hybrid), applied over a liquid epoxy, fusion-bonded epoxy, or other compatible primer layer
	14D	Coatings based on heat-shrinkable materials, polypropylene-based, applied over a liquid epoxy, fusion-bonded epoxy, or other compatible primer layer
15	15	Hot-applied microcrystalline wax coatings
16	16A	Elastomeric coatings, polychloroprene-based
	16B	Elastomeric coatings, EPDM-based
17	17A	Single-layer fusion-bonded epoxy powder coatings
	17B	Two-layer fusion-bonded epoxy powder coatings
18	18A	Liquid applied epoxy based coatings
	18B	Liquid applied polyurethane based coatings
	18C	Fibre-reinforced epoxy based coatings
	18D	Fibre-reinforced vinylester based coatings
	18E	Cast solid polyurethane based coatings
19	19A	Coatings based on flame-sprayed polypropylene powder applied over an epoxy layer
	19B	Coatings based on polypropylene tapes/sheets hot-applied over an epoxy layer
	19C	Coatings based on injection-moulded polypropylene over an epoxy layer
	19D	Coatings based on flame-sprayed polyethylene powder applied over an epoxy layer
	19E	Coatings based on polyethylene tapes/sheets hot-applied over an epoxy layer
20	20	Thermal spray aluminium (TSA) coatings

The FJC shall be compatible with the plant-applied coating and ensure continuity of corrosion protection.

The weld geometry and structure shall be taken into consideration during the selection of the FJC system.

The maximum service temperature, $T_{\max}$, of the FJC shall be equal to or greater than the maximum design temperature of the pipeline.

The FJC shall be compatible with the minimum operating temperature of the pipeline and the minimum ambient temperature during transportation and handling during the construction of the pipeline.

9 General requirements for surface preparation, coating application, testing and repair

9.1 Surface preparation

9.1.1 General

Surface preparation shall be carried out in accordance with the APS and as detailed below.