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

**Part 3:
Field joint coatings**

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

ISO 21809-3:2008
Partie 3: Revêtements des joints soudés sur site
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 21809-3 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 2, *Pipeline transportation systems*.

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: Fusion-bonded epoxy coatings*
- *Part 3: Field joint coatings*
- *Part 4: Polyethylene coatings (2-layer PE)*
- *Part 5: External concrete coatings*

A Part 6, dealing with bitumen, asphalt and coal tar coatings, a Part 7, dealing with liquid coatings, a Part 8, dealing with thermal insulation coatings, and a Part 9, dealing with epoxy polyamide powder coatings (2-layer) are under preparation.

Introduction

Users of this part of ISO 21809 should 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 should identify any variations from this part of ISO 21809 and provide details.

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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

1 Scope

This part of ISO 21809 specifies requirements for field joint coating of seamless or welded steel pipes for pipeline transportation systems in the petroleum 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 pipes and fittings (components) are joined by welding.

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

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

NOTE Pipes 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 31-0:1992, *Quantities and units — Part 0: General principles*

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 21809-3:2008(E)

ISO 1431-1:2004, *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 — Determination of the effect of liquids*

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

ISO 2781:2008, *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 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*

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

ISO 7619 (all parts), *Rubber, vulcanized or thermoplastic — Determination of indentation hardness*

ISO 8501-1:2007, *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 8502-3:1992, *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 8503-5:2003, *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 8504-3, *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 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature*

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 and submerged pipelines used in pipeline transportation systems — Part 2: Fusion-bonded epoxy coatings*

ASTM D 70 ¹⁾, *Standard Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)*

ASTM D 92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*

ASTM D 127, *Standard Test Method for Drop Melting Point of Petroleum Wax, Including Petrolatum*

ASTM D 149, *Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies*

ASTM D 257, *Standard Test Methods for DC Resistance or Conductance of Insulating Materials*

ASTM D 695, *Standard Test Method for Compressive Properties of Rigid Plastics*

ASTM D 937, *Standard Test Method for Cone Penetration of Petrolatum*

ASTM D 938, *Standard Test Method for Congealing Point of Petroleum Waxes, Including Petrolatum*

ASTM D 1000, *Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications*

ASTM D 1141, *Standard Practice for the Preparation of Substitute Ocean Water*

ASTM D 1321, *Standard Test Method for Needle Penetration of Petroleum Waxes*

1) American Society for Testing and Materials, 100 Harbour Drive, West Conshohocken, PA 19428-2959, USA.

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ASTM D 2084, *Standard Test Method for Rubber Property — Vulcanization Using Oscillating Disk Cure Meter*

ASTM D 4285, *Standard Test Method for Indicating Oil or Water in Compressed Air*

ASTM D 4541, *Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers*

SSPC-SP1 ²⁾, *Surface preparation specification No.1 — Solvent cleaning*

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

AWS C2.25/C2.25M ³⁾, *Specification for Thermal Spray Feedstock Solid and Composite Wire and Ceramic Rods*

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 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

3.5 bonding agent

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

3.6 certificate of compliance

one of the types of inspection documents defined by ISO 10474, issued in accordance with the purchasing requirements

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

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

3.9**end user**

company that owns and/or operates the pipeline system

3.10**field joint area**

⟨weld zone⟩ 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 document

3.14**manufacturer**

company responsible for the manufacture of coating material

3.15**maximum design temperature of field joint coating**

T_{\max}

maximum continuous temperature that the field joint coating can resist

3.16**maximum operating temperature**

maximum temperature that can be reached during operation of pipeline

3.17**overlap**

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

3.18**pipeline**

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

[ISO 13623:—, 3.14]

3.19**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

[ISO 13623:—, 3.16]

3.20
pre-production trial
PPT

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

3.21
primer

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

3.22
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

3.23
purchaser

company responsible for providing the product order requirements

3.24
wraparound sleeve

sleeve that is wrapped, circumferentially, around the steel pipe area being coated

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4 Symbols and abbreviated terms

4.1 Symbols

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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	thickness
T_{max}	maximum design 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

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5 General requirements

5.1 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 31-0:1992, Annex B, Rule A.

NOTE For the purposes of this provision, the rounding method of ASTM E 29 is equivalent to ISO 31-0:1992, Annex B, Rule A.

5.2 Compliance to standard

A quality system should be applied to assist compliance with the requirements of this part of ISO 21809.

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

The applicator shall be responsible for complying with the requirements of this part of ISO 21809. It shall be permissible for the purchaser to make any investigation necessary in order to be assured of compliance by the applicator and to reject any material that does not comply.