



DRAFT INTERNATIONAL STANDARD ISO/DIS 21809-2

ISO/TC 67/SC 2

Secretariat: UNI

Voting begins on
2012-08-30

Voting terminates on
2013-01-30

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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

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

Partie 2: Revêtements à base de résine simple époxydique appliquée par fusion

[Revision of first edition (ISO 21809-2:2007) and ISO 21809-2:2007/Cor.1:2008]

ICS 75.200

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO-lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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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 21809-2 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*.

This second edition cancels and replaces the first edition (ISO 21809-2:2007), which has been technically revised.

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*
- *Part 6: Multi Layer Fusion Bonded Epoxy coating systems*

Introduction

Users of this part of ISO 21809 should be aware that further or differing requirements might 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 if there is innovative or developing technology. If 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 2: Single Layer Fusion-bonded epoxy coatings

1 Scope

This part of ISO 21809 specifies the requirements for qualification, application, testing and handling of materials for plant application of single-layer fusion-bonded epoxy (FBE) coatings applied externally for the corrosion protection of bare steel pipe for use in pipeline transportation systems for the petroleum and natural gas industries as defined in ISO 13623.

NOTE Pipes coated in accordance with this part of ISO 21809 are considered suitable for additional 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 2815, *Paints and varnishes -- Buchholz indentation test*

ISO 8130-2, *Coating powders — Part 2: Determination of density by gas comparison pyknometer (referee method)*

ISO 8130-3, *Coating powders — Part 3: Determination of density by liquid displacement pyknometer*

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, *Preparation of steel substrates before application of paint 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 the conductometric determination of water-soluble salts*

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 10474:1991, *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 11127-6, *Preparation of steel substrates before application of paints and related products -- Test methods for non-metallic blast-cleaning abrasives -- Part 6: Determination of water-soluble contaminants by conductivity measurement*

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

ISO 13623:2000, *Petroleum and natural gas industries — Pipeline transportation systems*

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

EN 10204:2004, *Metallic products — Types of inspection documents*

AS 3894.6, *Site testing of protective coatings - Determination of residual contaminants*

ASTM D4060, *Standard test method for abrasion resistance of organic coatings by the taber abraser*

ASTM D4920, *Standard terminology relating to conditioning, chemical, and thermal properties*

SSPC-AB 1¹⁾, *Mineral and Slag Abrasives*

SSPC-AB 2, *Cleanliness of Recycled Ferrous Metallic Abrasives*

SSPC-AB 3, *Ferrous Metallic Abrasive*

SSPC-SP 1, *Solvent cleaning*

3 Terms and definitions

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

3.1

applicator

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

3.2

batch

quantity of epoxy powder produced using the same formulation and raw materials of the same source during a continuous production run of not more than 8 h

3.3

batch certificate

certificate of analysis issued by the manufacturer

3.4

by agreement

agreed between manufacturer and purchaser

1) SSPC: The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburg, PA 15222-4656, USA.

[ISO 14313:2007]

3.5

certificate of compliance with the order "2.1" declaration of compliance with the order "type 2.1"

document issued according to ISO 10474:1991 or EN 10204:2004 stating compliance with the purchase order for coated pipes, but without mention of any test results, issued in accordance with the purchasing requirements

3.6

cutback

length of pipe left uncoated at each end for joining purposes

3.7

glass transition

reversible change in an amorphous polymer or in amorphous regions of a partially crystalline polymer from (or to) a viscous or rubbery condition to (or from) a hard and relatively brittle one

[ISO 11357-2:1999]

3.8

glass transition temperature

approximate midpoint of the temperature range over which the glass transition takes place

NOTE The assigned glass transition temperature, T_g , can vary, depending on the specific property and on the method and conditions selected to measure it.

[ISO 11357-2:1999]

3.9

holiday

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

3.10

laboratory-coated test specimen

specimen taken from a laboratory-prepared panel

3.11

manufacturer

company responsible for the manufacture of coating material(s)

3.12

manufacturer's specification

document that specifies the characteristics, test requirements and application recommendations for the coating materials

3.13

pipe diameter length

any length along the pipe axis equal to the specified outside diameter of the pipe

3.14

pipeline

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

[ISO 13623:2000]

3.15

pipeline transportation 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

3.16

purchaser

company responsible for providing the product order requirements

3.17

test report

document that provides the quantitative test results for tests conducted in accordance with the requirements of this part of ISO 21809

3.18

test ring

sample taken from production-coated pipe

3.19

Inspection certificate "3.1.B"

Inspection certificate 3.1 "type 3.1"

document in accordance with ISO 10474:1991 or EN 10204:2004 giving the results of the testing of coated pipes, supplied and signed by a representative of the applicator authorized to issue such documents

3.20

design temperature range

temperature range including maximum and minimum temperatures likely to be reached during transport, handling, storage, installation and operation

3.21

powder recycle

FBE powder that has been automatically and continuously recycled in the delivery system

3.22

powder reclaim

Powder that has escaped the powder recovery system or has been spilled on the floor

3.23

powder shipment

Amount of powder transported in one container

3.24

end user

Company(s) who is/are owning and / or operating the pipeline system

3.25

manufacturer's specification

Document which specifies the characteristics, test requirements and application recommendations for the coating material

3.26

procedure qualification trial

Application of a coating and subsequent inspection/testing of its properties, to confirm that the APS is adequate to produce a coating with the specified properties, carried out prior to the start of production

4 Symbols and abbreviated terms

4.1 Symbols

C	percentage conversion of FBE coating
d	thickness
ΔH	exothermic heat of reaction
M	mass
R	mandrel radius
T_g	glass transition temperature in degrees Celsius ($^{\circ}\text{C}$)
ΔT_g	variation of the glass transition temperature in degrees Celsius ($^{\circ}\text{C}$)
w_{ep}	mass fraction of the epoxy powder retained on a sieve, expressed as a percent of total sample
w_m	mass fraction of moisture, expressed as a percent

4.2 Abbreviations

APS	application procedure specification
d.c.	direct current
DSC	differential scanning calorimetry
FBE	fusion-bonded epoxy
HRC	Rockwell "C" scale hardness
ID	inner diameter
ITP	inspection and testing plan
NPS	nominal pipe size
OD	outer diameter
ppd	per pipe diameter
PQT	procedure qualification trial

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 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.