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

Part 11: Coatings for in-field application, coating repairs and rehabilitation

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

Partie 11: Réparations et réhabilitation du revêtement 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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document 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*.

A list of all the parts in the ISO 21809 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The objective of this document is to define the technical requirements for corrosion protection by the coating of external surfaces of carbon steel pipes that are used in oil and gas industry and have the need for a coating replacement or repair to be performed on site (corrosion protection for other metallic pipes should be considered on an individual basis). This document also provides technical guidance for developing project specifications and to ensure conformance in coating material selection and performance with contract requirements.

Users of this document should be aware that further, or differing, requirements can be needed for individual applications. This document does not limit contractors and manufacturers from proposing, or the purchaser from accepting, alternative engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is proposed, the specification issuer should identify any deviation from this document and provide details.

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

Part 11: Coatings for in-field application, coating repairs and rehabilitation

1 Scope

This document specifies the criteria and requirements for the in-field application of coatings, coating repair and coating rehabilitation on buried pipelines.

This document specifies:

— coating assessment (new and existing);

— removal of degraded coatings;

— surface preparation;

— on site or in situ application of external coatings.

It is applicable to petroleum or natural gas pipelines, with or without a cathodic protection system.

The pipelines could be operational during the removal, preparation and application process.

This document states qualification/testing for field contractors and site applied coatings to all of the pipeline components, including bends, tees, fittings, valves and interfaces between different coatings in soil-to-air pipeline sections.

Technical and performance characteristics of the repair and rehabilitation coating materials are referenced to ISO 21809-3.

The coating of field joints is outside the scope of this document. Field joint coatings are dealt with in ISO 21809-3.

This document excludes the application of coatings when the pipeline is immersed (submerged).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 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 8503-4, *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 10474:2013, *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 21809-3, *Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems — Part 3: Field joint coatings*

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

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

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

NACE SP0287, *Field Measurements of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21809-3 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
application procedure specification
APS
document describing procedures, methods, equipment and tools used for coating application

3.2
applicator
organization, contractor or subcontractor having the technical capability, knowledge, equipment and qualified personnel that is approved by the purchaser for the coating processes as required by this document

3.3
coating operative
individual undertaking coating activity on the work site, including surface preparation

3.4
contractor
company that agrees to furnish materials and/or perform specific services to the purchaser

3.5
inspection and testing plan
ITP
document providing an overview of the sequence of inspections and tests, including resources, procedures and acceptance criteria

3.6
inspection document
document stating conformance with the requirements given in the purchase order

Note 1 to entry: This document is in conformance with ISO 10474:2013.

3.7
purchaser
company responsible for providing the product order requirements and for approving and possibly making the appropriate selection of the repair or rehabilitation coating, including preparation and application method

3.8
rehabilitation
<coating> activity performed on a pipeline, including:

1. assessment of the existing coating
2. removal of the existing coating
3. preparation of the surface on which the new coating is applied
4. application of a new coating

in order to reach a level of corrosion protection that enables a metallic structure to continue in service operation safely and economically

3.9
repair
<coating> activities dedicated to restore the integrity of the coating when the damage are localized on small areas

Note 1 to entry: Typically these activities are performed manually.

3.10
total coating thickness
thickness of a coating system, including all the layers, after installation is completed

Note 1 to entry: For liquid coatings, this can be Dry Film Thickness (DFT), which is the thickness of a cured coating system after installation is completed.

4 Abbreviations

AC	Alternating Current
ACVG	Alternating Current Voltage gradient Survey
APS	Application Procedure Specification
ASTM	American Society for Testing &Materials

BIT	Bitumen based coating
CP	Cathodic Protection
DC	Direct Current
DCVG	Direct Current Voltage Gradient Surveys
EP	Epoxy based coating
FBE	Fusion Bonded Epoxy
FC	Field Coating (System)
HSE	Health, Safety and Environment
HSS	Heat Shrinkable Sleeve
ILI	In Line Inspection
ITP	Inspection and Testing Plan
MIC	Microbiological Induced Corrosion
PE	Polyethylene
PP	Polypropylene
PPT	Pre-Production Trial
PQT	Procedure Qualification Trial
PU	Polyurethane based coating
RH	Relative Humidity
RP	Recommended Practice
PDS	Product Data Sheet
SDS	Safety Data Sheet
SSPC	The Society for Protecting Coatings
TDS	Technical Data Sheet, also known as PDS
VOC	Volatile Organic Compounds

5 General requirements

5.1 Responsibility of the purchaser

The purchaser shall be responsible for approving and possibly making the appropriate selection of the repair or rehabilitation coating, including application and surface preparation methods, in accordance with the expected working, environmental and service conditions.

The general responsibilities map is given in Figure 1.

5.2 Rounding

Unless otherwise stated in this document, 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[1)].

NOTE For the purposes of this provision, the rounding method of ASTM E 29 is equivalent to ISO 80000-1:2009, Annex B, Rule A.

5.3 Conformity to requirements

Systems for quality and environmental management, and the competence of testing and calibration laboratories, should be applied to assist conformity with the requirements of this document.

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

2. ISO 14001 gives requirements with guidance for the use of an environmental management system.

3. ISO/IEC 17025 gives general requirements for the competence of testing and calibration laboratories.

The applicator shall be responsible for complying with all the applicable requirements for the application of this document. The purchaser shall be allowed to make any investigation necessary to ensure conformity by the applicator and to reject any material and/or coating that does not comply.

6 Information to be supplied by the purchaser

6.1 General information

The purchase order shall include the following information:

a) designation of this part of ISO 21809 and year of publication (ISO 21809-11:2019);

b) type of field coating system(s);

c) minimum and maximum thickness of the field coating (if applicable);

d) minimum and maximum operating and design temperature of the pipeline;

e) type of pipe (seamless or welded with longitudinal or helical seam, material/grade);

f) pipe nominal outer diameter and wall thickness;

g) existing coating system(s), including thickness(es);

h) technical specifications/data sheets and inspection/testing result/reports of the existing coating system;

i) length of pipe or pipeline component to be coated;

j) pipeline geometry (bends, fittings, other pipeline components);

k) site conditions (accessibility, etc.);

l) type and frequency of inspection document in accordance with ISO 10474:2013 (or EN 10204:2004) .

1) Under preparation. Stage at the time of publication: ISO/DIS 80000-1.

6.2 Additional information

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

a) coating material qualification trial and parties to be involved;

b) permissible coating repairs;

c) acceptable level of soluble salts;

d) any special requirement with regard to FC overall thickness and/or thickness of individual layers;

e) overlap on the existing (e.g. “plant-applied”) coating or detailed drawing of the field coating with dimensional tolerances;

f) requirements for traceability and marking;

g) requirements for documentation and schedule of supply of documentation;

h) qualification of the applicator's personnel who apply and/or inspect the coating;

i) purchaser’s approval of the application procedure specification (APS);

j) use of specific proprietary coating materials;

k) additional mechanical protection;

l) procedure qualification trial (PQT) and parties to be involved;

m) pre-production trial (PPT) and parties to be involved;

n) technical support required from manufacturer;

o) subsequent coating (or infill) being applied;

p) environmental conditions during surface preparation, application, curing, backfilling;

q) status of the pipeline (e.g. operational or gas in transit);

r) specific surface conditions at the moment of surface preparation and coating application;

s) method of (re)installation of the pipeline;

t) time constraints for application and number and dimensions of working stations, if relevant;

u) specific testing conditions and minimum requirements if different from those of ISO 21809-3 and this document;

v) backfilling, e.g. material and methodology.

7 Qualification processes and application procedures

7.1 General

The qualification process is consists of the following steps from A to D:

a) the qualification of coating materials, that shall be qualified by the manufacturer (see 7.1.1),

b) the qualification of applied coating system, that shall be qualified by the applicator (see 7.1.2),

c) the APS, that shall be validated, if required, by a Procedure Qualification Trials (PQT) (see 7.1.3),

d) the inspection at the Pre-Production Trials (PPT) and during production, that shall be performed according to an approved Inspection and Testing Plan (ITP) (see 7.1.4 and 7.1.5).

Of the above steps A, B and D are mandatory while C shall be specified by the purchaser.

Those parts of the qualification process that are waived by the purchaser, shall be clearly stated and identified in the contract.

The overall qualification and responsibilities map and its application to the several steps of the rehabilitation activities, is represented in Figure 1.

7.1.1 Coating material qualification, by the manufacturer (coating materials qualification)

Each coating material shall be qualified by the manufacturer in conformance with the requirements of ISO 21809-3 or other agreed standards. The manufacturer shall qualify and report the coating material qualification in accordance with the requirements, where applicable. The test report issued by the manufacturer may be also verified by an end user.

The qualification shall be repeated every five years and in case of changes in the material composition, the production process that influence the material processing behaviour or a change in the production facility.

The test report shall contain the results of the qualification tests and the technical data required by the purchaser, see also 7.6.

7.1.2 Qualification of the coating system, by the applicator (coating system qualification)

The applicator, receiving the manufacturer's test report, shall verify that it meets the requirements of ISO 21809-3 or other agreed standards requested for the coating material. The applicator shall also review the coating selection considerations of this document.

Each coating system shall be qualified by the applicator. The applicator shall prepare an APS (see 7.2) and an ITP (see 7.5) related to the qualification of the specific coating system.

Where applicable the applicator shall carry out and report the coating qualification in accordance with the requirements. The test report shall contain the results of the qualification tests and requirements.

7.1.3 Procedure Qualification Trials (PQT) if requested by the purchaser

In case a PQT is requested, a specific ITP shall be prepared and implemented for the PQT. See 7.3 (PQT) and 7.5 (ITP).

7.1.4 Pre-Production Trial (PPT)

Before production starts, a PPT shall be performed according to a dedicated ITP. A specific ITP shall be prepared and implemented for the PPT. See 7.4.

7.1.5 Production test

A specific ITP shall be prepared and implemented for the Production activity. See 7.5.