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**Erdöl und Erdgasindustrie –
Umhüllungen für erd- und wasserverlegte Rohrleitungen in
Transportsystemen –
Teil 1: Polyolefinumhüllungen (3-Lagen-PE und 3-Lagen-PP)
(ISO 21809-1:2011);
Englische Fassung EN ISO 21809-1:2011**

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) (ISO 21809-1:2011);
English version EN ISO 21809-1:2011

Industries du pétrole et du gaz naturel –

Revêtements externes des conduites enterrées ou immergées utilisées dans les systèmes
de transport par conduites –

Partie 1: Revêtements à base de polyoléfines (PE tricouche et PP tricouche)
(ISO 21809-1:2011);

Version anglaise EN ISO 21809-1:2011

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Normenausschuss Erdöl- und Erdgasgewinnung (NÖG) im DIN

Nationales Vorwort

Dieses Dokument (EN ISO 21809-1:2011) wurde von der WG 14 „External pipeline protective coatings“ (Sekretariat: ANSI, Vereinigte Staaten von Amerika) im Technischen Komitee ISO/TC 67 „Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries“ (Sekretariat: NEN, Niederlande) in Zusammenarbeit mit dem Technischen Komitee ECISS/TC 110 „Stahlrohre und Fittings für Eisen- und Stahlrohre“ (Sekretariat: UNI, Italien) erarbeitet.

Das zuständige deutsche Gremium ist der Arbeitsausschuss NA 032-02-09 AA „Außenkorrosion“ im Normenausschuss Gastechnik (NAGas). Der Arbeitsausschuss NA 109-00-02 AA „Fernleitungssysteme“ im Normenausschuss Erdöl- und Ergasgewinnung (NÖG) hat an diesem Dokument mitgearbeitet.

Dieses Dokument enthält unter Berücksichtigung des Präsidialbeschlusses 1/2004 nur die englische Originalfassung der EN ISO 21809-1:2011. Nur der Abschnitt Begriffe wurde übersetzt.

4 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

4.1

Adhäsion

Verbund zwischen Umhüllung und Grundmaterial gemäß den äußeren Prüfungsbedingungen

4.2

Beschichter

Unternehmen, welches Umhüllungen nach diesem Teil der ISO 21809 herstellt

ANMERKUNG Wenn die Aufbereitung/Mischung von der obersten Schicht vor oder während der Aufbringung durch den Beschichter erfolgt, dann ist der Applikator als Hersteller anzusehen (siehe 4.13).

4.3

Spezifikation der Beschichtungsprozedur

APS

(en: application procedure specification)

Dokument, welches den Prozess, die Methode und die technische Ausrüstung der Beschichtungsaufbringung beschreibt

4.4

Charge

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

4.5

Chargenzeugnis

Analysenzertifikat der Charge des Herstellers

4.6

Konformitätsbescheinigung

Herstellerbescheinigung nach ISO 10474 oder EN 10204, welche die Einhaltung der bestellten Anforderungen für beschichtete Rohre ohne Nennung von Testergebnissen bestätigt

4.7

Rückschnitt, Endenausführung

verbleibendes unbeschichtetes Rohrende

4.8

Designtemperaturbereich

Temperaturbereich einschließlich maximalen und minimalen Temperaturen, die bei Transport, Handhabung, Installation und Betrieb erreicht werden

ANMERKUNG Der Designtemperaturbereich der Beschichtung kann schmaler sein als die für das Rohrmaterial und/oder das Rohrleitungssystem angegeben.

4.9

Endverbraucher

Unternehmen und/oder Betreiber, welches(r) die Umhüllung kauft und einsetzt

4.10

Fehlstelle

Umhüllungsdiskontinuität, die elektrische Leitfähigkeit aufweist, wenn eine bestimmte Spannung aufgebracht wird

4.11

Abnahmeprüfzeugnis 3.1.B

Abnahmeprüfzeugnis 3.1

Herstellerbescheinigung nach ISO 10474 oder EN 10204 mit den Ergebnissen der Prüfung von beschichteten Rohren

4.12

Überwachungs- und Prüfplan

ITP

(en: inspection and testing plan)

Dokument, welches einen Überblick über den Ablauf der Inspektionen und Prüfungen einschließlich geeigneter Mittel und Verfahren beinhaltet

4.13

Hersteller

Unternehmen, welches für die Herstellung der Umfüllungsmaterialien verantwortlich ist

4.14

Herstellerspezifikationen

Dokument, das die Eigenschaften, Prüfanforderungen und Anwendungsempfehlungen für die Umhüllungsmaterialien angibt

4.15

Betriebstemperatur

max. und/oder min. Temperatur, welche während des Betriebs der Rohrleitung (Komponente) und/oder des Pipeline-Systems auftreten kann und innerhalb des Designtemperaturbereiches liegt

4.16

Schälwiderstand

Kraft, die zum Abziehen der Umhüllung vom Trägermaterial (Stahloberfläche) erforderlich ist

4.17

Äquivalente Länge zum Rohrdurchmesser

Länge entlang der Rohrachse, welche dem Rohraußendurchmesser entspricht

4.18

Rohrleitung

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

ANMERKUNG Übernommen aus ISO 13623:2009, Definition 3.14.

4.19

Rohrleitungssystem

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

ANMERKUNG Übernommen aus ISO 13623:2009, Definition 3.16.

4.20

Vorfertigungs-Qualitätssicherungsprüfung

PQT

(en: procedure qualification trial)

Aufbringen einer Beschichtung und anschließende Inspektion/Prüfung der geforderten Eigenschaften, um sicherzustellen, dass die APS erfüllt werden, durchgeführt vor dem Beginn der Produktion

4.21

Besteller

Unternehmen, welches für die Festlegung der Bestellanforderungen verantwortlich ist

4.22

Prüfbericht

Dokument, das die quantitativen Testergebnisse der Tests in Übereinstimmung mit den Anforderungen dieses Teils von ISO 21809 beinhaltet

4.23

Gesamtschichtdicke

Summe der Schichtdicken der einzelnen Lagen

— Leerseite —

English Version

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)
(ISO 21809-1:2011)

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n in Transportsystemen —
Teil 1: Polyolefinumhüllungen
(3-Lagen-PE und 3-Lagen-PP)
(ISO 21809-1:2011)

This European Standard was approved by CEN on 30 June 2011.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN ISO 21809-1:2011) 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 January 2012, and conflicting national standards shall be withdrawn at the latest by January 2012.

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 21809-1:2011 has been approved by CEN as a EN ISO 21809-1:2011 without any modification.

Introduction

It is necessary that users of this part of ISO 21809 be aware that further or differing requirements can be required 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, it is the responsibility of the vendor to identify any variations from this part of ISO 21809 and provide details.

1 Scope

This part of ISO 21809 specifies requirements of plant-applied external three-layer polyethylene- and polypropylene-based coatings for corrosion protection of welded and seamless steel pipes for pipeline transportation systems in the petroleum and natural gas industries in accordance with ISO 13623.

NOTE Pipes coated in accordance with this part of ISO 21809 are considered suitable for further protection by means of cathodic protection.

2 Conformance

2.1 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.

NOTE For the purpose of this provision, the rounding method of ASTM E29 is equivalent to ISO 80000-1.

2.2 Compliance with standard

A quality system and an environmental management 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 and ISO 14001 gives guidance on the selection and use of an environmental management system.

The applicator shall be responsible for complying with all the applicable requirements of this part of ISO 21809. The purchaser shall be allowed to make any investigations necessary to ensure compliance by the applicator and to reject any material and/or coating that does not comply.

3 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 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*

- ISO 179-2, *Plastics — Determination of Charpy impact properties — Part 2: Instrumented impact test*
- ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*
- 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 1133, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics*
- ISO 1183 (all parts), *Plastics — Methods for determining the density of non-cellular plastics*
- ISO 1872-2, *Plastics — Polyethylene (PE) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*
- ISO 1873-2, *Plastics — Polypropylene (PP) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*
- ISO 2808, *Paints and varnishes — Determination of film thickness*
- ISO 2811 (all parts), *Paint and varnishes — Determination of density*
- ISO 3251, *Paints, varnishes and plastics — Determination of non-volatile matter content*
- ISO 4892-2:2006, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*
- 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 paints and related products — Test 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 — Test for the assessment of surface cleanliness — Part 6: Extraction of soluble contaminant 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 (all parts), *Plastics — Differential scanning calorimetry (DSC)*

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

ISO 15512, *Plastics — Determination of water content*

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

AS 3894-6, *Site testing of protective coatings — Determination of residual contaminants*

ASTM D792¹⁾, *Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement*

ASTM D1505, *Standard Test Method for Density of Plastics by the Density-Gradient Technique*

ASTM D1693, *Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics*

ASTM D4138, *Standard Practice for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means*

ASTM D4940, *Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blasting Abrasives*

EN 10204:2004²⁾, *Metallic materials — Types of inspection documents*

SSPC-AB 1, *Mineral and Slag Abrasives*

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

SSPC-AB 3, *Ferrous Metallic Abrasive*

SSPC-SP 1³⁾, *Solvent Cleaning*

4 Terms and definitions

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

4.1

adhesion

bond between coating and substrate after environmental testing

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

2) CEN, European Committee for Standardization, Central Secretariat, Rue de Stassart 36, B-1050, Brussels, Belgium.

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

4.2

applicator

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

NOTE If the compounding of the top layer is done prior to or during the application process by the applicator, then the applicator is regarded as the manufacturer (see 4.13).

4.3

application procedure specification

APS

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

4.4

batch

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

4.5

batch certificate

certificate of analysis issued by the manufacturer

4.6

certificate of compliance

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

4.7

cutback

length of pipe left uncoated at each end for joining purposes

4.8

design temperature range

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

NOTE The design temperature range of the coating may be narrower than that specified for the steel pipe material and/or the pipeline system.

4.9

end user

company (companies) that own(s) and/or operate(s)

4.10

holiday

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

4.11

inspection certificate 3.1.B

inspection certificate 3.1

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

4.12

inspection and testing plan

ITP

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

4.13

manufacturer

company responsible for the manufacture of coating material(s)

4.14

manufacturer's specification

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

4.15

operating temperature

maximum and/or minimum temperature that can be endured by a pipeline (component) and/or pipeline system during operation, and that shall be within the design temperature range

4.16

peel strength

force required for peeling the coating from the substrate

4.17

pipe diameter length

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

4.18

pipeline

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

NOTE Adapted from ISO 13623:2009, definition 3.14.

4.19

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

NOTE Adapted from ISO 13623:2009, definition 3.16.

4.20

procedure qualification trial

PQT

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

4.21

purchaser

company responsible for providing the purchase order requirements

4.22

test report

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

4.23

total coating thickness

sum of all three layers

5 Symbols and abbreviated terms

5.1 Symbols

C	percentage conversion of FBE coating
d	effective sample thickness, expressed in millimetres
D	outside diameter of the pipe, expressed in millimetres
ΔH	exothermic heat of reaction, expressed in Joules per gram
M	mass, expressed in kilograms or grams
P_m	mass of pipe per metre length, expressed in kilograms per metre
dQ/dt	differential heat flow, expressed in watts per square metre
r	mandrel radius, expressed in millimetres
R_{MF}	melt flow rate, expressed in grams per 10 minutes
T_g	glass transition temperature, expressed in degrees Celsius
ΔT_g	difference in the glass transition temperature between two successive thermal analysis scans, expressed in degrees Celsius
w_m	mass fraction of moisture, expressed as a percentage
ρ_p	density of the epoxy powder, expressed in grams per litre

5.2 Abbreviations

APS	application procedure specification
DSC	differential scanning calorimetry
ESCR	environmental stress cracking resistance
FBE	fusion-bonded epoxy
HDPE	high-density polyethylene
IR	infrared
ITP	inspection and testing plan
LDPE	low-density polyethylene
MDPE	medium-density polyethylene
MFR	melt flow rate
NPS	nominal pipe size
PDL	pipe diameter length
PE	polyethylene
PP	polypropylene
PPT	preproduction trial
PQT	procedure qualification trial

SAW	submerged arc welding
UV	ultraviolet
3LPE	three-layer polyethylene coating
3LPO	three-layer polyolefin coating
3LPP	three-layer polypropylene coating

6 Information supplied by the purchaser

6.1 General information

The purchase order shall include the following information:

- number of this part of ISO 21809 and year of publication (ISO 21809-1:2011);
- pipe quantity, outside diameter, minimum wall thickness, minimum, maximum and nominal length, grade of steel;
- bare pipe standard or specification designation, e.g. ISO 3183;
- design temperature range in accordance with 7.2;
- coating class and coating thickness class in accordance with 7.2 and 7.3;
- cutback configuration and finish (length, angle, visible epoxy, temporary protection, etc.);
- type of certificate of compliance.

6.2 Additional information

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

- pipe tracking and traceability of pipes to coating materials;
- permissible number of coating repairs, if different from the one defined in Clause 12;
- marking of pipes;
- handling procedures;
- storage procedures;
- documentation and schedule for supply of documentation;
- purchaser approval of APS;
- inspection and testing plan and/or daily log;
- inspection of incoming pipes;
- pipe end protection;

- minimum thickness of epoxy layer and/or total coating thickness required, if exceeding those in Table 2 and Table 9, respectively;
- surface profile of PE/PP coating (e.g. prior to concrete weight coating or special laying methods);
- surface pretreatment;
- special requirements relative to supply of coating materials (e.g. FBE or liquid, manufacturer-specific products and certification);
- methods, frequency and acceptance criteria for inspection and testing differing from this part of ISO 21809;
- procedure qualification trial (PQT);
- protection against adverse ambient conditions during storage.

7 Coating classification

7.1 General

Coating class shall be selected based on the design temperature range and expected field duty.

Coating thickness class shall be selected based on transport, handling, laying conditions and the expected operating and environmental conditions.

7.2 Coating classes

The coating shall be capable of withstanding the temperature range required, as shown in Table 1. The coating class shall be specified in the purchase order.

Table 1 — Coating classes and design temperature ranges

Coating class	A	B	C ^a
Top layer material	LDPE	MDPE/HDPE	PP
Design temperature ranges (°C)	–20 to +60	–40 to +80	–20 to +110
^a Installation and transportation at temperatures below 0 °C can cause mechanical damage.			

Use of coating classes outside these guidelines shall be approved by the purchaser or end user.

7.3 Coating thickness classes

Coating thickness class shall be selected by the purchaser or end user based on installation and service conditions and pipe dimensions. The coating thickness class, as shown in Table 2 as a function of coating class and pipe weight, shall be specified in the purchase order.