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Oil and gas industries including lower carbon energy — Wet thermal insulation systems for pipelines and subsea equipment —

Part 3: **Interfaces between systems, field joint system, field repairs and prefabricated insulation**

Industries du pétrole et du gaz, y compris les énergies à faible teneur en carbone — Systèmes d'isolation thermique en milieu humide pour conduites et équipements sous-marins —

Partie 3: Interfaces entre systèmes, systèmes de joints soudés sur site, réparations sur site et isolation préfabriquée

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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 document 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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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, *Oil and gas industries including lower carbon energy*, Subcommittee SC 2, *Pipeline transportation systems,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Oil and gas industries including lower carbon energy,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 12736-3, together with ISO 12736-1 and ISO 12736-2, cancels and replaces ISO ISO 12736:2014.

The main changes are as follows:

— clearer delineation between commercial projects and validation;

— introduction of material classes;

— introduction of interface types;

— elimination of system specific qualification testing tables;

— introduction of project specific functional tests;

— addition of items related to pre-fabricated insulation;

— addition of Annexes A, B and D with guidance for using this document, design of systems, and pre-fabricated insulation.

A list of all parts in the ISO 12736 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.

Oil and gas industries including lower carbon energy — Wet thermal insulation systems for pipelines and subsea equipment —

Part 3: Interfaces between systems, field joint system, field repairs and prefabricated insulation

1 Scope

This document specifies requirements for project specific product and process qualification of field applied wet thermal insulation systems applied at interfaces (e.g. field joints) and pre-fabricated insulation in the petroleum and natural gas industries.

This document is applicable to wet thermal insulation systems submerged in seawater.

This document is not applicable to:

— the project qualification of anticorrosion coatings or the requirements for application thereof;

— thermal insulation in the annulus of a steel pipe-in-pipe system.

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 48-4, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 4: Indentation hardness by durometer method (Shore hardness)*

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

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 1133-2, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 2: Method for materials sensitive to time-temperature history and/or moisture*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

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

ISO 2884-2, *Paints and varnishes — Determination of viscosity using rotary viscometers — Part 2: Disc or ball viscometer operated at a specified speed*

ISO 3104, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 3219 (all parts), *Rheology*

ISO 6502 (all parts), *Rubber — Guide to the use of cure meters*

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 8502-4, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 4: Guidance on the estimation of the probability of condensation prior to paint application*

ISO 12736-1, *Oil and gas industries including lower carbon energy — Wet thermal insulation systems for pipelines, flow lines, equipment and subsea structures — Part 1*

ISO 12736-2, *Oil and gas industries including lower carbon energy — Wet thermal insulation systems for pipelines, flow lines, equipment and subsea structures — Part 2*

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

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

3 Terms and definitions

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

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

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

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

3.1
agreed
specified in the purchase order

Note 1 to entry: To be discussed by the *system provider* (3.41) and *system purchaser* (3.42) with input from *end user* (3.9) as required.

3.2
application procedure specification
APS
quality specification document, or group of specifications, describing procedures, method, equipment, tools, etc. used for *system* (3.40) application

3.3
batch
quantity of *material* (3.22) produced in a continuous manufacturing operation using raw materials of the same source or grade

3.4
blown foam
insulation *material* (3.22) formed by incorporating a gas phase into a polymer matrix

3.5
certificate of analysis
document provided by the manufacturer that indicates results of specific tests or analysis, including test methodology, performed on a specified lot of the manufacturer's product and corresponding conformity ranges

3.6
chamfer
exposed pre-shaped termination of a *system* (3.40) to be interfaced with

Note 1 to entry: Chamfer geometry (e.g. angle, shape) and tolerances are project specific.

3.7
cool down time
time taken for a fluid contained within a *pipeline* (3.25) or *subsea equipment* (3.38) to reach a pre-determined temperature from specific start temperatures (internal and external) when flow is stopped

3.8
cutback
length of item left uncoated at each end for joining purposes

Note 1 to entry: Welding is an example of joining purposes.

3.9
end user
company that owns and/or operates the *pipeline* (3.25) or *subsea equipment* (3.38)

3.10
factory applied
applied in a permanent facility

3.11
field joint
field joint system
uncoated area that results when two pipe sections, or a pipe section and a *fitting* (3.12), with *cutbacks* (3.6) are assembled by welding or other methods

3.12
fitting
receptacle on a piece of *subsea equipment* (3.38), which interfaces to a *pipeline* (3.25)

3.13
high molecular weight precursor thermoset
material (3.22), which is a polymeric compound that remains malleable until application of sufficient heat to cause network formation and then does not flow upon reheating

EXAMPLE Butyl rubber.

3.14
inorganic syntactic foam
insulation *material* (3.22) formed by dispersing inorganic hollow particles within a polymer matrix

3.15
inspection and test plan
ITP
document providing an overview of the sequence of inspections and tests, including appropriate resources and procedures

3.16
inspection document
document issued by the *system provider* (3.41) and attesting that the supplied *system* (3.40) is in conformity with the requirement given in the purchase order

Note 1 to entry: See also ISO 10474.

3.17
interface
location where two *systems* (3.40) meet and affect each other

Note 1 to entry: A *field joint* (3.11) *system* (3.40) has two interfaces.

Note 2 to entry: In the case of multilayer *systems* (3.40), interfaces can be made up of multiple sub-interfaces.

3.18
J-lay
method of *pipeline* (3.25) installation in which pipelines are assembled by welding together pre-insulated pipes with subsequent application of a *field joint* (3.11) *system* (3.40) in a vertical position, onboard an installation vessel with a tower

Note 1 to entry: The pipeline is lowered into the water vertically and creates a characteristic J-shape when touching the seabed.

Note 2 to entry: This method is used mainly for deep water.

3.19
liquid precursor elastomeric thermoset
material (3.22), which is a polymeric compound with its glass transition below ambient temperature, that is produced via combination of one or more components that can be pumped and flow as liquids and which react to create a crosslinked polymer that does not flow upon reheating

EXAMPLE Liquid precursor silicone rubber.

3.20
liquid precursor non-elastomeric thermoset
material (3.22), which is a polymeric compound with its glass transition above ambient temperature, that is produced via combination of one or more components that can be pumped and flow as liquids and which react to create a crosslinked polymer that does not flow upon reheating

EXAMPLE Liquid epoxy.

3.21
mainline
portion of a *pipeline* (3.25) that is not a *field joint* (3.11)

3.22
material
polymeric compound applied to the *substrate* (3.39) protected or insulated in units of discrete thickness (layers) to build up a *system* (3.40)

3.23
material data sheet
document containing typical data regarding the physical and mechanical properties of a particular *material* (3.22) used in the coating process including guidelines and recommendations for its processing and use

3.24
material manufacturer
entity responsible for the manufacture of one or more *materials* (3.22) utilized in a *system* (3.40)

3.25
pipeline
flowline
tubular piping used to convey fluids

Note 1 to entry: Pipeline includes jumpers, *risers* (3.32) and *field joints* (3.11).

3.26
pi tape
precision Vernier periphery tape that allows the direct and accurate measurement of the diameter of tubular objects without the need for callipers or micrometres

3.27
pre-fabricated insulation
section of stand-alone insulation, which is factory manufactured into its final form and then installed in the field by mechanically fastening or bonding to a corrosion protected structure

3.28
pre-production trial
PPT
series of tests performed immediately before the start of production, designed to demonstrate that the requirements of the *validated* (3.48) *system* (3.40) and *procedure qualification trial* (3.29) or both are achieved

Note 1 to entry: Requirements for PPT are as outlined in this document and as *agreed* (3.1).

3.29
procedure qualification trial
PQT
series of tests designed to demonstrate that the *materials* (3.22), *system provider* (3.41), equipment and procedures can produce the *system* (3.40) in accordance with the *validation dossier* (3.49) and meet specific *project* (3.30) requirements as *agreed* (3.1)

Note 1 to entry: Requirements for PQT are as outlined in this document and as *agreed* (3.1).

3.30
project
scope of work agreed upon contractually between *system purchaser* (3.42) and *system provider* (3.41)

3.31
R-lay
reel-lay
method of *pipeline* (3.25) installation in which long *stalks* (3.37) of pre-insulated pipes are pre-assembled by welding and application of *field joint* (3.11) *system* (3.40) onshore before being spooled onto large reels onboard the installation vessel, which then lays the pipes by unspooling the reel offshore

3.32
riser
vertical portion of a *pipeline* (3.25), including the bottom bend, arriving on or departing from an offshore surface installation

3.33
safety data sheet
SDS
DEPRACATED: material safety data sheet
document intended to provide workers and emergency personnel with procedures for handling and working with a *material* (3.22) utilized in the manufacture of the *system* (3.40) in a safe manner including physical data, first aid, etc.

Note 1 to entry: Physical data can include flash point and toxicity.

3.34
service life
specified period of use for a *system* (3.40) in service

3.35
S-lay
method of *pipeline* (3.25) installation in which pipelines are assembled by welding together pre-insulated pipes, with subsequent application of a *field joint* (3.11) *system* (3.40), onboard an installation vessel in a horizontal orientation

Note 1 to entry: The pipeline curvature created from the vessel down to the seabed is a characteristic S-shape.

Note 2 to entry: This method is used mainly for low to medium water depths.

3.36
solid/solid filled
insulation *material* (3.22) that systematically does not contain voids, or hollow particles

3.37
stalk
continuous string of welded and *field joint* (3.11) coated pipe, which is prepared in readiness for pipe spooling onto a R-*lay* (3.31) barge

Note 1 to entry: A number of stalks will normally be required to make up a *pipeline* (3.25).

3.38
subsea equipment
components from a subsea production system, including subsea processing items and structures, meant to control hydrocarbons, not including *pipelines* (3.25)

EXAMPLE Valve, connector, manifold, christmas tree, flowline end termination.

3.39
substrate
surface to which a *material* (3.22) is applied or will be applied

3.40
system
all of the various *materials* (3.22) and the combination thereof, which can include layers of anti-corrosion, insulation, adhesive, and protective materials, as defined by cross-section to the underlying *substrate* (3.39) at a single point, which function together to act as a *wet thermal insulation* (3.50)

3.41
system provider
entity which is selling the applied *system* (3.40)

3.42
system purchaser
entity which is purchasing the applied *system* (3.40)

3.43
thermal conductivity
k-value
conductivity
heat flow through a unit length of *material* (3.22) under the influence of a thermal gradient

Note 1 to entry: Thermal conductivity is expressed in $W \cdot m^{-1} \cdot K^{-1}$.

3.44
thermoplastic
material (3.22), which is a polymeric compound that solidifies upon cooling and can flow and be reformed upon reheating

EXAMPLE Polypropylene.

3.45
tie-in field joint
connection of a *pipeline* (3.25) to a facility or *subsea equipment* (3.38), to other pipeline, or the connecting together of different sections of a single pipeline

3.46
unit of production
quantity of product, given as either a percentage of total output, produced over a short period of time or produced from a specific combination of raw *material* (3.22) *batch* (3.3) numbers, as *agreed* (3.1)

Note 1 to entry: A short period of time can be for example up to 24 hours, or across shift changes, which is based on manufacturing capacity, job length and product line.

3.47
U-value
overall heat transfer coefficient
rate of heat transfer from a reference surface under the influence of a thermal gradient

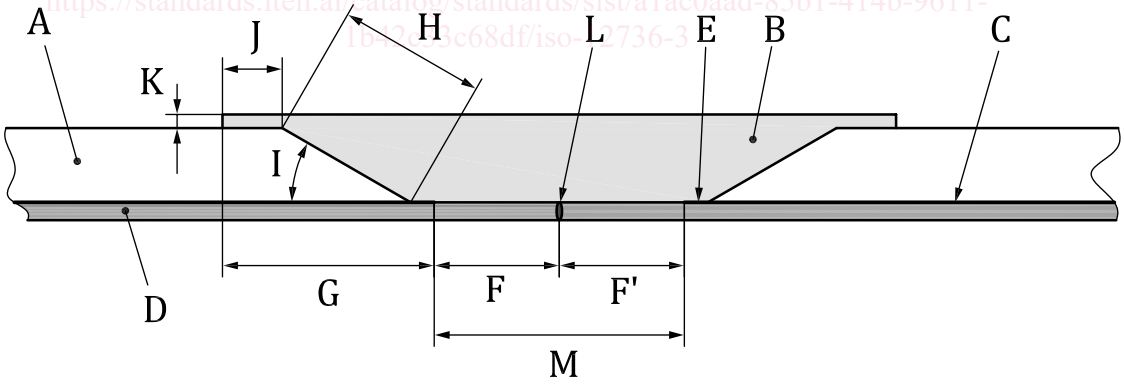
Note 1 to entry: U-value is expressed in $W \cdot m^{-2} \cdot K^{-1}$.

3.48
validation
demonstration of *material* (3.22) and *system* (3.40) performance during storage, handling and operation, within a specified envelope of use, as determined by the *system provider* (3.41)

3.49
validation dossier
collection of documentation and test reports, prepared in accordance with specific requirements, which provides detailed information on the proposed *system* (3.40), method of application, the *materials* (3.22) which form said *system* (3.40), and demonstration of *system* (3.40) performance

Note 1 to entry: Specific requirements are found in ISO 12736-1:202X, 7.6.

3.50
wet thermal insulation
system (3.40) that provides external corrosion protection and thermal insulation, and that is in direct contact with surrounding seawater



Key

A	factory applied mainline system	G	mainline system and field joint system interface
B	field joint system	H	chamfer
C	mainline ACC	I	chamfer angle
D	steel substrate	J	overlap length of field joint system over mainline system
E	exposed mainline ACC	K	thickness of field joint system overlap over mainline system
F	cutback	L	weld

F' cutback, may not the same as F

M field joint

4 Abbreviated terms

ACC anti-corrosion coating

CP cathodic protection

HSE health, safety and the environment

MFR melt flow rate

OD outer diameter

QC quality control

ROV remotely operated vehicle

5 Conformance

5.1 Rounding

Unless otherwise stated in this document 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 80000-1:2009, Annex B, Rule A.

5.2 Conformity to requirement

Systems for quality and environmental management, and the competence of testing and calibration laboratories, should be used.

NOTE The following documents can be used:

— ISO 29001 gives sector-specific requirements with guidance for the use of quality management systems;

— ISO 14001 gives requirements with guidance for the use of environmental management systems;

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

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

6 Field joint material, system interfaces and repairs

6.1 Material classes

The wet thermal insulation systems covered by this document are based on materials classified in Table 1. Each material used to make up the field joint system shall have been classified into the appropriate class by the system provider as part of the validation dossier in accordance with ISO 12736-1.

Table 1 — Material classes

	Solid/solid filled	Blown foam	Inorganic syntactic foam
Thermoplastics	1A	1B	1C
Liquid precursor non-elastomeric thermosets	2A	2B	2C
Liquid precursor elastomeric thermosets	3A	3B	3C
High molecular weight precursor thermosets	4A	4B	4C
NOTE Reproduction of ISO 12736-1:202X, Table 1.			

6.2 Types of interfaces

The different types of interfaces shall be defined as per Table 2.

Table 2 — Types of interfaces

	Interface reference	Interface description
R-lay	a)	Between factory applied system on a pipeline and onshore field applied system applied over a field joint between two pipeline sections. This interface can be between similar or dissimilar materials.
	b)	Between factory applied system on a pipeline and onshore field applied system applied over a tie-in field joint between two pipeline sections. This interface can be between similar or dissimilar materials.
	c)	Between factory applied system on a pipeline and offshore field applied system applied over a tie-in field joint between two pipeline sections. This interface can be between similar or dissimilar materials.
S or J-lay	d)	Between factory applied system on a pipeline and onshore field applied system applied over a field joint between two pipeline sections. This interface can be between similar or dissimilar materials.
	e)	Between factory applied system on a pipeline and offshore field applied system applied over a field joint between two pipeline sections. This interface can be between similar or dissimilar materials.
Subsea equipment	f)	Between a field joint system bridging a factory applied system on a pipeline and a system on subsea equipment at the fitting. This interface is typically between dissimilar materials, possibly on both sides.

Each field joint has two interfaces. In the case of multilayer systems, interfaces may be made up of multiple sub-interfaces.

7 Project specific qualification processes for production and application procedures for field joints

7.1 General requirements

The following requirements apply for project specific qualification and QC activities:

a) All materials and systems shall be previously validated in conformity with the requirements of ISO 12736-1. ACC should be applied in accordance with ISO 21809-3.

b) The validation dossier of the materials and systems shall be given by the system provider to the system purchaser and/or end user for approval.