

---

---

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

Part 3:

**Interfaces between systems, field  
joint systems, field repairs and pre-  
fabricated 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*



iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

[ISO 12736-3:2023](https://standards.iteh.ai/catalog/standards/sist/a1ac0aad-85b1-414b-9611-1b42c33c68df/iso-12736-3-2023)

<https://standards.iteh.ai/catalog/standards/sist/a1ac0aad-85b1-414b-9611-1b42c33c68df/iso-12736-3-2023>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
Foreword.....	v
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references.....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>2</b>
<b>4 Abbreviated terms.....</b>	<b>8</b>
<b>5 Conformance.....</b>	<b>8</b>
5.1 Rounding.....	8
5.2 Conformity to requirement.....	8
<b>6 Field joint material, system interfaces and repairs.....</b>	<b>8</b>
6.1 Material classes.....	8
6.2 Types of interfaces.....	9
<b>7 Project specific qualification processes for production and application procedures for field joints.....</b>	<b>9</b>
7.1 General requirements.....	9
7.2 Purchase order requirements.....	10
7.2.1 General information.....	10
7.2.2 Additional information.....	11
7.3 Production qualification process.....	11
7.3.1 Process description.....	11
7.3.2 Project specific qualification considerations.....	12
7.3.3 Procedure qualification trial.....	12
7.3.4 Pre-production trial.....	13
7.3.5 Production testing.....	13
7.4 Application procedures.....	13
7.4.1 Application procedure specification.....	13
7.4.2 Inspection and testing plan.....	15
7.4.3 Qualification of operators.....	15
<b>8 Production testing and inspection for field joints.....</b>	<b>17</b>
8.1 General.....	17
8.2 Material tests and inspection.....	17
8.3 System test and inspection.....	17
8.4 Inspection documents and traceability.....	17
8.5 Guidance in generating an ITP.....	17
<b>9 Requirements for field repairs of wet thermal insulation and field joints.....</b>	<b>34</b>
9.1 General.....	34
9.2 Damage/defect characterization.....	34
9.3 Repair materials for each of the material classes and compatibility.....	34
9.4 Repair execution.....	34
<b>10 Final documentation.....</b>	<b>34</b>
<b>11 Pre-fabricated insulation.....</b>	<b>35</b>
11.1 General.....	35
11.2 Material classes.....	35
11.3 Project specific qualification processes.....	35
11.4 Information to be supplied by the system purchaser.....	36
11.5 Manufacturing of pre-fabricated insulation.....	36
11.6 Inspection and testing plan.....	36
11.7 Requirements for repairs.....	37
11.7.1 General.....	37
11.7.2 Damage/Defect characterization.....	37
11.7.3 Repair method.....	38

11.7.4	Repair materials	38
11.8	Final documentation	38
11.9	Installation of pre-fabricated insulation	47
<b>12</b>	<b>Handling, storage and transportation at site for field joints and pre-fabricated insulation</b>	<b>47</b>
<b>Annex A</b> (informative)	<b>Guidelines for using this document</b>	<b>48</b>
<b>Annex B</b> (informative)	<b>Guidelines on the design of field joint systems on a project basis</b>	<b>52</b>
<b>Annex C</b> (informative)	<b>Field joint adhesion testing</b>	<b>55</b>
<b>Annex D</b> (informative)	<b>Guidelines for pre-fabricated insulation</b>	<b>58</b>
<b>Annex E</b> (informative)	<b>Pre-fabricated insulation leak test</b>	<b>62</b>
<b>Bibliography</b>		<b>65</b>

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

[ISO 12736-3:2023](https://standards.iteh.ai/catalog/standards/sist/a1ac0aad-85b1-414b-9611-1b42c33c68df/iso-12736-3-2023)

<https://standards.iteh.ai/catalog/standards/sist/a1ac0aad-85b1-414b-9611-1b42c33c68df/iso-12736-3-2023>

## 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](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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](http://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](http://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 systems, field repairs and pre-fabricated 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 12736-3:2023(E)

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.

ISO 12736-3:2023

<https://standards.iteh.ai/catalog/standards/sist/a1ac0aad-85b1-414b-9611-1b42c33c68df/iso-12736-3-2023>

**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)

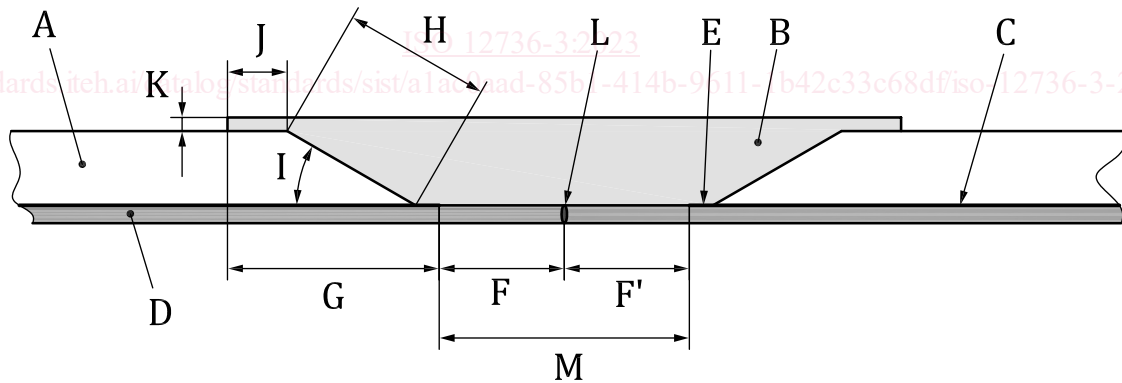
**3.49**  
**validation dossier**

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 12736-1:2023, 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 be 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 80000-1:2022, 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.