

Supplementary Specification to NORSOK M-004 Insulation for Piping and Equipment

Revision history

VERSION	DATE	PURPOSE
1.0	December 2020	Issued for Use

Acknowledgements

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Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2014).

Table of Contents

	Foreword	1
	Introduction	4
1	Scope	6
2	Normative references	7
3	Terms and definitions	9
4	Symbols and abbreviations	11
5	Qualification requirements	11
	5.1 Qualification of personnel	11
	5.2 Qualification of insulation system	13
	5.3 Insulation procedure	13
6	Materials	14
	6.1 Environmentally requirements	14
	6.2 Selection of insulation materials	14
	6.3 Selection of cladding	15
	6.4 Aluminium foils	17
	6.5 Sealers and sealing tape and gasket	17
	6.6 Perforated guards	17
	6.7 Accessories	17
	6.8 Insulating coating	17
7	Design engineering	18
	7.1 Designing for insulation	18
	7.2 Calculation of insulation thickness	18
	7.3 Combination of insulation classes	19
8	Installation and inspection	20
	8.1 General	20
	8.3 Vessel insulation	20
	8.4 Cladding	20
	8.5 Flanges and valves	21
	8.7 Drainage	22
	8.8 Instrument insulation	23
	8.9 Sealing of penetrations	23
	8.10 Inspection	23
	Annex A (informative) Key data for insulation	24
	Annex B (normative) General	25
	Annex C (informative) Test piece for site test	26
	Annex D (normative) Material data sheets (MDSs)	27
	Annex E (informative) Example insulation checklist	40

List of Tables

Table 1 - Selection of insulation material	15
Table 3 - Selection of cladding material.....	15
Table 4 - Cladding thickness, SS304 and SS316.....	16
Table 9 - Length of distance holders	19

Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of insulation for piping and equipment in accordance with NORSOK M-004, 1st Edition, December 2018, Piping and equipment insulation for application in the petroleum and natural gas industries.

This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.



JIP33 Specification for Procurement Documents Supplementary Technical Specification

This specification is to be applied in conjunction with the supporting data sheet, quality requirements specification (QRS) and information requirements specification (IRS) as follows.

IOGP S-738: Supplementary Specification to NORSOK M-004 Insulation for Piping and Equipment

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to NORSOK M-004, following the NORSOK M-004 clause structure. Clauses from NORSOK M-004 not amended by this specification apply as written to the extent applicable to the scope of supply.

Modifications to NORSOK M-004 defined in this specification are identified as *Add* (add to clause or add new clause), *Replace* (part of or entire clause) or *Delete*.

IOGP S-738D: Data Sheet for Insulation for Piping and Equipment

The data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The data sheet may also include fields for supplier provided information attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents may also be incorporated or referenced in the data sheet to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-738Q: Quality Requirements for Insulation for Piping and Equipment

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the data sheet or in the purchase order.

IOGP S-738L: Information Requirements for Insulation for Piping and Equipment

The IRS defines the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke information requirements.

The terminology used within this specification and the supporting data sheet, QRS and IRS follows that of Norsok M-004 and is in accordance with ISO/IEC Directives, Part 2 as appropriate.

The data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The supplementary specification and QRS are fixed documents.

The order of precedence (highest authority listed first) of the documents shall be:

- a) regulatory requirements;
- b) contract documentation (e.g. purchase order);
- c) purchaser defined requirements (data sheet, QRS, IRS);
- d) this specification;
- e) Norsok M-004.

1 Scope

Replace section with

This specification covers the minimum requirements for the procurement of insulation for equipment and packages for offshore/onshore installations. Insulation of pipes, equipment, vessels, tanks, valves, flanges and instrument tubing are covered. Thermal insulation, personnel protection, fire protection and acoustic protection for a normal operation temperature range of -200 °C to 800 °C is covered by this specification.

The scope of this specification includes the following:

- selection of insulation materials and cladding;
- material data sheet (MDS) for insulation materials and cladding;
- requirement for calculation of thickness for thermal and personnel protection;
- requirement for qualification of insulation system for fire and acoustic insulation;
- design requirement for proper installation of insulation;
- requirement for qualification of insulation installation personnel and inspection personnel;
- installation requirements;
- inspection requirements, including inspection checklist.

In all above areas, there is a high focus on reduced risk for corrosion under insulation.

The scope of this specification excludes the following:

- insulation of subsea equipment and piping (flowline risers);
- insulation of burners, furnaces or similar;
- insulation of buildings and civil structures;
- insulated ducting for heating, ventilation and air condition (HVAC);
- insulation of buried equipment and piping systems;
- insulation of flowlines and pipelines;
- pre-insulated manufactured tubing as a finished product;
- pre-insulated piping;
- spray-on passive fire protection (PFP);
- passive fire protection of structure, including piping and equipment supports with concrete based system;
- enclosures (thermal and acoustic);
- internal insulation (e.g. any kind of insulating refractory lining);
- pipe penetrations in bulkhead and deck;

- loose fill insulation;
- sprayed and in-situ formed foam;
- onshore field fabricated atmospheric storage tanks;
- explosion testing in connection to fire testing of insulation systems.

2 Normative references

Delete from section

ASTM E662, *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*

DNVGL-CP-0165, *Cable and pipe penetrations*

IACS UR S14, *Testing procedures for watertight compartments*

IMO 2010, *FTP Code Part 1 Non combustibility test*

IMO 2010, *FTP Code Part 2 Smoke and toxicity test*

IMO 2010, *FTP Code Part 3 Test for "A", "B", and "F" Class Divisions*

IMO 2010, *FTP Code Part 5 Test for surface flammability*

ISO 9865, *Textiles – Determination of water repellency of fabrics by the Bundesmann rain shower test*

NES713, *Toxicity Test Apparatus*

NORSOK C-002, *Architectural components and equipment*

NORSOK M-001, *Material selection*

NORSOK M-501, *Surface preparation and protective coating*

NORSOK S-001, *Technical Safety*

NORSOK S-002, *Working environment*

Marine Equipment Directive, Directive no.2014/90/EU

PSA, *The Facilities Regulations (Innretningsforskriften)*

PSA, *Technical and Operational Regulations (Teknisk og operasjonell forskrift for landanlegg)*

Add to section

ASTM A240M, *Standard Specification For Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*

ASTM B209, *Standard Specification for Aluminium and Aluminium-Alloy Sheet and Plate*

ASTM C302, *Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation*

ASTM C303, *Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation*

ASTM C533, *Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation*

ASTM C534 / C534M, *Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form*

ASTM C547, *Standard Specification for Mineral Fiber Pipe Insulation*

ASTM C552, *Standard Specification for Cellular Glass Thermal Insulation*

ASTM C553, *Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications*

- ASTM C591, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation*
- ASTM C592, Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)*
- ASTM C610, Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation*
- ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation*
- ASTM C680, Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs*
- ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel*
- ASTM C892, Standard Specification for High-Temperature Fiber Blanket Thermal Insulation*
- ASTM C1729, Standard Specification for Aluminum Jacketing for Insulation*
- ASTM C1767, Standard Specification for Stainless Steel Jacketing for Insulation*
- ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastics Elastomers — Tension*
- ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers*
- ASTM D751, Standard Test Methods for Coated Fabrics*
- ASTM D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*
- ASTM D1622, Standard test Method for Apparent Density of Rigid Cellular Plastics*
- ASTM D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor*
- ASTM D3039, Standard test Method for Tensile Properties of Polymer Matrix Composite Materials*
- ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials*
- ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials*
- ASTM E136, Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C*
- ASTM E228, Standard Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer*
- EAD 040643-00-1201, Fiber reinforced silica aerogel thermal insulation*
- EN 485, Aluminium and aluminium alloys – Sheet, strip and plate*
- EN 14306, Thermal insulation products for building equipment and industrial installations – Factory made calcium silicate (CS) products – Specification*
- EN 14308, Thermal insulation products for building equipment and industrial installations – Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products – Specification*
- EN 15501, Thermal insulation products for building equipment and industrial installations – Factory made expanded perlite (EP) and exfoliated vermiculite (EV) products – Specification*
- EN 10088–2, Stainless steels – Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*
- IOGP S-715, Supplementary Specification to Norsok M-501 Coating and Painting for Offshore, Marine Coastal and Subsea Environments*
- ISO 34, Rubber, vulcanized or thermoplastics — Determination of tear strength*
- ISO 6361, Wrought aluminium and aluminium alloys — Sheets, strips and plates*
- ISO 9223, Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*

ISO 12623, *Thermal insulating products for building equipment and industrial installations — Determination of short-term water absorption by partial immersion of preformed pipe insulation*

ISO 29767, *Thermal insulating products for building equipment and industrial installations — Determination of short-term water absorption by partial immersion of performed pipe insulation*

UL1709, *Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel*

3 Terms and definitions

3.5 temperature definitions

Add after second sentence

Minimum operating temperature: minimum temperature including plant operation at unstable condition. Unstable condition includes start-up/ shutdown, control requirements and process upsets

Replace last sentence with

Material selection: **maximum operating temperature, T_m** , shall be used for insulation material selection for systems above ambient and **minimum operation temperature, T_l** , for systems below ambient.

The ambient temperature shall be used for the cladding selection. The temperature on the outer layer of the insulation material shall be calculated according to section 7.2.

3.10 Insulation Class 3: Personnel protection

Replace definition with

Protection of personnel from hot and cold surfaces to avoid burns and frostbite.

3.13 Insulation class 6, 7, 8 and D: Acoustic insulation

Replace definition with

Acoustic insulation is specified in order to ensure that noise emission from piping, valves, flanges and equipment meets the area noise requirements for the working environment. The definition of the classes of acoustic insulation is as given in ISO 15665, Clause 4 for class 6, 7 and 8 and as given in Annex F for class D. This standard specifies the minimum insertion loss for each class related to the diameter of the pipe on which it is to be applied.

Class 6

Minimum insertion loss shall be in accordance with the definition given in ISO 15665 for class A. Valves and flanges shall be insulated when and as required by Company.

Class 7

Minimum insertion loss shall be in accordance with the definition given in ISO 15665 for class B. Flanges to be insulated. Valves to be insulated when and as required by Company.

Class 8

Minimum insertion loss shall be in accordance with the definition given in ISO 15665 for class C. Valves and flanges shall be insulated.

Class D

Minimum insertion loss shall be in accordance with the definition given in annex F for class D. Valves and flanges shall be insulated.

Add new term

3.15

blanket

Flexible fibrous insulation product supplied rolled or flat and which may be faced or enclosed.

Note to entry 1: Also known as mat.

Add new term

3.16

boxes

Insulation enclosed in metal cladding in two or more parts and secured by ex-center locks to be used on flanges, valves, instruments, small equipment, etc. for quick removal and re-installation of the insulation.

Note to entry 1: Also known as enclosure in ISO 15665.

Add new term

3.17

cladding

Rigid, semi rigid or flexible frequent pre-formed material that provides mechanical and/or environmental protection to insulation.

Note to entry 1: Also known as jacketing.

Add new term

3.18

cryogenic temperature

Temperature between -100 °C and -200 °C.

Add new term

3.19

insulating jacket

Flexible assembly of insulation material totally enclosed in fabric that is designed to fit individual items forms.

Note to entry 1: Also known as mattress and as insulation blanket in North America.

Add new term

3.20

scrim

Reinforcing mesh that is included within the thickness of the material. Scrim (cloths) provides tension reinforcement and puncture resistance.

Add new term

3.21

non-contact insulation system

Insulation system with no direct contact between the surface of the pipe/equipment and the insulation material.

Add new term

3.22

insulating coating

Coating that reduces the heat flux of a metal surface and that is used for personnel protection to avoid burns. Insulating coating does not necessarily provide corrosion protection.

4 Symbols and abbreviations

Add to section

CS	Calcium Silicate
CSPE	Chlorosulphonated Polyethylene
EP	Expanded Perlite
EPDM	Ethylene Propylene Diene Monomer
FEM	Flexible Elastomeric Membrane
GA	General Arrangement
MDS	Material Data Sheet
NCTI	Netherlands Centre for Technical Insulation
NIA	National Insulation Association (US)
PIR	Polyisocyanurate

5 Qualification requirements

5.1 Qualification of personnel

Replace section 5.1.1 title with

5.1.1 Qualification of insulation system installation personnel

Replace first paragraph with

Personnel installing insulation and cladding shall be individually qualified by the certified organization as specified in the data sheet, the insulation material manufacturer, the non-metallic cladding manufacturer or the insulation contractor.

Add to first paragraph

If personnel are qualified by insulation materials manufacturer, non-metallic cladding manufacturer or insulation contractor, a qualification procedure shall be established.

Add to first paragraph

The qualification procedure shall cover the evaluation of the personnel competences in theoretical and practical aspects.

Delete second paragraph

Delete third paragraph

Replace fourth paragraph with

The theoretical part of the qualification shall include:

- knowledge of health and safety hazard including waste handling;
- use of protection equipment;
- insulation materials;
- cladding material;
- application of insulation materials;
- application of cladding;
- surface requirements of insulation systems ;
- prevention of ingress of moisture in the insulation system;
- drainage to avoid accumulation of trapped water in the insulation system.

Delete fifth paragraph

Replace sixth paragraph with

The practical part of the qualification shall be performed in accordance with the sections of the insulation procedure specification (IPS) related to the equipment/packages to be insulated.

Delete seventh paragraph

Replace first sentence of eighth paragraph with

The theoretical and practical training and testing shall be documented.

Delete second sentence of eighth paragraph

5.1.2 Qualification of supervisors, foremen and QC personnel

Replace first paragraph with

Personnel carrying out inspection or verification shall be qualified by FROSIO (Inspector level III), NCTI or NIA.

Add NOTE to first paragraph

NOTE FROSIO Inspector level II may carry out the inspection work under the supervision of an inspector level III.

Replace second paragraph with

Supervisors and foremen shall have three years of documented insulation work experience corresponding to the work described in this specification.

Replace third paragraph with

QC and supervision personnel shall be familiar with the requirements of this specification.

5.2 Qualification of insulation system

In first sentence, delete "when required Type Approved/Certified"

In second list item, add after "Class 6,7 and 8"

and D

Delete third list item

5.2.1 Class 5 and F Insulation

In first paragraph, replace first sentence with

Fire insulation system (including removable jackets or boxes) shall be tested and documented in accordance with the specified fire type and duration for the equipment location area, e.g.:

Delete first list item of first paragraph

In second list item of first paragraph, add after EN 1363-2

, ISO 834-3 or UL1709

Delete last sentence of second list item of first paragraph

Delete second and third sentence of third item of first paragraph

Delete fourth list item of first paragraph

Replace section 5.2.2 title with

5.2.2 Class 6, 7, 8 and D: Acoustic insulation

In first paragraph, replace "All systems" with

For class 6,7, 8 and D, the insulation system

Add to section

Acceptance criteria for class D shall be as given in Table F1.

5.2.3 Sealing of penetrations

Delete section 5.2.3

5.3 Insulation procedure

5.3.1 Insulation procedure specification (IPS)

In first paragraph, replace first sentence with

A detailed IPS shall be established.

Replace second list item of second paragraph with

— technical data sheet and material safety data sheet for all type of materials;

5.3.2 Drawings for penetration seals

Delete section 5.3.2

5.3.3 Inspection and test plan (ITP)

In first sentence of first paragraph, delete "both" and "and inspection log"

6 Materials

6.1 Environmentally requirements

Delete section 6.1

6.2 Selection of insulation materials

Delete second sentence of first paragraph

Delete third sentence of second paragraph

Delete third paragraph

Replace first sentence of fourth paragraph with

The insulation materials shall be as per MDSs in Annex D:

Add to list

- Calcium Silicate (CS);
- Expanded Perlite (EP);
- Polyisocyanurate (PIR).

Table 1 - Selection of insulation materialReplace Table 1 with

Insulation class	Offshore + Onshore with corrosivity category C5 or higher according to ISO 9223, Annex C	Onshore with corrosivity category C4 or lower according to ISO 9223, Annex C
1 Heat conservation	Aerogel, AES fibre 1), Cellular glass 1) or Mineral wool 1), 2)	Aerogel, AES fibre 1) , Calcium silicate 1) , Cellular glass, Expanded perlite, FEF or Mineral wool 1), 2)
2 Cold medium conservation	Aerogel, Cellular glass or PIR ³	Aerogel, Cellular glass, FEF or PIR
3 Personnel protection	Tn ≤ 250 °C: Insulating coating or personnel guards	Tn ≤ 250 °C: Insulating coating or personnel guards
	Tn ≥ 250 °C: as class 1	Tn ≥ 250 °C: as class 1
	Tn < -10 °C: Personnel guards	Tn < -10 °C: Personnel guards
4 Frost protection	Aerogel, Cellular glass ¹⁾ or Mineral wool ^{1), 2)}	Aerogel, Cellular glass ¹⁾ or Mineral wool ^{1), 2)}
5 Fire protection	As per qualified system (5.2.1)	As per qualified system (5.2.1)
6, 7, 8 and D Acoustic insulation	As per qualified system (5.2.2)	As per qualified system (5.2.2)
9 External condensation and icing protection	Aerogel or Cellular glass ¹⁾	Aerogel, Cellular glass, FEF or PIR
Notes		
¹⁾ At Tn < 180 °C, AES, Calcium silicate, Cellular glass and mineral wool shall only be used as part of a non-contact insulation system or used as a secondary (outer layer) insulation material applied over e.g. aerogel. Minimum 20 mm air gap between insulation material and metallic surface of flange/valve in insulation boxes is a type of non-contact insulation. ²⁾ In mechanically ventilated room with no sprinkler/deluge system, mineral wool may be used directly on pipes/vessels with Tn > 40 °C. Indoor areas with regular cleaning or testing of seawater deluge system are not considered dry. ³⁾ Only for cryogenic temperature. ⁴⁾ For insulation of equipment and piping in service with self-igniting fluid (i.e. ethylene oxide) an insulation materials with closed cell structure (i.e. cellular glass) that is non-reactive to the fluid shall be used.		

6.3 Selection of cladding

Table 3 - Selection of cladding materialReplace Table 3 with

Insulation class	Cladding material
All, except class 5 or F	Stainless steel: SS316 ¹⁾ GRP FEM with reinforcement FEM without reinforcement For onshore only: Aluminium alloy: 3003 H14 or 3105 H14
5 or F	Cladding to be tested and documented as part of the system
Note	
¹⁾ SS304 may be used onshore with corrosivity category C4 or lower according to ISO 9223, Annex C, if specified by the purchaser.	

6.3.1 Metallic cladding

6.3.1.1

Replace first paragraph with

Type of stainless steel cladding shall be one of the following:

- ASTM 240M type SS316;
- EN 10088-2 number 1.4401;
- ASTM 240M type SS304;
- EN 10088-2 number 1.4301.

The stainless steel cladding shall have 2D finish.

The thickness of the stainless steel cladding shall be according to Table 4 or ASTM C1767.

Table 4 - Cladding thickness, SS304 and SS316

Replace Table 4 with

Thickness, minimum	OD < 250 mm	250 mm ≤ OD ≤ 900 mm	OD > 900 mm
SS304 and SS316 2D sheet	0,5 mm	0,7 mm	0,9 mm

6.3.1.2 Aluminium alloy

Replace first paragraph with

Aluminium cladding shall be type 3003 H14 or 3105 H14 according to ISO 6361, ASTM B209 or EN 485.

Thickness of aluminium cladding shall be according to Table 5 or ASTM C1729.

6.3.1.3 Aluzinc

Delete section 6.3.1.3

6.3.2 Non-metallic cladding

Replace first paragraph with

Non-metallic cladding shall be according MDS GRP, MDS FEM with reinforcement or MDS FEM without reinforcement in Annex D.

Delete second paragraph

Delete third paragraph

Delete fourth paragraph

Delete Table 7

Delete fifth paragraph

Delete sixth paragraph

6.4 Aluminium foils

Delete second paragraph

Add to section

If materials others than aluminium foil are used for vapour barrier, the MDSs shall be included in the IPS and be approved by Company.

6.5 Sealers and sealing tape and gasket

Add to section

Flexibility shall be documented by test reports or track record field experience.

Add to section

The test shall be according to ISO 12944-9, Annex B Cyclic aging test.

Add to section

The joint sealer after the test shall remain flexible and be well bounded to the substrate without surface cracks when visually examined under X7 magnification.

6.6 Perforated guards

Delete fourth paragraph

6.7 Accessories

Replace second sentence of first paragraph with

For aluminium cladding, direct contact between the aluminium cladding and SS316 accessories shall be avoided by using a polymer gasket, washer, etc.

Add Note 2 to Table 8

²⁾ The values are minimum values.

Add new section

6.8 Insulating coating

Company approved insulating coating for class 3 shall be applied in accordance with the supplier's recommendations.

7 Design engineering

7.1 Designing for insulation

In first paragraph, replace “P&IDs’, and piping isometrics” with

P&IDs’, GAs and piping isometrics

Delete second paragraph

Delete ninth paragraph

Delete tenth paragraph

7.1.3 Insulation of valves and flanges

Delete first paragraph

Delete third sentence of second paragraph

Delete fourth sentence of second paragraph

In third paragraph, replace “suitable for quick removal and reinstallation.” with

used.

Delete fourth paragraph

In first sentence of fifth paragraph, replace “which shall be frequently subject for inspection and maintenance” with

when specified

Delete third sentence of fifth paragraph

In first sentence of sixth paragraph, replace “with the “roof tile” principles” with

for water shedding

Add to sixth paragraph

The top of the box shall have 10° incline from the horizontal plane on top of the box.

Add to section

An extended valve stem or extended bonnet shall be used to accommodate the specified box insulation thickness.

7.2 Calculation of insulation thickness

7.2.1 Class 1,2,4 and 9

In first paragraph, add after “EN ISO 12241”

or ASTM C680

Replace second paragraph with

For thermal calculations on non-contact insulation systems, the thermal conductivity of annular gap/void provided by the spacer system shall be accounted for in thickness calculations.

7.2.2 Class 3

Add before first paragraph

Where normal operation temperature exceeds the values given in the data sheet, personnel protection class 3 shall be used.

Replace second sentence of first paragraph with

Guards installed for normal operating temperatures under and including 250 °C shall be made of perforated SS316 plate or insulating coating.

Replace third sentence of first paragraph with

For normal operating temperatures above 250 °C, the insulation thickness shall be calculated in accordance with EN ISO 12241 or ASTM C680.

Table 9 - Length of distance holders

Replace Table 9 with

Nominal pipe size (DN)	Normal operation temperature (°C)	
	60 °C ≤ Tn ≤ 250 °C	Tn < -10 °C
DN < 250 mm	50 mm	50 mm
DN ≥ 250 mm	100 mm	50 mm

Delete fourth paragraph

7.2.3 Class 5 and F

Delete third paragraph

7.3 Combination of insulation classes

7.3.1 General

Replace first paragraph with

For insulation systems with combinations of insulation classes, the insulation system shall fulfil the insulation requirement for each insulation class.

Delete second paragraph

7.3.2 Thermal insulation and/or personnel protection combined with fire protection

Delete section 7.3.2

7.3.3 Thermal insulation and/or personnel protection combined with acoustic insulation

Delete section 7.3.3

7.3.4 Fire protection combined with acoustic insulation

Delete section 7.3.4

7.3.5 Thermal insulation and/or personnel protection combined with fire protection and acoustic insulation

Delete section 7.3.5

8 Installation and inspection

8.1 General

In first sentence, replace "P&ID, piping isometric, data sheets and IPS" with

P&ID, GA, piping isometric, data sheets and IPS

8.1.1 Workmanship

Delete fifth paragraph

8.1.3 Insulation with vapour barrier

Add to end of first list item of third paragraph

for cryogenic temperatures

8.3 Vessel insulation

8.3.2 Segment insulation of vessel

8.3.2.1 Insulation with vapour barrier

Delete first paragraph

8.4 Cladding

8.4.1 Metallic cladding

Replace first sentence of first paragraph with

All cladding seams shall be installed to shed water.

In first sentence of second paragraph, replace "pipelines" with

pipes

Add to second paragraph

Longitudinal seams shall be crimped 30 mm from the edge on one side for OD < 150 mm and 50 mm from the edge on one side for OD ≥ 150 mm.

Add to second paragraph

Longitudinal seams shall be staggered.

In first sentence of third paragraph, replace "pipelines" with

pipes

In first sentence of seventh paragraph, add before "sealant"

flexible, non-hardening elastomeric

Add to seventh paragraph

The sealant shall be applied prior to the closure of the seam.

Add to seventh paragraph

The sealant shall be (25 +/- 5) mm wide and (3 +/- 1) mm thick.

Add to seventh paragraph

The sealant shall be applied to display continuously external 2 to 3 mm of sealant at completed seam.

Delete twelfth paragraph

Add to fourteenth paragraph

Metal bands shall be installed on circumferential overlaps and in the middle of circumferential overlaps with a minimum c/c of 250 mm.

8.4.2 Non-metallic cladding

Delete first paragraph

Replace second sentence of second paragraph with

If the maximum temperature of piping exceeds the maximum service temperature of the non-metallic cladding, a special termination solution against piping shall be made.

8.4.3 GRP

Replace section with

The installation of GRP cladding shall be according to MDS GRP.

8.5 Flanges and valves

8.5.1 General

Add to second paragraph

Insulation boxes shall overlap with minimum insulation thickness on connection pipes.

Add to section

All cut-outs in the insulation boxes shall be sealed to avoid water ingress.

8.5.2 Surface material for jackets

Replace first sentence of first paragraph with

The jacket shall prevent water ingress.

Replace second sentence of first paragraph with

The material shall have an adequate wear resistance to withstand frequent handling and normal wear and tear.

Replace third sentence of first paragraph with

The surface material shall be tested for reaction to fire according to ASTM E84 or EN 13501-1.

Delete second paragraph

Delete guidance note

Add to section

Material properties for surface material and sewing thread shall be documented and included in the IPS.

8.5.3 Insulation materials for prefabricated boxes

Add to section

For insulation classes without a vapour barrier, there shall be a minimum 20 mm air gap between flange/valve and the insulation material except for penetrations in the box (pipe, stem, etc.).

8.5.4 Insulation boxes with vapour barrier

Delete first sentence of first paragraph

Delete second sentence of first paragraph

Delete second paragraph

8.5.6 Identification

Delete third paragraph

8.7 Drainage

In first paragraph, replace "10" with

15

8.8 Instrument insulation

Delete section

8.9 Sealing of penetrations

Delete section

8.10 Inspection

Add Note

NOTE Annex E provides a checklist of typical inspection activities related to installation of insulation.

Annex A
(informative)
Key data for insulation

Delete Annex A

Annex B
(normative)
General

Delete Annex B

Annex C
(informative)
Test piece for site test

Delete Annex C

Annex D (normative) Material data sheets (MDSs)

Replace section with

The materials shall be delivered in accordance with the standard referred to in the MDS. In addition, the MDS specifies the selected options in the referred standard and additional requirements which shall be added or shall supersede the corresponding requirements in the referred standard. For tests, specified in the MDS for insulation materials, that are not included in the insulation material standard given in the MDS, the tests shall be material or product qualification tests and shall not be regular production tests. The tests specified in the MDS for non-metallic cladding shall be material or product qualification tests and shall not be regular production tests. Where the MDS does not specify any additional requirements, all the requirements of the referred standard apply. The latest edition of the referred standard shall apply unless a specific year of issue is specified by the purchaser.

Replace MDS AES with

MATERIAL DATA SHEET		MDS AES	Rev. 01
TYPE OF MATERIAL: Alkali Earth Silicate (AES)			
Standard	Grade / Type	Additional requirements	
ASTM C892 <i>(EN standard not available. ASTM standard to be used in Europe)</i>	Type II, grade 6 and 8	Section 11.1.9 ASTM E84 and ASTM E136	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or shall supersede the corresponding requirements in the referred standard. Products shall meet the requirements for bio-soluble fibres in Note Q of Regulation (EC) No. 1272/2008.		
Products	AES insulation products are supplied in slabs and blankets.		
Application	AES can be used for class 1 and 3. At normal operation temperatures < 180 °C, AES can only be used as part of a non-contact insulation system or as a secondary (outer layer) insulation material applied over e.g. aerogel.		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C892		
Traces of water soluble ions and pH	Section 11.1.9		
Reaction to fire	ASTM E136 and ASTM E84		
INSTALLATION REQUIREMENTS			
General	Installation according to installation manual from Manufacturer. For classes 5, 6, 7 and 8, installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.		

Replace MDS AG with

MATERIAL DATA SHEET		MDS AG	Rev. 01
TYPE OF MATERIAL: Aerogel (AG)			
Standard	Grade / Type	Additional requirements	
ASTM C1728	Type I: Grade 1B Type III: Grade 1A and 2A	Section 7.11	
EAD 040643-00-1201		Section 2.2.1 (Acceptance criteria) Section 2.2.2 EN 14607 / EN 14707 EN 13468	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or shall supersede the corresponding requirements in the referred standard.		
Products	Blankets		
Application	Aerogel can be used for all insulation classes.		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C1728	EAD 040643-00-1201	
Maximum service temperature		EN 14706 / EN 14707	
Water absorption		Section 2.2.2	
Traces of water soluble ions and pH	Section 7.11	EN 13468, Acceptance criteria: Figure 1 in ASTM C795 pH-value = 7-12,5	
Reaction to fire		Section 2.2.1, Acceptance criteria: minimum B-s1, d0	
INSTALLATION REQUIREMENTS			
General	Installation according to installation manual from Manufacturer. For classes 5, 6, 7 and 8, installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.		

Replace MDS CG with

MATERIAL DATA SHEET		MDS CG	Rev. 01
TYPE OF MATERIAL: Cellular glass (CG)			
Standard <i>Either ASTM or EN standard shall be used.</i>	Grade / Type	Additional requirements	
ASTM C552	Grade 6	Section 12.10 ASTM E136 and ASTM E228	
EN 14305		Section 4.2.4 (Acceptance criteria) Sections 4.3.2, 4.3.3, 4.3.4, 4.3.10, 4.3.11, 4.3.12, C.6 and C.7	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or shall supersede the corresponding requirements in the referred standard.		
Products	Cellular glass insulation products are supplied as prefabricated piping and equipment elements / sections. The product shall be delivered with anti-abrasive coating if used directly on piping / equipment.		
Application	<p>CG can be used for thermal insulation for all insulation classes.</p> <p>At normal operation temperatures < 180 °C, cellular glass can only be used as part of a non-contact insulation system or as a secondary (outer layer) insulation material applied over e.g. aerogel for offshore and onshore with corrosivity category C5 or higher according to ISO 9223, Annex C.</p> <p>CG can be use alone or in combination with other materials for class 5, 6,7 and 8 as per qualified system.</p> <p>For temperature above +180 °C, an outside reinforcement mesh/coating should be used.</p>		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C552	EN 14305	
Maximum service temperature		Section 4.3.2	
Minimum service temperature		Section 4.3.3	
Density		Section C.7	
Water absorption		Section 4.3.10	
Traces of water soluble ions and pH	Section 12.10	Section 4.3.12, Acceptance criteria: Figure 1 in ASTM C795 pH-value = 7-12,5	
Reaction to fire	ASTM E136	Section 4.2.4, Acceptance criteria: A1	
Compressive strength		Section 4.3.4, Acceptance criteria: Level CS(Y) 500	
Water vapour diffusion resistance		Section 4.3.11, Acceptance criteria: $\mu \approx \infty$	
Coefficient of thermal expansion/ contraction	ASTM E228	Section C.6	

MATERIAL DATA SHEET		MDS CG (continued)	Rev. 01
INSTALLATION REQUIREMENTS			
General	<p>Installation according to installation specification from Manufacturer.</p> <p>For classes 5, 6, 7 and 8 installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.</p> <p>Anti-abrasive coating shall be used to prevent damage to cellular glass and coating systems. The anti-abrasive coating shall be completely dry before the insulation material is mounted. The anti-abrasive coating shall be suitable at maximum operation temperatures.</p> <p>After wet applied anti-abrasive coating is applied, the surface shall have a smooth finish.</p> <p>For systems without vapour barrier, no sealant shall be used in the longitudinal and circumferential CG joints.</p> <p>For system with vapour barrier and a single layer application, all longitudinal and circumferential CG joint shall be sealed with a joint sealant. For a multi-layer application, only the longitudinal and circumferential CG joint of the uppermost layer shall be sealed with joint sealant.</p>		
Piping	<p>CG shall be prefabricated as pipe insulation elements according to dimensions and shape. To cover fittings and other irregular surfaces, sections may be cut and fitted on site.</p> <p>Minimum thickness up to DN150 shall be 30 mm. Above DN150, minimum thickness shall be 40 mm.</p>		
Vessel	<p>CG vessel (DN200) segments shall be mechanically fastened and tightened with metal bands. For \leq DN150 segments, glass fibre reinforced tape shall be used.</p>		
CG with non-metallic cladding	<p>Prefabricated CG with factory applied non-metallic cladding shall be joint sealed with suppliers recommended sealant.</p>		

Add new MDS CS

MATERIAL DATA SHEET		MDS CS	Rev. 01
TYPE OF MATERIAL: Calcium silicate (CS)			
Standard <i>Either ASTM or EN standard shall be used.</i>	Grade / Type	Additional requirements	
ASTM C533	Type 1		
EN 14306		Section 4.2.4 (Acceptance criteria) Sections 4.3.2, 4.3.5 and D.9	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.		
Products	The products are manufactured in the form of boards, pipe section, segments and prefabricated ware.		
Application	CS can be used onshore with corrosivity category C4 or lower according to ISO 9223, Annex C for systems with continuously temperature higher than 180 °C.		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C533	EN 14306	
Maximum service temperature		Section 4.3.2	
Density		Section D.9	
Traces of water soluble ions		Section 4.3.5, Acceptance criteria: Figure 1 in ASTM C795 pH=7-12,5	
Reaction to fire		Section 4.2.4, Acceptance criteria: Class A	
INSTALLATION REQUIREMENTS			
General	Installation according to installation manual from Manufacturer. For classes 5, 6, 7 and 8, installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.		

Add new MPS EP

MATERIAL DATA SHEET		MDS EP	Rev. 01
TYPE OF MATERIAL: Expanded Perlite (EP)			
Standard <i>Either ASTM or EN standard shall be used.</i>	Grade / Type	Additional requirements	
ASTM C610		ASTM C302 / ASTM C303	
EN 15501		Section 4.2.4 (Acceptance criteria) Sections 4.3.2, 4.3.5, 4.3.7 and E.8	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.		
Products	The products are manufactured in the form of boards, pipe sections, segments and prefabricated ware.		
Application	EP can be used onshore with corrosivity category C4 or lower according to ISO 9223, Annex C for systems with temperature higher than ambient.		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C610	EN 15501	
Maximum service temperature		Section 4.3.2	
Density	ASTM C302 / ASTM C303	Section E.8	
Water absorption		Section 4.3.7	
Traces of water soluble ions and the pH value		Section 4.3.5, Acceptance criteria: Figure 1 in ASTM C795 pH=7-12,5	
Reaction to fire		Section 4.2.4, Acceptance criteria: Class A	
INSTALLATION REQUIREMENTS			
General	Installation according to installation manual from Manufacturer. For classes 5, 6, 7 and 8, installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.		

Replace MDS FEF with

MATERIAL DATA SHEET		MDS FEF	Rev. 01
TYPE OF MATERIAL: Flexible Elastomeric Foam (FEF)			
Standard <i>Either ASTM or EN standard shall be used.</i>	Grade / Type	Additional requirements	
ASTM C534 / C534M	Grade 3	ASTM D1622	
EN 14304		Section 4.2.4 (Acceptance criteria) Sections 4.3.2, 4.3.3, 4.3.5 and 4.3.6 and D4	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard. Either ASTM or EN standard shall be used.		
Products	Flexible Elastomeric Foam products with or without factory -applied non-metallic cladding are delivered in prefabricated pipe section, rolls and slabs.		
Application	FEF can be used for instrument tubing with diameter DN ≤ 32 mm for all insulation classes for temperatures ≤ 110 °C. FEF can also be used for thermal insulation of piping and equipment for onshore with corrosivity category C4 or lower according to ISO 9223, Annex C.		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C534 / C534M	EN 14304	
Maximum service temperature		Section 4.3.2	
Minimum service temperature		Section 4.3.3	
Density	ASTM D1622	Section D4	
Water absorption		Section 4.3.5	
Traces of water soluble ions		Section 4.3.6, Acceptance criteria: Figure 1 in ASTM C795 pH=7-12,5	
Reaction to fire		Section 4.2.4, Acceptance criteria: minimum DI-s3,d0	
INSTALLATION REQUIREMENTS			
General	Installation according to installation manual from Manufacturer. For classes 5, 6, 7 and 8, installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.		

Replace MDS MW with

MATERIAL DATA SHEET		MDS MW	Rev. 01
TYPE OF MATERIAL: Mineral wool (MW)			
Standard <i>Either ASTM or EN standard shall be used.</i>	Grade / Type	Additional requirements	
ASTM C547 (pipe section)	Type II	Section 11.1.10, ASTM E136 and ISO 12623/ISO29767	
ASTM C553 (mats without mesh)	Type VII	Section 11.9, ASTM E136 and ISO 12623/ISO29767	
ASTM C592 (mats, wired mats)	Type II	Section 11.11, ASTM E136 and ISO 12623/ISO29767	
ASTM C612 (block and boards)	Type IVB	Section 12.10 and ASTM E136 and ISO 12623/ISO29767	
EN 14303		Section 4.2.4 (Acceptance criteria) Sections 4.3.2, 4.3.5, 4.3.7 and B.2	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard. Products shall meet the requirements for bio-soluble fibres in Note Q of Regulation (EC) No. 1272/2008.		
Products	Mineral wool products are supplied as mandrel wound pipe sections, wired mats, mats and slabs. Wired mats shall be supplied with stainless steel (SS304) stitching wire and mesh in corrosive environments \geq C5 according to ISO 9223, Annex C. Galvanized stitching wire and mesh can be used in corrosive environments \geq C4 according to ISO 9223, Annex C.		
Application	All insulation classes except class 2 and 9. In corrosive environments \geq C5 according to ISO 9223, Annex C and at normal operation temperatures $<$ 180°C, MW shall only be used as part of a non-contact insulation system or used as a secondary (outer layer) insulation material applied over e.g. aerogel.		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C547/C553/C592/612	EN 14303	
Maximum service temperature		Section 4.3.2	
Density		Section B.2	
Water absorption	ISO 12623/ISO 29767, Acceptance criteria: maximum 0,2 kg/m ²	Section 4.3.5, Acceptance criteria: maximum 0,2 kg/m ²	
Traces of water soluble ions and pH	Sections 11.1.10, 11.9, 11.11 and 12.10 (ASTM C547/C553/C592/C612)	Section 4.3.7, Acceptance criteria: Figure 1 in ASTM C795 pH-value = 7-12,5	
Reaction to fire	ASTM E136	Section 4.2.4, Acceptance criteria: A1	

MATERIAL DATA SHEET		MDS MW <i>(continued)</i>	Rev. 01
INSTALLATION REQUIREMENTS			
General	Installation according to installation manual from Manufacturer. For classes 5, 6, 7 and 8, installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.		

Add new MDS PIR

MATERIAL DATA SHEET		MDS PIR	Rev.01
TYPE OF MATERIAL: Polyisocyanurate (PIR)			
Standard <i>Either ASTM or EN standard shall be used.</i>	Grade / Type	Additional requirements	
ASTM C591	Type II	Section 12.9	
EN 14308		Sections 4.3.2, 4.3.3, 4.3.5, 4.3.6.1, 4.3.6.2, 4.3.7, 4.3.8 and D.9	
General	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.		
Products	The products are manufactured in the form of boards, pipe sections, segments and prefabricated ware.		
Application	PIR can be used onshore with corrosivity category C4 or lower according to ISO 9223, Annex C for systems with temperature lower than ambient.		
MATERIAL DATA AND PROPERTIES (additional testing and acceptance criteria)			
Standard	ASTM C591	EN 14308	
Maximum service temperature		Section 4.3.2	
Minimum service temperature		Section 4.3.3	
Density		Section D.9	
Water absorption		Sections 4.3.6.1 and 4.3.6.2, Acceptance criteria: max 1 % (volume)	
Traces of water soluble ions and the pH value		Section 4.3.8, Acceptance criteria: Figure 1 in ASTM C795 pH= 7-12,5	
Reaction to fire	Section 12.9	Section 4.2.4, Acceptance criteria: min DI-s3,d0	
Close cell content		Section 4.3.7, Acceptance criteria: minimum 90 %	
INSTALLATION REQUIREMENTS			
General	Installation according to installation manual from Manufacturer. For classes 5, 6, 7 and 8, installation shall be done as described in the relevant test reports / installation instructions for the qualified systems.		

Delete MDS PBFP

Replace MDS GRP with

MATERIAL DATA SHEET		MDS GRP	Rev. 01
TYPE OF MATERIAL: Weather resistant glass fibre reinforced polymer (GRP) cladding			
General	This specification describes the minimum requirements for a GRP for cladding purposes.		
Products	Laminate based on glass fibre reinforced polyester and/or vinyl ester resins. The material can be supplied as prefabricated shells or as wet material by curing on site.		
Standard	NA		
Application	GRP is used for external areas subjected to mechanical loads or where a water tight cladding is required.		
MATERIAL DATA AND PROPERTIES			
General requirements	The cladding material shall have a maximum material temperature resistance: ≥ 90 °C.		
	Layer thickness: $\geq 1,5$ mm		
	Standard	Acceptance criteria	
Mechanical properties	ISO 178 / ASTM D790	Bending strength: ≥ 130 MPa	
	ISO 527 / ASTM D3039	Tensile strength: ≥ 50 MPa	
	ISO 527 / ASTM D3039	Elongation at break: ≥ 1 %	
	ASTM D2583	Barcol hardness shall be specified by Supplier.	
Reaction to fire	One of the following: ASTM E84 or EN13501-1	Tests shall be documented.	
Aging test	ISO 12944-9 (Exposure cycling test condition)	It shall be documented that the material (including system for joining) will maintain minimum 90 % of its tensile strength/elongation properties after the accelerated aging. The GRP can be tested with or without a UV durable topcoat.	
Additional requirements	Depending on design life and risk for direct sunlight exposure, GRP may be required protected by a UV durable topcoat, with quality in line with topcoat in system 1 (IOGP S-715). The coating can be pre-applied to the prefabricated shells or site applied.		
	GRP shall be antistatic and fulfil the requirements in EN 13463-1:2009/ISO 80079-36, Annex D (except high voltage spray electrode test).		
General	Installation according to installation manual from Manufacturer. GRP cladding shall be pre-cured before installation.		

Add new MDS FEM with reinforcement

MATERIAL DATA SHEET		MDS FEM with reinforcement	Rev. 01
TYPE OF MATERIAL: Weather resistant flexible elastomeric membrane (FEM) with reinforcement			
General	This specification describes the minimum requirements for a FEM for cladding purposes.		
Products	Woven glass scrim reinforced Chlorosulphonated Polyethylene (CSPE) polymeric covering where the CSPE content of the polymer content is greater than 30 %.		
Standard	NA		
Application	FEM is a water proof cladding system designed to prevent water ingress into the insulation material.		
MATERIAL DATA AND PROPERTIES			
General requirements	The cladding material shall have an applicable temperature range from -50 °C to + 100 °C.		
	Layer thickness: ≥ 1 mm		
	Test standard	Acceptance criteria	
Mechanical properties	ASTM D751 (Trapezoidal tear test) or ASTM D624 (Trouser tear test) / ISO 34-1 (Method A)	Trapezoidal tear strength (ASTM D751) ≥ 80 N Tear strength (ASTM D624 or ISO 34-1) ≥ 25 N/mm	
	ASTM D751 or ASTM D412 / ISO 37	Breaking strength in machine direction ≥ 10 MPa	
	ASTM D751 or ASTM D412 / ISO 37	Elongation at break in machine direction ≥ 200 %	
	ASTM D751	Puncture resistance ≥ 100 N	
Reaction to fire	ASTM E84 / EN 13501-1	Tests shall be documented.	
Aging test	ISO 12944-9, Annex B (Exposure cycling test condition)	It shall be documented that the material (including system for joining) will maintain min. 90 % of its tensile strength/elongation properties after the accelerated aging.	
Water vapour permeance	ASTM E96, procedure E / EN 12086	Acceptance criteria: max 0,001 g/(m ² ·h·mm Hg)	
General	Installation according to installation manual from Manufacturer.		

Add new MDS FEM without reinforcement

MATERIAL DATA SHEET		MDS FEM without reinforcement	Rev. 01
TYPE OF MATERIAL: Weather resistant flexible elastomeric membrane (FEM) without reinforcement			
General	This specification describes the minimum requirements for a FEM for cladding purposes.		
Products	Chlorosulphonated Polyethylene (CSPE) polymeric covering where the CSPE content of the polymer content is greater than 30 % without woven glass scrim reinforcement Ethylene Propylene Diene Monomer (EPDM) polymeric covering		
Standard	NA		
Application	FEM is a water proof cladding system designed to prevent water ingress into the insulation material		
MATERIAL DATA AND PROPERTIES			
General requirements	The cladding material shall have an applicable temperature specified by the supplier in the material data sheet.		
	Layer thickness: ≥ 1 mm		
	Test standard	Acceptance criteria	
Mechanical properties	ASTM D624 / ISO 34	Tear strength ≥ 5 N/mm	
	ASTM D412 / ISO 37	Breaking strength ≥ 4 MPa	
	ASTM D412 / ISO 37	Elongation at break ≥ 150 %	
Reaction to fire	ASTM E84 / EN 13501-1	Tests shall be documented.	
Aging test	ISO 12944-9, Annex B (Exposure cycling test condition)	It shall be documented that the material (including system for joining) will maintain min. 90 % of its tensile strength/elongation properties after the accelerated aging.	
Water vapour permeance	ASTM E96, procedure E / EN 12086	Acceptance criteria: max 0,001 g/(m ² · h · mm Hg)	
General	Installation according to installation manual from Manufacturer.		

Add new Annex E

Annex E (informative) Example insulation checklist

This checklist is for typical inspection activities related to installation of insulation.

This checklist can be part of the ITP.

	Accepted, date and signature	Comments
1. Before insulation installation		
1.1 Materials according to specification		
1.1.1 Material type at site as specified in IPS		
1.1.2 Product data sheet for the materials according to IOGP S-738		
1.2 Materials stored protected from weather and from any risk of degradation		
1.3 Surface to be insulated clean and dry		
1.4 Coating under insulation complete (when applicable)		
1.5 Hydraulic testing complete and system released for insulation		
1.6 Heat tracing installation complete (when applicable)		
1.7 Clearance around items to be insulated according to specification		
1.8 Stem extension for valves installed		
1.9 Correct type of support installed and installed correctly		
2. Installation of insulation materials		
2.1 Insulation installed where required according to P&ID, GA, etc.		
2.2 Thickness and number of layers as specified in IPS		
2.3 Insulation joints staggered according to IPS		
2.4 Insulation properly fitted		
2.5 Insulation layers secured (type and dimensions) according to IPS		
2.6 Expansion joints installed according to IPS (when applicable)		
2.7 Vapour barrier installed according to IPS (when applicable) and undamaged		
3. Installation of cladding		
3.1 Cladding material as specified in IPS (type, thickness, finish, etc.)		

3.2	Cladding installed to shed water		
3.3	Cladding overlap according to IPS		
3.4	Cladding secured according to IPS		
3.5	Sealant applied to avoid any ingress of water		
3.6	Drain holes installed according to IPS		
3.7	Dripping edge installed according to IPS		
3.8	S-clips installed according to IPS (when applicable)		
4. Boxes and jackets for flanges and valves			
4.1	Allowance for bolt removal according to specification		
4.2	Overlap with pipe according to specification		
4.3	Identification plate according to specification, installed		
4.4	Jackets according to IPS — Insulation material and surface material — Fasteners		
4.5	Removable boxes according to IPS — Insulation wrapped in aluminium foil — 10° incline on top — Foldout — Drain holes at lowest point of box • System without vapour barrier: drain hole through the insulation system • System with vapour barrier: drain hole only in cladding — Minimum 20 mm air cap around flange/valve inside the box, except at penetrations in the box (not for systems with vapour barrier) — Sealing in all penetrations		

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