



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS EP PVV 771

Thermal insulation (hot service)

05	10/2009	Update of reference documents
04	10/2008	Addition of new insulation and polymeric cladding materials
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1. Scope

This general specification defines the technical requirements of thermal insulation materials for equipment and piping on offshore and onshore installations.

The following are excluded:

- Equipment and piping:
 - For cold service
 - For cyclic service
 - Buried
 - Subject to acoustic protection.
- Instruments.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
ASTM A 653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 165	Compressing properties, practice for measuring
ASTM C 168	Standard terminology relating to thermal insulating Materials
ASTM C 177	Standard test method for steady-state heat flux measurement and thermal transmission properties by means of the guarded-hot-plate apparatus
ASTM C 203	Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C 209	Standard Test Methods for Cellulosic Fiber Insulating Board
ASTM C 240	Standard test methods of testing cellular glass insulation block
ASTM C 303	Standard test method for density of pre-formed block type thermal insulation
ASTM C 411	Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
ASTM C 516	Vermiculate loose fill for nominal sizes of pipe/tubing, NBS system, practise

Reference	Title
ASTM C 518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 533	Standard specification for calcium silicate block and pipe thermal insulation
ASTM C 534	Preformed Flexible Elastomeric cellular thermal insulation in Sheet and Tubular forms
ASTM C 547	Standard specification for mineral fibre preformed pipe insulation
ASTM C 549	Perlite loose fill for nominal sizes of pipe/tubing, NBS system, practise
ASTM C 552	Standard specification for cellular glass thermal insulation
ASTM C 585	Inner/outer diameters of rigid thermal insulation for nominal sizes of pipe/tubing, NBS system, practise
ASTM C 592	Standard specification for mineral fibre blanket insulation and blanket-type pipe insulation (Metal-mesh covered) (Industrial type)
ASTM C 612	Standard specification for mineral fibre block and board thermal insulation
ASTM C 647	Properties/test of mastics/coatings of thermal insulation, guide
ASTM C 687	Standard Practice for Determination of Thermal Resistance of Loose-Fill Building Insulation
ASTM C 764	Mineral fibre (nodulated) loose fill for nominal sizes of pipe/tubing, NBS system, practise
ASTM C 795	Standard specification for thermal insulation for use in contact with austenitic stainless steel
ASTM C 871	Standard test methods for chemical analysis of thermal insulation. Materials for leachable chloride, fluoride, silicate, and sodium ions
ASTM C 892	Standard specification for high-temperature fibre blanket thermal insulation
ASTM C 921	Packaging material properties/testing
ASTM C 929	Standard practice for handling, transporting, shipping, storage, receiving and application of thermal insulation material for use in contact with austenitic stainless steel
ASTM C 1046	In situ measurement of heat flux measurement of heat flux and temperature on building envelope component, practise
ASTM C 1086	Glass fibre felt thermal insulation for nominal sizes of pipe/tubing, NBS system, practise
ASTM D 1621	Standard test method for compressive properties of rigid cellular plastics
ASTM D 1622	Standard test method for apparent density of rigid cellular plastics

Reference	Title
ASTM D 2126	Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D 6226	Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM E 84	Standard test method for surface burning characteristics of building materials
ASTM E 96	Standard Test Methods for Water Vapor Transmission of Materials
ASTM E 228	Standard Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer
BS 476- 6	Fire tests on building materials and structures - Part 6: Method of test for fire propagation for products
BS 476-7	Fire tests on building materials and structures - Part 7: Method of test to determine classification of the surface spread of flame products
BS 4370	Methods of test for Rigid cellular materials
EN 826	Determination of compression behaviour
EN 1604	Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions
EN 1609	Thermal insulating products for building applications. Determination of short term water absorption by partial immersion.
EN 10456	Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EN 12086	Thermal insulating products for building applications. Determination of water vapour transmission properties
EN 12087	Thermal insulating products for building applications - Determination of long term water absorption by immersion
EN 12667	Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance
EN 12939	Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Thick products of high and medium thermal resistance
EN 13469	Determination of water vapour transmission properties of preformed pipe insulation
EN 13471	Determination of the coefficient of thermal expansion
EN 13501	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

Reference	Title
prEN 14303	Thermal insulation products for building equipment and industrial installations - Factory made mineral wool(MW) products - Specification
prEN 14304	Thermal insulation products for building equipment and industrial installations - Factory made flexible elastomeric foam (FEF) products - Specification
prEN 14305	Thermal insulation products for building equipment and industrial installations - Factory made cellular glass products - Specification
prEN 14706	Thermal insulating products for building equipment and industrial installations - Determination of maximum service temperature
prEN 14707	Thermal insulating products for building equipment and industrial installations - Determination of maximum service temperature for preformed pipe insulation
ISO 37	Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties
ISO 845	Cellular plastics and rubbers; Determination of Apparent Density
ISO 2581	Plastics. Rigid cellular plastics. Determination of thermal conductivity
ISO 2811	Paints and varnishes - Determination of density
ISO 2896	Rigid cellular plastics - Determination of water absorption
ISO 8301	Thermal insulation - Determination of steady-state thermal resistance and related properties - Heat flow meter apparatus
ISO 12944-2	Paints and varnishes-Corrosion protection of steel structures by paint systems - Part 2: Classifications of environments

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
IMO Res. MSC61 (67) - Annex 1 Part 2	International maritime Organisation Resolution - Fire test procedures - Smoke and toxicity test
IMO Res. MSC61 (67) - Annex 1 Part 5	International maritime Organisation Resolution - Fire test procedures - Test for surface flammability

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP ECI 002	Drawings and Symbols - Principles of presentation at Project identification phase
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP PVV 212	Design and fabrication of pressure vessels according to BSI PD 5500

3. Insulation systems

3.1 Design of systems

The thermal insulation systems are defined in the standards referred to in section 2.

For specific cases not covered by these standards, the CONTRACTOR shall submit any variant to the COMPANY for approval before application.

3.2 Use of the systems

The following parameters and criteria provide a quick guide for selecting the most appropriate system or systems for each situation.

3.2.1 Type of equipment

- Pressure vessels and heat exchangers
- Storage tanks
- Piping systems.

3.2.2 Definition of atmosphere or environment

The external corrosion threat has to be assessed in terms of local conditions since not all atmospheric conditions lead to a CUI threat. Consequently the insulation systems can be

divided into industrial, marine and offshore with increasing level of environmental severity and CUI threat as follows (ISO 12944-2 definitions are referred):

Rural atmosphere: the atmosphere prevailing in rural areas and small towns, without significant contamination by corrosive agents such as sulphur dioxide and/or chlorides.

Urban atmosphere: the contaminated atmosphere prevailing in densely populated areas without significant industry. It has moderate concentrations of pollutants such as sulphur dioxide and/or chlorides.

Industrial atmosphere: the atmosphere contaminated by corrosive pollutants from local and regional industry (mainly sulphur dioxide)

Marine atmosphere: atmosphere which prevails at sea, along coastlines and immediately in land, and characterised by the presence in the air of sea water spray, more or less saline mist and by the absence of dust.

Notes:

The **rural** and urban atmospheres are treated as **industrial** atmosphere for specification of insulation systems.

The **tropical** atmosphere is treated as **industrial** or **marine** atmosphere, depending on the geographic location of the structure.

Offshore environment shall be considered as specific atmospheres. Offshore atmospheres are assumed to represent exposure conditions that are always severe and represent a major external corrosion threat.

3.3 Parameter coding system and identification of systems

3.3.1 Parameter coding system

Environment	
IN	Rural, urban and industrial
MA	Marine
OS	Offshore

Temperature range:

SNNN/SNNN: two-part code comprising a sign (S) and three digits (NNN) indicating the minimum and maximum operating temperatures.

Note:

The **maximum operating** temperature shall be used to select the thermal insulation system and to determine the thermal insulation thickness.

This temperature will be that referenced in the line list associated with process design.

For a given unit, it may be necessary to define two or more thermal insulation systems.

3.3.2 Identification of systems

Insulation systems are described in Appendix 1 and the detailed material specifications for these systems are indicated in Appendix 2.

Appendix 3 indicates typical assembly details for insulation systems but manufacturers/applicators require to be consulted for specific job requirements also.

Alternative protective jacketing may be used, depending on the area in which the equipment is installed.

In the vicinity of stainless steel equipment, galvanised steel jacketing should not be used due to the risk of liquid metal embrittlement of stainless steel equipment by molten zinc in the event of fire.

For installations in which a significant Corrosion Under Insulation (CUI) threat is identified in a temperature range ambient to +120°C, then closed cell insulation systems such as cellular glass and FEF shall be specified, in conjunction with polymeric jacketing.

4. Performance level

The specific insulation codes as provided below refer to **GS EP ECI 002** which is the controlling document for specification of insulation codes.

Class H: Heat retention

Maximum unit heat loss according to values given in the job specification (W/m² on equipment and W/ml on piping).

Classes P: Personnel protection

Maximum surface temperature: 70°C.

Note: metal mesh protection is the preferred solution.

Class I and K: protection from condensation, freezing and ice formation within piping/vessels

No disruption of service when temperatures fall below 0°C.

Class E, R and S: Insulation with reheating (Electrical heat tracing, liquid tracing and Steam tracing)

Maximum unit heat loss according to values given in the job specification.

Class B: Protection against solar radiation

The temperature of equipment or piping protected by covers or screens shall not exceed the critical temperature of the fluids contained (taking into account maximum local solar radiation).

The thermal efficiency and integrity of the thermal insulation shall be guaranteed for a minimum of five years from the date of acceptance.

4.1 Fire Protection

Unless otherwise specified the combustible insulation materials such as FEF shall meet the requirements of **ASTM E 84** for flame spread index and smoke development index.

Other requirements for fire performance in terms of heat generation, flame spread and smoke development may apply depending on the facilities being assessed and local fire regulations require to be specified e.g. **BS 476 part 6, 7** may be specified for Northern Continental shelf or **IMO 476** regulations for shipping or FPSO units.

5. General conditions for execution of works

5.1 Proficiency of installation Contractors

Operators shall be individually qualified to tradesman level as “insulation applicator”. This proficiency shall be documented by a trade organisation if applicable. No untrained or unsupervised personnel shall be used for insulation installation. A register of qualified operators (with photographic record) shall be documented. In the case of FEF insulation, the choice of system applicators shall be endorsed by the system manufacturers.

5.2 Conditions on materials

5.2.1 Supply and storage

All materials shall be supplied according to the material specifications in Appendix 2 with their certificate of conformity.

5.2.1.1 Insulating materials

The materials required for insulation shall be procured before commencement of operations, and shall remain in the original packaging, indicating the composition, type, density and thicknesses. They shall be stored sheltered from water and in accordance with the instructions in the SUPPLIER'S data sheets.

5.2.1.2 Fixing materials (glues, mastics)

These shall be procured before commencement of operations, unless the shelf life of the products is shorter than the duration of the works, and shall be stored in their original packaging according to instructions in the SUPPLIER'S data sheets. In some cases, it may be necessary to store them in air-conditioned premises to prevent them becoming denatured.

5.2.1.3 Protective jacketing

Jacketing materials shall be procured in packaging, with the protection needed to prevent any surface deterioration. Shop-prefabricated elements shall be carefully identified and stored to prevent any distortion or corrosion.

5.2.2 Adhesives, Mastic Sealants and impregnated Polyester Tapes

Adhesives used for bonding insulation sections together or to adjacent metal surfaces shall be selected and applied in strict accordance with insulation SUPPLIERS' recommendations.

Joint sealants for metal cladding shall be based on cross-linked silicone mastics. Grades to be selected in strict accordance with maximum operating temperature of the systems.

Joint sealant for elastomeric jacketing shall be specified with adhesion characteristics and which are compatible with the jacketing material and as recommended by the supplier.

Polyester tapes and mastics for weather protection of foam glass insulation shall be as per Suppliers recommendations.

Webbing tapes used to prevent metal-to-metal contact shall be reinforced fibres treated with waterproof sealants and as per SUPPLIERS' recommendations.

5.2.3 Sampling of insulation materials, fixing materials and protective jacketing

The CONTRACTOR shall take a sample from each batch of materials used for conformance checking.

The dimensions and the necessary quantities shall be determined according to the requirements of the specifications pertaining to inspection of materials.

5.3 Preliminary conditions

The CONTRACTOR shall not commence installation operations until a report on the premises has been prepared, indicating that:

The thermal insulation supports and circular collars have been installed according to the insulation fabrication design documentation as per specification **GS EP PVV 211** and/or **GS EP PVV 212** (depending which is applicable).

The surfaces have been appropriately protected in accordance with **GS EP COR 350** for carbon steels and austenitic stainless steels having a service temperature of less than 120°C.

All tracer fastenings have been suitably installed, and the systems have been tried out (or tested in the case of electrical trace heating).

An Inspection and Test Plan for the execution of the work has been approved by Company or his representative.

5.4 Execution conditions

5.4.1 General

The **Contractor** shall obtain technical assistance from the SUPPLIERS.

The insulation shall be placed on dry, clean and degreased surfaces.

Insulation shall only be fitted if the substrate temperature is at least 3°C above the dew point.

No work shall be carried out during period of rain or in a damp environment, except under shelter and in a controlled atmosphere.

5.4.2 Insulating material installation conditions

Insulation thicknesses: these shall comply with the information contained in the job specification.

The materials shall be applied according to the erection principles (Appendix 3).

Only sound and dry materials shall be applied.

The minimum and maximum temperatures of the environment or the application surfaces shall be limited according to the SUPPLIER'S data sheets concerning the materials and products used.

Cuts in the insulation material shall be clean, and shall allow perfect juxtaposition of the items.

Insulation shall be mounted in zigzag fashion, and in the case of multi-layer insulation, the upper layer joints shall be offset from those of the lower layers.

Each layer of insulation shall be secured independently.

The tension of the retaining straps shall be such that the insulation is not damaged.

5.4.3 Protective jacketing installation

5.4.3.1 Mechanical protection

Before starting to fit the protective jacketing, the insulation and the insulation limits shall be checked for compliance with the specifications (if applicable, proceed with partial acceptance testing, see section 7).

Application of the protective jacketing shall immediately follow installation of the insulation.

Overlaps in the protective jacketing shall also be offset from those of the insulation.

Protective jacketing shall be implemented and applied in accordance with the assembly principles in Appendix 3.

For vertical joints, the direction of overlap shall take into account the prevailing wind direction.

Protective jacketing sheet shall slightly compress the underlying insulation.

At accessories such as supports, nozzles, inspection hatches and nameplates, the cut-outs shall be made with precision and finishing collars shall be applied to make the cuts rigid and minimise the ingress of water. Mastic sealant shall be used as appropriate.

Bolts used for securing jacketing sheets shall be compatible with the type of sheet.

Expansion joints shall be provided to absorb differential movements due to thermal variations.

5.4.4 Equipment insulation

The insulating materials shall be fitted in accordance with sections 5, and in accordance with Appendix 1 and information from the SUPPLIERS.

5.4.5 Piping insulation

Insulation materials shall again be applied in accordance with sections 5, and according to Appendix 1 and information from the SUPPLIERS.

Metallic cladding for elbows shall be created by the use of cut segments or stamped elbows.

On piping less than 2 in diameter, the elbows may be squared.

Elbows shall be designed and installed to provide protection against surface run-off water.

For reasons of leak detection and prevention of water ingress, flanges, valves and accessories shall not normally be insulated. However, when specified for process reasons, insulation shall be provided by removable boxes or flexible insulating blankets. They shall be designed to be dismantled and reassembled easily without damage. The use of flexible blankets shall be subject to the COMPANY's approval.

5.4.6 Installation of mineral wool and FEF with Elastomeric cladding

Insulation shall be installed in strict accordance with the SUPPLIERS' instructions. Typical assembly details for Elastomeric jacketed mineral wool and FEF are shown in Appendix 3. However, this list is not exhaustive and insulation installation details for piping, pressure vessels and tanks shall be developed in the insulation handbook between CONTRACTOR and SUPPLIER.

For systems operating between ambient and 120°C and when CUI is of principal concern, closed cell FEF (or alternatively cellular glass) shall be used as this affords greater protection against the threat of CUI compared with open cells systems.

For closed cell Flexible Elastomeric foam (FEF), the design and installation shall take account of thermal expansion of the insulation material with temperature. The jacketing material shall be capable of accommodating the expansion without causing splitting of the outer membrane and/or insulation.

Mineral wool or FEF insulation shall be installed with seams or joints sealed with contact adhesive. Seams shall be staggered when applying multiple layers of insulation.

The polymeric outer jacket shall be applied as per the SUPPLIER'S instructions and all circumferential and longitudinal joints shall have a minimum overlap of 50 mm. Overlaps shall be designed to provide natural "water shedding". All jacket sealants shall be constituted with adhesive and joint sealant properties. Jacket sealant shall be applied with a minimum throat thickness of 3 mm and with a minimum bead width of 10 mm.

For small bore pipe penetration, i.e. 2" NB and below, located upwards between 10 o'clock and 2 o'clock position and at any protrusion where a correct application of watertight sealant bead at the termination is not practical or at COMPANY request, the jacketing termination shall be constructed with a double sealing arrangement. Typical arrangement with "Chinese hat" is shown on Appendix 3. Alternate arrangement with fully glued polymer double barrier may be proposed, subject to review and approval by COMPANY before implementation.

5.5 Repair of execution defects

By agreement with the COMPANY, after determining the extent of the defects, the following methods of repair shall be applied.

5.5.1 Minor cladding defects

Minor defects shall be repaired locally, overlapping the adjacent parts.

5.5.2 Insulation system execution defects

The elements shall be removed and replaced.

6. Technical content of tenders

Tenders shall include the following details for thermal insulation systems:

- Methods and means used to install the insulation
- Data sheets for the proposed materials, and their sources
- Certificates issued by approved laboratories (concerning trials and tests relating to the proposed materials)
- Detailed length measurements for each item of equipment, and summary by type of equipment and insulation classes
- A quality assurance plan (QAP), including Inspection and Test Plan ITP) and in particular:
 - A nominal functional organisation chart
 - The presence of an specialised inspector
 - The list of installation and inspection phases, and their associated procedures
 - List of installation and inspection equipment
 - Resources provided for protection against adverse climatic conditions.

7. Tests, inspections and acceptance

7.1 Tests

During the work, the CONTRACTOR shall check the following points, in accordance with the systems selected. The results of these checks shall be recorded in the control sheets.

- Conformity of thermal insulation supports
- Condition of surfaces to which the thermal insulation is applied
- Climatic conditions of application
- Surface temperatures
- Quality of materials (compliance with specifications)
- Thickness and number of layers
- Quality of implementation
- Effectiveness of fixings and clamping elements
- Quality of prefabrication of sheet components
- Compression of sheets on equipment and piping
- Fixing of sheets to each other, and to insulation supports, overlaps
- Finishing
- Water tightness of insulation
- Quality and water tightness of the termination seals
- Quality and strength of removable boxes (assembly/dismantling)
- Compliance with specifications
- Compliance with fire testing specifications for combustible materials.

7.2 Inspection

As part of the Quality Plan, an Inspection and Test Plan (ITP) including all points indicated in section 7.1 shall be prepared and submitted to COMPANY who shall indicate the insulation operations to be reviewed or witnessed in the various phases of execution and inspection (see section 7) of the work.

7.3 Acceptance

7.3.1 Quality control

During acceptance testing by nominated party, a check shall be run to ensure that all the inspections listed in section 7 (tests) have been carried out and that the results are satisfactory. Particularly emphasis shall be made with respect to inspection of jacket seals at penetrations and terminations and insulation overlaps to ensure natural water shedding is achieved.

7.3.2 Thermal efficiency

After start-up of the installation, the following checks shall be carried out:

- Surface temperature
- Heat losses infra-red cameras or other appropriate means, according to the requirements of the COMPANY (means, measurement locations, duration, number of measurements, etc.).

The results of the tests shall be confirmed by a report.

A second check shall be carried out before the end of the warranty period.

Acceptance test operations shall be confirmed by a report.

The CONTRACTOR shall guarantee that the insulation has been executed in strict compliance with this specification. Compliance shall be established through insulation thickness tables.

8. Technical documentation

The technical documentation submitted by the CONTRACTOR on completion of the work shall include:

- Certificates of conformity of materials
- Certificates of manufacture of the thermal insulation materials
- Certificates connected with tests and inspections by approved laboratories
- Certificates of fire performance as required by this specification
- Detailed execution standards
- Miscellaneous inspection forms
- Reports of tests and checks on thermal efficiency and effectiveness
- Acceptance test report.

Appendix 1

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List of thermal insulation systems

Equipment \ Parameters of choice	Env	Operating T°C min/max	Type of jacket	System No.	Remarks
1 - Pressure vessels and heat exchangers 1.1 Vertical or horizontal	IN/MA	Amb. - 300	Aluminium	001	(2)
	IN/MA	Amb. - 300	Stainless steel	002	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	IN	Amb. - 300	AluZinc coated steel	004	
	IN	Amb. - 300	Galvanised steel	005	(1)
	OS	Amb. - 300	316L stainless steel	006	Generally applicable to OS
	IN	301 - 500	Galvanised steel	008	(1)
	IN/MA	301 - 500	Stainless steel	009	Grades AISI 430 or AISI 316L Generally applicable to MA
	OS	301 - 500	316L Stainless steel	010	Generally applicable to OS
	IN/MA	501 - 800	Stainless steel	011	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	IN/MA IN OS	Amb. - 300 Amb. - 300 Amb. - 300	Hypalon cladding	047	(4)
	IN/MA IN OS	Amb. - 120 Amb. - 120 Amb. - 120	Hypalon cladding	048	(5)
Note: (1) Prohibited in stainless area (2) Watertight: silicon mastic sealant applied to all areas of overlap and fits (3) If necessary, retaining straps to be applied to equipment jacketing sheets or tall piping open to wind (4) To be used with mineral wool insulation (5) To be used with Flexible Elastomeric Foam (FEF) insulation					

Appendix 1

Parameters of choice Equipment	Env	Operating T°C min/max	Type of jacket	System No.	Remarks
1.2 Spherical	IN/MA	Amb. - 300	Aluminium	012	(2)
	IN/MA	Amb. - 300	Stainless steel	013	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	IN	Amb. - 300	AluZinc coated steel	015	
	IN	Amb. - 300	Galvanised steel	016	(1)
	OS	Amb. - 300	316L stainless steel	017	Generally applicable to OS
	IN	301 - 500	Galvanised steel	016	(1)
	IN/MA	301 - 500	Stainless steel	013	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	OS	301 - 500	316L Stainless steel	017	Generally applicable to OS
	IN/MA	501 - 800	Stainless steel	018	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	IN/MA IN OS	Amb. - 300 Amb. - 300 Amb. - 300	Hypalon cladding	049	(3)
	IN/MA IN OS	Amb - 120 Amb. - 120 Amb. - 120	Hypalon cladding	050	(4)
Note: (1) Prohibited in stainless area (2) Watertight: silicon mastic sealant applied to all areas of overlap and fits (3) System designed with mineral wool (4) System designed with Flexible Elastomeric Foam (FEF) insulation					

Appendix 1

Equipment	Parameters of choice	Env	Operating T°C min/max	Type of jacket	System No.	Remarks
2 - Storage tanks		IN/MA	Amb. - 350	Aluminium	019	(2)
		IN/MA	Amb. - 350	Stainless steel	020	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
		IN	Amb. - 350	AluZinc coated steel	022	
		IN	Amb. - 350	Galvanised steel	023	(1)
		OS	Amb. - 350	316L stainless steel	024	Generally applicable to OS
		IN/MA IN OS	Amb. - 350	Hypalon cladding	051	(4)
		IN/MA IN OS	Amb. - 120	Hypalon cladding	052	(5)
Note: (1) Prohibited in stainless area (2) Watertight: silicon mastic sealant applied to all areas of overlap and fits (3) If necessary, retaining straps to be applied to equipment jacketing sheets or tall piping open to wind (4) System designed with mineral wool (5) System designed with FEF						

Parameters of choice Equipment	Env	Operating T°C min/max	Type of jacket	System no.	Remarks
3 - Piping 3.1 Without trace heating or jacketed (3)	IN/MA	Amb. - 300	Aluminium	025	(2)
	IN/MA	Amb. - 300	Stainless steel	026	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	IN	Amb. - 300	AluZinc coated steel	028	
	IN	Amb. - 300	Galvanised steel	029	(1)
	OS	Amb. - 300	316L stainless steel	030	Generally applicable to OS
	IN	301 - 500	Galvanised steel	033	(1)
	IN/MA	301 - 500	Stainless steel	082	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	OS	301 - 500	316L stainless steel	034	
	IN/MA	501 - 800	Stainless steel	035	Grades AISI 430 or AISI 316L Generally applicable to MA (2)
	IN/MA IN OS	Amb. - 300 Amb. - 300 Amb. - 300	Hypalon cladding	053	(4)
	IN/MA IN OS	Amb. - 120 Amb. - 120 Amb. - 120	Hypalon cladding	054	(6)
Note: (1) Prohibited in stainless area (2) Watertight: silicon mastic sealant applied to all areas of overlap and fits (3) If necessary, retaining straps to be applied to equipment jacketing sheets or tall piping open to wind (4) System designed with mineral wool. (5) The COMPANY shall specify the choice of trace heating. Never use conductive cement with electrical trace heating (6) System designed with Flexible Elastomeric Foam (FEF) insulation					

Equipment	Parameters of choice	Env	Operating T°C min/max	Type of jacket	System no.	Remarks
3.2 Trace heated with chambers or trace heated with conductive cement (3-5)		IN/MA	Amb. - 300	Aluminium	036	(2)
		IN/MA	Amb. - 300	Stainless steel	037	(2)
		IN	Amb. - 300	AluZinc coated steel	039	
		IN	Amb. - 300	Galvanised steel	040	(1)
		OS	Amb. - 300	316L Stainless steel	041	Generally applicable to OS
		IN	301 - 500	Galvanised steel	043	(1)
		IN/MA	301 - 500	Stainless steel	044	(2)
		OS	301 - 500	316L Stainless steel	045	Generally applicable to OS
		IN/MA	301 - 800	Stainless steel	046	Generally applicable to OS (2)
		IN/MA IN OS	Amb. - 300 Amb. - 300 Amb. - 300	Hypalon cladding	055	(4)
		IN/MA IN OS	Amb. - 120 Amb. - 120 Amb. - 120	Hypalon cladding	056	(6)
Note: (1) Prohibited in stainless area (2) Watertight: silicon mastic sealant applied to all areas of overlap and fits (3) If necessary, retaining straps to be applied to equipment jacketing sheets or tall piping open to wind (4) System designed with mineral wool. (5) The COMPANY shall specify the choice of trace heating. Never use conductive cement with electrical trace heating (6) System designed with Flexible Elastomeric Foam (FEF) insulation						

**Description of system No. 001
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Dia min 1 mm	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		16 x 0.5 mm	
	Floating rings		Dia 6 mm	
Jacketing material	Flat aluminium alloy sheets		Aluminium alloy AA3003 or 3005 H24 temper to ASTM B 209 or equivalent Heads, shell and removable parts Ø ≤ 750 mm 0.8 mm thick Ø > 750 mm 1.0 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Aluminium alloy cheese-head self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Aluminium alloy	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind

**Description of system No. 002
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Dia min 1 mm	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		16 x 0.5 mm	
	Floating rings		Dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 430 or AISI 316L or equivalent Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind

**Description of system No. 004
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 70 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Galvanised steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Galvanised or aluminium-coated steel 16 x 0.5 mm min	
	Floating rings		Galvanised steel, dia 6 mm	
Jacketing material	Flat AluZinc coated sheets		Alu zinc steel jacketing to ASTM A 792 or equivalent. Coating weight to be 185 g/m ² both sides. Heads, shell and removable parts Ø ≤ 750 mm 0.63 mm thick Ø > 750 mm 0.75 mm thick	
Jacket fixing	Fixing screws		Bichromated, cadmium plated or stainless steel thread-forming screws dia 6.3 x 19 mm min + neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Bichromated, cadmium plated or stainless steel cheese-head self-tapping screws dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Bichromated, cadmium plated or stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind

**Description of system No. 005
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 70 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Galvanised steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Galvanised or aluminium-coated steel 16 x 0.5 mm min	
	Floating rings		Galvanised steel, dia 6 mm	
Jacketing material	Flat galvanised steel sheets		ASTM A 653 with zinc layer 350 g/m ² for both sides Heads, shell and removable parts Ø ≤ 750 mm 0.63 mm thick Ø > 750 mm 0.75 mm thick	
Jacket fixing	Fixing screws		Galvanised steel thread-forming screws dia 6.3 x 19 mm min + galvanised/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Galvanised steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Galvanised steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Galvanised steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind

**Description of system No. 006
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05, 56**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 70 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Stainless steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Stainless steel 16 x 0.5 mm min	
	Floating rings		Stainless steel, dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 316L Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head self-tapping screws, dia 4.8 x 15.9 mm min + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Sheet sealing	Mastic	no. 580	Elastomer coat type Hypalon ^R or equivalent	6 kg/m ² 3 layers min
	sealant	no. 610	Polyester fabric	2 layers min

Note: (3) If necessary, on equipment exposed to wind

**Description of system No. 008
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 100 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Galvanised steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Galvanised or aluminium-coated steel 16 x 0.5 mm min	
	Floating rings		Galvanised steel, dia 6 mm	
Jacketing material	Flat galvanised steel sheets		ASTM A 653 with zinc layer 350 g/m ² for both sides Heads, shell and removable parts Ø ≤ 750 mm 0.63 mm thick Ø > 750 mm 0.75 mm thick	
Jacket fixing	Fixing screws		Galvanised steel thread-forming screws dia 6.3 x 19 mm min + galvanised/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Galvanised steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Galvanised steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Galvanised steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 009
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 100 kg/m ³	On stainless steel equipment, mat sewn onto stainless
				steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		16 x 0.5 mm min	
	Floating rings		Dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 430 or AISI 316L or equivalent Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 010
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05, 56**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh)	no. 020 or 021 or 022	Heads, shell and removable parts: min 100 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Stainless steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Stainless steel 16 x 0.5 mm min	
	Floating rings		Stainless steel, dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 316L Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head self-tapping screws, dia 4.8 x 15.9 mm min + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Sheet sealing	Mastic sealant	no. 580	Elastomer coat type Hypalon ^R or equivalent	6 kg/m ² 3 layers min
		no. 610	Polyester fabric	2 layers min

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 011
to be used with standard drawing(s)
Appendix 3 no. 01, 02, 03, 04, 05**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Ceramic mat	no. 020 or 021 or 022All areas - 2nd layer	Heads, shell and removable parts: min 100 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	+ Rock wool mat	no. 040All areas - 1st layer	Heads, shell and removable parts: min 96 kg/m ³	
Insulation fixing	Lacing wire		Dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		16 x 0.5 mm	
	Floating rings		Dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 430 or AISI 316L or equivalent Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 012
to be used with standard drawing(s)
Appendix 3 no. 06, 07**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		16 x 0.5 mm min	
	Floating rings		Dia 6 mm	
Jacketing material	Flat aluminium alloy sheets		Aluminium alloy AA3003 or 3005 H24 temper to ASTM B 209 or equivalent Heads, shell and removable parts Ø ≤ 750 mm 0.8 mm thick Ø > 750 mm 1.0 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Aluminium alloy cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Aluminium alloy	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 013
to be used with standard drawing(s)
Appendix 3 no. 06, 07**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Galvanised steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Galvanised or aluminium-coated steel 16 x 0.5 mm min	
	Floating rings		Galvanised steel, dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 430 or AISI 316L or equivalent Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 015
to be used with standard drawing(s)
Appendix 3 no. 06, 07**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Galvanised steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Galvanised or aluminium-coated steel 16 x 0.5 mm min	
	Floating rings		Galvanised steel, dia 6 mm	
Jacketing material	Flat AluZinc coated steel sheets		Alu zinc steel jacketing to ASTM A 792 or equivalent Coating weight to be 185 g/m ² both sides Heads, shell and removable parts Ø ≤ 750 mm 0.63 mm thick Ø > 750 mm 0.75 mm thick	
Jacket fixing	Fixing screws		Bichromated, cadmium plated or stainless steel thread-forming screws dia 6.3 x 19 mm min + neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Bichromated, cadmium plated or stainless steel cheese-head self-tapping screws dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Galvanised steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Bichromated, cadmium plated or stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 016
to be used with standard drawing(s)
Appendix 3 no. 06, 07**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Galvanised steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Galvanised steel 16 x 0.5 mm min	
	Floating rings		Galvanised steel, dia 6 mm	
Jacketing material	Flat galvanised steel sheets		ASTM A 653 with zinc layer 350 g/m ² for both sides Walls and removable parts Ø ≤ 750 mm 0.63 mm thick Ø > 750 mm 0.75 mm thick	
Jacket fixing	Fixing screws		Galvanised steel thread-forming screws dia 6.3 x 19 mm min + galvanised/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Galvanised steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Galvanised steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Galvanised steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 017
to be used with standard drawing(s)
Appendix 3 no. 06, 07, 56**

Component	Description	Reference	Requirements	Remarks
	Metal band			To be supplied by pressure vessel manufacturer
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Stainless steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Stainless steel 16 x 0.5 mm min	
	Floating rings		Stainless steel, dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 316L Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings	no. 576	Stainless steel	
Sheet sealing	Mastic sealant	no. 580	Elastomer coat type Hypalon ^R or equivalent	6 kg/m ² 3 layers min
		no. 610	Polyester fabric	2 layers min

Note: (3) If necessary, on equipment exposed to wind.

**Description of system no. 018
to be used with standard drawing(s)
Appendix 3 no. 06, 07**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool 1st layer + Rock wool mat 2nd layer	no. 020 or 021 or 022	Heads, shell and removable parts: min 100 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
		no. 020 or 021 or 022	Heads, shell and removable parts: min 100 kg/m ³	
Insulation fixing	Lacing wire		Dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		16 x 0.5 mm	
	Floating rings		Dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 430 or AISI 316L or equivalent Heads, shell and removable parts Ø ≤ 750 mm 0.5 mm thick Ø > 750 mm 0.6 mm thick	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 19 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system no. 019
to be used with standard drawing(s)
Appendix 3 no. 08, 09**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		16 x 0.5 mm min	
	Floating rings		Dia 6 mm	
Jacketing material	Flat or sectional aluminium alloy sheets		Aluminium alloy AA3003 or 3005 H24 temper to ASTM B 209 or equivalent Thickness for Plane Steel section Roof 0.7 to 1.0 mm shell 0.7 to 0.8 mm removable parts 0.8 mm	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Aluminium alloy cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 19 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Aluminium alloy	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: (3) If necessary, on equipment exposed to wind.

**Description of system No. 020
to be used with standard drawing(s)
Appendix 3 no. 08, 09**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 50 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Stainless steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Stainless steel, 16 x 0.5 mm min	
	Floating rings		Stainless steel, dia 6 mm	
Jacketing material	Flat stainless steel sheets		Type AISI 430 or AISI 316L or equivalent Thickness Plane Steel section Roof 0.6 to 0.8 mm shell 0.6 mm removable parts 0.6 mm	
Jacket fixing	Fixing screws		Stainless steel thread-forming screws dia 6.3 x 19 mm min + stainless steel/neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Stainless steel cheese-head-self-tapping screws, dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Stainless steel, 19 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: If there are likely to be people moving around on the roof of the tank, additional sealing should be applied using an insulating mortar with a density greater than 70 kg/m³.

(3) If necessary, on equipment exposed to wind.

**Description of system No. 022
to be used with standard drawing(s)
Appendix 3 no. 08, 09**

Component	Description	Reference	Requirements	Remarks
	Metal band			
	Insulating blocks	no. 577		
Insulation	Rock wool (mat with metal mesh or aluminium clad)	no. 020 or 021 or 022	Heads, shell and removable parts: min 70 kg/m ³	On stainless steel equipment, mat sewn onto stainless steel mesh or glued onto high-grade aluminium
	Cellular glass	no. 031	To be coated with Anti-abrasive coating no. 500	
Insulation fixing	Lacing wire		Galvanised steel, dia 1 mm min	Of same type as mesh used above For attaching straps on heads or around nozzles
	Straps		Galvanised or aluminium-coated steel 16 x 0.5 mm min	
	Floating rings		Galvanised steel, dia 6 mm	
Jacketing material	Flat or sectional AluZinc coated steel sheets		Alu zinc steel jacketing to ASTM A 792 or equivalent Coating weight to be 185 g/m ² both sides Thickness Plane Steel section Roof 0.75 to 1.0 mm shell 0.75 mm removable parts 0.75 mm	
Jacket fixing	Fixing screws		Bichromated, cadmium plated or stainless steel thread-forming screws dia 6.3 x 19 mm min + neoprene washers	Fixing sheets on insulation supports
	Self-tapping screws		Bichromated, cadmium plated or stainless steel cheese-head-self-tapping screws dia 4.8 x 15.9 mm + neoprene washers	Fixing sheets to sheets
	Straps		Galvanised steel, 16 x 0.5 mm min	Retaining sheets (3)
	Quick-rel fastenings		Bichromated, cadmium plated or stainless steel	
Water-proofing sealants	Preformed cords	no. 534	Diameter according to bead	Applied continuously
	Neutral silicon mastic in cartridges	no. 534		For sealing the finishing work

Note: If there are likely to be people moving around on the roof of the tank, additional sealing should be applied using an insulating mortar with a density greater than 70 kg/m³.

(3) If necessary, on equipment exposed to wind.