 LINDE AG Process Engineering and Contracting Division	Specification for the Insulation of Oxygen-Bearing Plant Components General Requirements		LINDE STANDARD 151-07 Part 1
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1 Scope

1.1 This standard shall apply to the insulation of oxygen-bearing plant components with an oxygen content of $\geq 70\%$ and an operating temperature of $\geq -10\text{ °C}$ to 100 °C .

2 Purpose

2.1 This part of the standard describes the generally applicable design and material criteria for the application of a functionally effective insulation.

As a supplement to this part, Parts 2 to 5 describe the special design criteria for the application of an insulation with mineral fibre insulating materials.

As a supplement to this part, Parts 6 and 7 describe the special design criteria for the production of the condensation prevention insulation systems with foamglass insulating material as an alternative to mineral fibre insulating materials.

2.2 Furthermore, this standard serves as basis:

- for quotations from Linde Process Engineering and Contracting Division to the customer
- for enquiries from Linde Process Engineering and Contracting Division to manufacturers
- for quality control.

3 Definitions

3.1 *Insulation systems* are the individual, function-specific design of the insulation work. These are referred to in the technical documents as insulation types.

3.2 *Insulation type* is the abbreviated designation for a service condition depending on the design of insulation defined in the insulation specifications.

3.3 *Insulation thickness* is the thickness of the installed insulating material.

3.4 *Construction insulation thickness* is the thickness of the complete insulation construction, such as e.g.: Insulation thickness plus ventilation gaps and jacketing.

3.5 *Jacketing* is the protection against mechanical damage and the effects of weathering, generally the sheet metal jacket surrounding the insulation. It also plays a role in achieving the necessary sound insulating effect of the various sound insulation types.

3.6 *Supporting structures* are structures which hold the jacketing away from the plant component at a distance of the insulation thickness.

3.7 *Bearing structures* transmit the weight of the insulation and the forces acting on the insulation to the object to be insulated.

4 Reference Codes and Standards

4.1 DIN Standards

- 4.1.1 DIN 4102, Part 1 Fire Behaviour of Building Materials and Building Components; Building Materials, Concepts, Requirements and Tests.
- 4.1.2 DIN 52275 Testing of Mineral Fibrous Insulating Materials; Determination of Linear Dimensions and Bulk Density. Part 1 Plain Products, Part 2 Casings.
- 4.1.3 DIN 52612, Part 1 Testing of Thermal Insulating Materials; Determination of Thermal Conductivity with the Guarded Hot Plate Apparatus; Test Procedure and Evaluation.
- 4.1.4 DIN 52613 Testing of Thermal Insulating Materials; Determination of Thermal Conductivity by the Tube Method.
- 4.1.5 DIN 52615, Part 1 Testing of Thermal Insulations; Determination of Water Vapour Permeability of Building and Insulating Materials; Test Procedure and Evaluation of Results.

4.2 VDI Guidelines

- 4.2.1 VDI 2055 Thermal Insulation for Heated and Refrigerated Industrial and Domestic Installations; Calculations, Guarantees, Measuring and Testing Methods, Quality Assurance, Supply Conditions

4.3 AGI Guidelines

- 4.3.1 Q 02 Insulation of Industrial Installations, Concepts
- 4.3.2 Q 118 Insulation of Air Atomisation Plants.
- 4.3.3 Q 132 Mineral Wool as Insulating Materials for Industrial Installations.
- 4.3.4 Q 135 Insulation Work; Determination of Water-Soluble Chlorides in Mineral Fibre Insulating Materials
- 4.3.5 Q 136 Insulation Work on Industrial Installations; Determination of Hydrophobic Properties of Mineral Fibre Insulating Materials.

4.4 Accident Prevention Regulations

- 4.4.1 VBG 62 Accident Prevention Regulations Oxygen

4.5 Linde Standards

- 4.5.1 LS 151-10 Insulation Thickness for Hot and Cold Insulation
- 4.5.2 LS 151-11 Weight of Hot and Cold Insulation

5 Identification of the Insulation Types

5.1 In the technical documents, the insulation systems are identified with insulation type and insulation thickness in mm.

For the condensation prevention insulation systems, an air gap of 20 mm shall be added to the insulation thickness, in order to obtain the construction insulation thickness.

Condensation prevention insulation systems will be used in Central Europe for temperatures ≤ 15 °C. The temperature limit shall be determined on the basis of the project concerned.

The definitions of the insulation types and the correlation between the insulation and the relevant part of this standard are given in Table 1.

Table 1: Insulation Types

Insulation type	Description of the insulation	Insulating material	see Part
OW	Thermal insulation (hot service)	Mineral fibres	2
OWS	Thermal insulation (hot service) with simultaneous function as sound insulation	Mineral fibres	2
OPP	Personnel protection insulation	Mineral fibres	2
OS	Sound insulation	Mineral fibres	3
OC	Condensation prevention insulation	Mineral fibres	4
		Foamglass	6
OK	Condensation prevention insulation with simultaneous function as thermal insulation (hot service)	Mineral fibres	4
		Foamglass	6
OCS	Condensation prevention insulation with simultaneous function as sound insulation	Mineral fibres	5
OKS	Condensation prevention insulation with simultaneous function as sound and thermal insulation (hot service)	Mineral fibres	5
OS..C..	Combined condensation prevention / sound insulation (sound insulation under condensation prevention insulation)	Foamglass and ceramic fibres	7
OS..K..	Combined condensation prevention / sound insulation with simultaneous function as thermal insulation (hot service) (sound insulation under condensation prevention insulation)	Foamglass and ceramic fibres	7
ON	Not insulated		

6 Materials

6.1 Delivery, Storage and Documentation

6.1.1 Material Delivery

The material for the specific project will be delivered by the Linde Process Engineering and Contracting Division or by the contractor for the insulation work.

6.1.2 Storage of the Materials

After delivery to the site and until they are installed, the insulating materials shall be stored oil and grease-free, dry and free from dust. In addition, the storage instructions of the insulating material manufacturer shall be observed. Appropriate measures shall be taken to reliably prevent any contamination of the insulating materials with oil or grease during prefabrication and installation.

The sheet metal shall be protected during transport and during any intermediate storage before use in such a way that formation of white rust is prevented. The insulating materials may only be brought to the place of installation immediately before installation. In the case of foamglass mouldings, ensure that these are transported and stored upright.

6.1.3 Material Documentation

Prior to start of the work, the inspection documents and/or the materials data sheets of all materials to be used shall be presented to the Buyer for approval in the form of a material documentation file.

6.2 Supporting and Bearing Structures

6.2.1 Where the insulating layer comprises mineral fibre mats, the supporting and bearing structure shall be made from foamglass mouldings, see section 6.3.3.

6.2.2 For the condensation prevention insulation systems, a ventilated jacketing is required. The supporting structure for the jacketing shall be made e.g. of galvanised sheet metal strips measuring 50 x 0.63 mm in the form of a corrugated profile strip. Alternative design shall be permitted, but must be approved by Linde Process Engineering and Contracting Division in advance.

6.3 Insulating Layer

6.3.1 General

In accordance with the UVV Sauerstoff (VBG 62) (Accident Prevention Regulations Oxygen), the organic constituents in the insulating materials to be used must not exceed max. 0.5% by weight; in addition, the insulating materials shall be free from oil and grease.

6.3.2 Mineral Fibre Mats (Standard Version)

Industrially manufactured quilted mineral fibre mats on galvanised wire mesh shall be used as insulating material, e.g.:

Manufacturer: Grünzweig + Hartmann

Type: Isover[®] MD 2, or MD2/K140
or equivalent product.

The material shall meet the following minimum requirements:

Bulk density:	min. 80 kg/m ³
Fire behaviour:	Building material class A1 to DIN 4102
Chemical behaviour:	Low in chlorides, AS quality as per AGI Q 135
Application temperature limits:	– 260 °C to 680 °C in accordance with AGI Q 132
Percentage by weight of organic substances:	max. 0.5%
Thermal conductivity:	

t _m °C	50	100	150	200	250	300
λ W/(m×K)	0.038	0.045	0.053	0.063	0.074	0.088

6.3.3 Foamglass Mouldings (Alternative Version)

Industrially manufactured foamglass mouldings shall be used as insulating material, e.g.:

Manufacturer: Pittsburgh Corning

Type: Foamglas[®] T 2,
or equivalent product.

The material shall meet the following minimum requirements:

Bulk density:	min. 125 kg/m ³
Fire behaviour:	Building material class A1 to DIN 4102
Application temperature limits:	– 260° C to + 430° C
Percentage by weight of organic substances:	max. 0.5 %
Thermal conductivity:	

t _m °C	- 20	0	10	20
λ W/(m×K)	0.041	0.044	0.046	0.048

6.3.4 Ceramic Fibre Mats (Alternative Version)

Industrially manufactured ceramic fibre mats shall be used as insulating material for production of the sound insulation, e.g.:

Manufacturer: SEPR*)

Type: Kerlane 45,
or equivalent product.

*) Société européenne des produits réfractaires

The material shall meet the following minimum requirements:

Bulk density:	min. 96 kg/m ³
Fire behaviour:	Building material class A1 to DIN 4102
Application temperature limits:	– 260 °C to 1150 °C
Percentage by weight of organic substances:	max. 0.5%
Thermal conductivity at tm 200 °C:	0.043 W/m*K

6.4 Jacketing

The following materials shall be used for the jacketing, as required:

6.4.1 Hot-dip galvanised steel sheet, as per DIN EN 10142, TE P 02 G Z 275, zinc coating 275g/m² (on both sides), unless otherwise requested by the customer, or

6.4.2 Steel sheet coated with aluminium/zinc alloy in accordance with DIN EN 10215 in the grade P02 AZ 185-N-U, aluminium/zinc coating 185g/m² (on both sides) or, if required by the customer,

6.4.3 Aluminium sheet, in accordance with DIN 1725, Page 1, Material No. 3.3527, resistant to sea water.

Note: For sound insulation systems, the jacketing shall be made from hot-dip galvanised steel sheet, as per section 6.4.1 or 6.4.2. In exceptional cases, approval for the use of aluminium sheet shall be obtained in writing from Linde Process Engineering and Contracting Division.

When using aluminium sheet care shall be taken that for the insulation types using mineral fibre mats on galvanized wire mesh (type OW, OWS, OPP and OS) a wrapping with glassfibre fabric shall be applied without air gap, in order to avoid contact corrosion.

6.5 Accessory Materials

6.5.1 Abrasion Protection Coating

The inside of the first layer of the foamglass mouldings coming into contact with the plant component shall receive an inorganic abrasion protection coating. The abrasion protection to be used shall comply with the UVV Sauerstoff (VBG 62) (Accident Prevention Regulations Oxygen), e.g.:

Manufacturer: Pittsburgh Corning

Type: PC[®] High Temperature Anti-Abrasive,
or equivalent product.

6.5.2 Foamglass Adhesive

The industrially prefabricated mouldings which, in some cases, are made of several pieces shall be installed using an inorganic cement. The same applies to the bonding of mouldings on site. The cement to be used shall comply with the UVV Sauerstoff (VBG62), (Accident Prevention Regulations Oxygen) e.g.:

Manufacturer: Pittsburgh Corning

Type: PC[®] High Temperature Adhesive,
or equivalent product.

6.5.3 Slotted Pan Head Tapping Screws

Slotted Pan Head Tapping Screws according to DIN ISO 1481 Form C of A2 with plastic washers shall be used.

Dimensions on :	Piping:	4.2 × 13 mm
	Equipment:	4.8 × 13 mm

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6.5.4 Rivets

Blind rivets for galvanised steel sheet
and/or for steel sheet with coating of
aluminium-zinc alloy:

DIN 7337-A3 × 6 – A2 – St 35 – A1P

Blind rivets for aluminium sheet:

DIN 7337-A3 × 6 – A2 – St 36 – A1P

6.5.5 Vapour Barrier

The vapour barrier on condensation prevention insulation systems shall be made from a 60µm thick aluminium foil.

6.5.6 Self-Adhesive Aluminium Tapes

The overlapping of the aluminium foil shall be sealed vapour-tight with self-adhesive aluminium foil, width 50 mm, e.g.:

Manufacturer: Beiersdorf AG
Type: Tesametal 4504,
or equivalent product.

6.5.7 Sealing Tapes

The longitudinal and circumferential joints of the jacketing shall be sealed with 20 mm wide sealing tapes, e.g.:

Manufacturer: Teroson
Type: Terostat II,
or equivalent product.

6.5.8 Gun-Grade Elastic Sealing Compound

Non-insulated passages through the jacketing shall be sealed with gun-grade elastic sealing compound, e.g.:

Manufacturer: Teroson
Type: Terostat 4004,
or equivalent product.

6.5.9 Mat Hooks, Binding Wire

Galvanised mat hooks, size min. 2 x 125 mm, or galvanised binding wire, dia. 1mm, shall be used to secure the mineral fibre mats.

6.5.10 Retaining Strips for Foamglass Mouldings

Soft-annealed stainless steel strips, 12.7x 0.5 mm, of 1.4301 material (AISI Type 304), or fibre-reinforced self-adhesive tapes, width 20 mm, shall be used to secure the foamglass mouldings.

7 Performance of the Insulation Work

7.1 General

7.1.1 The insulation of plant components not described in this standard is performed up to a diameter of 600 mm (incl. insulation thickness) as for piping, above this diameter as for equipment.

7.1.2. After successful completion of the pressure test and the subsequent coating work, the object shall be released for insulation. The insulation of the flange connections is to be carried out later.

7.1.3. All plant components to be insulated shall be free from moisture, ice, oil, grease and other contamination.

7.2. Supporting and Bearing Structure

7.2.1 Supporting and Bearing Structures for Insulating Layer of Mineral Fibres

Supporting structures shall be provided on the plant components at intervals of 950 mm, on elbows, spacers and other parts at the beginning and end. If the outside radius of elbows before insulation exceeds 700 mm, additional supporting structures are required.

The foamglass supporting rings shall be attached to the plant component using galvanised binding wire or fibre-reinforced self-adhesive tapes.

Foamglass bearing rings shall be attached to the plant component using foamglass cement and additionally with a stainless retaining strip. Gaps resulting from the installation work shall be stuffed using loose mineral fibre wool. The coating thickness of the supporting and bearing structures depends on the insulation thickness of the plant component in question. The width of the supporting or bearing rings for piping is 50 mm, for equipment 100 mm.

7.2.2 Supporting Structures for Jacketing

The corrugated profile strips are located in the same areas and at the same intervals as described in section 7.2.1. The corrugated profile strip shall be installed continuously and with an overlapping of at least 30 mm on the vapour barrier. The strip shall be secured with 2 blind rivets as per section 6.5.4.

As protection against damage, an aluminium sheet strip, 100 x 0.6 mm, shall be arranged underneath the corrugated profile strip. The sheet metal strip shall be overlapped by 30mm and secured all round with a glassfibre-reinforced self-adhesive tape.

7.3 Insulating Layer

7.3.1 General

The insulation thicknesses shall be defined according to the operating temperatures, the appropriate insulation thickness tables in the Linde Standard 151-10, or on the basis of the project concerned.

7.3.2 Design of the Insulating Layer with Mineral Fibre Mats (Standard Version)

The mineral fibre mats shall be installed and secured without gaps between the foamglass supporting rings.

Gaps resulting from the installation work shall be carefully stuffed using loose mineral fibre wool. The mineral fibre mats shall be so cut that the required insulation thickness exists at all points even after the installation.

The longitudinal and circumferential joints shall be secured with galvanised wire hooks. The distance between the hooks is max. 150 mm. If additional securing is necessary, galvanised binding wire of 1.0 mm diameter shall be used.

The structure of the insulating layers is as follows:

up to 100 mm insulation thickness:	1-layer insulation
up to 180 mm insulation thickness:	2-layer insulation
up to 270 mm insulation thickness:	3-layer insulation

Mineral fibre mats of the same grade as for piping shall be used for the insulation of flanged plant components. The mineral fibre mats shall be installed in the bonnet parts in such a way that the wire mesh faces towards the object to be insulated.

The mineral fibre mats shall be secured in the cap or bonnet using insulation pins, max. distance between the pins approx. 200 mm (but not less than 4 pins). The insulation pins shall be attached to the sheet metal shell using blind rivets. The extent of insulation on flanged plant components shall be defined specifically for each project.

The design of the insulating layer on piping and flanged plant components is illustrated in Parts 2 to 5.

The design of the insulating layer on equipment and magnetic level indicators is shown in Figures 1 to 5.

7.3.3 Design of the Insulating Layer with Foamglass (Alternative Version)

Industrially manufactured foamglass mouldings shall be used as insulating material. The foamglass mouldings are installed dry. In the area of flanged connections, the insulation shall be installed up to bolt length+ 20 mm. The foamglass mouldings shall be secured with 2 stainless retaining strips per standard length. Inorganic foamglass cement can be used as an installation aid.

In the case of multi-layer insulations, the first insulating layer shall be secured with fibre-reinforced self-adhesive tapes. The distance between the retaining strips at elbows and other mouldings must not exceed 250mm.

The insulation thicknesses of the individual insulating layers and the layer steps are as follows:

Table 2: Number of Insulating Layers

Piping	1-layer up to	2-layer up to 1)	3-layer up to 1)
up to DN 40	40 mm	90 mm	split into preformed sections
up to DN 400	60 mm	150 mm	of equal insulation
over DN 400	70 mm	180 mm	thickness
1) If the total insulation thickness cannot be split equally, the outer preformed section layer shall have the greatest thickness.			

Due to the thermal contraction, contraction joints shall be provided at intervals of max. 10 metres.

The contraction joints shall have a width of 20 mm, and be stuffed with ceramic fibre wool.

In the case of multi-layer insulations, the contraction joints shall be offset by 200 mm per layer.

The vapour barrier in the area of the contraction joint shall be made with a 50 mm wide aluminium/bitumen self-adhesive tape. In the case of multi-layer insulations, only the outer contraction joint has to be sealed.

Preformed sections or segments shall be used for the insulation of flanged plant components; for valves, plate material is also permissible.

The foamglass mouldings shall also be secured mechanically as described above. Unavoidable voids and gaps shall be stuffed with ceramic fibre wool.

The extent of insulation on flanged plant components shall be specified individually for the particular project.

The design of the insulating layer on piping and flanged plant components is illustrated in Parts 6 and 7.

The design of the insulating layer on equipment and magnetic level indicators is shown in Figures 1 to 5.

7.4 Jacketing

7.4.1 Jacketing of Piping

The jacketing shall be manufactured from the material described in section 6.4.

The sheet metals shall be formed, longitudinal and circumferential joints shall be corrugated. The corrugation on the circumferential joint shall be offset by 50 mm. The longitudinal joints can also be folded. On horizontal piping the circumferential joints, on vertical piping the longitudinal joints shall be sealed using a sealing tape.

The longitudinal joints on vertical piping shall be placed on the side not exposed to the weather. The longitudinal joints of horizontal piping shall be arranged approx. 45° above the pipe axis. The longitudinal joints shall be offset from one another by min. 50 mm.

On pipe elbows and other mouldings, the joints **must not** be offset by 45°.

The overlapping of the longitudinal joint shall be fastened with at least 6 slotted pan head tapping screws per metre. The slotted pan head tapping screws shall be arranged at equal intervals. The overlapping of the longitudinal and circumferential joints and the sheet metal thicknesses are shown in Tables 3 and 4.

Overlapping, corrugations, bending up, etc. shall be so arranged that no moisture can penetrate the insulation.

Non-insulated protrusions shall be cut cleanly out of the jacketing and sealed with a gun-grade elastic sealing compound. On gaps of more than 2 mm, a blind shall be additionally provided for.

The design of the insulation on piping is illustrated in Parts 2 to 7.

Table 3: Galvanised Steel Sheet and/or Steel Sheet with Coating of Aluminium-Zinc Alloy

Circumference of the sheet metal shell in mm	Sheet Metal thickness min. mm	Overlapping of longitudinal joints mm	Overlapping of circumferential joints mm
up to 400	0.5	30	50
up to 800	0.6	40	50
up to 1250	0.7	50	50
over 1250	1.0	50	50

Table 4: Aluminium Sheet ¹⁾

Circumference of the sheet metal shell in mm	Sheet Metal thickness min. mm	Overlapping of longitudinal joints mm	Overlapping of circumferential joints mm
up to 400	0.5	30	50
up to 500	0.6	40	50
up to 1000	0.8	50	50
up to 2000	1,0	50	50
over 2000	1.2	50	50

7.4.2 Jacketing of Insulation End Sections

Insulation end sections up to a piping diameter of 150 mm (including insulation) are made with a corrugated end disc, above 150 mm with an end cap. A glassfibre tape of at least 25× 3 mm shall be arranged between the end disc and the plant component as a thermal insulator. The end disc shall be so cut out that it ends flush with the glassfibre tape. End discs shall be sealed to the glassfibre tape with gun-grade elastic sealing compound, if required.

7.4.3 Jacketing of Pipe Elbows

Pipe elbows are manufactured from segments. The number of segments depends on the length of the insulated pipe elbow measured over the back of the elbow.

The segments are linked with corrugations. The size and depth of the corrugation depends on the diameter of the jacketing. The corrugation size shall be so selected that thermal expansions can be compensated.

The number of segments for the various pipe elbow lengths is shown in Table 5.

Table 5: Number of Segments for Pipe Elbows

Elbow length up to	Number of Segments	End pieces	Centre pieces
500 mm	3	2 end pieces (= 1 part)	+ 2 centre pieces
800 mm	4	2 end pieces (= 1 part)	+ 3 centre pieces
1400 mm	6	2 end pieces (= 1 part)	+ 5 centre pieces
2000 mm	8	2 end pieces (= 1 part)	+ 7 centre pieces
3000 mm	10	2 end pieces (= 1 part)	+ 9 centre pieces
> 3000 mm	2)		
2) For elbows with greater lengths, a segment width of 400 mm should not be exceeded. In special cases, the length of the elbow segment shall be selected on the basis of local and technical criteria. However, the insulation thickness must not be less than 90% of the required insulation thickness at any point of the elbow.			

1) For weight reasons, jacketing for sound insulation shall be made of galvanised steel sheet and/or steel sheet with coating of aluminium-zinc alloy.

7.4.4 Jacketing of Flanged Plant Components

The jacketing of flange caps shall be made from min. 0.75 mm thick sheet metal; in addition, Table 6 shall apply analogously.

The caps shall be installed in the piping rain-tight. The upper face of vertical caps shall have a rolled edge profile and be inclined at an angle of at least 3°. This requirement applies also to the supports of horizontally installed nozzle caps. In order to ensure a rain-tight connection of the upper face of the caps with the piping jacketing, the lower edge of the piping jacket shall be made with a bending up of approx. 20 mm.

The length of the cap shall be limited to the necessary size, whereby the subsequent pipe insulation must be covered by at least once the insulation thickness on both sides.

The jacketing shall be performed in such a way that valve glands can be retightened without having to remove the caps.

In order to prevent vertically arranged caps from slipping, cap supports shall be arranged on the piping jacket at intervals of max. 250 mm.

The cap elements shall be retained by at least two galvanised lever locks per joint. For caps of more than 500 mm length, the distance between the lever locks must not exceed 300 mm. The dimensions of the lever lock are shown in Table 6.

The lever locks shall be attached to the jacketing with stainless blind rivets and secured with galvanised split pins suitable for the lever locks, to prevent unauthorised opening. The dimensions of the blind rivets to be used are shown in Table 6.

If, for space reasons, the cap elements can only be attached with stainless strips, these must be fastened to one cap element with a stainless blind rivet of 3.2 mm diameter.

The design of the insulation on flanged plant components is illustrated in Parts 2 to 7.

Table 6: Sheet Metal Thickness and Dimensions of Fasteners for Caps and Bonnets

Cap and bonnet circumference	Sheet metal thickness min.	Length of the lever locks for caps	Diameter of the blind rivets min.
up to 800 mm	0.6	35 mm	3.2
over 800 up to 1250 mm	0.7	55 mm	3.2
over 1250 mm	1.0	75 mm	4.0

The cap forms are defined as follows:

- *Flange caps* are cylindrical caps of two or more parts with two snap-type end faces.
- *Form caps* are all flange caps with non-circular snap-type end faces.
- *Nozzle caps* are flange caps of two or more parts with a support riveted to the body at right angles or at an acute angle whose diameter is equal to, smaller than or larger than the body diameter.

7.4.5 Jacketing of Equipment

The equipment jacketing shall be performed, wherever possible, as for piping jacketing. In addition, the following shall be observed:

The form of the jacketing in the top and bottom area shall be as per Table 7.

Table 7: Design of Jacketing in the Top and Bottom Area

Equipment diameter	Top Area	Bottom Area within ¹⁾ Supporting Skirts
< 1000 mm	funnel-shaped	flat
≥ 1000 mm up to 2000 mm	spherical-shaped	flat or funnel-shaped
≥ 2000 mm	Zeppelin-shaped	spherical-shaped
1) For bottom area within supporting skirts section 8.1.2.1 and section 8.1.2.2 shall apply analogously.		

Assembly joints and other supplement joints on the vessel head jacketing shall be made with a 30 mm recessed corrugation and secured with screws at intervals of max. 200 mm. The joints shall be sealed with elastic sealing tape. The design of the equipment jacketing is illustrated in Figures 1 to 4.

Insulation end points on equipment shall always be made with a snap-type end disc (end cap). On vertically flanged equipment, the upper end discs shall be attached to the jacketing in funnel form so that they repel moisture. On the lower end cap, the face discs shall be made of perforated sheet metal.

7.4.6 Jacketing of Drains/Vents

Section 7.4.4 applies analogously.

7.4.7 Jacketing of Magnetic Level Indicators

Sections 7.4.1 and 7.4.4 apply analogously. In addition, the following shall be observed:

On magnetic level indicators, the jacketing within 100 mm of the magnetic strip shall be made of a nonmagnetic material.

The jacketing in the area of the shutoff valves shall take the form of caps, wherever possible. If this form is not possible for space reasons, the jacketing shall be prefabricated so that removal of the shutoff valves is possible without extensive removal of the subsequent jacketing. (Appropriate supplement joints shall be provided for).

This requirement applies also to drains and vents, if any.

The design of the jacketing on magnetic level indicators is illustrated in Figure 8.

8 Drawings and Sketches

8.1 Vessels

8.1.1 Insulation of Horizontal Vessels

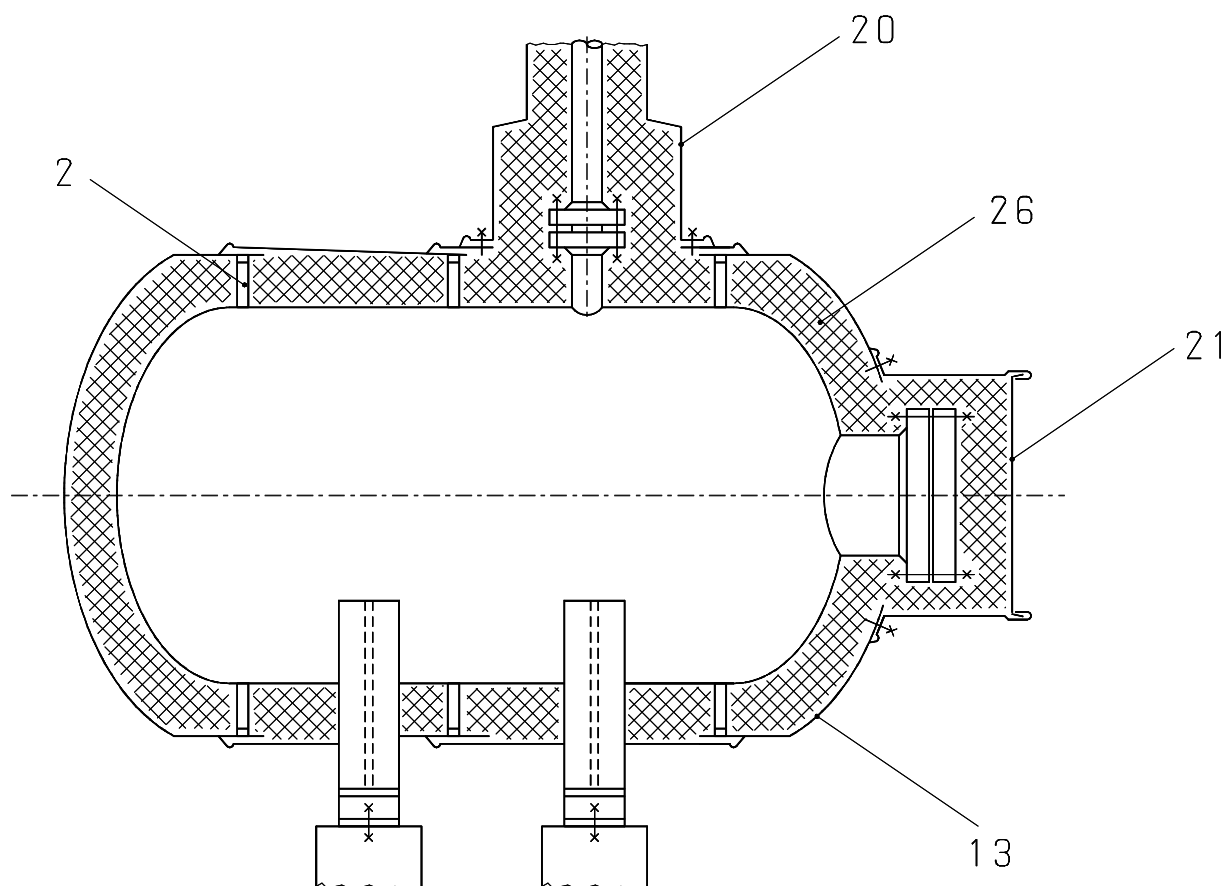


Figure 1

- 2 Supporting structure for jacketing
- 13 Jacketing
- 20 Flange cap
- 21 Manhole cap
- 26 Insulating layer

8.1.2 Insulation of the Vessel Head

8.1.2.1 Funnel Head

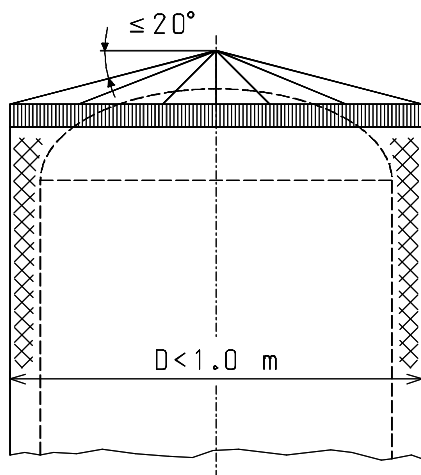


Figure 2

8.1.2.2 Spherical Head

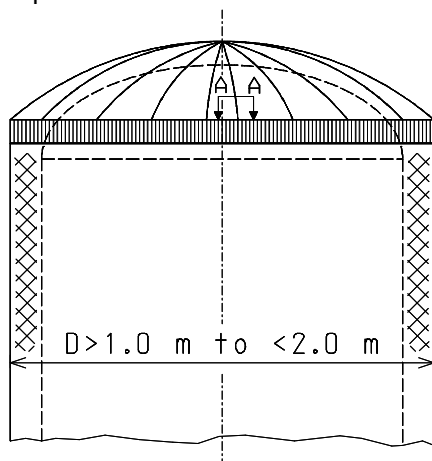


Figure 3

8.1.2.3 Zeppelin head

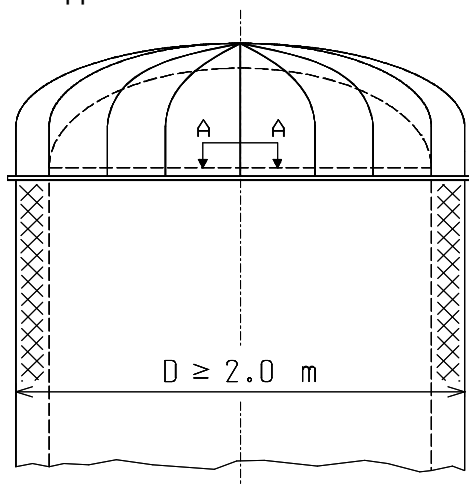
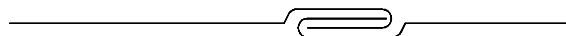


Figure 4



Section A-A

8.1.3 Insulation of the Magnetic Level Indicator

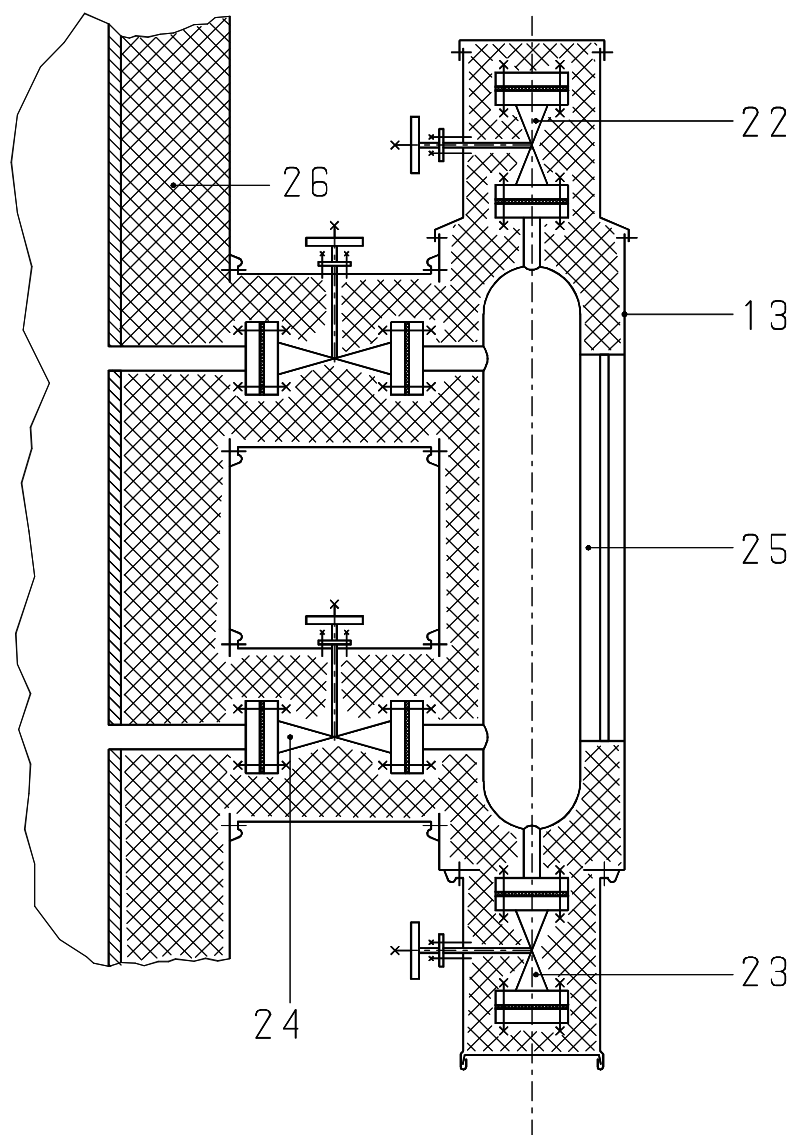


Figure 5

- 13 Jacketing
- 22 Vent valve
- 23 Drain valve
- 24 Shutoff valve
- 25 Magnetic strip
- 26 Insulating layer