

ISV

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2 Standards & Material

2.1 List of rules and standards

The construction and technical layout of insulation generally must be corresponding to the state-of-the-art, e.g. AGI, DIN etc. In addition to this insulation rules must be followed below listed norms and standards

Rules and Standards	– AGI Q03	Insulation works at industrial installations; Execution of thermal and cold insulation
	– AGI Q101-1	Thermal insulation of steam generators
	– AGI Q102	Insulation works at industrial installations; Stacks and ducts
	– AGI Q131-1	Technical data sheet Mineral wool
	– AGI Q132	Thermal insulation Mineral wool
	– AGI Q135	Insulation work; Determination of water soluble chlorides in mineral wool insulants
	– AGI Q152	Insulation work at industrial installations; Protection against penetration of moisture
	– AGI Q 153 / AGI Q 154	Insulation works at industrial installations; Supporting constructions
	– DIN EN 287	Approval testing for welders - Fusion Welding – Item 1: Steels
	– DIN 4102	Behaviour of materials in fire
	– DIN 4140	Thermal insulation for heated and refrigerated industrial and domestic installations
	– DIN EN 485-1	Aluminium and aluminium alloys; Item 1: Technical conditions for inspection and delivery
	– DIN18800-7	Steel structures; construction, certification for welding
	– DVS 0902	Drawn-arc Stud Welding
	– FDBR 19	Drawn-arc Stud Welding Execution and Quality Control
	– VDI 2055	Thermal insulation for heated refrigerated industrial and domestic installations

This list represents no claim of completeness

2.2 List of Material

Position Item Position	Einheit Unit Unité	Gegenstand Description Désignation	Abmessung Dimension Dimension	Material/Norm Material/Standard Matière/Norme	Bemerkungen Remarks Remarques
01	Stck pcs pièce	Isolierstift Insulation pin Clip pour clou d'isolation	Ø 4 x ...	1.0168 (St.37-3K)	
02	m ² m ² m ²	Mineralwolldrahtnetzmatte Mineral wool mat with wire mesh Feutre de la laine minérale avec treillis métallique		80 kg/m ³	z.B. Heralan Typ WM D8
03	Stck pcs pièce	Clips für Isolierstift, verzinkt Insulation clips, galvanised Clip pour clou d'isolation	Ø 38	St 2 K 70	
04	Stck pcs pièce	Mattenhaken, verzinkt Mat hook, galvanised Feutre crochet	Ø 2 x 95	1.0010 (D9-1)	
05	m ² m ² m ²	Aluminiumfolie Aluminium foile Alufolie	80 µm		
06	m m m	U-Profil, verzinkt, l = 6'000 mm U-profile, galvanised U-profilé, galvanisé	30x50x30x2	1.0037 (St 37-2) S235JR	
07	m m m	Flachstahl, verzinkt, l = 6'000 mm Flat steel, galvanised Produits laminés plats, galvanisé	40 x 3	1.0037 (St. 37-2) S235JR	
08	Stck pcs pièce	Trennschicht, asbestfrei Separation layer, free off asbestos Couche séparativé, sans amiante	40 x 40 x 3		
09	Stck pcs pièce	Blindniete für nietbare Materialstärke 8 mm Blind rivet for material thickness 8 mm Rivet borgne pour matière grosseur 8 mm	Ø 4,8 x	Stahl, verz. Steel galv. Acier galv.	z.B. Tucker Typ TSP/D/BS 612
10	Stck pcs pièce	Profilblech Profiled sheet Tôle profilée		3.0526 (AlMn1Mg1)	z.B. 40/167/1,0
11	Stck pcs pièce	Glattblech Plain sheet Plaine tôle	2000 x 1000 x 1.0	3.527 AlMg2Mn0,8	
12	Stck pcs pièce	Fassadenschraube mit Neopren-Dichtscheibe Cladding screw with sealing washer Facade vis avec rondelle étanchement	Ø 6,5 x 19	1.4301 (X4CrNi1810)	
13	Stck pcs pièce	Blechteilschraube mit Neopren-Dichtscheibe Tapping screw with sealing washer Parker avec rondelle étanchement	Ø 4,8 x 16	1.4301 (X5CrNi1810)	
14	m m m	Kunststoffklebeband Plastic adhesive stripe Adhésif plastique feuillard	50		

Position Item Position	Einheit Unit Unité	Gegenstand Description Désignation	Abmessung Dimension Dimension	Material/Norm Material/Standard Matière/Norme	Bemerkungen Remarks Remarques
15	m m m	Dichtband, dauerelastisch Sealing stripe, permanent elastic Feuillard d'étanchéité, permanente élastique	20 x 2		
16	m ² m ² m ²	Glattblech Plain sheet Tôle noire	2000x1000x0,7	1.0226 + Z275-N-A (St. 02Z-275NA)	
17	m m m	Profilfüller zum Schliessen der grossen Sicke Profile filler for closing the big bead Profilée pour fermer de grande mouleure		Mineralwolle Mineral wool Laine minéralé	z.B. Typ ISOchemie
18	m m m	Aluminium-Klebeband Aluminium stripe, self-adhesive Adhesif alu feuillard	100		
21	m ² m ² m ²	Glasfasergewebe mit Drahteinlage Glass cloth with wire inlay Toile de verre	≥ 600 g/m ²		z.B. Typ: Klevers 2002 V4A G1
22	m m m	Garn, Draht Yarn, wire Filasse, fil			z.B. Typ: Klevers
23	m m m	Bindedraht, verzinkt Binding wire, glavanised Matelas crochet, galvanisé	Ø 0,65	1.0010 (D9)	
24	Stck pcs pièce	Matratzenhaken, verzinkt Mattress hook, galvanised Matelas crochet, galvanisé		1.0010 (D9)	
31	Stck pcs pièce	Glattblech Plain sheet Plain tôle	2000 x 1000 x 0,8	1.4301 (X5CrNi1810)	
32	Stck pcs pièce	Glattblech Plain sheet Plain tôle	2000 x 1000 x 0,5	1.4301 (X5CrNi1810)	
33	Stck pcs pièce	Spannverschluss mit Sicherung Lever fastener with securing Attacher à levier avec assurage	75	1.4301 (X5CrNi1810)	z.B. Typ Camloc
34	Stck pcs pièce	Gegenhaken 1 Counter hook Contre crochet		1.4301 (X5CrNi1810)	z.B. Typ Camloc
35	Stck pcs pièce	Gegenhaken 2 zum Spannen über Eck Counter hook for tensing crosswise Contre crochet		1.4301 (X5CrNi1810)	z.B. Typ OKI
36	Stck pcs pièce	Blindniete für nietbare Materialstärke 4 mm Blind rivet for material thicknes 4 mm Rivet borgne pour matière grosseur 4 mm	Ø 3,2 x	1.4303 (X5CrNi1812)	z.B. Tucker Typ SSD 44 SS

3 General instructions

General instructions	This insulation instruction (IsV) is a general instruction for the execution of the thermal insulation work. It does not release the execution company from his obligation to realise the insulation work accurate and in a manner that corresponds to the state-of-the-art.
Qualified personal	In order to guarantee the appropriate and professional execution of the insulation work, only qualified skilled workers must be used.
Rules	The insulation work should be done in compliance with this insulation instruction (IsV), the insulation description (IsB) as well as in compliance with order specific standards and rules.
Item Nr.	The mentioned item numbers in this insulation instruction that give information about the used material can be found in the material list under reference No.2.2.
Insulation thickness	The required insulation thicknesses are determined by the thermal conditions, the valid specifications and standards.
Cladding distance Insulation thickness	Reducing of cladding distance resulting of space conditions on site need no additional drawings and individual approvals. Kind and extend of this modifications and in consideration of thermal expansions are decisions of insulation company. When it is necessary to decrease insulation thickness too, insulation company is obligated to apply for permission of such a modification (in written form) for approval.
Sequence of work	Before starting the insulation erection it is required to establish the sequence of work in detail in reference to applicable documents.
Thermal extension	Special attention should be paid to the thermal extension and therefore to the exact sequence for installation of support construction (fix points and sliding points) as well as installation of sheets (sliding seams).
Waterproof	The waterproofness must be guaranteed by outside installations.
Storage	The supplied insulation material has to be stored dry and protected against mechanical damages.

- Quality Assurance** During erection work and at the end, the insulation company has to check whether
- the work is done correctly
(e.g. installation of support construction, fixing of the insulant mats, completion of the cladding and the removal of all protection foils)
 - movements of sheets are possible as required
 - the waterproofness is guaranteed
 - the Quality assurance inspection plan (QSPP) will be carried out properly and the required certificates are available.
- Documentation** Immediately after finishing the work the complete QA-Documentation according the QSPP has to be handed over to the client (ELEX).
- Modifications** If modification of the current design is necessary, **ELEX has to be informed prior of execution of modification.**

4 Design of thermal insulation

4.1 Support construction

The support construction is to manufacture from following materials:

- **U-profile** (item no. 06) for sheet supporting
Material: 1.0037 (St.37-2 / S235JR),
galvanised
Dimension: 30 x 50 x 30 x 2mm, l = 6.000 mm
- **Flat steel** (item no. 07) for webs
Material: 1.0037 (St.37-2 / S235JR)
galvanised
Dimension: 40 x 3 mm, l = 6.000 mm
- **Rivet** (item no. 09) for the connection of U-profile with webs
Material: steel, galvanised,
Dimension: ø 4,8 for material thickness 8 mm
- **Separation layer** (item no. 08) for thermal interruption
Material: free of asbestos
Dimension: 40 x 40 x 3 mm
- **Potential separation** (item no. 14) between support construction
and cladding sheets
Material: PVC-adhesive stripe
Dimension: 50 mm wide

By larger areas the support construction needs to be calculated statically. The dimension of the above components then may be change.

4.2 Insulation material:

For insulation the material hereinafter is to use

- **Mineral wool mat** (item no. 02) with galvanised quilting stitching wire
and galvanised metal mesh
Bulk density: $\geq 80 \text{ kg/m}^3$
Durable for permanent working temperature: $\geq 500^\circ\text{C}$
Non-burning category according DIN 4102: A1
AS-quality according AGI Q 135: Yes
Dimension: thickness according order
- **Insulation pin** (item no. 01) for fastening of mineral wool mats
Material: 1.0168 (St.37-3K)

- Dimension: \varnothing 4 mm, length according insulation thickness + 20 mm
- **Clips** (item no. 03) for pins
 - Material: St 2k 70, galvanised
 - Dimension: \varnothing 38 mm
 - **Wire hook** (item no. 04) for interconnection of mats
 - Material: 1.0010 (D9-1), galvanised
 - Dimension: \varnothing 2 x 95 mm
 - **Binding wire** (item no. 23) for interconnection of mineral wool mats and mattresses
 - Material: 1.0010 (D9), galvanised
 - Dimension: \varnothing 0,65 mm

4.3 Mattresses

Mattresses consists of following materials:

- **Glass cloth** (item no. 21) with wire inlay
 - Material: $\geq 600 \text{ g/m}^2$
 - Durable for permanent working temperature: $\geq 400 \text{ }^\circ\text{C}$
- **Mineral wool mat** (item no. 02) with galvanised quilting stitching wire and galvanised metal mesh
 - Bulk density: $\geq 80 \text{ kg/m}^3$
 - Durable for permanent working temperature: $\geq 500 \text{ }^\circ\text{C}$
 - Non-burning category according DIN 4102: A1
 - AS-quality according AGI Q 135: Yes
 - Dimension: thickness according order
- **Yarn, wire** (item no. 22)
 - Material: identical to glass cloth (item no 21)
- **Matress hook** (item no. 24) for fixing or for closing seams
 - Material: galvanised

4.4 Cassettes (Boxcladding)

Cassettes are to manufacture from following materials:

- **Plain sheet** (item no. 31, 32)

Material:	1.4301 (X5 CrNi18 10)
Dimension:	2.000 x 1.000 x 0,8 mm
	2.000 x 1.000 x 0,5 mm

- **Mineral wool mat** (item no. 02) with galvanised quilting stitching wire and galvanised metal mesh

Bulk density:	≥ 80 kg/m ³
Durable for permanent working temperature:	≥ 500 °C
Non-burning category according DIN 4102:	A1
AS-quality according AGI Q 135:	Yes
Dimension:	thickness according order

- **Lever fastener with securing** (item no. 33)

Material:	1.4301
Dimension:	75 mm

- **Counter hook** (item no. 34)

Material:	1.4301
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- **Counter hook** (item no. 34)

Material:	1.4301
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- **Blind rivet** (item no. 54)
for fixing of lever fastener and counter hook as well as for temporary attachment

Material:	1.4303 (X5 CrNi18 12)
Dimension:	ø 3,2 mm for material thickness 3-5 mm

4.5 Cladding

For cladding following material is foreseen, if no other specification is made:

- **Profiled sheet** (item no. 10)

Material:	3.0526 (AlMn1Mg1)
Dimension:	thickness 1 mm
Type of profile:	according order

- **Plain sheet** (item no. 11)

Material:	3.2527 (AlMg2Mn08)
Dimension:	2.000 x 1.000 x 1,2 mm

- **Cladding screw** (item no. 12) for fixing of sheets with support construction
Material: 1.4301 (X5 CrNi10 18)
with sealing disk
- **Tapping screw** (item no. 13) for fixing sheets among each other
Material: 1.4301 (X5 CrNi10 18)
Dimension: ø 4,8 x 16 mm

4.6 Sealing material

Outside building vertical seams of plain sheet have to be sealed:

- **Sealing stripe** (item no. 15)
Material: permanent elastic
Dimension: 20 x 2 mm

4.7 Partitioning

4.7.1 Partitioning (horizontal)

The horizontal Partitioning will be done by

- **Aluminium foil** (item no. 05)
Thickness: 80 µm

4.7.2 Partitioning (vertical)

For vertical itemitioning following materials are used:

- **Plain sheet** (item no. 16)
Material: 1.0226+Z275-N-A
(St.02Z-275NA)
Thickness: 0,7 mm
- **Profile filler** (item no. 17)
Material: mineral wool
Dimension: according profiled
sheet (item no. 10)
- **Aluminium stripe** (item no. 18)
Material: self adhesive
Dimension: 100 mm

5 Erection of thermal insulation

5.1 Insulation pins (20/01)

For the erection of mineral wool mats insulation pins \varnothing 4 mm are to weld by means of stud welding sets with hoisting ignition. The quantity of pins per m² is shown in drawing no. 20/01.

5.2 Support construction (20/03)

The support construction consists of U-profile (item no.06) and webs (item no.07) with separation layer (item no.08). The webs are bended and connected with U-profile by means of blind rivets (item no.09). For thermal interruption a separation layer (item no. 08) ist to put in between U-profile and webs.

Webs at fix points are straight, at sliding points webs are twisted 90 °.

- The distance of support construction one with another for profiled sheets results from thermal and statics requirements.
- The distance of support construction one with another for plain sheets amounts generally 930 mm.
- The distance of webs one with another results from statics requirements.

5.2.1 Potential separation (only outside building)

For potential separation between galvanised support construction and aluminium sheets a PVC-adhesive stripe (item no. 14) is to place on support construction.

5.2.2 Matting (20/02, 20/04)

The surfaces which are to be insulated shall be uniformly covered and above all the insulation shall be absolutely free of voids. Care has be taken that the mats are in close contact with casing but not excessively compressed at any spot. The mineral wool mats (item no. 02) are cut to size on site in 2 layers in accordance to specified insulation thicknesses and then fitted on plant. The mats are to fix with staggered seams (at least 200-300 mm). The seams of mats have to be fixed and to connect with one another by mat hooks (item no. 04) with min. 6 pcs / m seam. For the fixing of mineral wool mats on pins clipses (item no. 03) are to use. Each layer of insulation material is to fix with clips at each pin.

The insulation of stiffeners is shown in drawing no. 20/04.

Use of loose mineral wool is only admitted in places where mineral wool mats cannot be used (e.g. plugging of hollow spaces, gaps, inaccessible corners etc.).

The stuff density has to be high enough so that occurring vibrations do not lead to the collapse of the material (stuff density \geq 80 kg/m³).

5.3 Cladding

The vertical parts will be in general executed with profiled sheets. (Item No. 10). The bended sides like hopper, cones and gas ducts with plain sheets (Item No. 11).

All cut-outs, penetration points and inserts have to be closed careful with plain sheet. It is to ensure that there is sufficient space for thermal movement. Doing this the thermal movements of casing system are to take in account.

5.3.1 Plain sheets (20/07)

Plain sheets are neatly to crimp and to fold diagonally. The fixing of plain sheets are to screw at support construction with cladding screws (item no. 12).

- Inside building 2 pcs/m
- Outside building 6 pcs/m

The connection of plain sheets with one another is to execute at horizontal and vertical seams with stainless tapping screws (item no. 13). Overlapping of sheets amounts at least 50mm.

5.3.2 Profiled sheets

The profiled sheets are to screw at support construction with cladding screws (item no. 12).

- Inside building 1 pcs / 2 bead
- Outside building 1 pcs / bead

The connection of profiled sheets with one another is to execute with tapping screws (item no. 13) at least 6 pcs / m.

5.3.3 Horizontal sliding seams (20/05, 20/06)



ATTENTION:

It is not allowed to screw up sliding seams or to connect with other means of fastening.

5.3.3.1 Plain sheet

At horizontal sliding seams the overlapping amounts at least 70 mm.

5.3.3.2 Profiled sheet

At horizontal sliding seams the overlapping amounts at least 100 mm.

5.3.4 Vertical sliding seams (20/05, 20/06)

5.3.4.1 Plain sheet

At vertical sliding seams the overlapping amounts at least 70 mm.

5.3.4.2 Profiled sheet

Care has to be taken that in the area of the vertical sliding seams. One bead valley of the profiled sheet have not be screwed with the support construction.

5.3.5 Typical details

Typical details for execution are shown in drawings listed below:

- Corner connection: 20/11-15
- Roof connection: 20/30, 31
- Screw conveyor: 20/40, 41
- Bearing: 20/35
- Connection hopper – hopper: 20/38

5.4 Penetrations

Penetrations (e. g. supports for platforms, ladders etc.) have to be cut out properly and have to be closed with cover-plates respectively with inserts (item no. 11). The cover plates and inserts have to be executed in such a way, that occurring thermal expansions do not cause tensions or create gaps in the cladding.

5.5 Manholes (20/20, 20/21, 20/22)

In installations with a high dew-point manholes get an additional insulation with mattresses.

The mattresses will be covered with glass cloth. For strength, glass cloth must have a wire inlay and a minimum weight of 600 g/m² (item no. 21). Mattresses must be sewn and in the surface stitched with identical yarn/wire (item no. 22) at maximum distances of 100 mm. Mattresses must be closed at the longitudinal seams dependent upon the strain with galvanised steel wire (item no. 23).

5.6 Boxes (20/24, 20/25, 20/26)

Boxes on precipitator roof have to be executed easy removable with insulation cassettes. The external surface forms stainless sheet 0,8mm (item no. 31), the internal surface and face surfaces **stainless steel** 0,5mm (item no. 32). The fixing of cassettes is to carry out with lever fastener (item no. 33) and counter hooks (item no. 34, 35). Lever fastener and counter hooks will be fixed to sheet by means of blind rivets (item no. 36). The shape has to be in a way that the cassettes can be often opened and closed.

Insulation cassettes

5.7 Hopper (20/08)

Hopper heating

The hoppers are executed with a hopper heating in certain applications. The insulation company fixes these heatings with the for this propose foreseen pins and clips according to arrangement drawing No. 01/54. For an optimal heat distribution the electrical heating has to be covered with an aluminium foil (item No. 05). The edges have to be closed with a self-adhesive aluminium stripe. The cables have to be layed along the support construction up to the hopper doors. The cables are fixed with cablebinds on the support construction. Attention must be paid to the fact that no damage is caused to cables and heating mats. For the penetration of the cables a blind made of stainless steel 1.0 mm is planned above the door. For the penetration of the cables holes (2-5) with \varnothing 23 mm have to be drilled and PG 16 screws have to be used.

Identification

The cable ends must be marked corresponding to the identification number on drawing No. 01/54 using shields and waterresistant prints.

5.8 Partitioning (20/16)

For reducing respectively minimizing heat loss horizontal and vertical partitionings are necessary.

5.8.1 Horizontal partitioning

By temperatures > 250 °C this insulation is to cover with aluminium foil (item no. 05). The foil is to fix with the clip (item No. 03) at each pin common with the outer mat layer of insulation.

5.8.2 Vertical partitioning

The execution of vertical insulation is to be done with galvanised plain sheet (item no. 16) fixed at U-profile (item no. 06) by means of blind rivets (item no. 36) min. 6 pcs / m. For closing inside beads of profiled sheets, profile filler (item no. 17) is to use. For fixing profile filler in beads, self-adhesive aluminium stripe (item no. 18) are foreseen. To prevent convection in profile filler beads are to seal up in addition also with aluminium stripes (item no. 18).

Distance of vertical partitioning one with another has to be ≤ 4.000 mm.

5.9 Welding works

5.9.1 Requirements

For requirements quality control of welding work as well as for qualification of welder staff
DIN 18800-7, DIN EN 287, DVS 0902 and FDBR 19 are valid.

5.9.2 Pretreatment of the Welds

Before welding corrosion prevention (e.g. zinc or painting) at area of welds have to be removed.

5.9.3 Cleaning of the Welds

Slag of welding seams is to remove. Afterwards the weld has to be prevented against corrosion with a priming coat ($\geq 40 \mu\text{m}$).

6 Contractual documents

6.1 List of documents

For the execution of the thermal insulation the insulation instruction (IsV) as also the principle drawings of the insulation description (IsB) and the layouts must be complied with.

A summary of this documents is listed in the table below.

Doc. No.	Description	Doc. No.	Description
00/01	Layout EP	20/20	Inspection door hopper
00/02	Layout CT	20/21	Inspection door
01/53	Hopper heating	20/22	Inspection door
20/09			
01/54	Heatment arrangement	20/24	Box large 1
		20/25	Box large 2
IsB	Insulation description:		
20/00	General Arrangement Thermal Insulation Electrostatic Precipitator	20/26	Box small
20/01	Studding	20/30	Roof connection
20/02	Fixing mineral wool mat	20/31	Roof connection
20/03	Support construction	20/35	Bearing
20/04	Stiffener	20/38	Hopper - Hopper
20/05	Sliding seam profiled sheet	20/40	Dust conveyor
20/06	Sliding seam plain sheet	20/41	Dust conveyor
20/07	Plain sheet, diagonal folded	20/45	Duct angular
20/08	Hopper	20/46	Duct round
20/11	Corner connection 1	20/50	Cooling tower with plain sheet
20/12	Corner connection 2	20/51	Cooling tower with profiled sheet
20/13	Corner connection 3	20/52	CT support construction
20/14	Corner connection 4	QSPP	Quality assurance inspection plan for insulation.
20/15	Corner connection 5		
20/16	Itemitioning		

6.2 Hierarchy of the contractual documents

Below the general valid Hierarchy of the contractual documents is specified. This hierarchy will be valid in case no other sequence was agreed in the order.

1. Order
2. Technical specification
3. Contract specific standards
4. General Insulation instruction (IsV)
5. General Insulation description (IsB)
6. Offer

Contradictions In case of contradictions is in general the stricter instruction valid. **The Supplier has to draw the attention of ELEX to such contradictions.**