Drywall Systems | 2010-11

Knauf Safeboard

Lead-free X-ray Shielding

Knauf Gips

Contents

In this brochure, the permissible wall heights for the respective system are stated depending on the installation zone acc. to DIN 4103-1.

Installation zone 1
Walls in rooms with low traffic, e.g. dwellings, hotels, office and hospital rooms including corridors and halls or similar facilities.

Installation zone 2
Walls in rooms with high traffic, e.g. meeting halls, school classrooms, lecture rooms, exhibition halls and sales-rooms and rooms with floor height differences of ≥ 1 m.

X-ray shielding

With Drywall Systems

X-ray examination rooms require structural radiation shielding to adjacent rooms.
The rules for the application of structural radiation protection (useful and stray radiation) are defined in DIN 6812.
The basis of all structural measures for X-ray protection is the radiation protection plan, which has to be created by the manufacturer of the X-ray unit.
The thickness of the required radiation shielding depends on the tube voltage of the device type used (depending on the medical application) and is stated for lead as the shielding material.
The higher the tube voltage, the thicker the necessary layer of lead.

For shielding layers made of other materials, the protection effect is stated as lead equivalence. The lead equivalence of a material specifies the lead thickness to which the shielding effect of the material is equivalent.
Information on lead equivalences of various building materials is listed in DIN 6812, table 18.

Heavy concrete used previously for X-ray shielding in hospitals and medical practices can now easily and efficiently be replaced by Knauf X-Ray Shielding Systems.
Knauf X-ray Shielding Systems are applied in the fields of X-ray diagnostics and low-power X-ray therapy. Radiation protection is provided in the form of shielding, room-enclosing components with specific lead equivalences of the used materials.
However, due to their weight, the gypsum boards with lead sheet lamination used so far are difficult to apply and require extreme care during installation in order to provide flawless radiation protection.

Technical data and properties of Knauf Safeboard

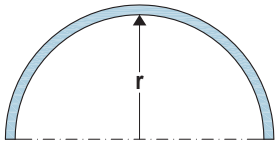
Edge type

- Long edge: HRK

- Front edge: SK

Minimum permissible bending radii

- Dry bending: r ≥ 2750 mm
- Wet bending: r ≥ 1000 mm



Safeboard X-Ray Shielding Board	
Board thickness:	12.5 mm
Board width:	625 mm
Board length:	2,500 mm
Board weight:	17 kg/m²
Board type acc. to DIN EN 520	DF
Board type acc. to DIN 18180	GKF
Yellow dyed gypsum core	

Planning aid for individual X-ray shielding solutions with Safeboard

No. of boards	Total thickness mm	Lead equivalence of Knauf Safeboard X-Ray Shielding Boards (mm Pb) depending on the tube voltage (kV) 60	70	80	90	100	125	150
1	12.5	0.45	0.60	0.75	0.70	0.70	0.50	0.40
2	25	0.90	1.20	1.50	1.40	1.40	1.00	0.80
3	37.5	1.35	1.80	2.20	2.10	2.10	1.50	1.10
4	50	1.80	2.30	2.90	2.80	2.80	2.00	1.40
5	62.5					3.40	2.40	1.70
6	75					4.00	2.80	2.00

Note: Intermediate values can be interpolated in linear fashion. Estimation of lead equivalence acc. to DIN 6812.

One layer of Safeboard is sufficient for X-ray shielding in mammography (35 kV) screening

The lead equivalence of X-Ray Shield Partitions Safeboard is increased by 0.1 mm Pb if an additional layer of 12.5 mm thick Diamant boards is applied on both sides.

mm Pb ... Unit of the lead equivalence

An exemplary material of lead equivalence 1 mm Pb (Pb = chemical symbol for lead) provides the equivalent shielding effect as 1 mm thick lead sheet.

X-ray Shielding

With Knauf Safeboard

- ► **Your benefits**
- **Cost-effective X-ray protection**
- **Without lead sheet lining**
- **Low weight compared to boards with lead sheet**
- **Fire-resistant board**
- **Fire protection in conjunction with X-ray shielding also for suspended ceilings**
- **Excellent sound insulation**
- **Mitring and moulding technology for unlimited design**
- **Easy installation, avoiding faults in workmanship**
- **Easier disposal due to the lead free material**

The System for X-Ray Shielding

Safeboard X-Ray Shielding Boards

The Knauf Safeboard had been developed to minimize the additionally required effort for the application of X-ray shielding systems compared to conventional drywall systems. Together with the Safeboard Filler, this X-ray shielding board can be applied much like a regular gypsum board and simultaneously offers all the technical characteristics (sound insulation, fire resistance) of a conventional gypsum board.
Thus, fire protection requirements of suspended X-ray shielding ceilings can also be met.

Knauf Safeboard are gypsum boards type DF in accordance with DIN EN 520, or GKF in accordance with DIN 18180 with the additional feature of X-ray shielding.

Safeboard Filler

Knauf Safeboard Filler is a compound specifically for filling joints of Knauf Safeboard X-ray Shielding Boards by hand application without reinforcement tape to provide flawless shielding.

Safeboard filler is dyed yellow for purposes of identification.

Knauf alutop® Access Panel Safeboard

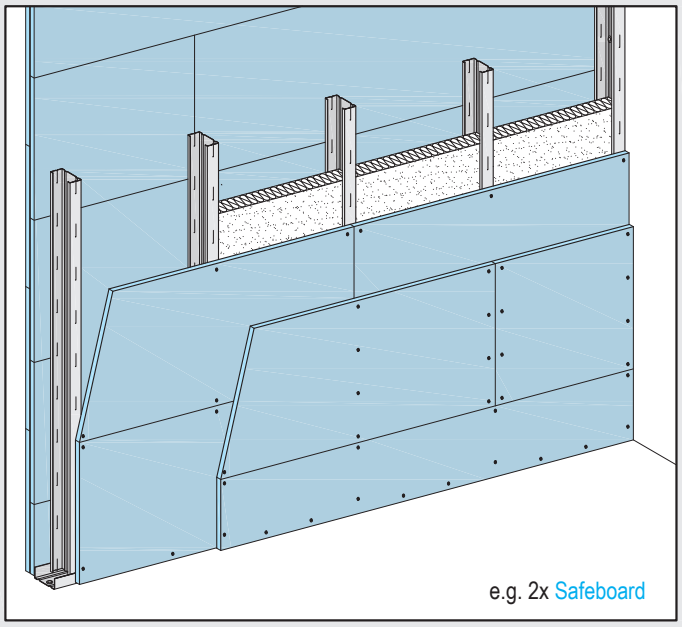
Access panel with flush mounted Safeboard, for universal application in Knauf Safeboard X-Ray Shield partitions, ceilings and furrings.

For cladding thicknesses:

- 1x 12.5 mm Safeboard
- 1x 12.5 mm Safeboard + 1x 12.5 mm Diamant
- 2x 12.5 mm Safeboard
- 2x 12.5 mm Safeboard + 1x 12.5 mm Diamant

Construction

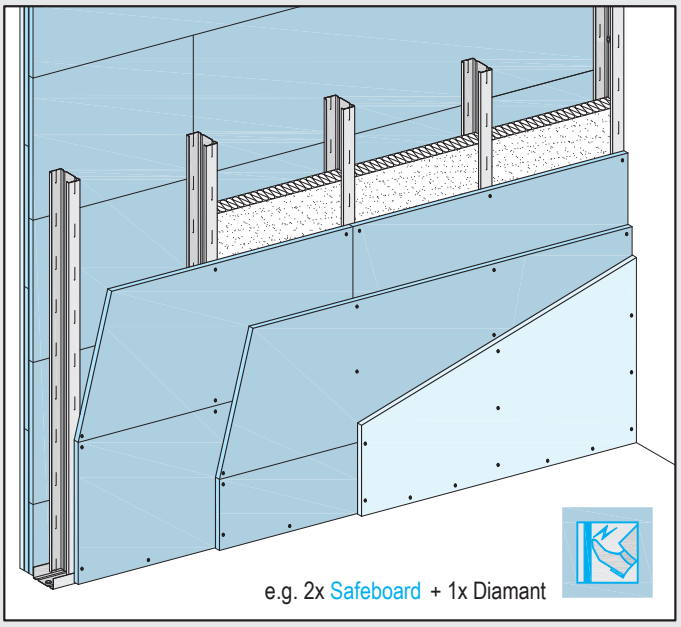
K131 Safeboard



X-Ray Shield Partition Safeboard

- Fire resistance class e.g. F90
- Sound reduction index $R_{w,R}$ e.g. 65 - 68 dB

K131 Safeboard + Diamant



X-Ray Shield Partition Safeboard + Diamant

- Fire resistance class e.g. F120
- Sound reduction index $R_{w,R}$ e.g. 69 dB
- **Diamant top layer**
  - → Stable premium surface
  - → Lead equivalence is increased by 0.1 mm Pb by 2 layers of Diamant boards (1 layer per partition side)

X-Ray Shield Partitions

With Knauf Safeboard

Knauf Safeboard X-Ray Shield Partitions are metal stud partitions consisting of a metal stud framework with cladding made of Knauf Safeboard X-Ray Shielding Boards and an optional top layer made of Diamant boards on both sides.

The systems shown on Pages 8 to 9 are sample construction variants. The design of individual solutions for X-ray shielding can be carried out with the table of lead equivalences on Page 7.

The stud framework is connected to the adjacent structure along the entire perimeter.
Insulation material for sound and thermal insulation or fire protection as well as sanitary or electric built-ins can be installed into the metal frame construction while ensuring continuous shielding (backings/covering boxes of penetrations or built-ins). Movement joints of the main structure have to be included into the construction of the partitions. For continuous partitions, use control joints at approx. 15 m.
The installation of X-ray shielding doors is possible. Follow instructions of the door supplier for the construction of the door opening.

In order to protect the X-ray shielding layers made of Knauf Safeboard from damage caused by mechanical influences, it is recommended that you apply a top layer made of 12.5 mm Knauf Diamant boards.

Technical data

Knauf System	Fire resistance class	Cladding per partition side type / thickness t mm	Stud cavity h mm	Partition thickness T mm	Weight without insulation approx. kg/m²	Sound reduction $R_{w,R}$ 1) Knauf CW Stud dB	Insulation layer 2) min. thickness mm	Premium drywalling
K131 Safeboard								X-Ray Shielding Partition
■ Single layer 3)	**F30**	Safeboard **12.5**	50	75	39	**54**	40	
			75	100		**57**	60	
			100	125		**58**	80	
■ Double layer	**F90**	Safeboard **2x 12.5**	50	100	75	**65**	40	
			75	125		**67**	60	
			100	150		**68**	80	
K131 Safeboard with Diamant top layer								X-Ray Shielding Partition
■ Double layer	**F90**	Safeboard **12.5** + Diamant **12.5**	50	100	65	**64**	40	
			75	125		**65**	60	
			100	150		**65**	80	
■ Triple layer	**F120**	Safeboard **2x 12.5** + Diamant **12.5**	50	125	100	**69**	40	
			75	150		**69**	60	
			100	175		**69**	80	

1) $R_{w,R}$ = calculation value of the rated sound reduction index of the parting component acc. to DIN 4109 without transmission via adjacent components
2) Insulation acc. to DIN EN 13162, length-related flow resistance acc. to DIN EN 29053: r ≥ 5 kPa·s/m², min. building material class B2 insulation filling degree 80 %, e. g. Knauf Insulation Trennwand-Dämmrolle TI 140 T
3) For fire resistance: melting point of insulation ≥ 1000 °C, density ≥ 30 kg/m³, thickness ≥ 40 mm or double layer cladding alternatively

Max. partition heights with / without fire resistance

Knauf Stud Metal gauge 0.6 mm	Axial stud spacing mm	K131 Safeboard single layer installation zone 1 m	2 m	double layer installation zone 1 m	2 m	triple/multi layer installation zone 1 m	2 m
CW 50	625	3	2.75	4	3.5	4.5 4 4)	4 3.5 4)
CW 75	625	4.5	3.75	5.5	5	6 5.5 4)	5.5 5 4)
CW 100	625	5	4.25	6.5	5.75	7 6.5 4)	6.5 5.75 4)

4) Maximum partition height for fire resistance
■ Solutions for higher partitions on request

Proofs

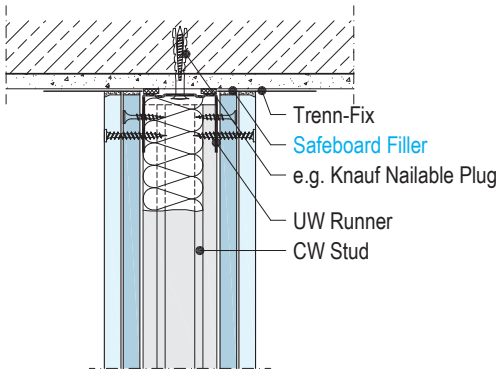
- X-Ray Shielding:
  TÜV NORD Röntgentechnik ,
  Technical report from 09-22-2008
- Sound insulation:
  Knauf Sound Insulation Proof L 018-01.09
  Knauf Sound Insulation Proof L 019-01.09
- Fire protection:
  National Technical Test Report
  ABP P-3310/563/07

► *See also W11 Knauf Metal Stud Partitions*

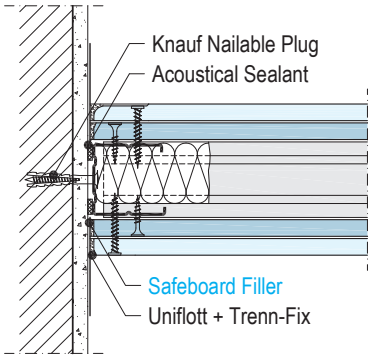
Details, scale 1:5

Example: Sample system with 1x Safeboard + 1x Diamant per partition side

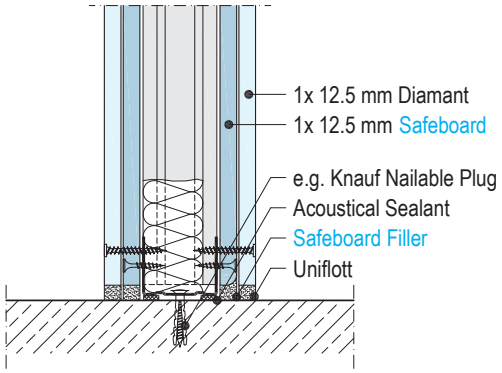
K131S-VO1 Connection to ceiling



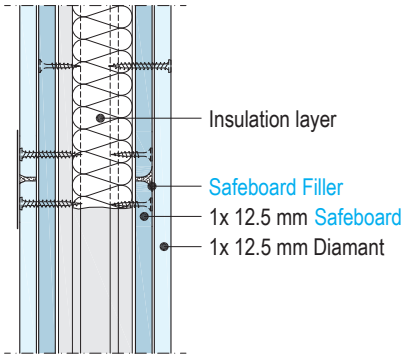
K131S-A1 Connection to solid wall



K131S-VU1 Connection to floor



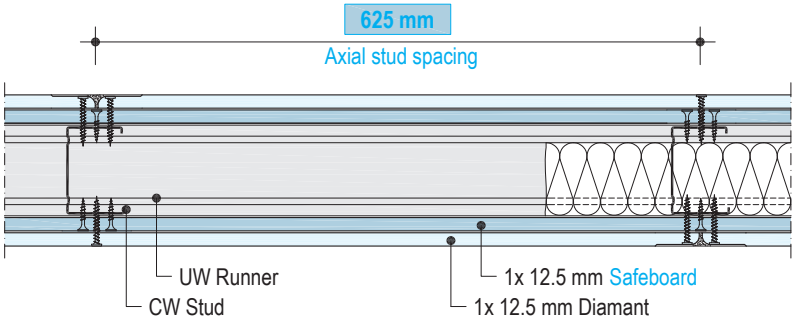
K131S-VM1 Board joint vertical section



K131 X-Ray Shield Partitions Safeboard

Single metal stud frame - double layer cladding (sample system)

Scheme drawing



System properties

- Axial stud spacing 625 mm
- CW Studs 50/75/100
- 1st layer: 12.5 mm Safeboard per side
  2nd layer: 12.5 mm Diamant per side

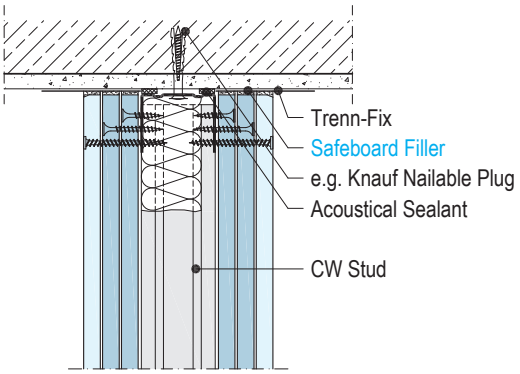
Lead equivalences for sample system with 1x Safeboard + 1x Diamant per partition side

Lead equivalence (mm Pb) depending on the tube voltage (kV)						
60 kV	70 kV	80 kV	90 kV	100 kV	125 kV	150 kV
1.0	1.3	1.6	1.5	1.5	1.1	0.9

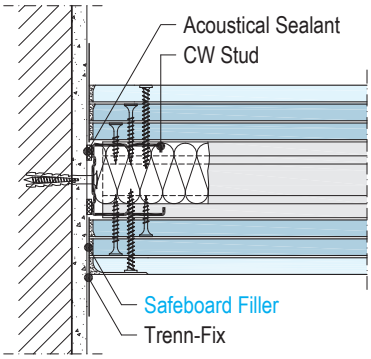
Details, scale 1:5

Example: Sample system with 2x Safeboard + 1x Diamant per partition side

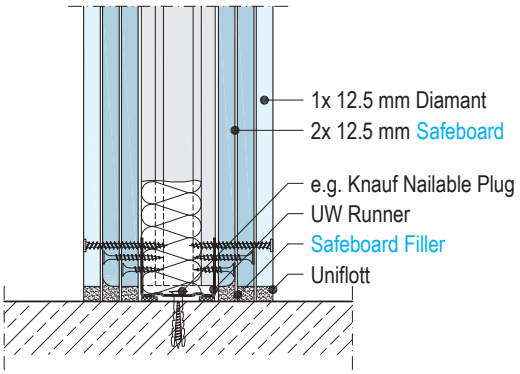
K131S-VO11 Connection to ceiling



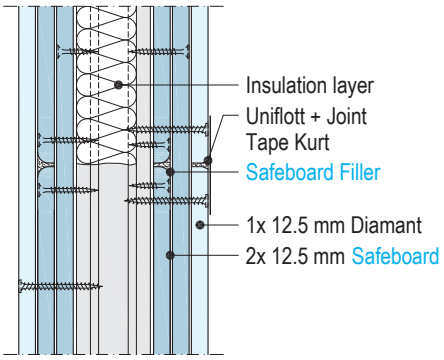
K131S-A11 Connection to solid wall



K131S-VU11 Connection to floor



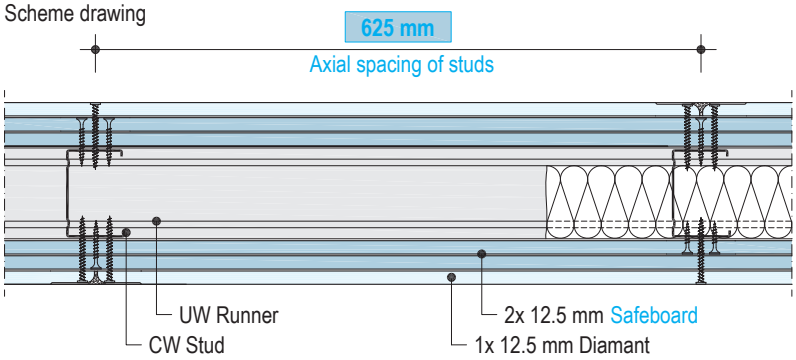
K131S-VM11 Board joint vertical section



K131 X-Ray Shield Partitions Safeboard

Single metal stud frame - triple layer cladding (sample system)

Scheme drawing



System properties

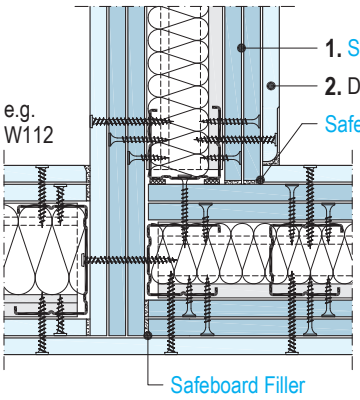
- Axial stud spacing 625 mm
- CW Studs 50/75/100
- 1st + 2nd layer: 12.5 mm Safeboard per side
  3rd layer: 12.5 mm Diamant per side

Lead equivalences for sample system with 2x Safeboard + 1x Diamant per partition side

Lead equivalence (mm Pb) depending on the tube voltage (kV)						
60 kV	70 kV	80 kV	90 kV	100 kV	125 kV	150 kV
1.9	2.4	3.0	2.9	2.9	2.1	1.5

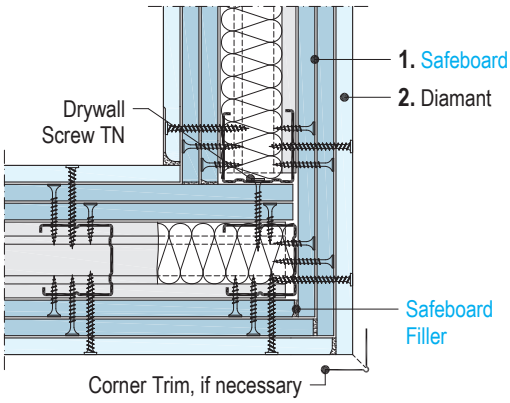
Details, scale 1:5 **Example: Sample system with 2x Safeboard + 1x Diamant per partition side**

K131S-C11 T-connection

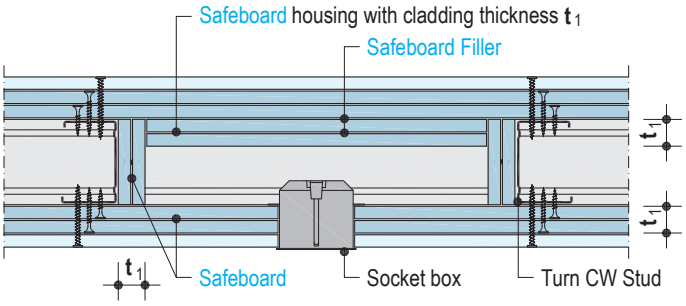


Order of application:
1. Finish continuous shielding layers of Safeboard completely
2. Apply Diamant top layer

K131S-D11 Corner

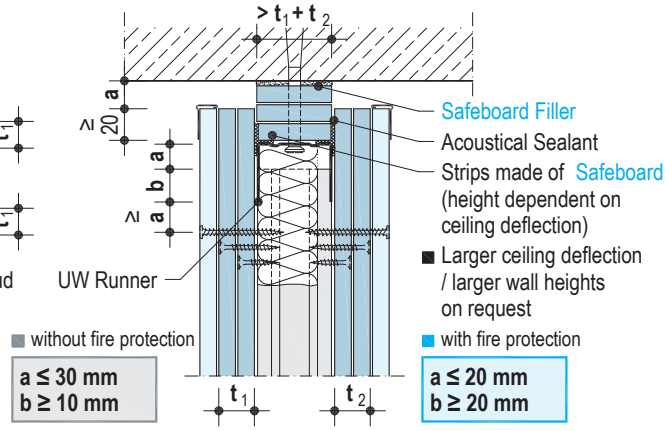


K131S-SO11 Socket box schematic section



K131S-VO12 Deflection head

■ **Permissible partition height: ≤ 6.50 m**



■ Larger ceiling deflection / larger wall heights on request

■ without fire protection
a ≤ 30 mm
b ≥ 10 mm

■ with fire protection
a ≤ 20 mm
b ≥ 20 mm

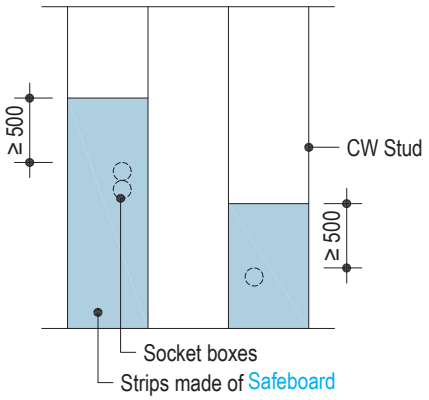
■ With deflection head, do not screw the boards onto the UW Runner.

K131 X-Ray Shield Partitions Safeboard

Details, installation of socket boxes, application

Installation of socket boxes

The housing acc. to the drawing above with cladding thickness t_1 has to be a size that exceeds the box by at least 500 mm in vertical direction and reaches up to the next stud in the horizontal direction. Alternative: X-Ray Shielding Caps



Fastening of the cladding with Knauf Diamant Screws or Knauf Diamant Screws with drill pin / Knauf Drywall Screws TN or TB, depending on the sheet metal gauge *s* in mm

Cladding Board thickness 12.5 mm	1st layer		2nd layer		3rd layer	
	s ≤ 0.7	s ≤ 2.25	s ≤ 0.7	s ≤ 2.25	s ≤ 0.7	s ≤ 2.25
1x Safeboard	TN 3.5x25 | TB 3.5x25 spacing: 200 mm [3]		-		-	
1x Safeboard + 1x Diamant	TN 3.5x25 | TB 3.5x25 spacing: 600 mm [1]		3.9x35 | 3.9x55 (drill pin) spacing: 250 mm		-	
2x Safeboard	TN 3.5x25 | TB 3.5x25 spacing: 600 mm [1]		TN 3.5x35 | TB 3.5x45 spacing: 200 mm [3]		-	
2x Safeboard + 1x Diamant	TN 3.5x25 | TB 3.5x25 spacing: 600 mm [1]		TN 3.5x35 | TB 3.5x45 spacing: 300 mm [2]		3.9x55 | 3.9x55 (drill pin) spacing: 250 mm	
3x Safeboard	TN 3.5x25 | TB 3.5x25 spacing: 600 mm [1]		TN 3.5x35 | TB 3.5x45 spacing: 300 mm [2]		TN 3.5x55 | TB 3.5x55 spacing: 200 mm [3]	

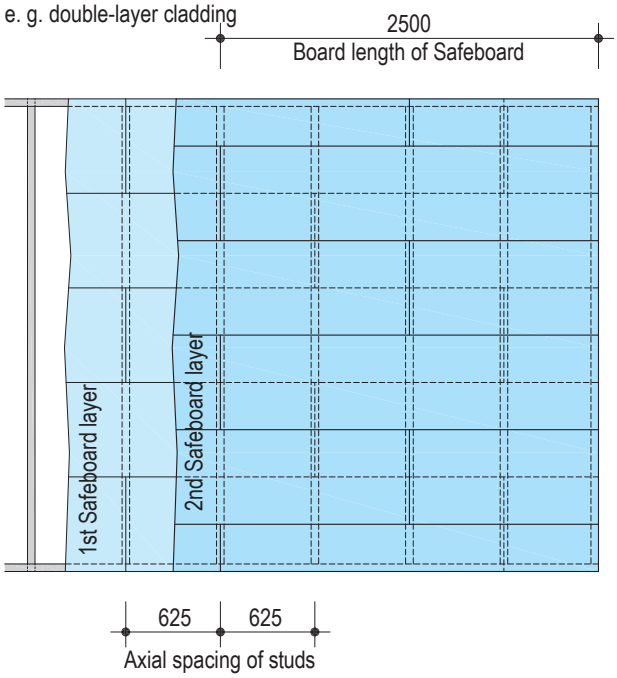
Number of screws per board width and stud: [1] min. 2 [2] min. 3 [3] min. 4

Installation scheme

Dimensions in mm

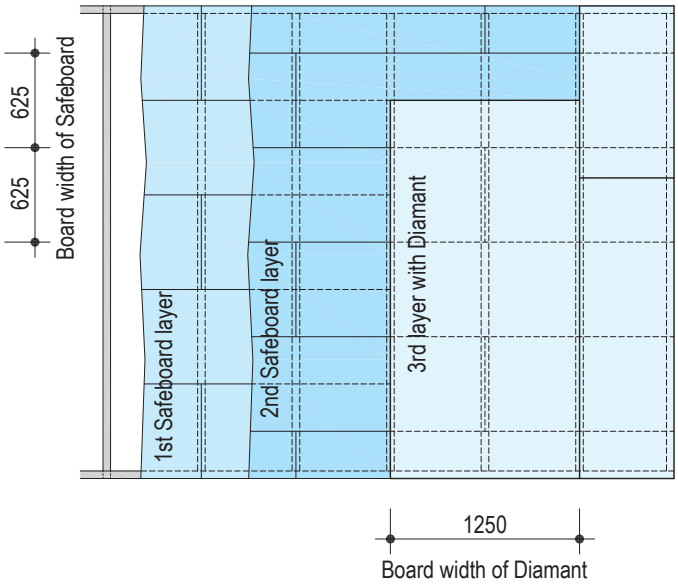
Horizontal application of Safeboard X-Ray Shielding Boards

e. g. double-layer cladding



- Stagger front edge joints by at least one stud spacing.
- Stagger long edge joints between board layers by half a board width in case of multi-layer cladding.
- Stagger front edge and long edge joints of opposite board layers as well.

Vertical application of the Diamant top layer



- Stagger front edge joints by at least 400 mm in case of non-room-high boards.
- Stagger front edge and long edge joints of opposite board layers as well.

► Safety note

Wear a dust respirator (P2) when working with Knauf Safeboards, particularly while sanding and sawing (e.g. with a hole saw) as well as during the sprinkling of the filling compound.

Substructure

- Apply Acoustical Sealant (two strings) or Sealing Tape to rear side of UW or CW perimeter profiles for the connection of flanking constructional components. For sound protection requirements seal up carefully with Acoustical Sealant according to DIN 4109, Supplement 1, Chapter 5.2; porous sealant strips like Sealing Tape are usually not suitable in this case.
- Connections to floor and ceiling with UW Runners, connections to walls with CW Studs.
- Anchor perimeter profiles with suitable anchors on the adjacent structure. Anchors for adjacent solid components: Nailable Plugs or Knauf Ceiling Steel Dowels / non-solid components: anchors that are particularly suitable for the respective building material.

Anchor spacing on floor and ceiling

Wall height	Knauf Nailable Plugs	Knauf Ceiling Steel Dowels
≤ 3 m	1 m	1 m
> 3 to ≤ 6.5 m	0.5 m	1 m
> 6.5 to ≤ 12*) m	-	0.5 m

*) Observe max. wall heights

Spacing of anchors on walls: 1 m max., at least 3 anchors per wall connection.

- If the estimated max. ceiling deflection is above 10 mm, install a deflection head as ceiling connection.
- Install cut-to-length CW studs at the required stud spacing into the UW runners and align.

Cladding

- Fastening of the cladding acc. to table on Page 10.
- Apply Knauf Safeboard horizontally.
  The optional Diamant top layer boards are applied vertically, preferably with room-high boards.
- Stagger board joints acc. to installation scheme.
- No joints at door opening profiles.
- Start fastening of Knauf Boards at centre or corner of boards in order to avoid sagging.
- Press Knauf Boards tightly to grid while fastening.
- In order to avoid dust formation it is recommendable to break the boards (score board liner with knife and break board along the edge, cut rear side board liner).

Rework and bevel edges with rasp.

Order of installation at connections

Provide a tight shielding at connections as well:

1. Finish the continuous x-ray shielding cladding completely first.
2. Apply optional Diamant top layer.

Filling and finishing

X-ray shielding layers Knauf Safeboard

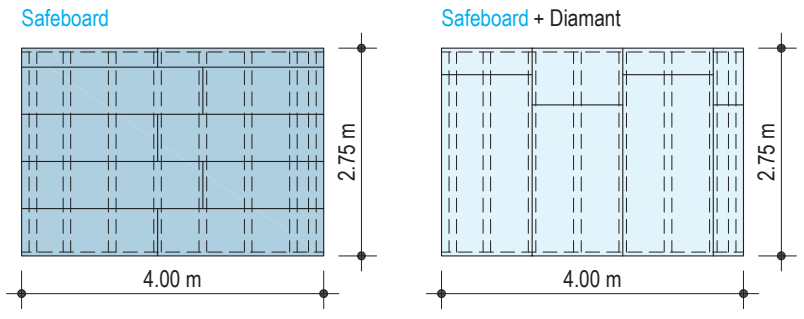
- In order to provide a tight shielding layer, completely fill all joints (board joints and connection joints) with Safeboard Filler, i.e. continuously and over the entire cladding thickness of all Safeboard cladding layers.
- Fill possible damages with Safeboard filler as well.
- See Pages 28/29 for Filler application and further information.

Top layer Diamant

- Joint filling and surface finishing acc. to Pages 28/29.

Material requirement per m² partition

Description	Unit	Quantity as average value			
		K131 Safeboard		**K131** Safeboard + Diamant	
		Single layer	Double layer	Double layer	Triple layer
Substructure					
or Knauf UW Runner 50x40x0.6; 4 m long or Knauf UW Runner 75x40x0.6; 4 m long Knauf UW Runner 100x40x0.6; 4 m long	m	0.7	0.7	0.7	0.7
or Knauf CW Stud 50x50x0.6 or Knauf CW Stud 75x50x0.6 Knauf CW Stud 100x50x0.6	m	2	2	2	2
or Knauf Acoustical Sealant	pcs	0.3	0.3	0.3	0.3
Knauf Sealing Tape (50/3.2 mm; 70/3.2 mm; 95/3.2 mm)	m	1.2	1.2	1.2	1.2
or Knauf Nailable Plug "K" 6/35 Knauf Nailable Plug "K" 6/50 (for plastered connection areas)	pcs	1.6	1.6	1.6	1.6
Insulation layer ..... mm thick; e.g. Knauf Insulation Trennwand-Dämmrolle TI 140 T	m²	as req.	as req.	as req.	as req.
Cladding					
Safeboard 12.5 mm	m²	2	4	2	4
Diamant 12.5 mm	m²	-	-	2	2
Knauf Drywall Screws TN / Diamant Screws 3.5 x 25 mm 3.5 x 35 mm / 3.9 x 38 mm 3.5 x 55 mm / 3.9 x 55 mm	pcs	 36 - -	 20 36 -	 20 30 -	 20 26 30
Knauf X-Ray Shielding Caps for socket boxes	pcs	as req.	as req.	as req.	as req.
Filling and Finishing					
Safeboard Filler	kg	0.5	1	0.5	1
Uniflott	kg	0.25	0.25	0.5	0.5
Joint Tape Kurt (front edges)	m	0.5	0.5	0.8	0.8
Trenn-Fix; 65 mm wide, self-adhesive	m	1.8	1.8	1.8	1.8
Knauf Edge Trim 23/13; 2.75 m long	m				
Knauf Corner Trim 31/31; 2.6 m / 3 m long	m	as req.	as req.	as req.	as req.
Alux Edge Trim; 52 mm wide	m				



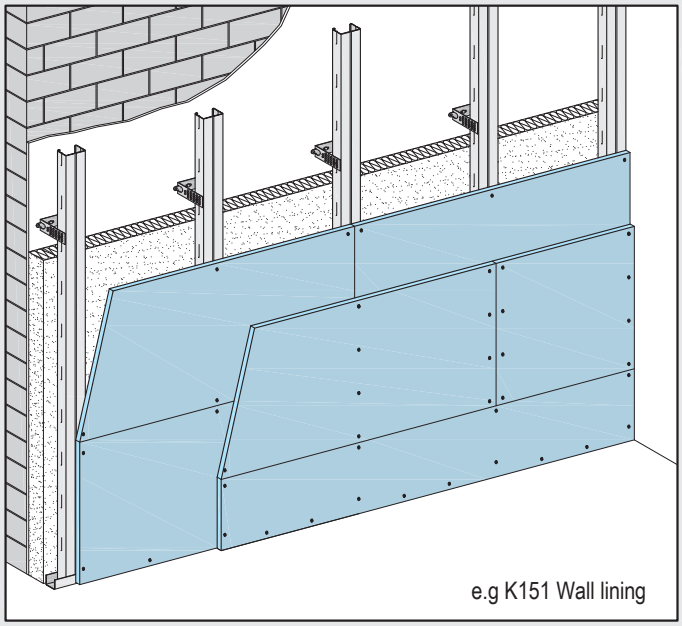
- The quantities relate to a partition area of: H = 2.75 m; L = 4.00 m; A = 11.00 m²
- Without allowance for loss and waste
- The figures are not based on specific building physical requirements
- as req. = as required

Tender Specifications

Item	Description	No. of units	Unit price	Total price
.....	Non-load bearing interior partition acc. to DIN 4103-1 as metal stud partition, installation zone 1/ 2 *, height in m ....., thickness in mm ..... . X-ray shielding, lead equivalence DIN 6812 in mm Pb ..... , tube voltage in KV 60/ 70/ 80/ 90/ 100/ 125/ 150.* Rated sound reduction index DIN 4109 $R_{w,R}$ in dB ..... . * Fire resistance class DIN 4102-2: F30/ F90/ F120.* * Substructure made of galvanized sheet metal profiles acc. to DIN 18182-1: Knauf CW 50/ 75/ 100 *, as single metal stud framework with entirely anchored connections. Insulation layer made of mineral wool acc. to DIN EN 13162, thickness 40/ 60/ 80 * mm, with a thermal conductivity of λ = 0.040 W/(mK),* length related flow resistance acc. to DIN EN 29053: r ≥ 5 kPa·s/m²,* Product: Knauf Insulation Trennwand-Dämmrolle TI 140 T *or equivalent*. * Cladding made of gypsum boards acc. to DIN 18180, on both sides: X-ray shielding layers: X-Ray Shielding Boards Knauf Safeboard, single/ double * layer, board thickness 12.5/ 2x 12.5 * mm. Top layer: Knauf Diamant, single layer, board thickness 12.5 mm. Application acc. to DIN 18181. Filling with Knauf Safeboard Filler and Uniflott, acc. to Code of Practice No. 2 (BVG) Quality standard Q1 as basic filling to be coated with plaster/..... */ Quality standard Q2 standard jointing.* Application and installation acc. to brochure ST02 Knauf Safeboard. System: **Knauf X-Ray Shielding Partition K131 Safeboard**	..... m²	..... €	..... €
.....	Non-load bearing interior partition acc to DIN 4103-1 as metal stud partition, installation zone 1/ 2 *, height in m ....., thickness in mm ..... . X-ray shielding, lead equivalence DIN 6812 in mm Pb ..... , tube voltage in KV 60/ 70/ 80/ 90/ 100/ 125/ 150.* Rated sound reduction index DIN 4109 $R_{w,R}$ in dB ..... . * Fire resistance class DIN 4102-2: F30/ F90/ F120.* Substructure made of galvanized sheet metal profiles acc. to DIN 18182-1: Knauf CW 50/ 75/ 100 *, as single metal stud framework with entirely anchored connections. Insulation layer made of mineral wool acc. to DIN EN 13162, thickness 40/ 60/ 80 * mm, with a thermal conductivity of λ = 0.040 W/(mK),* length related flow resistance acc. to DIN EN 29053: r ≥ 5 kPa·s/m²,* Product: Knauf Insulation Trennwand-Dämmrolle TI 140 T *or equivalent*. * Cladding made of gypsum boards acc. to DIN 18180, on both sides: X-Ray Shielding Boards Knauf Safeboard, single/ double/ triple * layer, board thickness 12.5/ 2x 12.5/ 3x 12.5 * mm, application acc. to DIN 18181. Filling with Knauf Safeboard Filler and Uniflott, acc. to Code of Practice No. 2 (BVG) Quality standard Q1 as basic filling to be coated with plaster/..... */ Quality standard Q2 standard jointing.* Application and installation acc. to brochure ST02 Knauf Safeboard. System: **Knauf X-Ray Shielding Partition K131 Safeboard**	..... m²	..... €	..... €
.....	X-ray shielding housing of cut out for socket boxes with cladding thickness equal to the cut out Safeboard cladding, Upgrading of the opposite cladding with X-Ray Shielding Boards Safeboard and installation of board strips in full partition cavity width on the adjacent metal studs. Size of housing reaching at least 500 mm above and below opening. Application and installation acc. to brochure ST02, acc. to drawing no. K131S-SO11.	..... pcs	..... €	..... €
** Cancel not applicable items*			Sub-total	..... €

Construction

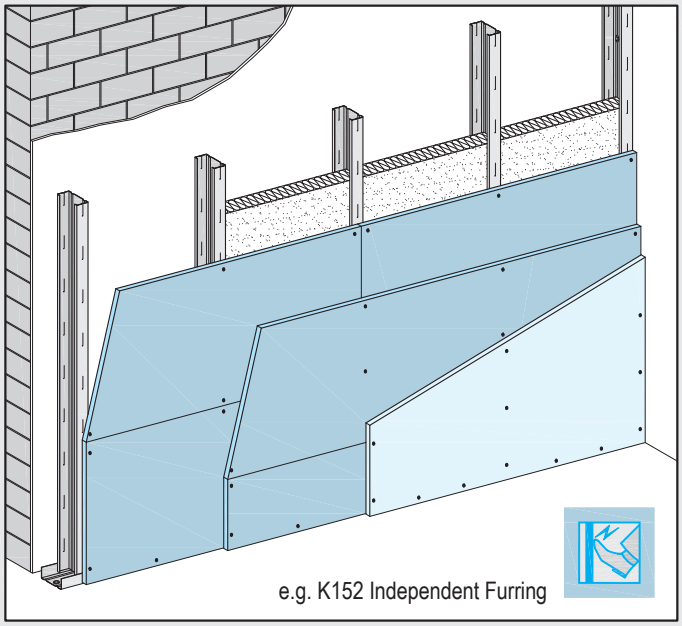
K151 / K152 Safeboard



X-Ray Shield Furring Safeboard

- Directly anchored wall lining or indepenent furring
- Sound reduction improvement $\Delta R_w \geq 17$ dB
- Sound reduction index $R_{w,R}$ 40 - 44 dB (System K152)

K151 / K152 Safeboard + Diamant



X-Ray Shield Furring Safeboard + Diamant

- Directly anchored wall lining or indepenent furring
- Sound reduction improvement $\Delta R_w \geq 17$ dB
- Sound reduction index $R_{w,R}$ 42 - 46 dB (System K152)
- **Diamant top layer**
  → Stable premium surface

X-Ray Shield Furrings

With Knauf Safeboard

With Knauf X-Ray Shield Furrings, existing walls can be upgraded for X-ray shielding. These systems are particularly cost-effective when combined with a Knauf Safeboard cladding.

The systems shown on Pages 16 to 17 are sample construction variants. The design of individual solutions for X-ray shielding can be carried out with the table of lead equivalences on Page 7.

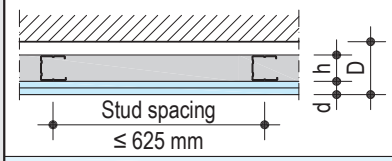
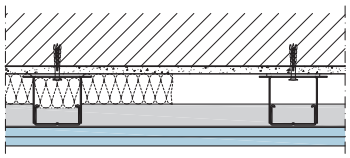
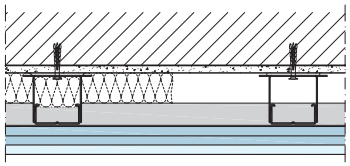
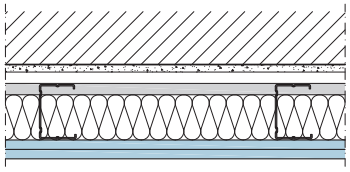
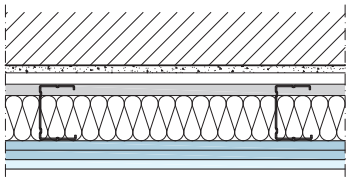
Knauf X-Ray Shield Furrings with metal stud framework are equipped with a cladding made of Knauf Safeboard X-Ray Shielding Boards according to the required lead equivalence and a top layer made of Diamant boards.

Furrings consist of a metal substructure and a one-sided single, double or triple layer cladding. The substructure is connected to the adjacent structure along the entire perimeter and in case of system K151 additionally anchored on the solid wall.
Insulation material for sound and thermal insulation as well as sanitary or electric built-ins can be installed into the metal frame construction while ensuring a continuous shielding (backings/covering boxes of penetrations or built-ins). Movement joints have to be included into the construction of the furrings. For continuous furrings, use control joints at approx. 15 m.

Proofs

- X-Ray Shielding:
  TÜV NORD Röntgentechnik,
  Technical report from 09-22-2008
- Sound insulation:
  Knauf Sound Insulation Proof L 017-01.09
- Statics:
  ABP P-1569/381/09 or Knauf dimensioning on the basis of ABP P-1569/381/09

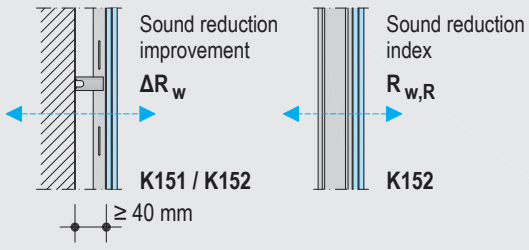
Technical data

Knauf System	Cladding	Profile	Min. thickness	Weight	Sound reduction			Premium drywalling
	type / thickness **d** mm	**h** mm	**D** mm	without insulation approx. kg/m²	Improvement [1] ΔR_w dB	Sound index [2] $R_{w,R}$ dB	Insulation layer [3] min. thickness mm	
K151 Safeboard								X-Ray Shield Wall Lining, directly anchored
■ Double layer 	Safeboard **2x 12.5**	27	≥ 52	38	**≥ 17**		≥ 40	
K151 Safeboard with Diamant								X-Ray Shield Wall Lining, directly anchored
■ Triple layer 	Safeboard **2x 12,5** + Diamant **12.5**	27	≥ 64.5	51	**≥ 17**		≥ 40	
K152 Safeboard								X-Ray Shield Furring
■ Double layer 	Safeboard **2x 12.5**	50	≥ 75	39	**≥ 17**	**40**	40	
		75	≥ 100			**42**	60	
		100	≥ 125			**44**	80	
K152 Safeboard with Diamant								X-Ray Shield Furring
■ Triple layer 	Safeboard **2x 12.5** + Diamant **12.5**	50	≥ 87.5	52	**≥ 17**	**42**	40	
		75	≥ 112.5			**44**	60	
		100	≥ 137.5			**46**	80	

Max. wall heights

Knauf Stud Metal gauge 0.6 mm	Axial stud spacing mm	K151 Safeboard m	K152 Safeboard Double layer installation zone 1 m	 2 m	K152 Safeboard Triple/multi layer installation zone 1 m	 2 m
CD 60x27	625	10				
CW 50	625		2.95		3.60	3.15
CW 75	625		4		4	
CW 100	625		4.50		5.10	

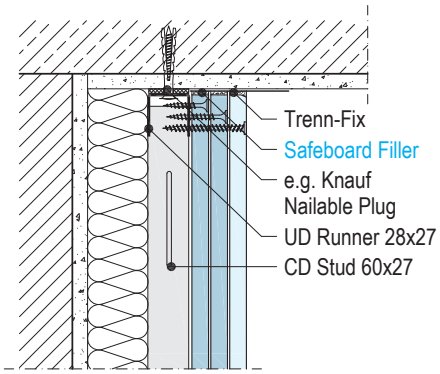
1) The improvement depends on the properties of the solid wall, example: solid wall of 160 kg/m² (solid bricks 11.5 cm with a density of 1400 kg/m³)
Note on wall linings: Use Damping Universal Bracket, depth of cavity ≥ 40 mm; for further information see W61
2) $R_{w,R}$ = calculation value without transmission via adjacent components
3) Insulation according to DIN EN 13162, length-related flow resistance acc. to DIN EN 29053: r ≥ 5 kPa·s/m²
e.g. Knauf Insulation Trennwand-Dämmrolle TI 140 T



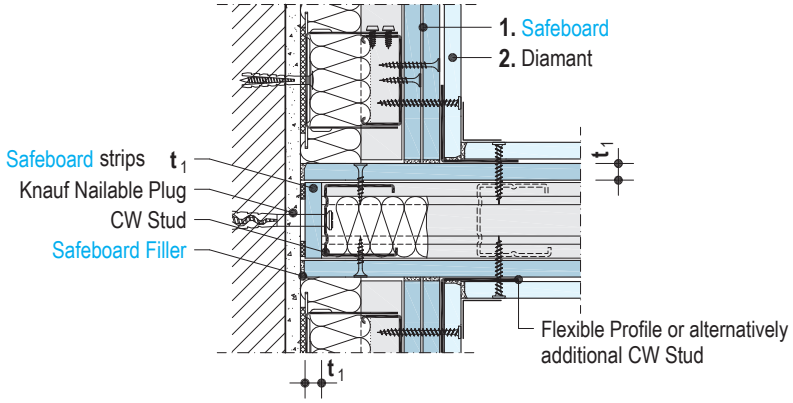
Details, scale 1:5

Example: Sample system with 2x Safeboard + 1x Diamant per partition wall

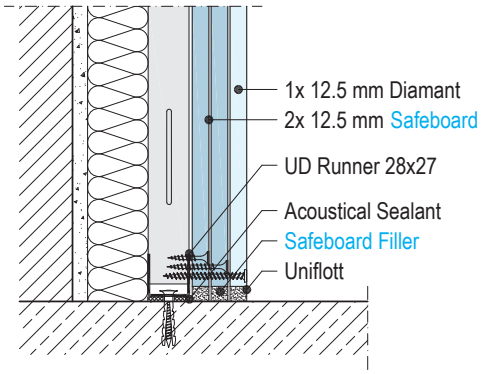
K151S-VO11 Connection to ceiling



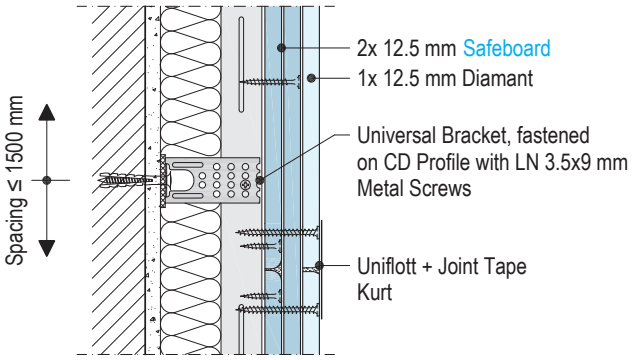
K151S-C11 Connection to X-Ray shielding partition



K151S-VU11 Connection to floor



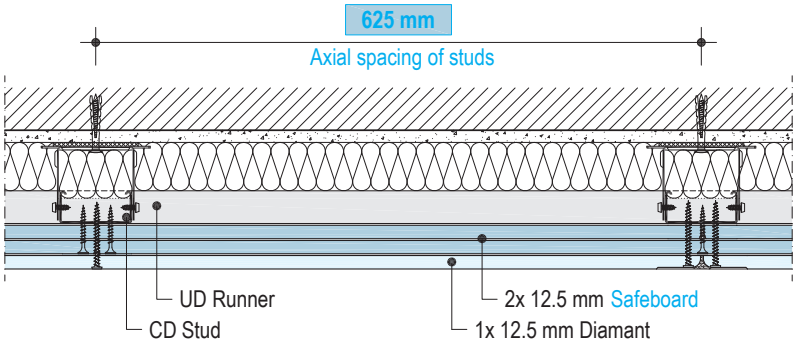
K151S-VM11 Board joint vertical section



K151 X-Ray Shield Furrings Safeboard

CD 60x27 directly anchored - triple layer cladding (sample system)

Scheme drawing



System properties

- Axial stud spacing 625 mm
- CD Channels 60x27 mm
- 1st + 2nd layer: 12.5 mm Safeboard
  3rd layer: 12.5 mm Diamant

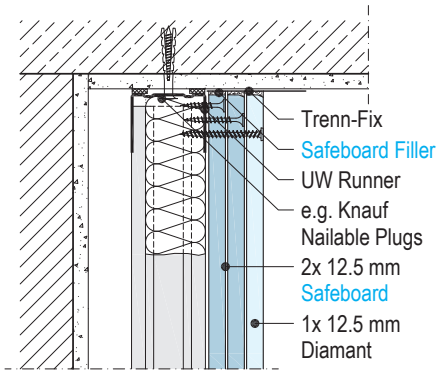
Lead equivalences for 2x Safeboard

Lead equivalence (mm Pb) **depending on the tube voltage** (kV)						
60 kV	**70** kV	**80** kV	**90** kV	**100** kV	**125** kV	**150** kV
0.9	1.2	1.5	1.4	1.4	1.0	0.8

Details, scale 1:5

Example: Sample system with 2x Safeboard + 1x Diamant per partition side

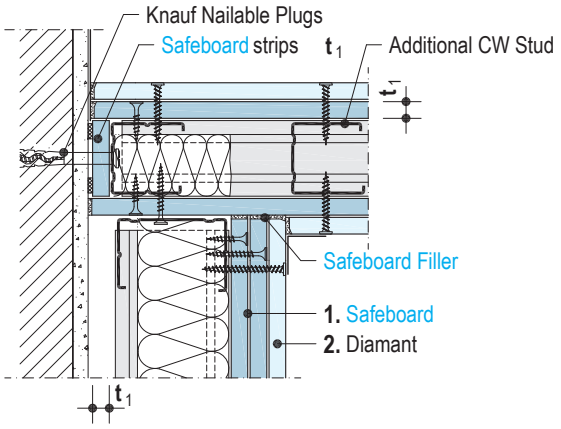
K152S-VO11 Connection to ceiling



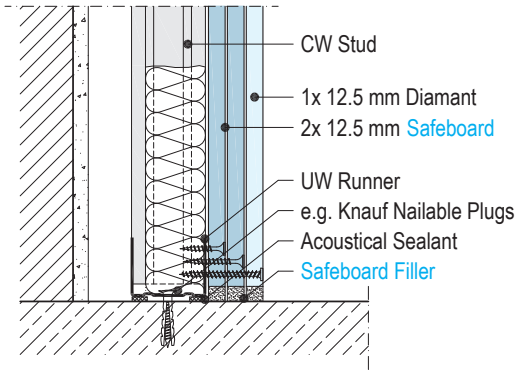
Order of application:

1. Finish continuous shielding layers of Safeboard completely
2. Apply Diamant top layer

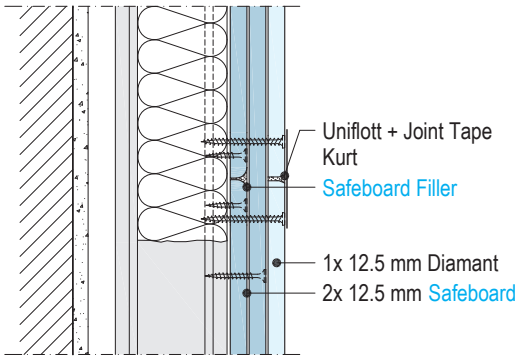
K152S-C11 Connection to X-ray shielding partition



K152S-VU11 Connection to floor



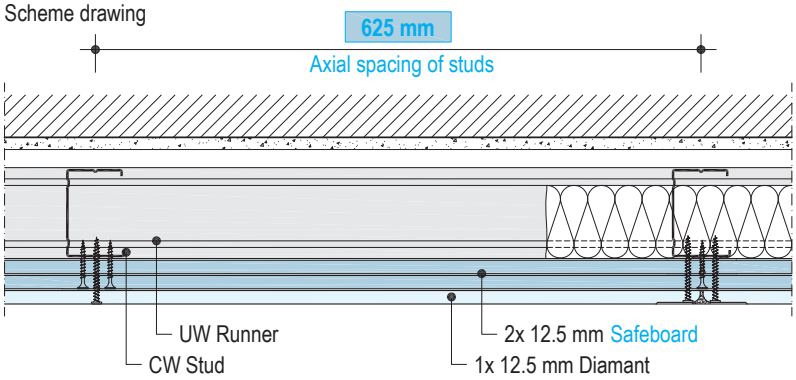
K152S-VM11 Board joint vertical section



K152 X-Ray Shield Furrings Safeboard

Independent CW studs - triple layer cladding (sample system)

Scheme drawing



System properties

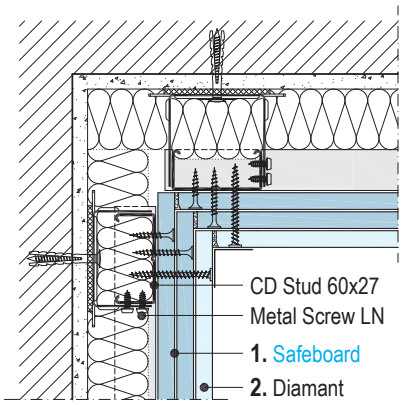
- Axial stud spacing 625 mm
- CW Studs 50/75/100
- 1st + 2nd layer: 12.5 mm Safeboard
  3rd layer: 12.5 mm Diamant

Lead equivalences for 2 x Safeboard

Lead equivalence (mm Pb) depending on the tube voltage (kV)						
60 kV	**70** kV	**80** kV	**90** kV	**100** kV	**125** kV	**150** kV
0.9	1.2	1.5	1.4	1.4	1.0	0.8

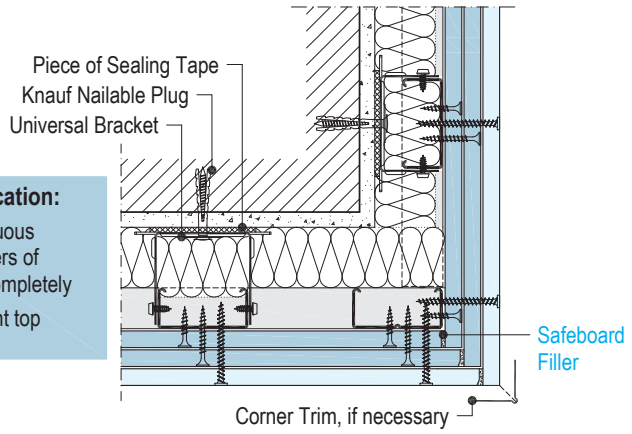
Details, scale 1:5 **Example: Sample system with 2x Safeboard + 1x Diamant per partition side**

K151S-E11 Inside corner

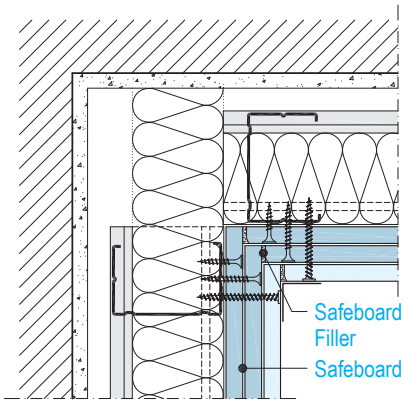


Order of application:
1. Finish continuous shielding layers of Safeboard completely
2. Apply Diamant top layer

K151S-D11 Outside corner

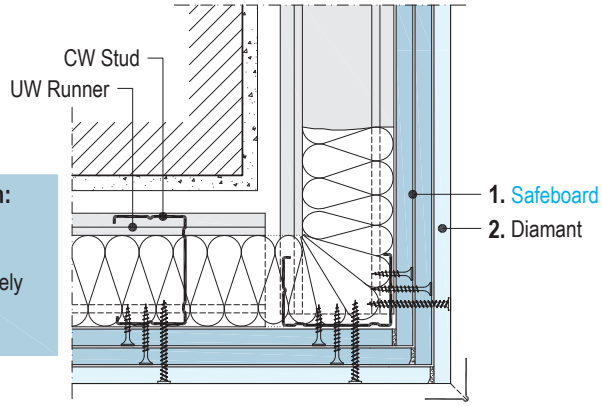


K152S-E11 Inside corner



Order of application:
1. Finish continuous shielding layers of Safeboard completely
2. Apply Diamant top layer

K152S-D11 Outside corner



K151/K152 X-Ray Shield Furrings Safeboard

Details, application

Fastening of the cladding with Knauf Diamant Screws or Knauf Diamant Screws with drill pin / Knauf Drywall Screws TN or TB, depending on the sheet metal gauge *s* in mm

Cladding	1st layer		2nd layer		3rd layer	
Board thickness 12.5 mm	s ≤ 0.7	s ≤ 2.25	s ≤ 0.7	s ≤ 2.25	s ≤ 0.7	s ≤ 2.25
1x Safeboard	TN 3.5x25 spacing: 200 mm [3]	TB 3.5x25	-		-	
1x Safeboard + 1x Diamant	TN 3.5x25 spacing: 600 mm [1]	TB 3.5x25	3.9x35 spacing: 250 mm	3.9x55 (drill pin)	-	
2x Safeboard	TN 3.5x25 spacing: 600 mm [1]	TB 3.5x25	TN 3.5x35 spacing: 200 mm [3]	TB 3.5x45	-	
2x Safeboard + 1x Diamant	TN 3.5x25 spacing: 600 mm [1]	TB 3.5x25	TN 3.5x35 spacing: 300 mm [2]	TB 3.5x45	3.9x55 spacing: 250 mm	3.9x55 (drill pin)
3x Safeboard	TN 3.5x25 spacing: 600 mm [1]	TB 3.5x25	TN 3.5x35 spacing: 300 mm [2]	TB 3.5x45	TN 3.5x55 spacing: 200 mm [3]	TB 3.5x55

Number of screws per board width and stud: [1] min. 2 [2] min. 3 [3] min. 4

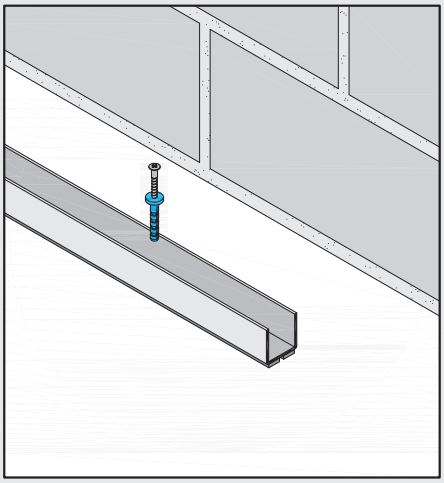
Installation of socket boxes acc. to Page 10.

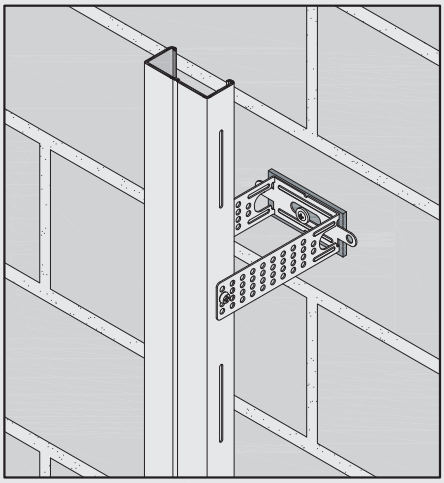
Substructure

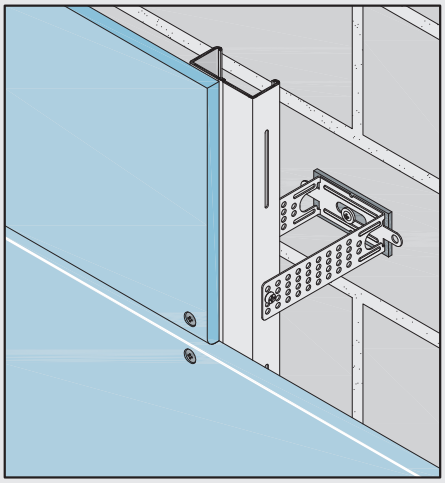
- Apply Acoustical Sealant (two strings) or Sealing Tape to rear side of perimeter profiles for the connection of flanking constructional components. For sound protection requirements, seal up carefully with acoustical sealant according to DIN 4109, Supplement 1, Chapter 5.2; porous sealant strips like Sealing Tape are usually not suitable in this case.
- K151 Safeboard: UD Profiles on floor and ceiling.
- K152 Safeboard: UW perimeter profiles at floor and ceiling, wall connections with CW Studs.
- Fasten perimeter runners with suitable anchors on the flanking structural components.

Installation

K151 X-Ray Shield Wall Lining Safeboard, directly anchored

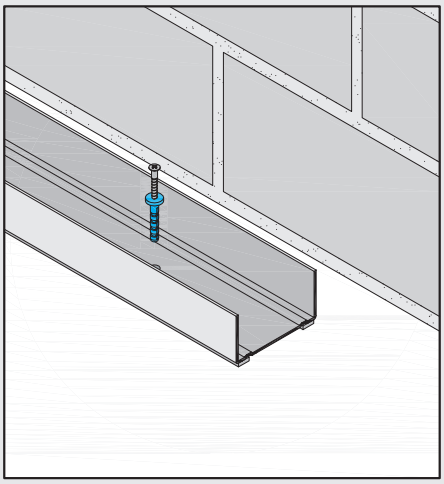


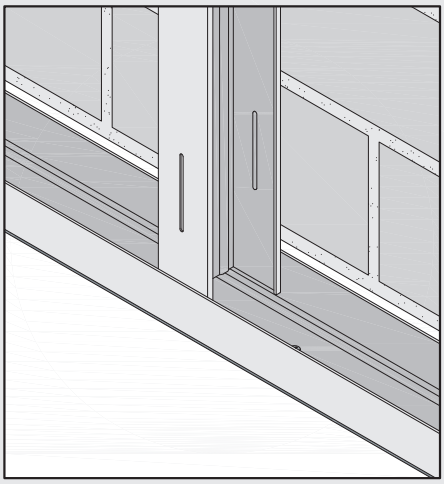


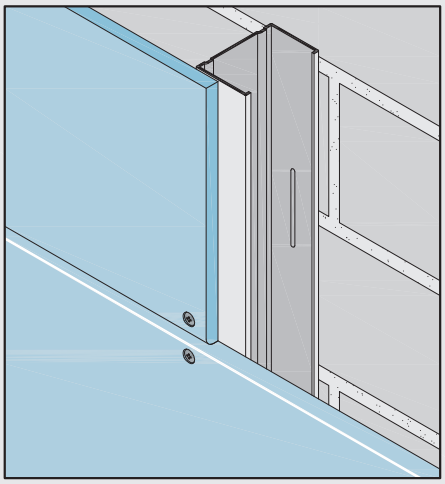


Installation

K152 X-Ray Shield Furring Safeboard, detached







► Note on safety

Wear a dust respirator (P2) when working with Knauf Safeboards, particularly while sanding and sawing (e.g. with a hole saw) as well as during the sprinkling of the filling compound.

Anchors for adjacent solid components: Knauf Nailable Plugs or Knauf Ceiling Steel Dowels/ non-solid components: anchors that are particularly suitable for the respective building material.

Fixing spacing to floor and ceiling

K151 → 1 m

K152 → see table

Wall height	Knauf Nailable Plugs	Knauf Ceiling Steel Dowels
≤ 3 m	1 m	1 m
> 3 to ≤ 6.5*) m	0.5 m	1 m

*) Observe max. wall height

Spacing of anchors at walls: 1 m, at least 3 anchors per wall connection.

- K151 Safeboard: Install cut-to-length CD studs at 625 mm stud spacing into the UD runners and align. Anchoring of the CD Profile studs on the existing wall with Universal Brackets or Damping Universal Brackets and suitable anchors (e.g. Knauf Nailable Plugs) at max. 1500 mm spacing.
  Fastening of brackets on CD Profiles with Metal Screws LN 3.5 x 9 mm.
  Use Damping Universal Brackets in order to avoid sound bridges.
- K152 Safeboard: Install cut-to-length CW Studs at the required stud spacing into the UW Runners and align.

Cladding

- Fastening of the cladding acc. to table on Page 18.
- Apply Knauf Safeboards horizontally.
  The optional Diamant top layer boards are applied vertically.
- Stagger board joints acc. to installation scheme on Page 11.
- No joints at door opening profiles.
- Start fastening of Knauf Boards at centre or corner of boards in order to avoid sagging.
- Press Knauf Boards tightly to grid while fastening.
- In order to avoid dust formation, it is recommended to break the boards (score board liner with knife and break board along the edge, cut rear side board liner).
  Rework and bevel edges with rasp.

Order of installation at connections

Provide a tight shielding at connections as well:

1. Finish the continuous x-ray shielding cladding completely first.
2. Apply optional Diamant top layer.

Filling and finishing

X-ray shielding layers Knauf Safeboard

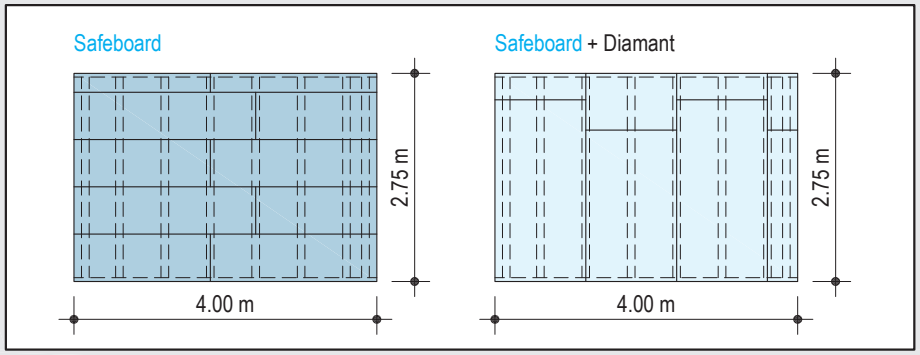
- In order to provide a tight shielding layer, completely fill all joints (board joints and connection joints) with Safeboard Filler, i.e. continuously and over the entire cladding thickness of all Safeboard cladding layers.
- Fill possible damages with Safeboard filler as well.
- See Pages 28/29 for Filler application and further information.

Top layer Diamant

- Joint filling and surface finishing acc. to Pages 28/29.

Material requirement per m² furring

Description	Unit	Quantity as average value			
		K151		K152	
		Safeboard Two layer	Safeboard + Diamant Three layer	Safeboard Two layer	Safeboard + Diamant Three layer
Substructure					
Knauf UD Profile 28x27x0.6; 3 m long	m	0.7	0.7	-	-
Knauf CD Profile 60x27; 4 m long	m	2	2	-	-
Knauf Universal Bracket for CD 60x27, 120 mm	pcs	0.7	0.7	-	-
or Knauf Sealing Tape Pieces 70/3.2 mm, 75 mm long	m	0.1	0.1	-	-
Knauf Damping Universal Bracket for CD 60x27, 120 mm (for sound insulation)	pcs	0.7	0.7	-	-
Knauf Metal Screw LN 3.5x9 mm (fastening of brackets)	pcs	1.4	1.4	-	-
or Knauf UW Runner 50x40x0.6; 4 m long or Knauf UW Runner 75x40x0.6; 4 m long Knauf UW Runner 100x40x0.6; 4 m long	m	-	-	0.7	0.7
or Knauf CW Stud 50x50x0.6 or Knauf CW Stud 75x50x0.6 Knauf CW Stud 100x50x0.6	m	-	-	2	2
or Knauf Acoustical Sealant	pcs	0.2	0.2	0.3	0.3
Knauf Sealing Tape (30/3.2 mm; 50/3.2 mm; 70/3.2 mm; 95/3.2 mm)	m	0.7	0.7	1.2	1.2
Suitable anchors					
or e.g. Knauf Nailable Plug "K" 6/35 or e.g. Knauf Nailable Plug "K" 6/50 (for plastered connection areas) e.g. Knauf Nailable Plug "L" 8/80 (for Damping Universal Bracket)					
Anchoring of Knauf perimeter runner profiles	pcs	0.9	0.9	1.6	1.6
Anchoring of the Universal Brackets / Damping Universal Brackets	pcs	0.7	0.7	-	-
Insulation layer ..... mm thick; e.g. Knauf Insulation Dämmrolle TI 140 T	m²	as req.	as req.	as req.	as req.
Cladding					
Safeboard 12.5 mm	m²	2	2	2	2
Diamant 12.5 mm	m²	-	1	-	1
Knauf Drywall Screws TN / Diamant Screws					
3.5 x 25 mm	pcs	10	10	10	10
3.5 x 35 mm	pcs	18	13	18	13
3.5 x 55 mm / 3.9 x 55 mm	pcs	-	15	-	15
Knauf X-Ray Shielding Caps for socket boxes	pcs	as req.	as req.	as req.	as req.
Filling and Finishing					
Safeboard Filler	kg	0.5	0.5	0.5	0.5
Uniflott	kg	0.13	0.25	0.13	0.25
Joint Tape Kurt (front edges)	m	0.25	0.4	0.25	0.4
Trenn-Fix; 65 mm wide, self-adhesive	m	0.9	0.9	0.9	0.9
Knauf Edge Trim 23/13; 2.75 m long	m				
Knauf Corner Trim 31/31; 2.6 m / 3 m long	m	as req.	as req.	as req.	as req.
Alux Edge Trim; 52 mm wide	m				

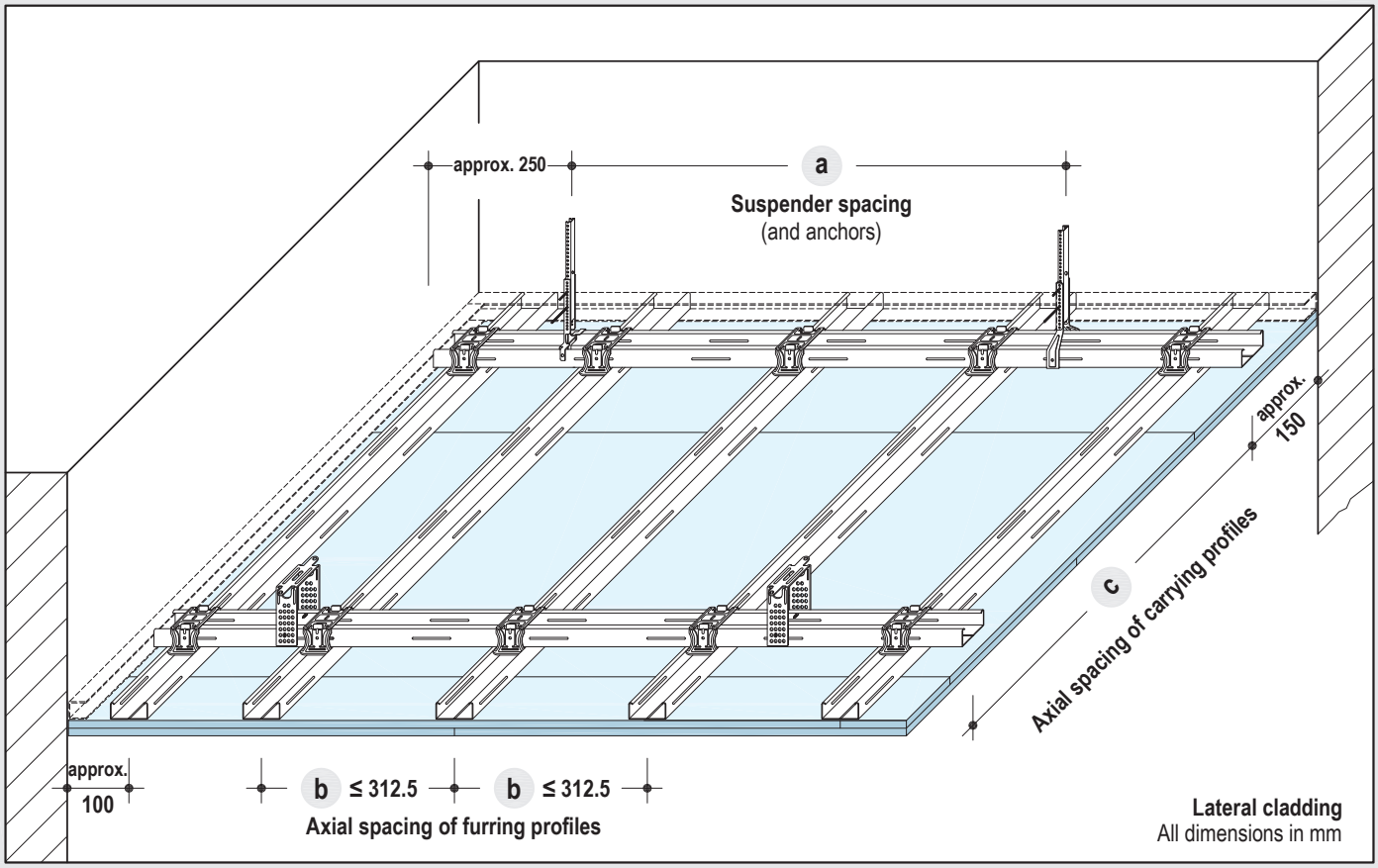


- The quantities relate to a wall area of: H = 2.75 m; L = 4.00 m; A = 11.00 m²
- Without allowance for loss and waste
- The figures are not based on specific building physical requirements
- as req. = as required

Tender specifications

Item	Description	No. of units	Unit price	Total price
.....	Wall lining, interior, height in m ....., anchored on reinforced concrete/ masonry ...../ timber/ light concrete.* X-ray shielding, lead equivalence DIN 6812 in mm Pb ..... , tube voltage in KV 60/ 70/ 80/ 90/ 100/ 125/ 150.* Rated sound reduction index DIN 4109 $R_{w,R}$ in dB ....., in conjunction with the existing wall, area weight in kg/m² ..... . * Substructure made of galvanized sheet metal profiles acc. to DIN 18182-1: stud profiles Knauf CD 60x27, anchored on the existing wall with Universal Brackets/ Damping Universal Brackets.* Insulation layer made of mineral wool acc. to DIN EN 13162, thickness 40/ 60/ 70/ 80 * mm, minimum density in kg/m³ ....., with a thermal conductivity of λ = 0.040 W/(mK),* length related flow resistance acc. to DIN EN 29053: r ≥ 5 kPa·s/m²,* Product: Knauf Insulation Trennwand-Dämmrolle TI 140 T *or equivalent**. Cladding made of gypsum boards acc. to DIN 18180: X-ray shielding layers: X-Ray Shielding Boards Knauf Safeboard, single/ double * layer, board thickness 12.5/ 2x 12.5 * mm. Top layer: Knauf Diamant, single layer, board thickness 12.5 mm.* Application acc. to DIN 18181. Filling with Knauf Safeboard Filler and Uniflott, acc. to Code of Practice No. 2 (BVG) Quality standard Q1 as basic filling to be coated with plaster/..... */ Quality standard Q2 standard jointing.* Application and installation acc. to brochure ST02 Knauf Safeboard. System: **Knauf X-Ray Shielding Wall Lining K151 Safeboard**	..... m²	..... €	..... €
.....	Independent furring acc. to DIN 4103-1, installation zone 1/ 2 *, height in m ....., thickness 75/ 87.5/ 100/ 112.5/ 125/ 137.5 * mm. X-ray shielding, lead equivalence DIN 6812 in mm Pb ..... , tube voltage in KV 60/ 70/ 80/ 90/ 100/ 125/ 150.* Rated sound reduction index DIN 4109 $R_{w,R}$ in dB ....., in conjunction with the existing wall, area weight in kg/m² ..... . * Substructure made of galvanized sheet metal profiles acc. to DIN 18182-1: Knauf CW 50/ 75/ 100 *, as single metal stud framework with entirely anchored connections. Insulation layer made of mineral wool acc. to DIN EN 13162, thickness 40/ 60/ 70/ 80 * mm, minimum density in kg/m³ ....., with a thermal conductivity of λ = 0.040 W/(mK),* length related flow resistance acc. to DIN EN 29053: r ≥ 5 kPa·s/m²,* Product: Knauf Insulation Trennwand-Dämmrolle TI 140 T *or equivalent**. Cladding made of gypsum boards acc. to DIN 18180: X-ray shielding layers: X-Ray Shielding Boards Knauf Safeboard, single/ double * layer, board thickness 12.5/ 2x 12.5 * mm. Top layer: Knauf Diamant, single layer, board thickness 12.5 mm.* Application acc. to DIN 18181. Filling with Knauf Safeboard Filler and Uniflott, acc. to Code of Practice No. 2 (BVG) Quality standard Q1 as basic filling to be coated with plaster/..... */ Quality standard Q2 standard jointing.* Application and installation acc. to brochure ST02 Knauf Safeboard. System: **Knauf X-Ray Shield Furring K152 Safeboard**	..... m²	..... €	..... €
.....	X-ray shielding caps for 1/ 2/ 3 * socket boxes. Product: **Knauf X-Ray Shielding Caps**	..... pcs	..... €	..... €
** Cancel not applicable items*			Sub-total	..... €

► *See also www.knauf.de*



X-Ray Shield Ceilings

With Knauf Safeboard

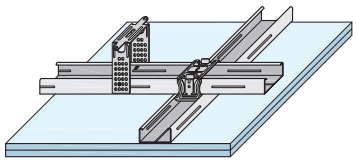
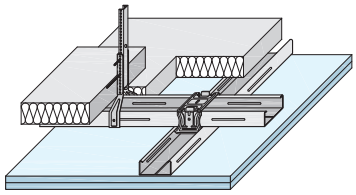
Knauf X-Ray Shield ceilings as suspended ceilings provide X-ray shielding for ceilings.
With a cladding made of Knauf Safeboard X-Ray Shielding Boards, such constructions are particularly cost-effective and can even fulfil requirements for fire protection.

The system shown on Page 24 is a sample construction variant. The design of individual solutions for X-ray shielding can be done with the table of lead equivalences on Page 7.

Knauf X-Ray Shield Ceilings with metal substructure as suspended ceilings are anchored on the basic ceiling with Universal Brackets or Nonius Suspensions and are equipped with a single, double or triple layer Safeboard cladding acc. to the required lead equivalence.

Insulation layers for fire protection or sound insulation and thermal insulation as well as installations that are anchored on the basic wall can be installed in the ceiling plenum.
Movement joints have to be transferred into the construction of the suspended ceilings. Use control joints in the case of ceiling areas over approx. 15 m length, or for narrow ceiling spaces caused by a break of a wall.

Technical data

Subceilings that are independently fire protection rated Requirements on the basic ceiling for fire protection: **From below** No fire protection requirements on basic ceiling **From above** (plenum) The basic ceiling has to have the same fire protection rating as the subceiling	Fire resistance class for fire exposure From below	From above	Cladding (Lateral application) Type / thickness mm	Furring channel Max. axial spacing (b) mm	Insulation required for fire protection Min. thickness mm	Min. density kg/m³
K112 Safeboard						X-Ray Shielding Ceiling
	**F30**		Safeboard **2x 12.5**	312.5	-	-
	**F30**	**F30**	Safeboard **2x 12.5**	312.5	Mineral wool (S) 40 (60) + Mineral wool (S) 40 (60) 150 mm wide on carrying channels	40 (30) 40 (30)

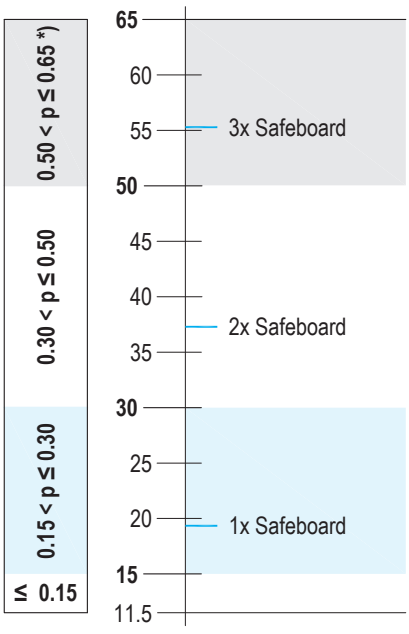
(S) Mineral wool insulation acc. to DIN EN 13162, building material class A, melting point ≥ 1000 °C to DIN 4102-17, e.g. Knauf Insulation Feuerschutz-Dämmplatte DPF-40 or DPF-30

Note: For fire resistance from below and from above in conjunction with basis ceilings of construction types I-III (solid ceilings) and IV (wood joist ceilings), refer to the Knauf brochure BS1 "Brandschutz mit Knauf", while observing the max. furring channel spacing of 312.5 mm.

Proofs

- X-Ray Shielding: TÜV NORD Röntgentechnik , Technical report from 09-22-2008
- Fire resistance: ABP P-3400/4965

Weight of the X-Ray Shielding Ceiling



*) Design rating for ceilings ≥ 0.50 kN/m² as well as to DIN 18168

Dimensioning of the substructure

1. Determination of the ceiling weight

Read off ceiling weight acc. to the chosen number of safeboard layers in kg/m².

2. Dimensioning the substructure

The required spacings of the substrucure components are stated in the right table depending on the load class / area load.

Note

Maximum additional load from insulation layers: 0.05 kN/m² (= 5 kg/m²)

Max. substructure spacings in mm

Carrying channel axial spacing (c)	Spacing of suspenders (a) Load class kN/m² ≤ 0.30	≤ 0.50	≤ 0.65
without fire resistance / fire resistance from below			
500	950	800	750
700	850	700	650
1000	750		
fire resistance from above/from above and from below			
600	600	600	600

(b) axial spacing of furring channels ≤ 312.5 mm

Suspenders Load bearing capacity class 0.40 kN

- Universal Bracket for CD 60x27
- Damping Universal Bracket for CD 60x27
- Nonius Stirrup for CD 60x27 + Nonius Top
- Nonius Hanger Bottom + Nonius Top

Channel connections carrying / furring channel

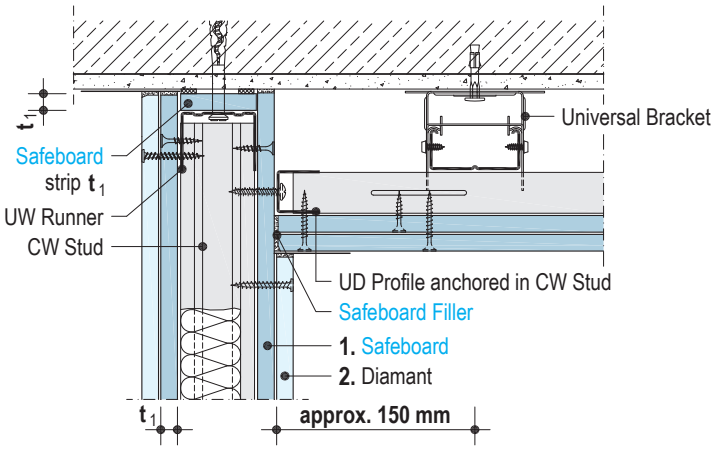
- Intersection Connector for CD 60x27
- Ankerwinkel Clip for CD 60x27

Screw connect Nonius Hanger Bottom and CD Channels with Metal Screws LN 3.5x9 mm if the ceiling weight exceeds 0.40 kN/m² or in case of fire protection requirements.

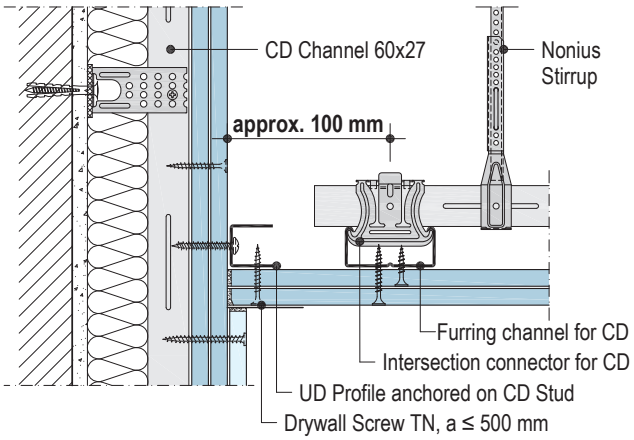
Details, scale 1:5

Example: Sample system with 2x Safeboard

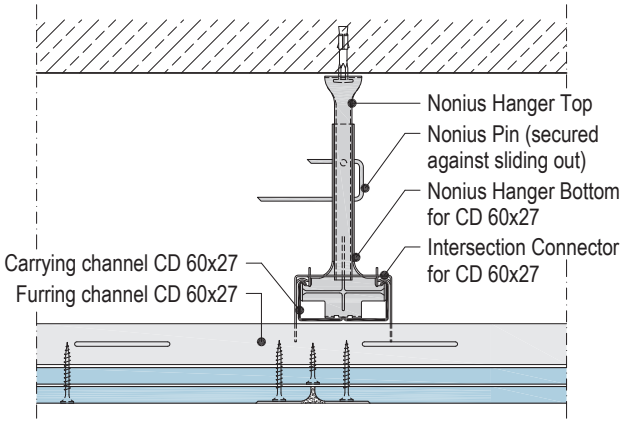
K112S-A1 Connection to X-Ray Shielding Partition



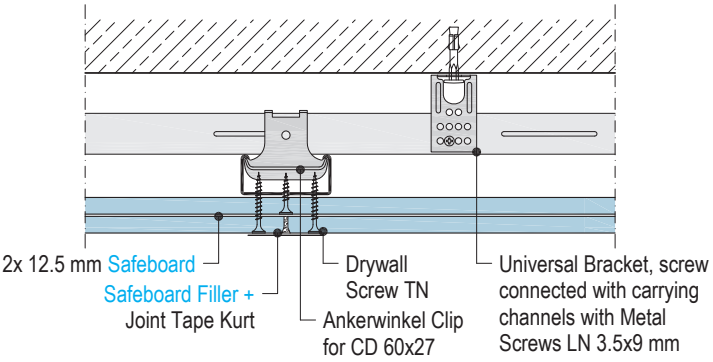
K112S-D1 Connection to X-Ray Shielding Wall Lining



K112S-B1 Long edge joint

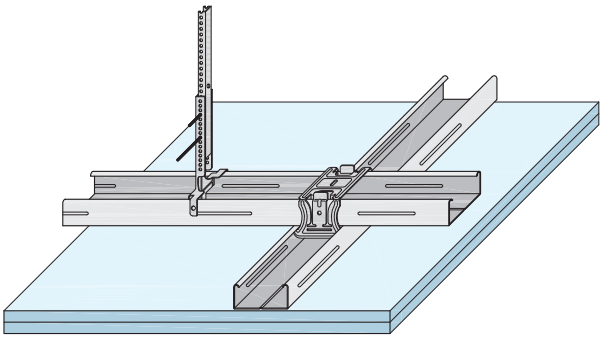


K112S-C1 Front edge joint



K112 X-Ray Shield Ceilings Safeboard

Metal grid CD 60x27 - double layer cladding (sample system)



System properties

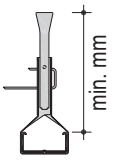
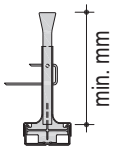
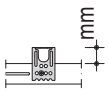
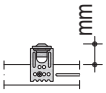
- Substructure with carrying channels and furring channels
- CD Channels 60x27 mm
- 2 layers 12.5 mm Safeboard

Lead equivalences for 2x Safeboard

Lead equivalence (mm Pb) depending on the tube voltage (kV)						
60 kV	**70** kV	**80** kV	**90** kV	**100** kV	**125** kV	**150** kV
0.9	1.2	1.5	1.4	1.4	1.0	0.8

Construction height

Height of construction = sum of suspension height, height of substructure and cladding thickness

Suspension Load capacity class 0.40 kN				**Substructure**		**Cladding**
with Nonius Top  Nonius Stirrup	 Nonius Hanger Bottom	 Universal Bracket	 Damping Universal Bracket	 Channel w x h	Total height mm	**Safeboard** mm
130	**130**	**15 to 180**	**15 to 190**	60x27 + 60x27	**54**	2x 12.5

Fastening of the cladding with Knauf Drywall Screws TN, sheet metal gauge s ≤ 0.7 mm			
Cladding Board thickness 12.5 mm	**1st layer**	**2nd layer**	**3rd layer**
1x Safeboard	TN 3.5x25 spacing: 150 mm [2]	-	-
2x Safeboard	TN 3.5x25 spacing: 300 mm [1]	TN 3.5x35 spacing: 150 mm [2]	-
3x Safeboard	TN 3.5x25 spacing: 300 mm [1]	TN 3.5x35 spacing: 300 mm [1]	TN 3.5x55 spacing: 150 mm [2]

Number of screws per board width and furring channel: [1] min. 3 [2] min. 5

Calculation example construction height

■ Nonius Hanger	130 mm
■ Carrying and furring channel	54 mm
■ Cladding (2x 12.5 mm Safeboard)	25 mm
Minimum construction height of suspended ceiling	**209 mm**

► Note on safety

Wear a dust respirator (P2) when working with Knauf Safeboards, particularly while sanding and sawing (e.g. with a hole saw) as well as during the sprinkling of the filling compound.

Substructure

Non-supporting wall connection (see also Knauf Technical Data Sheet D11) with UD Profile 28/27 as installation aid and in case of fire protection requirements.

In case of sound protection requirements, seal up carefully with Acoustical Sealant according to DIN 4109, supplement 1, chapter 5.2; porous sealant strips like Sealing Tape are usually not suitable in this case.

Anchoring spacing of the UD Profile perimeter runner ≤ 1 m.

Suspended with

a) Universal Bracket or Nonius Suspension:

Anchoring on basic ceilings made of

- wood: e.g. Knauf Flat Head Screw FN 5.1 x 35 mm (used and applied in accordance with National Technical Approval no. Z-9.1-251) on wood joists, see also Knauf Technical Data Sheet D15
- reinforced concrete: Knauf Ceiling Steel Dowel (used and applied in accordance with ETA-07/0049),
- other building materials: anchors that are suitable and approved or standardized for the respective material.

b) Damping Universal Bracket:

Anchoring on basic ceilings made of

- wood: e.g. Knauf Multi-purpose Screw FN 4.3 x 65 mm (used and applied in accordance with National Technical Approval no. Z-9.1-251) on wood joists, see also Knauf Technical Data Sheet D15
- other building materials: anchors that are suitable and approved or standardized for the respective material.

Connect carrying channels with suspenders and align them in the required suspension height.

Channel connections: Connect CD carrying and furring channels with Intersection Connectors or Ankerwinkel Clips. Spacings of suspenders and channels acc. to Page 23.

Cladding

- Fastening of the cladding acc. to table above.
- Apply Knauf Safeboards laterally to the furring channels, place front edge joints on the furring channels.
- Stagger front edge joints of adjoining cladding rows and between board layers by at least one channel spacing.
- Stagger long edge joints between board layers by half a board width in case of multi-layer cladding.
- Start fastening of Knauf Boards at centre or corner of boards in order to avoid sagging.
- Press Knauf Boards tightly to grid while fastening.
- In order to avoid dust formation, it is recommended to break the boards (score board liner with knife and break board along the edge, cut rear side board liner).
  Rework and bevel edges with rasp.

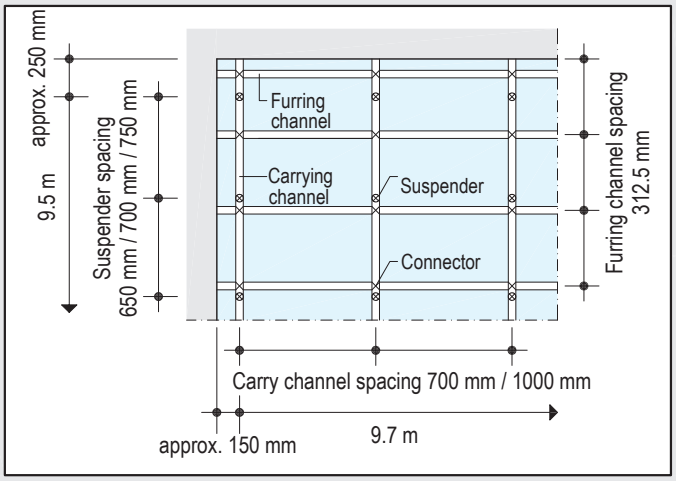
Filling and finishing

- In order to provide a tight shielding layer, fill all joints (board joints and connection joints) completely with Safeboard Filler, i.e. continuously and over the entire cladding thickness of all Safeboard cladding layers.
- Fill possible damage with Safeboard filler as well.
- See Pages 28/29 for filler application, finishing and further information.

► *See also D11 Knauf Board Ceilings*
D15 Knauf Holzbalkendecken-Systeme

Material requirement per m² furring

Description		Unit	Quantity as average value **K112** Safeboard 1	**K112** Safeboard 2	**K112** Safeboard 3
Connection to wall (as installation aid)					
Knauf UD Profile 28x27x0.6; 3 m long		m	0.4	0.4	0.4
Anchor suitable for the respective substrate e.g. Knauf Ceiling Steel Dowel		pcs	0.4	0.4	0.4
Substructure					
	Approved anchor e.g. Knauf Ceiling Steel Dowel	pcs	1.5	2.3	2.4
or	Knauf Universal Bracket for CD 60x27	pcs	1.5	2.3	2.4
	Knauf Damping Universal Bracket for CD 60x27 (sound insulation)	pcs	1.5	2.3	2.4
	Knauf Metal Screws 2x LN 3.5x9 mm (screw connection with CD Channel)	pcs	3	4.6	4.8
or	Knauf Nonius Hanger Top	pcs	1.5	2.3	2.4
	Knauf Nonius Pin	pcs	1.5	2.3	2.4
	Knauf Nonius Hanger Bottom	pcs	1.5	2.3	2.4
	Knauf Metal Screws 2x LN 3.5x9 mm (screw connection with CD Channel)	pcs	-	4.6	4.8
or	Knauf Nonius Stirrup for CD 60x27	pcs	1.5	2.3	2.4
Knauf CD Channels 60x27x0.6; 4 m long (carrying and furring channels)		m	4.4	4.8	4.8
Knauf Multi Connector (longitudinal connection of CD Channel)		pcs	0.9	1	1
or	Knauf Intersection Connector for CD 60x27	pcs	3.6	5	5
	2x Knauf Ankerwinkel Clips for CD 60x27	pcs	7.2	10	10
Insulation layer .... mm thick; e.g. Knauf Insulation Feuerschutz-Dämmplatte DPF-40 or DPF-30		m²	as req.	as req.	as req.
Cladding					
Safeboard 12.5 mm		m²	1	2	3
Knauf Drywall Screws TN					
3.5 x 25 mm		pcs	30	19	19
3.5 x 35 mm		pcs	-	30	19
3.5 x 55 mm		pcs	-	-	30
Filling and Finishing					
Safeboard Filler		kg	0.3	0.6	0.9
Uniflott		kg	0.15	0.15	0.15
Joint Tape Kurt (front edges)		m	0.35	0.35	0.35
Trenn-Fix; 65 mm wide, self-adhesive		m	0.4	0.4	0.4



Calculation of material requirement of selected examples

1	12.5 mm Safeboard	
≤ 0.30 *)	Hanger: 750 mm; carrying channel:1000 mm; furring channel: 312.5 mm	
2	2x 12.5 mm Safeboard	
≤ 0.50 *)	Hanger: 700 mm; carrying channel: 700 mm; furring channel: 312.5 mm	
3	3x 12.5 mm Safeboard	
≤ 0.65 *)	Hanger: 650 mm; carrying channel: 700 mm; furring channel: 312.5 mm	

*) Area load kN/m²

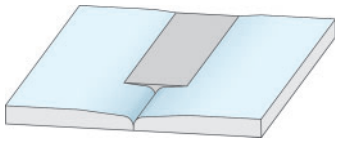
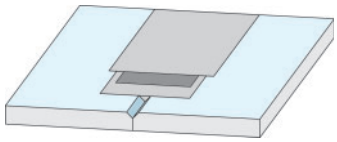
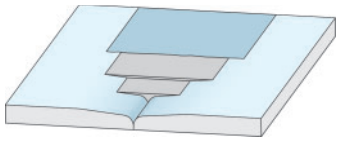
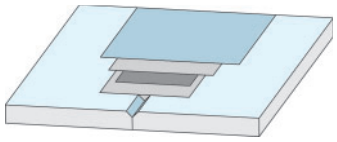
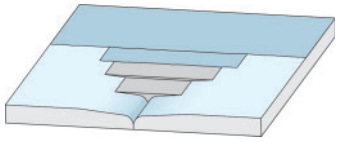
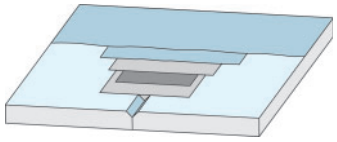
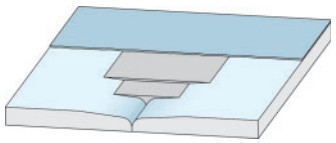
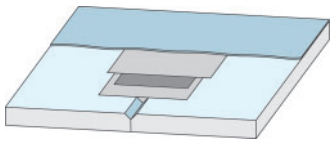
- Quantities relate to ceiling area of: 10 m x 10 m = 100 m²
- Without allowance for loss and waste
- The figures are not based on specific building physical requirements
- as req. = as required
- *Not provided by Knauf = Italics*

Tender specifications

Item	Description	No. of units	Unit price	Total price
.....	Suspended ceiling acc. to DIN 18168-1, installation height in m ....., suspension height in cm ..... . X-ray shielding, lead equivalence DIN 6812 in mm Pb ..... , tube voltage in KV 60/ 70/ 80/ 90/ 100/ 125/ 150.* Fire resistance class DIN 4102-2: F30, for the ceiling independently resistant to fire from below to protect the basic ceiling and the plenum, */ for the ceiling independently resistant to fire from the plenum to protect the room below the ceiling, */ for the ceiling independently resistant to fire from the plenum and from below to protect the room below the ceiling, the basic ceiling and the plenum.* Anchored on reinforced concrete/ wood joists, axial spacing in cm ...../ steel profiles, profile type ....., axial spacing in cm .....* Substructure made of galvanized sheet metal channels CD 60x27 acc. to DIN 18182-1, as metal grid consisting of carrying channels and furring channels, suspended with Universal Brackets/ Damping Universal Brackets/ Nonius Suspension *, anchored with anchors approved by a Technical Approval. Insulation layer made of mineral wool acc. to DIN EN 13162 thickness 40 mm, min. density 40 kg/ m³, building material class A, melting point ≥ 1000 °C (1832 °F), applied on the entire ceiling area upon the furring channels and 150 mm wide strips on the carrying channels. Product: Knauf Insulation Feuerschutzplatte DPF-40 *or equivalent.** Cladding made of gypsum boards acc. to DIN 18180: X-Ray Shielding Boards Knauf Safeboard, single/ double/ triple layer *, board thickness 12.5/ 2x 12.5/ 3x 12.5 * mm, application acc. to DIN 18181. Filling with Knauf Safeboard Filler and Uniflott, acc. to Code of Practice No. 2 (BVG) Quality standard Q2 standard jointing. Application and installation acc. to brochure ST02 Knauf Safeboard. System: **Knauf X-Ray Shield Ceiling K112 Safeboard**	..... m²	..... €	..... €
* *Cancel not applicable items*			Sub-total	..... €

► *See also www.knauf.de*

Quality standards

HRAK – half-rounded tapered long edge/ HRK – half-rounded long edge Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS		Sharp cut edge and bevelled cut edge (front and cut edges) / mixed joints all Knauf filling compounds	
Q1* Technically required filling (minimum)			
Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS		Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS **+ Joint Tape Kurt ****	
Q2* Standard finishing			
Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS Finish-Pastös		Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS **+ Joint Tape Kurt **** Finish-Pastös	
Q3* Top class finishing			
Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS Readygips		Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS **+ Joint Tape Kurt **** Readygips	
Q4* Premium finishing			
Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS Readygips / Putzgrund and Multi-Finish or Multi-Finish M		Uniflott / Safeboard Filler / Uniflott impregnated / TRIAS **+ Joint Tape Kurt **** Readygips / Putzgrund and Multi-Finish or Multi-Finish M	

* Quality standards acc. to Code of Practice no. 2 “Verspachtelung von Gipsplatten – Oberflächengüten” of the BVG, Industriegruppe Gipsplatten e.V., defining 4 quality standards.

** Recommendation:
Always apply Knauf Joint Tape Kurt when filling front or cut edge joints as well as mixed joints (e.g. HRAK + cut edge) of visible cladding layers.

Filling

of gypsum boards

Surface quality

- Fill and finish the gypsum boards for the specified quality standard Q1 to Q4.

Filling of Safeboard joints

- Bevel front edges and cut edges, e.g. with Knauf Beveller.
- Completely fill **all** joints (board joints and connections) with Safeboard Filler, i.e. continuously and over the entire cladding thickness of **all** Safeboard cladding layers.
- For visible layers and surface requirement Q2, create a smooth and levelled transition to the board surface in the second run with Knauf Uniflott.
- Fill all visible screw heads.
- Slightly sand visible surface after drying of filling compound, if necessary.

Filling of Diamant top layer joints

- Fill screw heads.
- Slightly sand visible surface after drying of filling compound, if necessary.

Filling of connection joints

- Fully fill joints of wall connections to floor with filler as well (all board layers). Use Safeboard filler for Safeboard layers.
- Apply Trenn-Fix or Joint Tape Kurt when filling joints to adjacent drywall constructions (ceiling or partition), depending on the conditions and requirements for crack safety.
- Apply Trenn-Fix when filling joints to adjacent solid construction components.
- Notes on the Code of Practice no. 3 “Gipsplattenkonstruktionen - Fugen und Anschlüsse” of the BVG (IGG) are to be observed.

Filling compounds

- Safeboard Filler: Hand filling of Safeboard X-Ray Shielding Boards
- Uniflott: Hand filling of Diamant top layers
- TRIAS: Hand filling of Diamant top layers
  Very low shrinkage, easy mixing, very smooth application and easy to sand, with high strength and suitable for areas of high humidity, reduced suction for surfaces with uniform appearance.

Finishing compound to create the required surface quality standard:

- Readygips: for Q3 and Q4
- Multi-Finish / Multi-Finish M: for Q4 in conjunction with Putzgrund primer

1st operation with Safeboard Filler

2nd operation with Uniflott

Application

Uniflott / Uniflott impregnated / TRIAS

- The filling process consists of at least 2 operations, depending on the required surface quality. Fill joints with Safeboard Filler; remove protruding filler (bulge) after 50 minutes. Create a smooth and levelled transition to the board surface in a second run with Knauf Uniflott using a Trowel or Wide Spatula for surface quality Q2 on visible top layers.

Safeboard Filler

- The application of Safeboard filler is equal to the Uniflott application. However, the second operation of visible board layers with quality standard Q2 is done with Uniflott.
  See also Technical Data Sheet of Safeboard Filler K467S.

Do not use hardening material. Remove slight bumps directly after setting. Clean tools and utensils with water after use. Sand with Knauf Hand Rasp / Rasp with Handle and Rasp Mesh after drying.

Application temperature/climate

- Fill and cover joints after the boards have been allowed to rest in the given humidity and temperature zones, and no more longitudinal changes can be expected, i.e. expansion or contraction.
- Do not fill joints at air and surface temperatures below 10 °C (50 °F).
- In case of mastic asphalt, gypsum and cement screed, fill joints after screed has been applied.
- Notes of the Code of Practice no. 1 “Baustellenbedingungen” of the BVG (IGG) are to be observed.

► Did you know?

Filling the joints of all concealed board layers with multi-layer cladding is necessary to preserve the required properties for X-ray shielding, fire protection, sound insulation and stability.

Board joints of concealed board layers

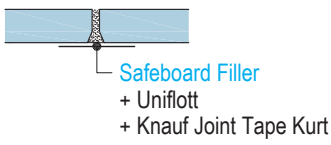
Long edge joint - HRK

Front edge joint - SK

Board joints of top board layers

Long edge joint - HRK

Front edge joint - SK



Coatings and linings

On gypsum boards

Pre-treatment

The surface should be dust-free before applying paints or coatings.

Pre-treat and prime gypsum board surfaces before the application of coatings and linings (wallpapers) in accordance with Code of Practice no. 6 of the BVG (IGG) “Vorbehandlung von Trockenbauflächen aus Gipsplatten zur weitergehenden Oberflächenbeschichtung bzw. -bekleidung”.

Ensure that the primer and the coating or paint or lining are compatible.

In order to settle the different suction properties of the filled areas and the paper surface, primers such as Knauf Tiefengrund / Spezialgrund / Putzgrund are suitable.

Where a wallpaper lining is used, a primer that facilitates easier removal of wallpaper for redecoration is recommended.

A sealing primer of Knauf Flächendicht is required for covering splash water areas with tiles.

Suitable coatings and linings

The following coatings and linings can be applied to Knauf Boards:

- Wallpaper:
  Paper, textile, and synthetic wallpaper.
  Use only adhesives made of methyl cellulose according to Code of Practice no. 16 “Technische Richtlinien für Tapezier- und Klebearbeiten” released by Bundesausschuss Farbe und Sachwertschutz.
- Ceramic tiles on partitions:
  Minimum cladding thickness with Knauf Boards
  - for stud spacing of ≤ 625 mm:
    2x 12.5 Knauf Boards

- Plasters:
  Knauf Top Coats (e.g. Noblo, Rolls, Diamant Spray Render) or skim coating (e.g. Readygips, Multi-Finish). Plastering only in conjunction with filling with Knauf Joint Tape Kurt.
- Paint coats:
  Knauf Dispersion Paints (e.g. Intol E.L.F., Malerweiss E.L.F.), multicoloured (rainbow) emulsion, Knauf silicate-based emulsion paints and Knauf Diamantweiss E.L.F. as a hybrid interior paint in conjunction with a suitable primer.

Not suitable:

- Alkaline coats such as lime, water glass colours and silicate-based paints.

After wallpapering with paper or fibre glass wallpapers and the application of resin / cellulose plasters, quick drying must be ensured through adequate airing.

Notes

Gypsum board surfaces that have constantly been exposed to light without any protection can cause yellowing after coating. Therefore, a trial coat is recommended that will extend across several boards including all joints. Yellowing can, however, be successfully avoided only by using a special primer, such as Aton Sperrgrund for top coats or Atonol for paint coats.

Fire protection: Common paints, coats or vapour barriers up to approx. 0.5 mm thickness and linings (with the exception of sheet steel) do not affect the fire resistance rating of Knauf Systems.

► Did you know?

Knauf Interior Paints consist of environmentally friendly constituents and bear the E.L.F. quality seal, and are certified by TÜV Rheinland.

- low emission
- solvent-free
- free of fogging active substances
- odourless

► *see also Technical Data Sheets of Knauf Plaster and Façade Systems*

Delivery via professional building material distributors only, in accordance with our current business, delivery and payment terms.

* A rate of 0.39 € per minute will be charged for calls from within the German landline network. Callers whose phone numbers are not registered in the address database of Knauf Gips KG, i.e. private builders or non-patrons, will be charged a rate of 1.69 € per minute. Calls from mobile phones will be charged acc. to net provider and call rate.

** 0.14 € per minute

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AQUAPANEL® Cement Boards, Perlites

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