Seitz + Kerler GmbH + Co. KG

The complete radiation protection program for research, medicine and industry

Aggregates for heavy and radiation shielding concrete	Barite grains, iron ore grains, heavy metal aggregates, aggregates containing boron or water of crystallisation
Bricks for radiation shielding walls	Röbalith bricks of different bulk densities for the relevant application
Special grains on the basis of barite for	Röbalith barium plaster, radiation protection floors, frame compound fillers, etc.
Ready-to-apply barite plaster	SEILO radiation protection barium finish plaster
Radiation protection dry interior work systems for wall and ceiling surfaces	Plaster-board lead slabs, special constructions of sandwich design to customer requirements
Special constructions	Shaped bricks for ceilings, lead bricks, rolled lead in all versions, etc.
Radiation protection gates / steel structure	Pivot and sliding gates for manual or electromotive actuation
Radiation protection gates / timber structure	Customised pivot and sliding gates
Radiation protection windows	Versions with timber or steel frames
Radiation protection safe systems and service hatches	Wall safes, attachment safes for manual or electrical operation
Nuclear medicine working table systems	Stainless steel and lead structures with moveable chest shields, etc.
Transport containers, mobile shielding structures etc.	In all designs and sizes
Radiation protection curtains	Strip, telescopic and vertical blind designs
Radiation protection cabins	Turnkey designs of different material combinations

If required, we can work out complete radiation protection solutions, assume responsibility for supervising the work on site and develop specific formulas and processing procedures.

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SEILO barite concrete

In general, barite concrete is heavy concrete with a volume weight of 3.2 g/m^3 made of barite grains and cement. However, barite won in our mines and thoroughly conditioned allows the production of a barite concrete with a greater volume weight. Moreover, since our high-quality barite is free from sulphidic ores and other cement contaminants, we can achieve the same concrete quality as with usual concrete aggregates. It ensures full homogeneity and hence safe radiation protection.

If required, concrete aggregates of different compositions can also be used. The following is available:
Mineral aggregates with a bulk density ranging from 4.0 to 4.9 g/cm^3
Metal aggregates with a bulk density ranging from 6.0 to 7.5 g/cm^3

Our barite mixtures comply with the regulations for the execution of structures made of reinforced steel according to DIN 1045.

We supply:

Special barite grains for radiation protection concretes of different volume weights, e.g. 3.2 – 3.5 g/cm^3. These volume weights can be safely achieved with the relevant special barite grains and common compacting procedures. High-density concretes with an even higher volume weight can be produced by adding further weight-increasing materials (for example, iron). On the other hand, by adding barite grains to normal concrete aggregates, we can produce concretes of individually required volume weights ranging between 2.2 (normal concrete) and 3.2. Our special barite grains consist of individual grain size fractions of **0 – 4 / 4 – 16 or 0 – 16 mm** grain diameter.

Processing:

On the basis of the required volume weight and the requested concrete quality we can calculate free of charge the exact composition of the mixture, including the water-cement ratio.
Our special barite grains for the production of high-density concrete can be processed like commonly used aggregates. However, the mixing ratios of grains and cement according to percentage of weight and water-cement factors must be exactly adhered to. Barite grains are not susceptible to humidity and climatic effects. However, their inherent natural humidity must be taken into account when calculating the amount of water to be added.
Moreover, intensive mixing, whenever possible in a pugmill mixer, is a precondition for a uniform protection effect of the concrete. Plasticizers, which must not contain any air-entraining agents, can be added as usual.
In general, barite grains are delivered as loose supply in the individual grain sizes. They have to be stored separately and protected against contamination until they are processed.

For the formula, see annex.

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SEILO radiation protection floors

Also concrete floors often require additional shielding. Here, a barite floor made of Röbalith sand is a suitable solution in most of the cases.
When calculating the material requirements, an additional margin of 5 – 10 % must be provided for natural humidity and losses occurring during spreading. The minimum thickness of the coating is 4 cm. In the case of layer thicknesses above 6 cm, a grain size of more than 4 mm should be added as second component.

Mixing ration per cubic metre	up to 6 cm	above 6 cm
Cement	approx. 350 kg	approx. 350 kg
Water	approx. 140 l	approx. 140 l
Röbalith sand 0-4	3000 kg	1500 kg
Räbalith sand 4-16	-	1500 kg

Radiation protection floors can be applied as composite floors or floating floors. With regard to processing, the same regulations and preconditions have to be applied as with normal cement-bound floors.

The floor mortar is to be mixed semidry according to the above ratio. The use of aluminous cement and accelerating agents is not permitted. In contrast to this, an approved mortar liquefier can be added according to factory instructions.

To avoid cracks caused by tension we recommend the use of a steel fabric mat, e.g. N 47 or similar.

In the case of surfaces greater than 20 m^2, the radiation protection floor is to be provided with separation joints, under which a 4-mm thick bituminous lead strip has to be laid to maintain the shielding effect. The joints have then to be filled with bitumen.

To avoid non-uniform curing, we recommend covering the floor with a sand or sawdust layer of 1 - 2 cm, which is to be kept moist for a period of about 8 days. In the case of buildings with heating system, the room heater has to be switched off.

The regulations of VOB have to be observed.

Absorption values: Lead equivalents – in mm of lead – at a tube voltage of				
Floor thickness	100 kV	150 kV	200 kV	250 kV
4.0 cm	5.40	2.40	2.10	2.10
5.0 cm	6.80	3.00	2.60	2.80
6.0 cm	8.40	3.60	3.20	3.50
8.0 cm	-	4.80	4.30	5.00

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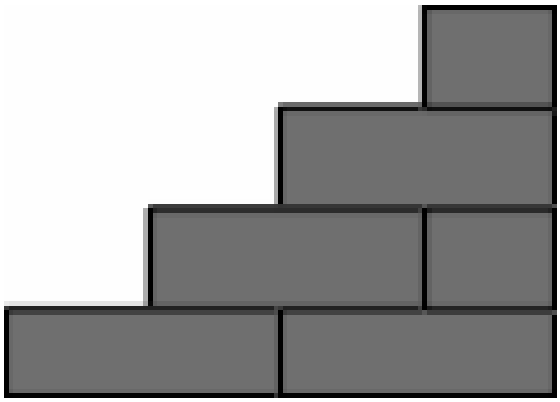
SEILO Röbalith bricks



Röbalith bricks with the associated joint fillers are used for the construction of radiation protection walls.

We produce 5 types of Röbalith bricks with the designations Rö 2, Rö 4, Rö 6, Rö 12 and Rö 12 S. All of them have the common format of a clay brick, 240 x 115 x 71 mm, but differ in the individual and volume weight and in the radiation protection coefficient.

In general, the following is provided:

For diagnostic X-ray systems Röbalith bricks Rö 2 and Rö 4, for therapeutic X-ray systems Röbalith bricks Rö 4 and Rö 6. In the case of gamma radiation, Röbalith bricks Rö 6, Rö 12 and Rö 12 S can be used.

Röbalith bricks must be laid using the associated joint filler that ensures the same radiation protection as the bricks.

Röbalith walls combine the static stiffness of a normal clay brick wall with the required radiation protection and is therefore extremely space and cost-saving.

Dimensions and volume weight are within the usual tolerance band. The specified lead equivalents were established by measuring a wall section (including joint).

Technical data:

Röbalith brick designation	Dimensions in mm	Approximate unit weight in kg	Approximate volume weight in kg/dm^3
Rö 2	240 x 115 x 71	5.5	2.8
Rö 4	240 x 115 x 71	6.3	3.2
Rö 6	240 x 115 x 71	6.9	3.5
Rö 12	240 x 115 x 71	7.3	3.7
Rö 12 S	240 x 115 x 71	7.5	3.8

Permissible compressive stress according to DIN 1053 corresponds to compressive strength class 12 MG III.

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Absorption values:
Lead equivalents – in mm of lead for areas exposed to X-rays and soft γ radiation

Röbalith brick designation	Wall thick-ness	Tube voltage/energy					
		100 kV	150 kV	200 kV	250 kV	300 kV	360 kV
Rö 2	11.5 cm 24.0 cm	10.0	4.5	4.4 9.7	5.0 11.5	5.5 13.0	5.2 18.7
Rö 4	11.5 cm 24.0 cm	16.0	7.0	6.8 14.8	7.7 18.0	8.0 20.0	13.7 39.2
Rö 6	– Not efficient in the area of X-ray applications						
Rö 12	– Suitable in the area of isotopes						
Rö 12 S	– Values from proof calculations to DIN 6812, 6844, 6846, 6847 and 25425						

For producing the joint mortar, the joint filler materials have to be mixed with cement only according to the weight ratios given in the table below. Water must be added to provide the usual consistence of mortar used for construction.

Mortar mixture: (for 1 m^3 finished mortar)

Aggregates	Röbalith bricks Rö 2 + Rö 4	Räbalith bricks Rö 6	Röbalith bricks Rö 12 + Rö 12 S
Cement CEM I 32.5	340 kg	370 kg	370 kg
Barite sand of natural humidity	3000 kg	2250 kg	2050 kg
Fe granulate	–	870 kg	1350 kg
Water	approx. 120 l	approx. 130 l	approx. 140 l

We supply mortar aggregates in 50 and 25-kg bags, or, for greater demands, in bulk units.

Material requirement: (for 1 m^2 masonry)
To determine the required bricks and joint filler, the planned masonry thickness must be specified.

Wall thickness in cm	Bricks per m^2 No.	Mortar aggregates in kg per m^2					
		Rö 2	Rö 4	Rö 6		Rö 12 + Rö 12 S	
		Barite	Barite	Barite	Fe gran.	Barite	Fe gran.
7.1	35	45	45	35	15	30	20
11.5	50	85	85	70	30	60	40
24.0	100	200	200	160	60	140	90
36.5	150	280	280	230	90	200	130
49.0	200	400	400	320	120	270	180
per m^3 masonry	400	760	760	610	240	560	370

Processing:
The bricks are to be laid according to the usual procedures for normal clay bricks. However, it must be made sure that the joints are thoroughly filled!

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SEILO Röbalith barium plaster

In many cases it is required to improve the radiation protection of existing walls. This increased radiation protection can often be achieved by means of a barite cement plaster containing Röbalith sand.

Röbalith sand consists of a specially conditioned barite having a grain size of 0 – 4 mm. The addition of cement as a bonding agent provides a scratch coat, whose thickness depends on the minimum lead equivalent and the tube voltage of the X-ray device. For this reason, we must know the relevant values to be able to process enquiries or orders with the required accuracy.

Shielding values	at 1000 kV	at 150 kV	kg/m^2
at 1.0 cm coat thickness	0.8 mm Pb	0.7 mm Pb	30
at 1.5 cm coat thickness	1.2 mm Pb	1.0 mm Pb	45
at 2.0 cm coat thickness	1.6 mm Pb	1.3 mm Pb	60
at 2.5 cm coat thickness	2.0 mm Pb	1.5 mm Pb	75

Mortar mixture:	for 1 m^3 finished mortar	for 1 bag (50 kg) Röbalith sand
Cement	270 kg	approx. 4,50 kg
Lime	80 kg	approx. 1,35 kg
Water	approx. 130 ltr.	approx. 2,15 ltr.
Barite grain 0 – 4 mm naturally humid	3.000 kg	approx. 50,00 kg

Processing: Approx. 8 parts by weight of Röbalith sand are mixed with 1 part by weight of cement/lime and stirred with water to obtain a mortar that is not too thin. Before starting the plasterwork, all the wall joints must be thoroughly filled with the plaster mortar. Any existing old plaster must be removed. **The plaster is applied in approx. 5 – 8 mm thick layers**. The max. plaster thickness of 2.0 – 2.5 cm should not be exceeded, if possible. In exceptional cases, the plaster may, of course, also be applied on both sides.

After this cement-bound scratch coat cured, a plaster skim coat may be applied. Plastered walls must be kept humid in order to prevent the formation of cracks. Artificial drying of the plaster is not permitted! Wall sockets have to be backed up by lead. Plaster coats must not be damaged. Barium plaster can be processed as normal lime cement plaster according to relevant regulations.

Unit size: 50 kg bags.

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SEILO radiation protection ready-to-apply plaster

The minimum lead equivalents required for diagnostic X-ray apparatus are relatively low. Nevertheless, problems often arise because, for instance, existing components made of light material cannot fully comply with the required protection values. Even solid clay brick walls often cannot guarantee the required shielding effect, since the clay bricks are not properly laid with solid joints.

SEILO radiation protection ready-to-apply plaster was specifically developed for such cases. Apart from its excellent shielding characteristics, it offers the advantage that it is particularly suitable for a decorative treatment of wall surfaces and thus allows modern and attractive interior designs.

SEILO radiation protection ready-to-apply plaster is characterised by high adhesion, is resistant to wear and extremely durable in any environment. By adding a shading paint, the white plaster can be toned to any colour of your choice. Surfaces to which SEILO plaster was applied are wipe-proof and wash-proof.

Shielding values	at 100 kV	at 150 kV
at 0.5 cm plaster thickness at 1.0 cm plaster thickness	0.9 mm Pb 1.8 mm Pb	0.5 mm Pb 0.9 mm Pb

Material requirement	per m^2	Unit supplied
for 0.5 cm plaster thickness for 1.0 cm plaster thickness	approx. 12 kg approx. 23 kg	25-kg Bucket

SEILO radiation protection resdy-to-apply plaster is supplied ready for application and adheres to any solid ground. **The plaster has to be applied in thin layers of 2 – 3 mm.** Before working on a new layer, ensure that the last layer has dried in order to prevent the formation of cracks and running down of the material. In the case of unplastered masonry, the joints should be filled with mortar and greater unevenness should be compensated for.

(Protect material from frost!)

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SEILO radiation protection panels

Application	Radiation protection and soundproofing Single and multi-panels for vertical mounting to frames as well as for retrofitting into existing systems as blinding panels.
Standard dimensions	2500 x 625 x 12.5 mm + lead (Pb) 2600 x 625 x 12.5 mm + lead (Pb)
Lead thicknesses	0.5 to 3.0 mm lead foil in gradations of 0.5 mm, back of the panels lined.
Panel weights	0.5 mm Pb approx. 16 kg/m^2 1.0 mm Pb approx. 22 kg/m^2 1.5 mm Pb approx. 28 kg/m^2 2.0 mm Pb approx. 34 kg/m^2 2.5 mm Pb approx. 40 kg/m^2 3.0 mm Pb approx. 46 kg/m^2
Joint covers	All joints as well as internal and external corners have to be backed using a 50-mm wide lead strip. Available in rolls of 20 m and thicknesses from 0.5 to 3.0 mm with 0.5 mm gradations.
Delivery	On special pallets up to max. 1.2 tonnes
Delivery time	At short notice
Special dimensions	Other thicknesses and panel sizes on enquiry.
Accessories	SEILO radiation protection covers for cavity wall switch boxes. Shielding value 3.0 mm Pb, single, double or triple version.

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SEILO radiation protection door elements

Application: For closing rooms with radiographic use (X-rays and nuclear medicine)

Construction: Protective door to DIN 68706/1, optionally with steel or timber frame
Structure 7-fold (can be painted)
9-fold (laminated surface)
Core made of extruded chip board with cavities
Lead insertion on both sides
Edges rebated on 3 sides to DIN 68706/1 or without rebate
Thickness 45 – 55 mm depending on the lead insertion and door leaf surface

Shielding value: 1.0 – 18.0 mm Pb

Surface: Limba that can be painted, laminated surface, wood veneer.
Edges glazed or painted in the relevant colour

Dimensions: Outside dimensions of the door leaf to DIN 18101

Rebated		Without rebate	
Width	Height	Width	Height
610 mm	1985 mm	585 mm	1972 mm
735 mm	1985 mm	710 mm	1972 mm
860 mm	1985 mm	835 mm	1972 mm
985 mm	1985 mm	960 mm	1972 mm
1110 mm	1985 mm	1085 mm	1972 mm
1235 mm	1985 mm	1210 mm	1972 mm

Other dimensions on enquiry.

Weight: Weight approx. 21 kg/m^2 with 1 mm Pb insert.

Design: Door leaf with 2 or 3 off 3-piece hinges, galvanized, with profiled cylinder or radiation protection lock, without locking cylinder and handle set.
Also available in special designs for dark room, smoke barrier, fire protection door elements, etc.

Other versions: Design with radiation protection window, radiation protection ventilation screen, floor seal that can be lowered, door closer, electric motor drive, handle sets, locking cylinder, etc. available.

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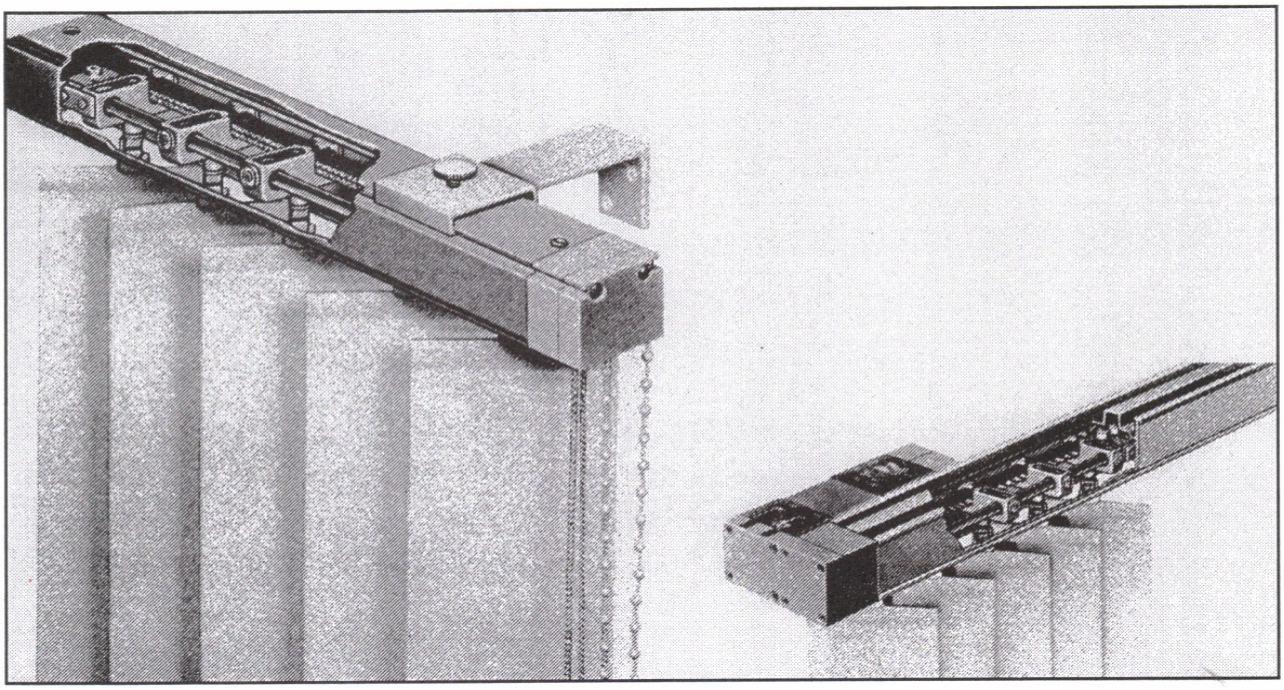
SEILO radiation protection vertical blind

for shielding in rooms with radiographic use



consisting of white vertical plastic strips with integral lead insert of 0.5 to 2.0 mm.

– Strip width: 127 mm
– Highly non-fading, bactericidal, washable
– Geared running carriage with integrated safety coupling
– Robust and wear-resistant mechanics
– Automatic running track made of aluminium, anodised or painted
– For ceiling or wall -mounting

In the closed condition, the individual strips overlap to 15 mm so that full shielding is achieved.

Turning of the strips by 180 ° at every blind opening width by means of a plastic chain via an integrated splined shaft.
The single or multi-piece blinds can be opened and closed by means of an operating cord.

Electric motor actuator on request.

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SEILO radiation protection lead glass

SEILO radiation protection lead glass offers a high-quality and transparent shield against X-rays in medicine, research and technology. The high lead content ensures optimum protection against ionizing radiation that occurs when operating apparatus having a tube voltage of 100 – 200 kilovolt (kV).

SEILO radiation protection lead glass is a heavy-flint glass whose protective effect is based on a great heavy metal oxide content of 70 percent by weight.
The lead oxide content alone amounts to 65 %. Thus, a density of 5,05 g/cm^3 can be achieved, which allows relatively low glass thicknesses.

SEILO radiation protection lead glass is marked with undeletable safety information or other permitted data and meets the requirements of the following national standards and statutory safety regulations:

DIN 6841 *IEC 61331-2*

Setpoint thicknesses in mm	Minimum lead equivalent for RD 50 for tube voltages in kV			Approximate Dimensions in mm	Approximate weight (kg) per 1000 cm^2
	80 kV	110 kV	200 kV		
5,0 - 6,5	1,6	1,6	1,4	1.700 x 1.000	33
7,0 - 8,5	2,2	2,2	2,0	2.100 x 1.050	43
8,5 - 10,0	2,7	2,7	2,5	2.100 x 1.050	51
10,0 - 11,5	3,2	3,2	2,9	2.000 x 1.000	59
11,5 - 13,0	3,6	3,7	3,3	2.000 x 1.000	66
16,0 - 18,0	5,1	5,1	4,7	1.500 x 800	91
20,0 - 22,0	6,3	6,4	5,9	1.500 x 800	112

The protective effect of a radiation protection glass against X-rays is specified by the lead equivalent. **SEILO radiation protection lead glass** features a lead equivalent of 32 % of the glass thickness at a tube voltage of 110 kV.
A **SEILO radiation protection lead glass** of a thickness of 10 mm and a lead equivalent of 32 % provides the protective effect of a 3.2 mm thick solid lead wall.
The protection guaranteed by **SEILO radiation protection lead glass** is specified by the lead equivalent in mm. The lead equivalent, which differs according to the different thicknesses of **SEILO radiation protection lead glass**, varies with the tube voltage (see table).