Radiation protection.
Electrical installation in radiation protection walls.
Radiation protection in connection with electrical installation in radiation protection walls represents a real challenge. Secure radiation protection must be ensured by means of special building construction measures. In particular, this affects hospitals, doctors’ practices and all medical facilities in which X-rays and gamma radiation equipment are used.
The ionising radiation which is generated by the X-ray devices is extremely hazardous for people in the vicinity. This means that adjacent rooms must be screened. Every installation opening in radiation protection walls interrupts the wall’s radiation protection function. Elaborate screening methods are needed in order to restore this function.

In many cases, screening is fitted in the form of lead encasing around traditional electrical installation boxes. The planning of the necessary electrical installation in these walls is a problem. It is extremely important that this is carried out in advance, because it is not possible to retrofit screening to these installation boxes using this traditional method in pre-constructed radiation protection walls.
Regulations and standards.

RöV and DIN 6812.

National and international laws and decrees have been passed, and standards specified, in order to protect people who are occasionally or constantly exposed to X-rays against the dangers from ionising radiation. In Germany, these include the Radiation Protection Act (StrlSchV) and the X-ray Ordinance (RoV). The latter describes the ordinance relating to protection against harm caused by X-rays, and this also applies to diagnostic radiology and radiation protection therapy.

Radiation protection in buildings is regulated in DIN 6812 for medical X-ray equipment up to 300 kV. In general a distinction is made in respect of the type of radiation between useful radiation and stray radiation. Useful radiation occurs in the direction specified for that purpose in the X-ray device; stray radiation displays a scattering effect and occurs in different directions and strengths.
Technical fundamentals.
Radiation protection walls.

Calculation of the necessary structural screening (thickness of the lead layer) is dependent on the type of radiation, the category of the room which is determined by the amount of time spent there by people, and on the output of the radiation equipment (tube voltage) and its proximity to the adjacent occupied area.

The screening effect of materials other than lead is stated as an equivalent lead layer thickness (lead equivalent value). The higher the tube voltage, the greater is the necessary lead layer thickness. Details of the necessary lead layer thicknesses or their equivalents are specified in DIN 6812.

An X-ray room must be radiation-protected on all sides, and special radiation protection walls are used for this purpose. In many cases these are lightweight walls which are lead-lined on the boarding side which faces the X-ray room. Because of difficulty in processing, increasingly radiation-protection wall construction systems without lead (e.g. Knauf Safeboard) are used in building and extension practice.
KAISER’s innovative radiation protection box protects against radiation used for medical purposes, e.g. in X-ray facilities. The high density of the radiation protection compound absorbs soft and hard X-rays. The box is especially suitable for lead-free radiation protection walls (e.g. Knauf Safeboard) and - because of its dose-reducing effect in the tube voltage range between 40 - 150 kV - guarantees a lead-equivalent value for the wall up to 3 mm Pb even with opposing installation. In addition, the box can easily be used in lead-lined walls. In this case, the radiation protection box achieves a lead-equivalent value of 1.5 mm Pb with walls which are lead-lined on one side.

• Protection against X-rays
• Suitable for lead-free and lead-lined radiation protection walls
• Lead-free - no health risks
• Retrofitting is possible
• Fast installation without additional screening measures
• Opposing installation is possible

Safety for X-ray rooms.

One-gang junction box for radiation protection walls.
The radiation protection box is very easily fitted in a Ø 74 mm installation opening in the same way as a traditional cavity wall box. Use the universal opening cutter to make the exact cable entry. For combinations with the standardised distance of 71 mm, simply remove the marked edge strip. Use the support connector to create fully-insulated through-wiring. By using the universal VDE cover (Art. No. 1184-90), the box can also be used as a junction box. Increasing existing installation openings from Ø 68 mm to 74 mm, for example during refurbishing, is also possible by using the centering insert 68/74 (Art. No. 1083-99).

Installation (lead-free and lead-lined)
1 Use the cutter (e.g. MULTI 4000, Art. No. 1084-10) to create a Ø 74 mm installation opening in lead-free and lead-lined walls.
2 Use the universal opening cutter (Art. No. 1085-80) to make exact entries.
3 Simply remove the marked edge strip for combinations with the standardised distance of 71 mm.
4 Use the support connector to create fully-insulated through-wiring.

Radiation protection one-gang junction box | Art. No. 9074-01
Support connector | Art. No. 9060-74

1 FX³ screw | 2 Radiation protection box for lead-free radiation protection walls | 3 Support connector

By using the universal VDE cover (Art.-No.1184-90), the box can also be used as a junction box.
**Wall constructions**

for lead-free and lead-lined radiation protection panels.

The following shows and describes different wall constructions in connection with the required number of lead-free Safeboard panels and a lead-lined plasterboard panel in accordance with the lead equivalents specified in DIN 6812. Details of the relevant lead equivalent are shown in the table below with the matching illustration on page 9.

For example, a lead equivalent of up to 2.75 mm Pb is achieved when 2 lead-free Safeboard panels are fitted on both sides.

<table>
<thead>
<tr>
<th>Lead equivalent in mm Pb</th>
<th>See illustration on p. 9</th>
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<tbody>
<tr>
<td>of 0.3 - 0.6</td>
<td>A</td>
</tr>
<tr>
<td>of 1.0 - 1.1</td>
<td>B</td>
</tr>
<tr>
<td>up to 1.5*</td>
<td>F</td>
</tr>
<tr>
<td>up to 1.75</td>
<td>C</td>
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<tr>
<td>up to 2.75</td>
<td>D</td>
</tr>
<tr>
<td>up to 3.0</td>
<td>E</td>
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</tbody>
</table>

* Because of the low screening effect of the rear plasterboard walls, combination with a lead-lined plasterboard panel is suitable at clearances from 2.5 m upwards for overtable and undertable X-ray equipment.
Two opposing radiation protection boxes achieve a lead equivalent of 3 mm Pb.

Use in lead-free radiation protection walls (e.g. Knauf Safeboard):

A

3

1

3

Lead equivalent: up to 0.6 mm Pb
Wall construction: 2 layers of boarding on both sides

B

3

1

Lead equivalent: up to 1.1 mm Pb
Wall construction: 2 layers of boarding on both sides

C

3

1

1

Lead equivalent: up to 1.75 mm Pb
Wall construction: 2 layers of boarding on both sides

D

1

1

Lead equivalent: up to 2.75 mm Pb
Wall construction: 2 layers of boarding on both sides

E

1

1

Two opposing radiation protection boxes achieve a lead equivalent of 3 mm Pb

Use in lead-lined radiation protection walls:

F

3

2

Up to 1.5 mm Pb, 2 layers of boarding on both sides for conventional X-ray equipment (e.g. dental tubes) overtable/undertable X-ray equipment (e.g. CT ≥ 2.5 m clearance)

1 lead-free radiation protection panel (e.g. Knauf Safeboard)
2 lead-lined plasterboard panel
3 plasterboard panel
The centering insert 68/74 makes it easy to enlarge existing installation openings Ø 68 mm auf Ø 74 mm. This can be with lightweight walls with single or multiple-layer boarding consisting of lead-free radiation protection panels (e.g., Knauf Safeboard) and of lead-lined plasterboard panels. This makes the later replacement of existing traditional cavity wall boxes with radiation protection boxes much easier. The centering insert 68/74 mm is an easy-to-use tool aid for Ø 74 mm cavity wall cutters (e.g., MULTI 4000) and provides the exact guide for expansion of the installation opening.
KAISER radiation protection system.
At a glance.

Installation in walls

<table>
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<tr>
<th>Radiation protection boxes</th>
<th>Support connector</th>
<th>Universal VDE cover</th>
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<td>Radiation protection box</td>
<td>9074-01</td>
<td>1184-90</td>
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<tr>
<td>Support connector</td>
<td>9060-74</td>
<td></td>
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<td>Universal VDE cover</td>
<td>1184-90</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Tools</th>
<th>Ø 74 mm</th>
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<tbody>
<tr>
<td>Universal opening cutter</td>
<td>1085-80</td>
</tr>
<tr>
<td>Turbo cutter MULTI 4000</td>
<td>1084-10</td>
</tr>
<tr>
<td>Centering insert 68/74</td>
<td>1083-99</td>
</tr>
</tbody>
</table>

More information on "Electrical installation in radiation-protection walls" can be found on the Internet or obtained directly from KAISER (see also back page)

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For other questions or information, please contact our team of technical consultants, who look forward to talking to you.

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