

GRADUS
Heat Cost Allocator
Installation Guide
with Common K_c Values



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1. GUIDE FOR THE INSTALLATION OF THE GRADUS ELECTRONIC HEAT COST ALLOCATOR

Proper installation is essential for correct metering values from the Gradus and to ensure that the heat cost bills based on it are legally secure. That is why the following DIN requirements and installation guidelines must be complied with.

1.1. REQUIREMENTS UNDER DIN EN 834/PREN 834

In addition to the temperature settings, the underside of the Gradus also shows the approval mark and number. These confirm that the device meets DIN EN 834. In addition to the requirements that the device must comply with, the DIN standard also provides the specifications for proper installation. Requirements arising from the standard:

1. Basic requirements for the use of electronic heat cost allocators

- the temperature setting limits must not be exceeded
- the KQ value for heat output must be clearly defined
- the heating surface must be accessible

It is therefore suitable for use with:

- underfloor heating
- radiant ceiling heating
- valve controlled radiators
- radiators with fans
- warm air systems and
- heating systems which use steam as the medium.

The heating system must be operated in accordance with the state of the art:
the DIN standard recommends

- that radiators are fitted with individual room thermostats
- that the flow temperature is set higher than the external temperature
- that the heating medium flow corresponds to the design conditions

2. The average heating medium design temperature of the heating system must fall within the range of the temperature setting limits on the heat cost allocator. For the Gradus, these are:

- Compact device $t_{min} = 55^{\circ}\text{C}$ $t_{max} = 90^{\circ}\text{C}$ for single sensor operation
- Compact device $t_{min} = 35^{\circ}\text{C}$ $t_{max} = 95^{\circ}\text{C}$ for two sensor operation
- Remote sensor device $t_{min} = 55^{\circ}\text{C}$ $t_{max} = 105^{\circ}\text{C}$ for single sensor operation
- Remote sensor device $t_{min} = 35^{\circ}\text{C}$ $t_{max} = 105^{\circ}\text{C}$ for two sensor operation

3. Installation should be carried out in such a way that the device can be maintained in the long term and protected from tampering. If the devices are attached using adhesive, it is essential to use adhesive layers of equal thickness in order to ensure even heat transfer (K_C values). Remote sensors mounted using adhesive must not be removable without leaving visible damage to the sensor.

4. The sensors should be attached to locations on the heating surface where there is a sufficient connection between the display value on the heat cost allocator and the heat output of the radiator for as large an operational area as possible to provide a result for the metering period.

The Gradus is usually fitted at 75% of the total height of the radiator; the information in the installation guide must be complied with (7.3).

5. It is not permitted to use heat cost allocators of different types or manufacturers within one billing unit (7.5).

6. When calculating the units, the factor K_Q must always be used, together with the factors K_C and K_T as appropriate.

The user must be able to justify the total valuation factor either from its display on the device or from proof on available documents (8.4).

The total valuation factor must contain the radiator output in segments of max. 60 watt or 5% for a radiator output of up to 3000 W and 3% for a radiator output of over 3000 W.

7. The valuation factor K_Q must be determined for the radiator on which the heat cost allocator is mounted (8.1).
8. The valuation factor K_C must then be used if its deviations within a billing period are greater than 3% (8.2).
9. Combinations of radiators and heat cost allocators with $c > 0.67$ (two sensors) or $c > 0.3$ (single sensor), measured under base conditions, are not permitted. In exceptional cases c -values of up to 0.72 (two sensors) or 0.4 (single sensor) are permitted in one billing unit, if the heated areas concerned do not exceed 25% of the total heated area or if the average heating medium design temperature is greater than 80°C.
Radiators for which the K_C value is not known at the time of billing may not be fitted with heat cost allocators (8.5).
10. The valuation factor K_T may only be used for internal design temperatures of less than 16°C.

1.2. GENERAL INSTALLATION INFORMATION

The Gradus heat cost allocator is essentially fitted in the middle of the length ($0.5 \times L$) of the radiator at a distance of $\frac{3}{4}$ the height ($0.75 \times H$) measured from the bottom, with regard to the centre of the heat cost allocator or the centre (centre marking) of the aluminium thermoconductor. **On radiators with a height of less than (<) 470 mm, it is mounted at 50% H.**

For radiators with an even number of units, the heat cost allocator is mounted between the two middle elements; for odd numbers of elements, the device is offset by one element towards the valve. A second EHCA may be fitted if above 2000 mm (recommended for accuracy), and must be fitted if above 3000 mm.

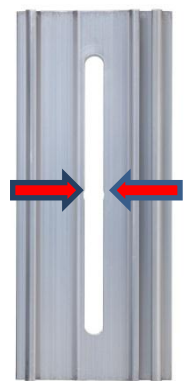
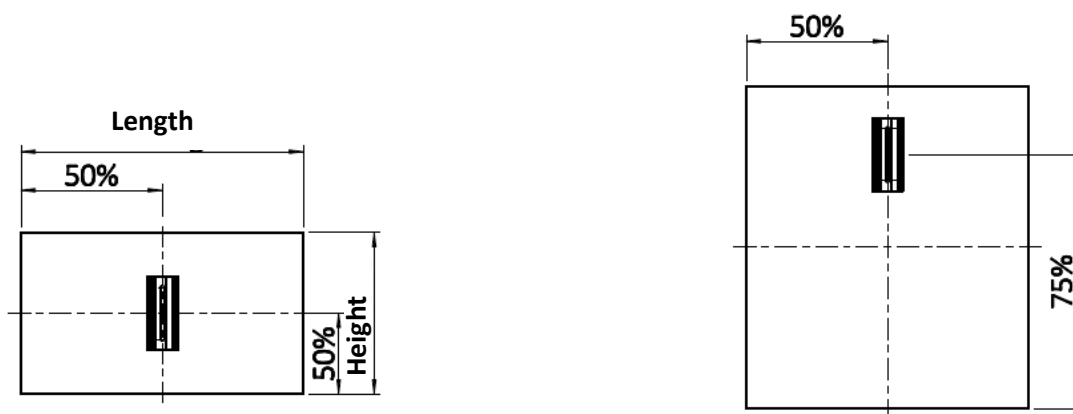
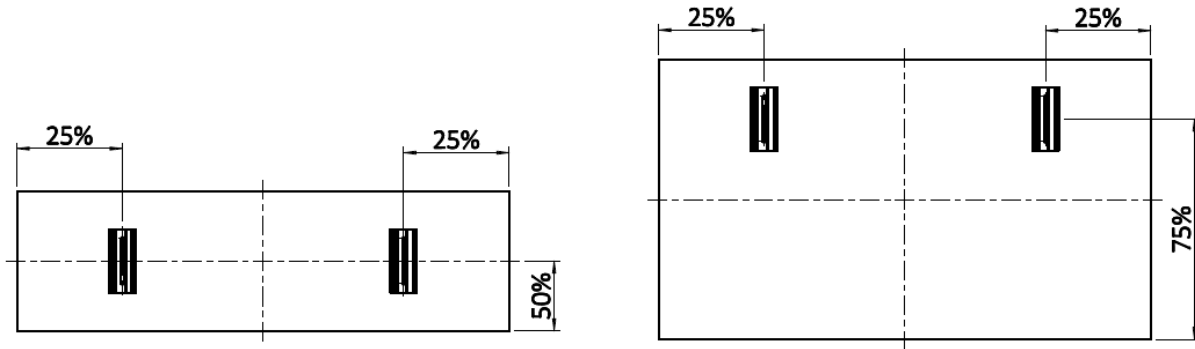


Figure 1: Centre marking

Height less than (<) 470 mm	Height over \geq 470 mm
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Length \leq 3000 mm



Length > 3000 mm

If a welded installation is used, the upper threaded bolts should be welded at half the length ($0.5 \times L$) and at a height of $(0.75 \times H) + 25$ mm, or if the height is less than ($<$) 470 mm, at a height of $(0.50 \times H) + 25$ mm (measured from the bottom).

The lower bolts are welded at intervals of 50 mm, vertically beneath the first. Before welding, the paint must be removed from the weld points. Care should be taken to ensure that the bolts are welded to a water-carrying surface or groove.

The aluminium thermoconductor should be aligned with the mark at half distance between the two welding studs (spacing between the upper and lower welding studs is 25 mm), fastened and fitted.

On radiators with a length greater than ($>$) 3000 mm, two heat cost allocators must be fitted. These radiators are thus regarded as two single radiators switched one after the other, but which are valued separately.

Warning! Only M3 threaded bolts with a maximum length of 10 mm may be used for attachment to heating pipes, as otherwise there is a risk that the device may be damaged.

Existing welding studs must be shortened accordingly!

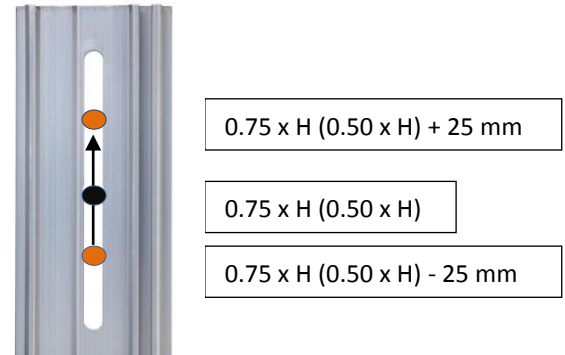
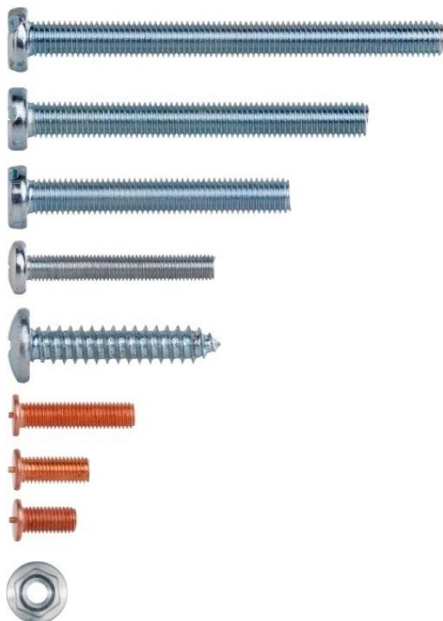


Figure 2: Spacing for bolts / centre marking

1.3. EXISTING WELDING STUDS MUST BE SHORTENED ACCORDINGLY! INSTALLATION MATERIALS

The following installation materials are required.

1.3.1. Standard parts



Description	Item No.
Cylinder bolt M4x55 DIN 84	1.KEGRALAC.3006
Cylinder bolt M4x45 DIN 84	1.KEGRALAC.3005
Cylinder bolt M4x35 DIN 84	1.KEGRALAC.3004
Countersunk screw M3x25 DIN 7985	1.KEGRALAC.3032
Self-tapping screw 4.2x25	1.KEGRALAC.3008
Threaded bolts M3x15 DIN32501	1.KEGRALAC.3003
Threaded bolts M3x12 DIN32501	1.KEGRALAC.3002
Threaded bolts M3x10 DIN32501	1.KEGRALAC.3001
Locknut M3	1.KEGRALAC.3029

1.3.2. Installation parts: Panel radiators and special radiators



Description	Item No.
Threaded bolts M3x15 DIN32501	1.KEGRALAC.3003
Threaded bolts M3x12 DIN32501	1.KEGRALAC.3002
Threaded bolts M3x10 DIN32501	1.KEGRALAC.3001
Shank nut M3x8.5	1.KEGRALAC.3009
Locknut M3	1.KEGRALAC.3029

1.3.3. Installation parts: Sectional radiators



Description	Item No.
Expanding bracket M4 53/65	1.KEGRALAC.3028
Expanding bracket M4 33/48	1.KEGRALAC.3027
Expanding bracket M4 23/35	1.KEGRALAC.3026

1.3.4. Installation parts: Tubular radiators



Description	Item No.
Pipe slide nut (36 mm)	1.KEGRALAC.3012
Pipe slide nut (45 mm)	1.KEGRALAC.3013

1.3.5. Installation parts: Lamellar radiators



Description	Item No.
Complete expanding bracket kit	1.KEGRALAC.3022

1.3.6. Installation parts: Aluminium radiators



Description	Item No.
Installation kit for aluminium radiators	1.KEGRALAC.3007
Self-tapping screw 4.2x25	1.KEGRALAC.3008

1.3.7. Installation parts: Convectors



Description	Item No.
Complete convector bracket	1.KEGRALAC.3024

1.3.8. Installation parts: Further installation parts

1.3.8.1. Aluminium thermoconductor



Description	Item No.
Aluminium thermoconductor	1.KEGRALAC.3025

The standard aluminium thermoconductor must be ordered separately for each EHCA!

1.3.8.2. Thermoconductor adapter, wide



Description	Item No.
Thermoconductor adapter, wide	1.KEGRALAC.3031

This additional adapter will be required for special types of radiator with unusual shapes or large spaces between elements.

This is attached behind the standard thermoconductor.

Dimensions: 90.7 x 60 x 5 (H x W x D) in mm

1.3.8.3. Safety seal



Description	Item No.
Safety seal accessory kit	1.KEGRALAC.3030

The minimum standard delivery unit of 40 EHCA (1 case) also contains a pack of 40 safety seals.

However, this additional pack of safety seals (Contents 40 pcs) is also available separately.

1.3.8.4. Further installation parts: Gradus plug-in remote sensor



Description	Item No.
Gradus plug-in remote sensor	1.KEGSR.0001

The plug-in remote sensor is available as a kit and consists of:

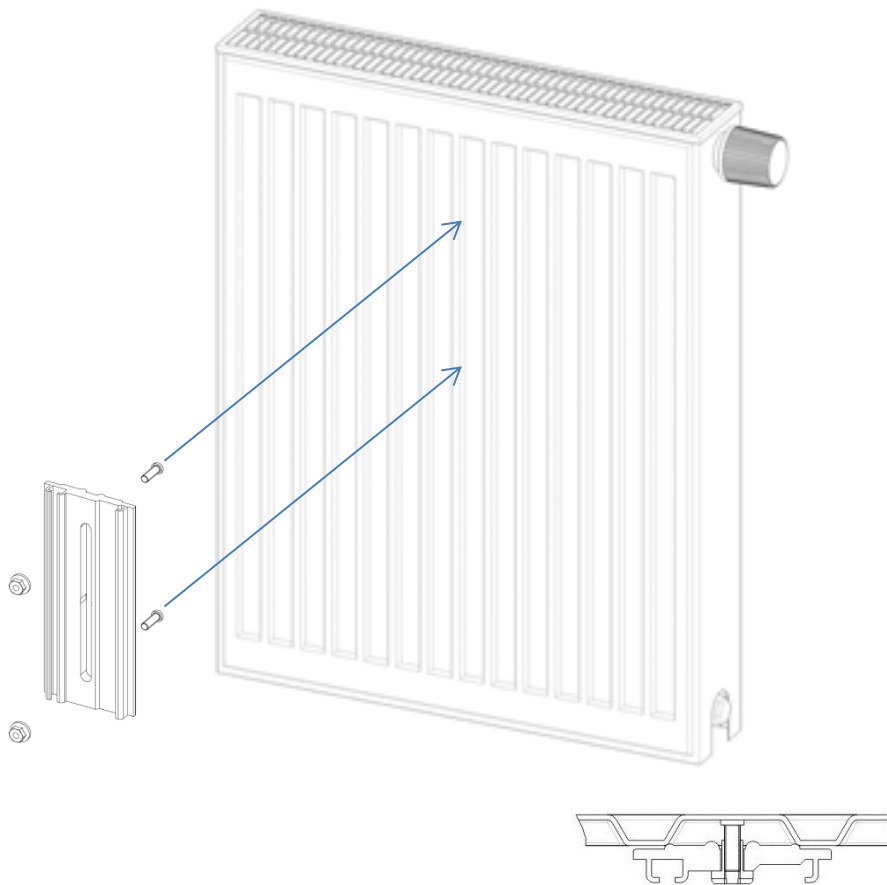
- Remote sensor cable 2 m
- Remote sensor cover
- Safety seal

1.4. INSTALLATION TYPES

The different types of installation are described below. These are intended to provide information on where on the various radiator types and using which installation materials the Gradus heat cost allocator can be fitted in its compact version (or also with plug-in remote sensors).

The first number gives the radiator type (e.g. “panel radiator”) and the second number the version (e.g. “vertical profiled”).

1.4.1. Installation type 1-1 Panel radiator vertical profiled (welded installation)



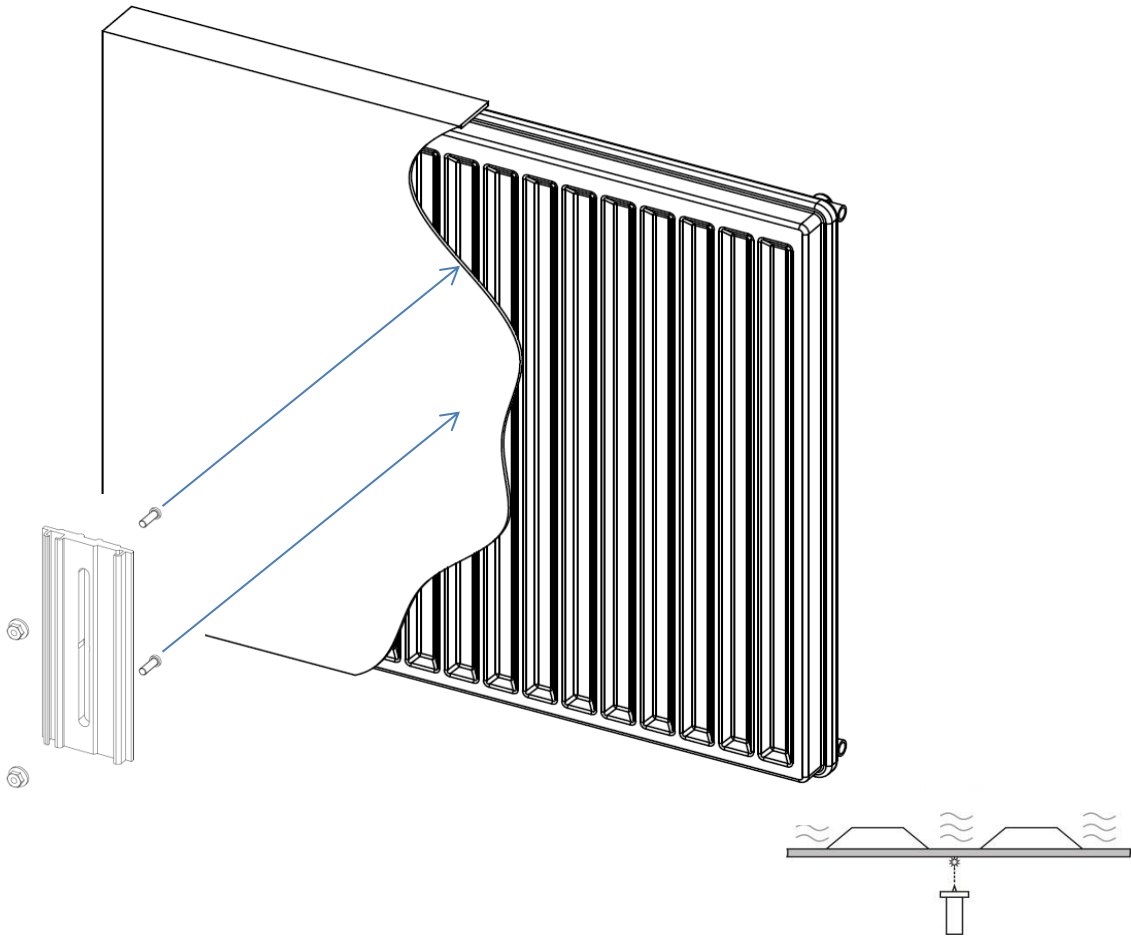
K_c values

Manufacturer	Model	K _{c1} value	K _{c2} value
Kermi	NT 2000	1.136	2.204

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Threaded bolts M3x12 DIN32501	1.KEGRALAC.3002	2	
Locknut M3	1.KEGRALAC.3029	2	
Shank nut M3x8.5	1.KEGRALAC.3009	2	Alternative

1.4.2. Installation type 1-2 Panel radiator non-profiled (welded installation)



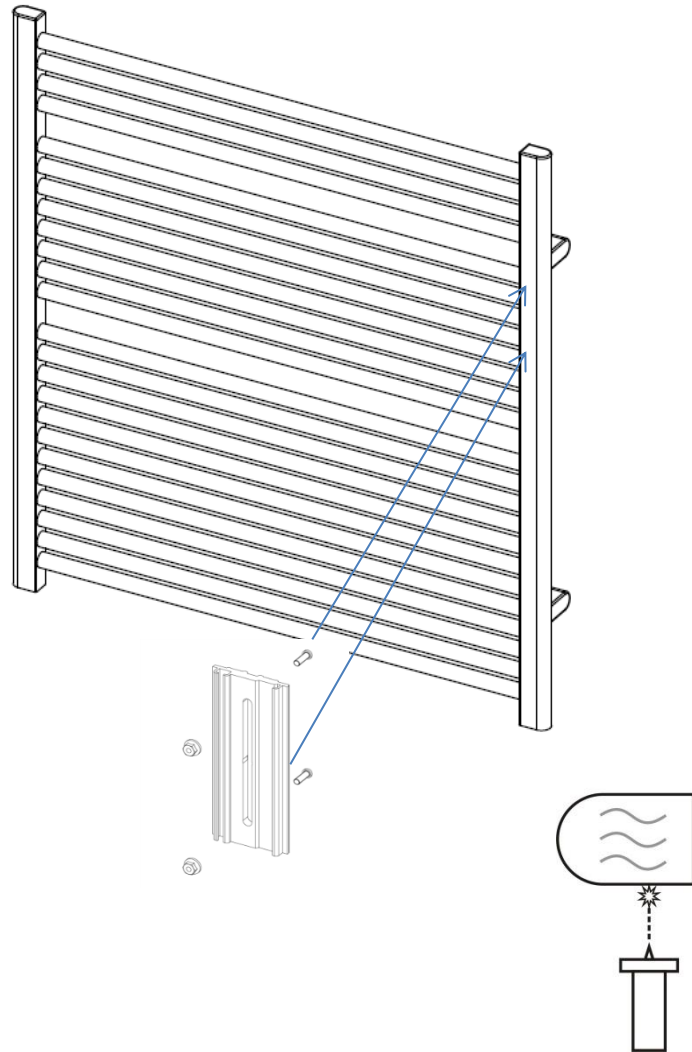
K_c values

Manufacturer	Model	K _c 1 value	K _c 2 value
Gerhard + Rauh	Essen	1.092	2.189

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Threaded bolts M3x12 DIN32501	1.KEGRALAC.3002	2	
Locknut M3	1.KEGRALAC.3029	2	
Shank nut M3x8.5	1.KEGRALAC.3009	2	Alternative

1.4.3. Installation type 2-1 Heated towel rails (welded installation)



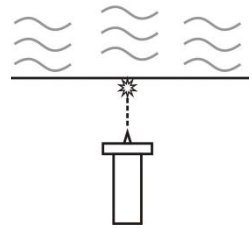
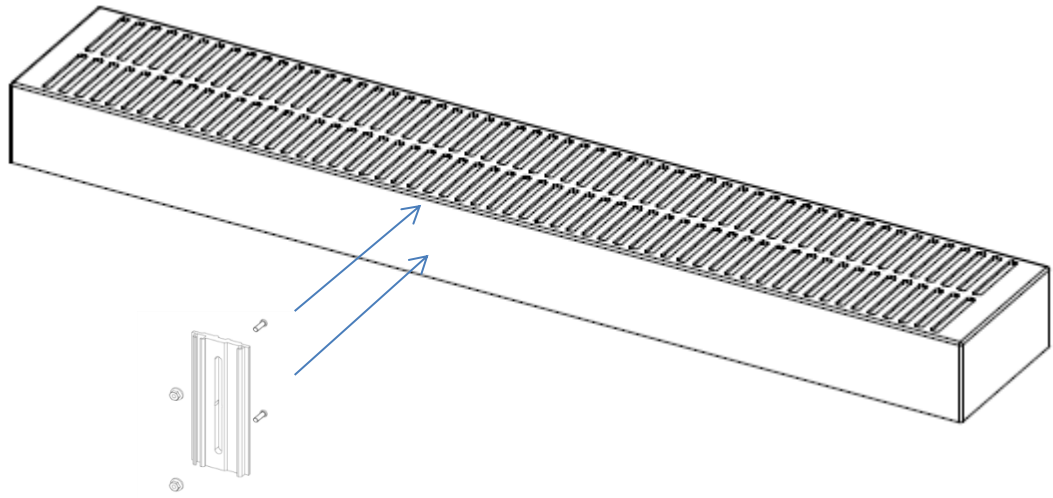
K_c values

Manufacturer	Model	K_c1 value	K_c2 value
Kermi	Basic 50 D	1.388	2.734

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Threaded bolts M3x12 DIN32501	1.KEGRALAC.3002	2	
Locknut M3	1.KEGRALAC.3029	2	
Shank nut M3x8.5	1.KEGRALAC.3009	2	Alternative

1.4.4. Installation type 3-1: horizontal convector, low profile (welded installation)



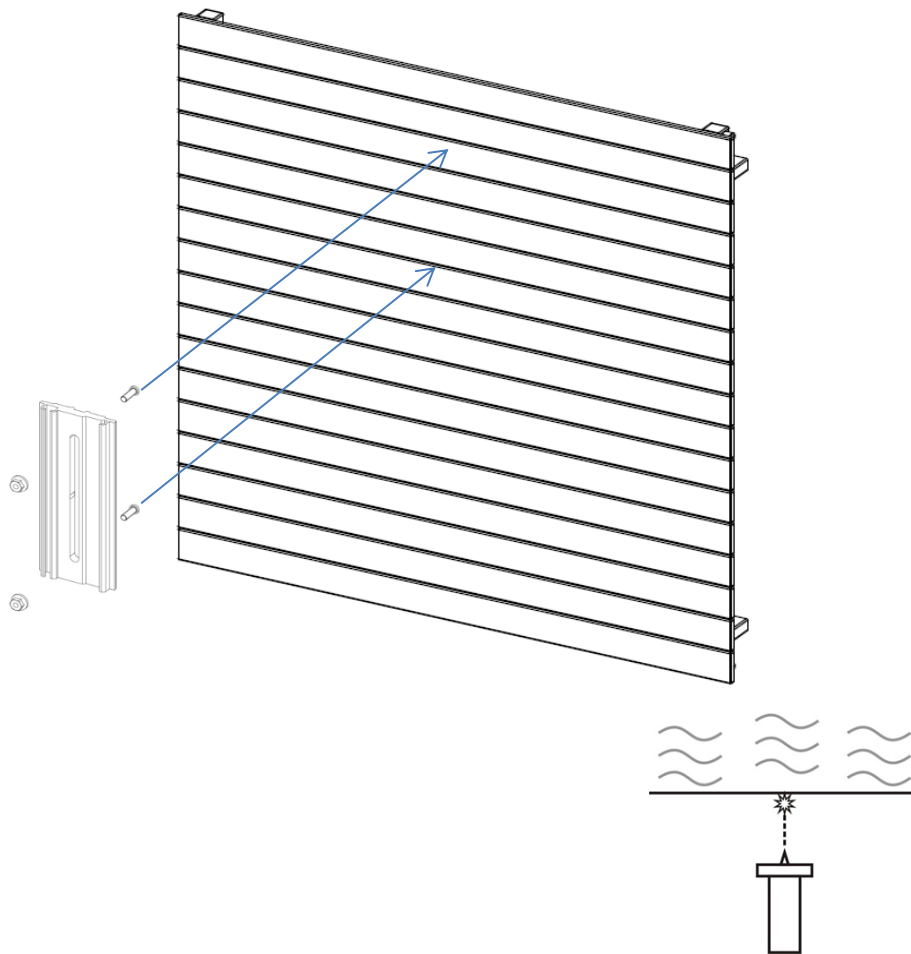
K_c values

Manufacturer	Model	K_c1 value	K_c2 value
Zehnder	Radiavektor (1 layer, height 70)	1.512	2.551

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Threaded bolts M3x12 DIN 32501	1.KEGRALAC.3002	2	
Locknut M3	1.KEGRALAC.3029	2	
Shank nut M3x8.5	1.KEGRALAC.3009	2	Alternative

1.4.5. Installation type 3-2 Panel radiator with horizontal water flow/wall heating panel (welded installation)



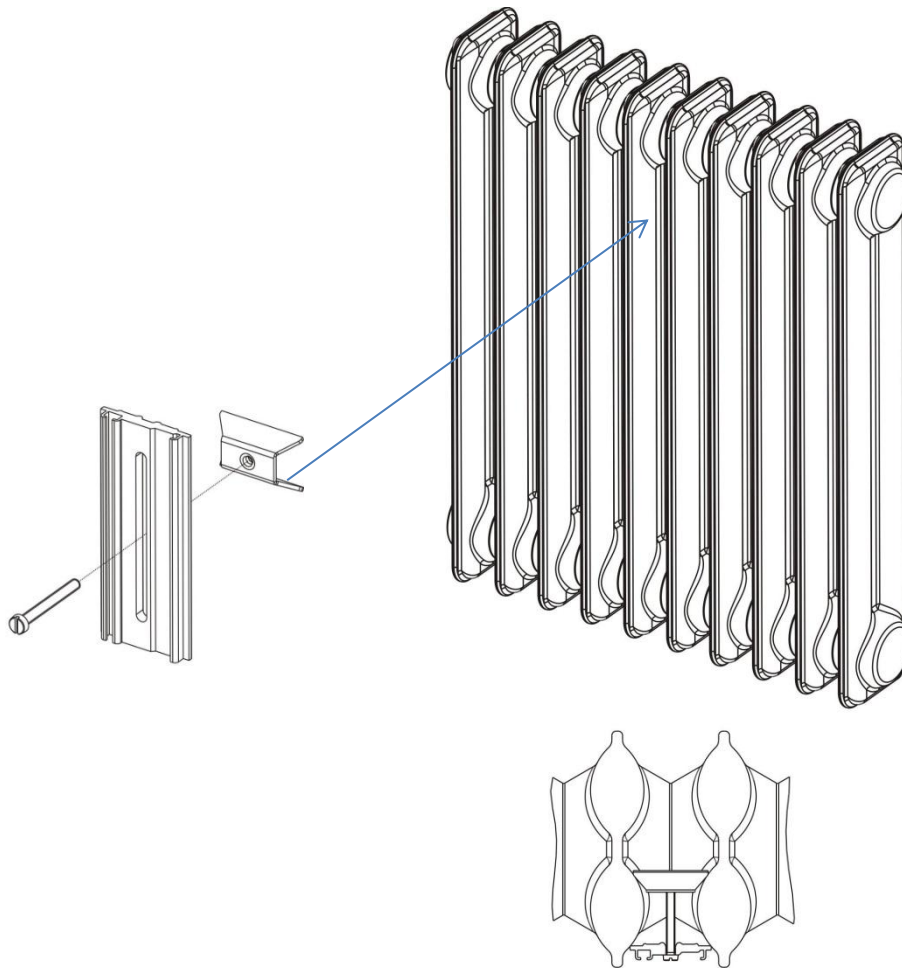
K_c values

Manufacturer	Model	K_c1 value	K_c2 value
Arbonia	S70	1.161	2.400

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Threaded bolts M3x12 DIN 32501	1.KEGRALAC.3002	2	
Locknut M3	1.KEGRALAC.3029	2	
Shank nut M3x8.5	1.KEGRALAC.3009	2	Alternative

1.4.6. Installation type 5-1 Sectional radiator, sections larger than (>) 40 mm (screw installation)



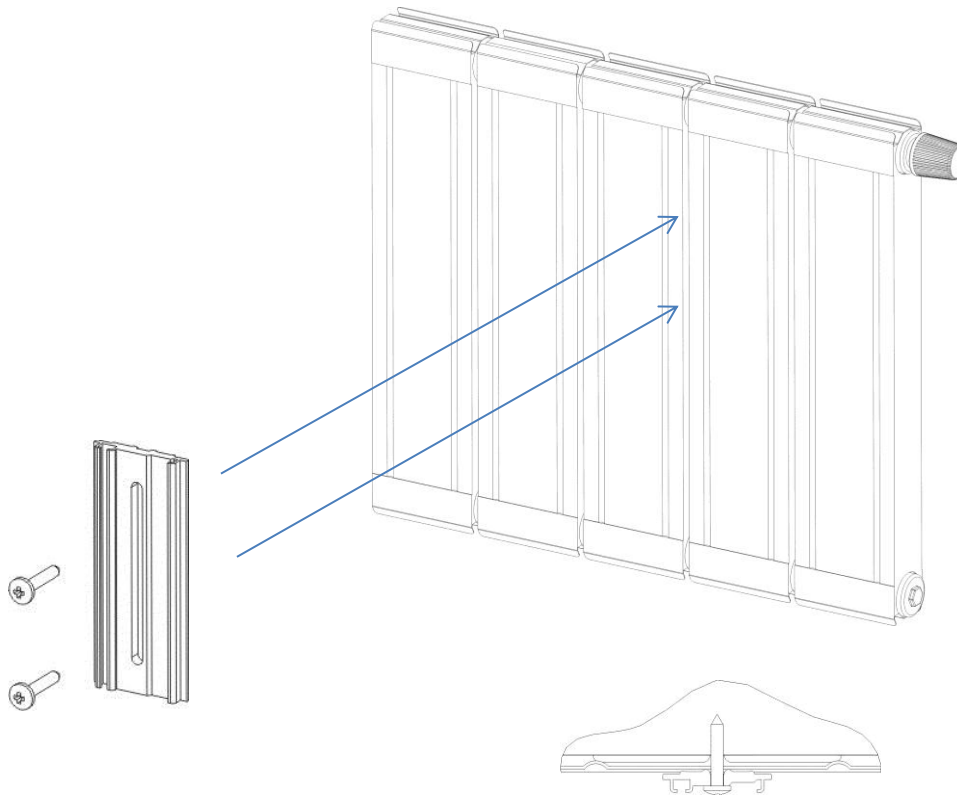
K_c values

Manufacturer	Model	K _c 1 value	K _c 2 value
Buderus	DIN cast iron	1.265	2.298
Buderus	DIN steel	1.160	2.337

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Expanding bracket M4 23/35	1.KEGRALAC.3026	1	
Expanding bracket M4 33/48 (50 mm)	1.KEGRALAC.3027	1	
Expanding bracket M4 53/65 (60 mm)	1.KEGRALAC.3028	1	
Cylinder bolt M4x45 DIN 84	1.KEGRALAC.3005	1	

1.4.7. Installation type 5-2 Aluminium sectional radiators (screw installation)



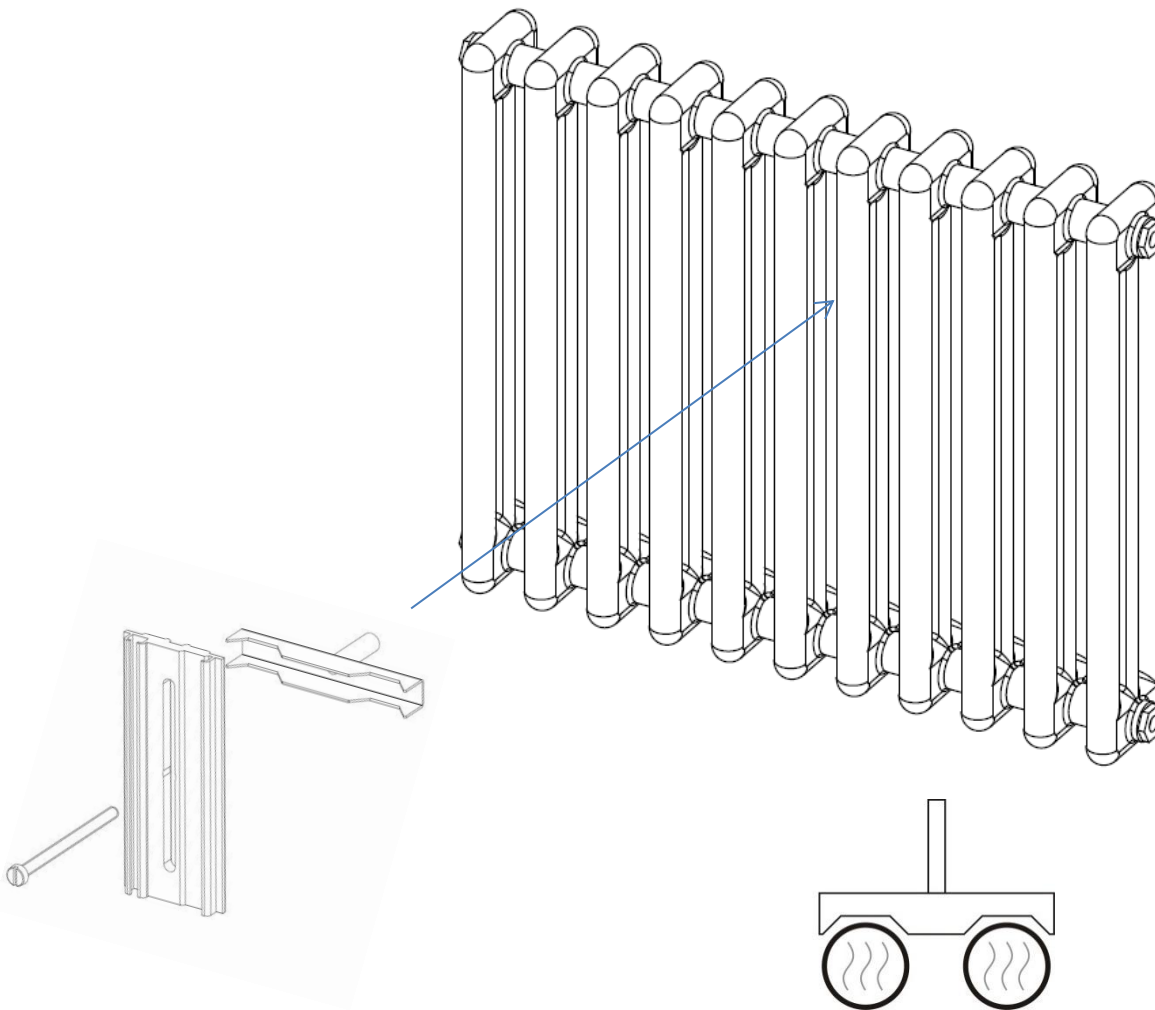
K_c values

Manufacturer	Model	K _{c1} value	K _{c2} value
Fondital	F/FS	1.517	3.080

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Self-tapping screw 4.2x25	1.KEGRALAC.3008	2	

1.4.8. Installation type 5-3 Tubular radiators (screw installation)



K_c values

Manufacturer	Model	K_c1 value	K_c2 value
Arbonia	Tubular	1.271	2.298

Installation materials required

Item Description	Item No.	Quantity	Note
Aluminium thermoconductor	1.KEGRALAC.3025	1	
Pipe slide nut (36 mm)	1.KEGRALAC.3012	1	
Pipe slide nut (45 mm)	1.KEGRALAC.3013	1	Alternative
Cylinder bolt M4x45 DIN 84	1.KEGRALAC.3005	1	
Cylinder bolt M4x55 DIN 84	1.KEGRALAC.3006	1	Alternative
Cylinder bolt M4x35 DIN 84	1.KEGRALAC.3004	1	Alternative