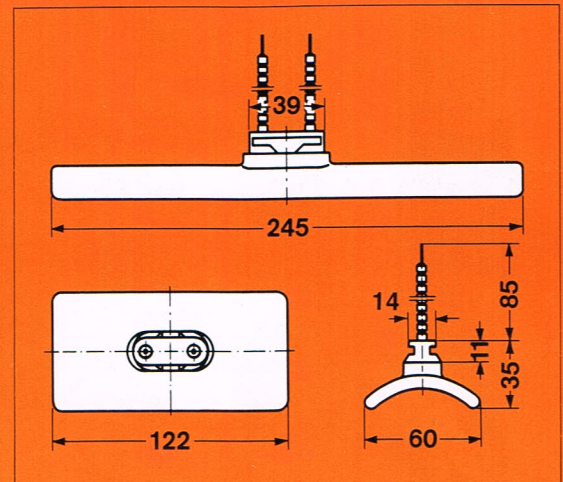
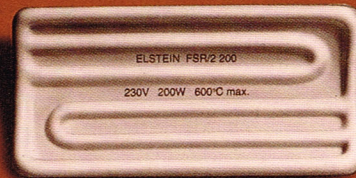
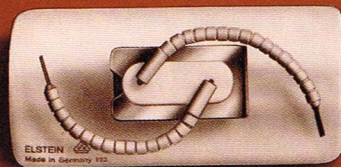
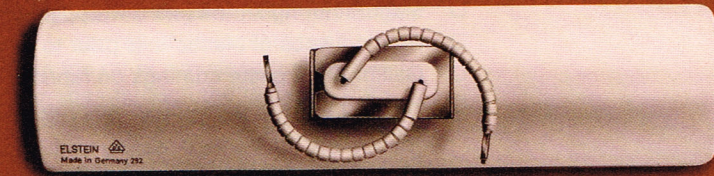


10 The photo shows the types of available FSR elements complete with spring fitting. From top: FSR (back), FSR (front); below FSR/2.

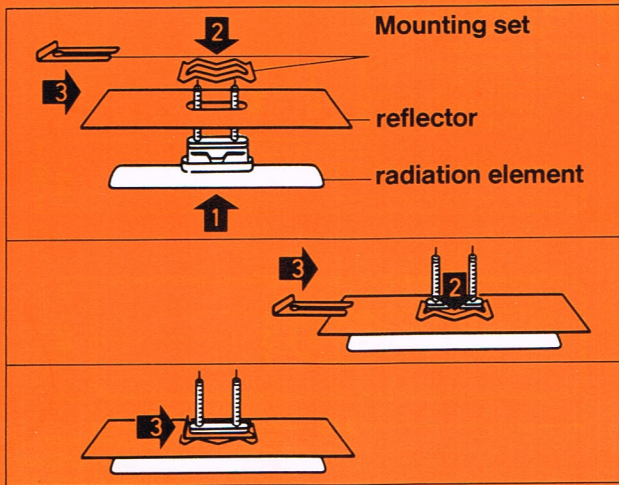
11 This drawing shows the most important dimensions of FSR radiation elements. It applies to both types (FSR and FSR/2).



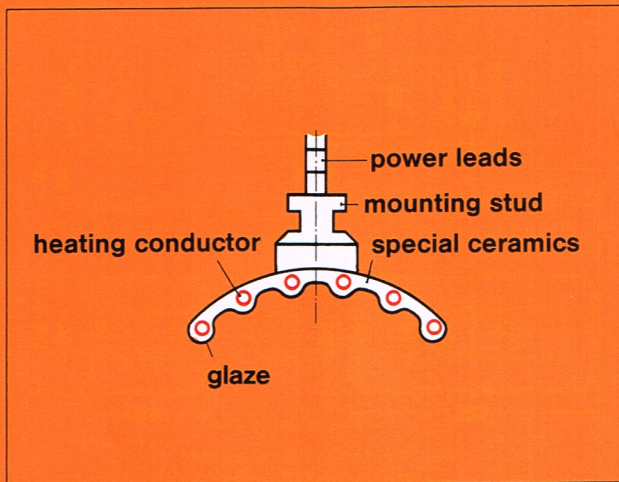
Type of radiation element and power of radiation element	FSR	250	400	650	1000	W
	FSR/2	125	200	325	500	W
Maximum power per m ² radiation area		16	25,6	41,6	64	kW
Typical operating temperature if unimpeded radiation is directed to the bottom vertically *		400	500	620	730	°C
Maximum permissible temperature *		550	600	700	750	°C
Wavelength range		2 - 10				μm
Heat-up constant to 63 % of the final temperature *		4,8	3,8	3,0	2,4	min
Mean cool-down time from the final temperature to 200 °C *		7	9	11	12	min
Typical temperature of exposed goods (guideline, since it strongly depends on the goods)		150	200	250	300	°C

* measured by using thermocouple

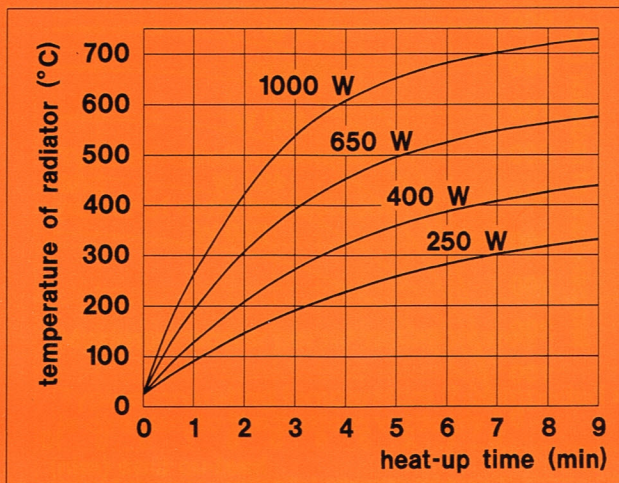
Table 1
Performance data of Elstein



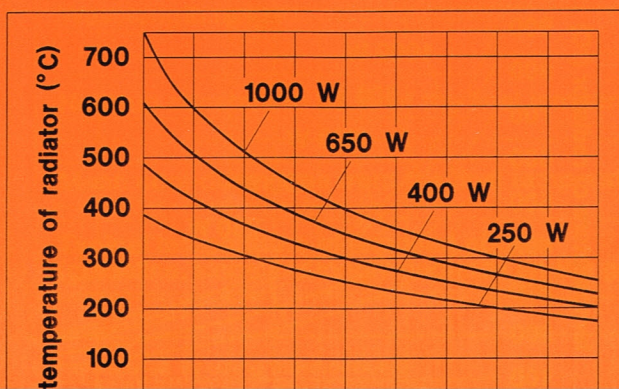
12 This is the way Elstein radiation elements are mounted. The mounting set, which consists of a slide and a spring, is always supplied together with the radiation elements.



13 The cross-section of a ceramic FSR element shows that the heating conductor is firmly embedded in the ceramic and thus, for the most part, is protected from oxidation.



14 This diagram shows the heat-up curves of Elstein FSR Infrared Radiation Elements.



(Pictures 10, 11 and 13) are modular radiation elements which have been manufactured in a special process. They have a firmly burnt-in heating coil consisting of highly heat proof resistance wire with almost constant resistance over the whole temperature range. This explains the superior service life of Elstein Infrared Radiation Elements. They have been manufactured for more than five decades, and their quality has been proven several million times. The firm embedding makes installation in any position possible.

The glaze used for Elstein elements has excellent radiation properties. As a result, the radiation efficiency is very high. Elstein Infrared Radiation Elements have their maximum emissivity within the favourable wavelength range between 2 and 10 μm . This corresponds to the requirements of practical operation particularly well. Their resistance against cyclical temperature stress is remarkable; they are insensitive to splashes of cold water. Elstein Infrared Radiation Elements do not oxidize, therefore the exposed goods always remain clean.

Elstein FSR Infrared Radiation Elements are available in two standard lengths: 245 mm (FSR) and 122 mm (FSR/2). Both models are 60 mm wide. FSR radiation elements are manufactured with the power ratings 250, 400, 650, and 1000 watts. The wattages of FSR/2 radiation elements are 125, 200, 325, and 500 watts. It can be seen that in each case half the length of the radiation element corresponds to half the wattage of the full length. So it becomes possible to build radiation panels with locally constant power per area by combining FSR and FSR/2 elements.

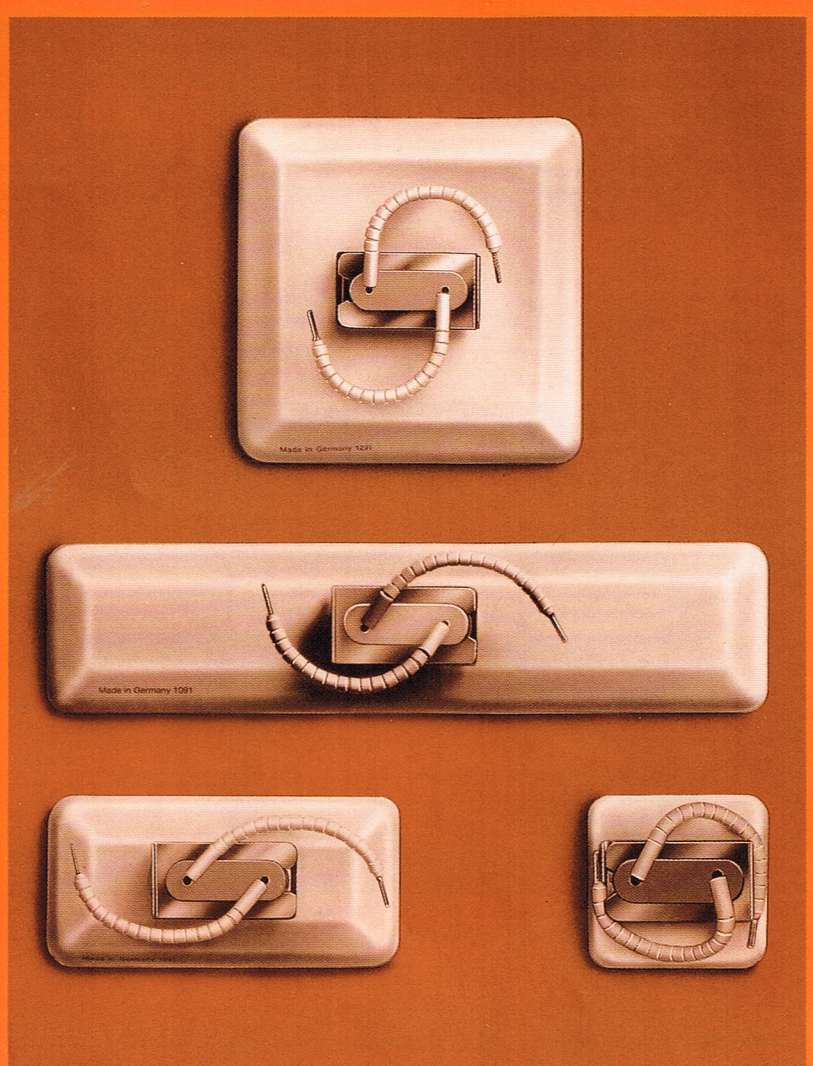
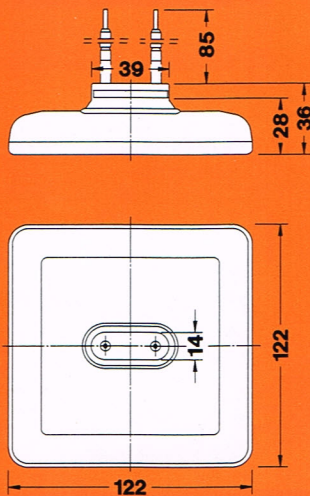
Standard radiation elements are rated for 230 volts mains voltage; please contact us if other voltages are required. Each radiation element is supplied together with a mounting set. The set consists of a wave spring and a slide. Picture 12 shows how the radiation elements are mounted on a metal reflector sheet. This may have a maximum thickness of 1.5 mm.

Elstein EBF Infrared Constructional Units, which are described on Pages 10 and 11, have proved to be ideal for the simple and speedy installation of plane or curved radiation panels or single rows of radiation elements. The power per area, surface temperatures etc. which can be achieved are shown in Table 1 on Page 6.

In many cases it is advantageous to install a temperature control system to achieve optimum operating conditions. You will find detailed information in the section "Temperature Controlling of Elstein Infrared Systems" on Page 15.

20 Designs and shapes of Elstein High Temperature Radiation Elements HTS (top), HTS/1 (centre), HTS/2 (bottom left), HTS/4 (bottom right).

21 Dimensions for the installation of Elstein HTS High Temperature Radiation Elements.



Type of radiation element and power of radiation element	HTS, HTS/1	250	400	600	800	1000	W
	HTS/2	125	200	300	400	500	W
	HTS/4	60	100	150	200	250	W
Maximum power per m ² radiation area		16	25,6	38,4	51,2	64	kW
Typical operating temperature if unimpeded radiation is directed to the bottom vertically *		450	570	700	810	900	°C
Maximum permissible temperature *		700	750	800	850	900	°C
Wavelength range		2 - 10					µm
Heat-up constant to 63 % of the final temperature *		3,2	2,8	2,2	2	1,8	min
Mean cool-down time from the final temperature to 200 °C *		5,5	7,5	9,5	10	11	min
Typical temperature of exposed goods (guideline, since it strongly depends on the goods)		180	230	270	300	330	°C

* measured by using thermocouple radiation element in FRF

Table 2
Performance data of Elstein

Elstein HTS High Temperature Radiation Elements

Elstein HTS High Temperature Radiation Elements offer the user an extended range of possibilities for infrared drying and heating. They are distinguished from FSR radiation elements by the following improvements:

1. Energy saving with integrated heat insulation.
2. Continuous operating temperature up to 900 °C.
3. Heat-up time reduced compared with infrared radiation element FSR

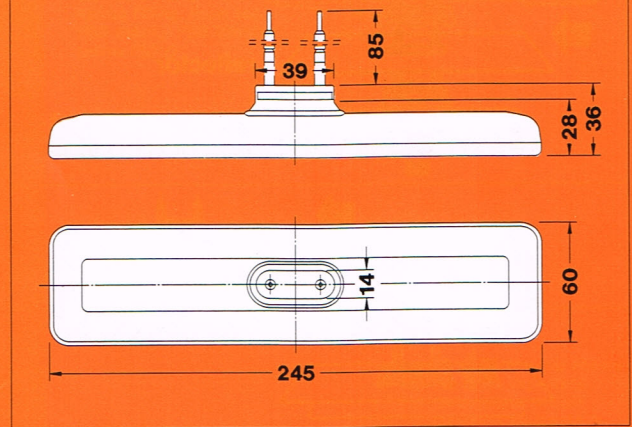
Elstein HTS High Temperature Radiation Elements consist of a ceramic body which is filled with highly efficient heat insulation material. The heating coil is firmly burnt into the ribs of the radiation area. The heat insulation integrated into Elstein HTS High Temperature Radiation Elements minimizes the heat losses at the back of the radiation elements and reduces the temperature in the wiring space. This results in increased efficiency and economic operation of systems equipped with these radiation elements, which is a contribution to saving valuable energy.

At the back of Elstein HTS High Temperature Radiation Elements there is the Elstein stud. So replacement to increase the performance of existing systems is easily possible. Elstein HTS High Temperature Radiation Elements can also be supplied with integrated NiCr-Ni thermocouple in order to detect the element temperature, for example for power controlling.

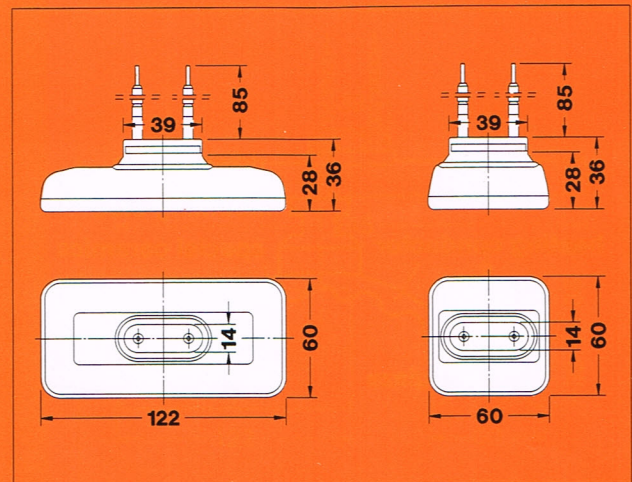
Experience has shown that temperature controlling is indispensable to achieve optimal results. Therefore we would recommend to consider such a control system in the projecting phase already. Further details can be found on Pages 14 - 16. Only the firstclass materials used to manufacture Elstein HTS High Temperature Radiation Elements guarantee their excellent properties. The use of these radiation elements at a continuous operating temperature of up to 900 °C has only become possible by developing special ceramics which can withstand temperature changes particularly well. The glaze also has excellent radiation properties. This results in high radiation efficiency. Elstein HTS High Temperature Radiation Elements primarily emit their energy in the wavelength range of 2 - 10 μm . Thus they fulfil the requirements for fast and efficient heating of modern materials. The reduction in heat-up time and the increase in the surface temperature of the radiation elements are made possible by the high-temperature insulation integrated into the radiation elements. The heat - up curves for radiation elements with various power ratings are shown in Picture 18. Picture 19 shows typical cool-down curves. The radiation elements respond to changes of the preset values quickly. In spite of this the elements are able to compensate for mains voltage fluctuations.

In order to build radiation systems in the form of rows or panels with HTS elements, the EBF and BSH systems described on Pages 10-13 can be used.

16 Dimensions for the installation of Elstein HTS/1 High Temperature Radiation Elements.



17 Dimensions for the installation of Elstein HTS/2 and HTS/4 High Temperature Radiation Elements.



18 Heat-up curves of Elstein HTS High Temperature Radiation Elements.

