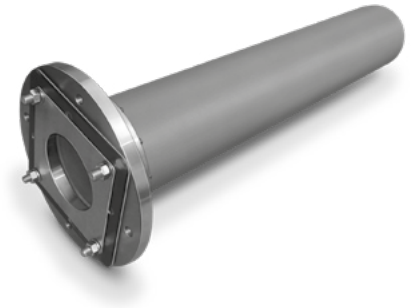


## Ceramic radiant tubes SER-C

### TECHNICAL INFORMATION

- Suitable for high temperature applications and high radiation output due to ceramic material
- Can be used in many applications due to different radiant tube diameters
- Patented flange connection for improved gas tightness
- No counter bearing required due to high dimensional stability
- Long maintenance intervals, no rotation of radiant tube
- Long service life due to high resistance to oxidation and corrosion



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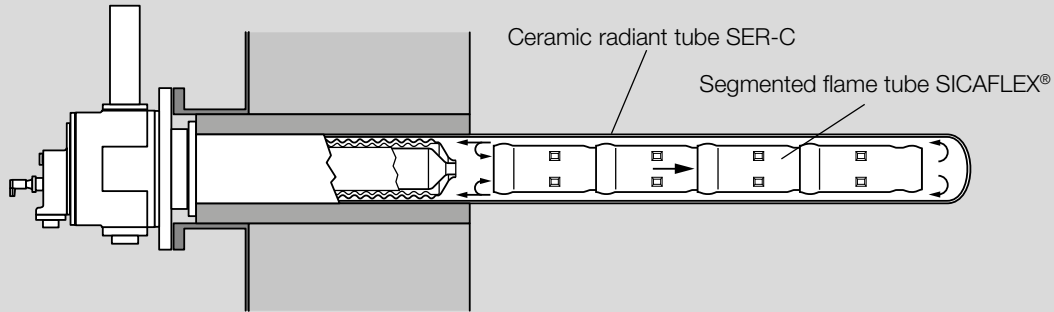
# Contents

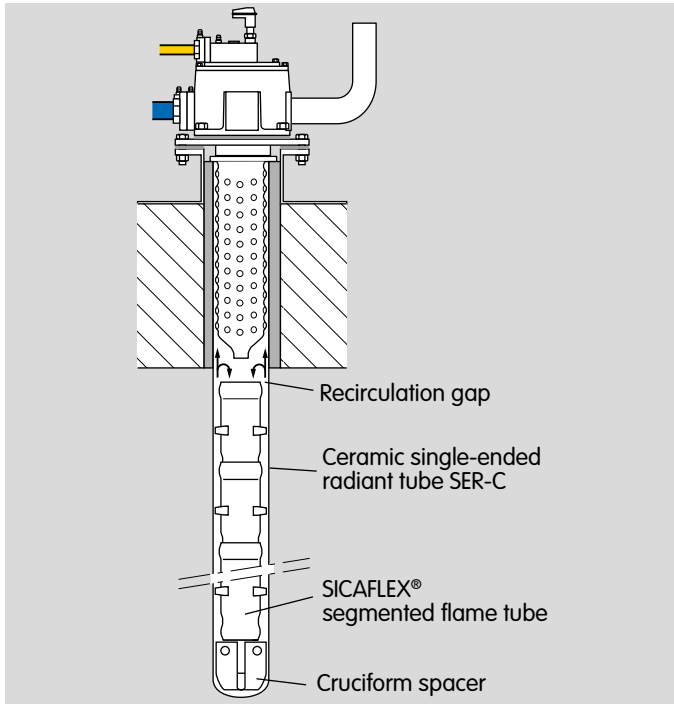
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## 1 Application

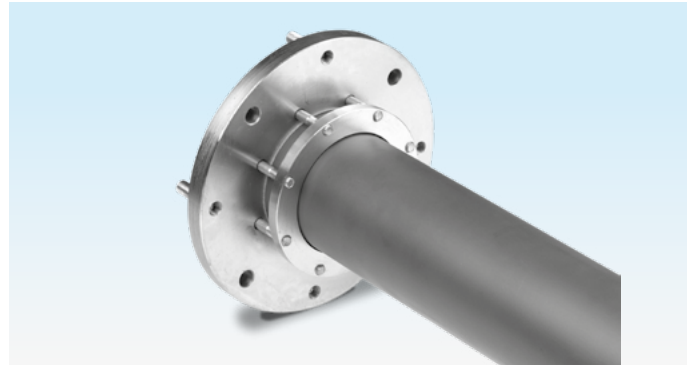
The ceramic radiant tube SER-C (SER = single ended radiant tube) is used in conjunction with a self-recuperative burner for indirect heating in heat treatment processes where the combustion gases must be separated from the

product. A flame tube must be fitted inside the ceramic radiant tube SER-C to guide the hot flue gases. In the case of vertical installation, a cruciform spacer must also be fitted to ensure optimum sizing of the recirculation gap – see page 14 (4 Accessories).

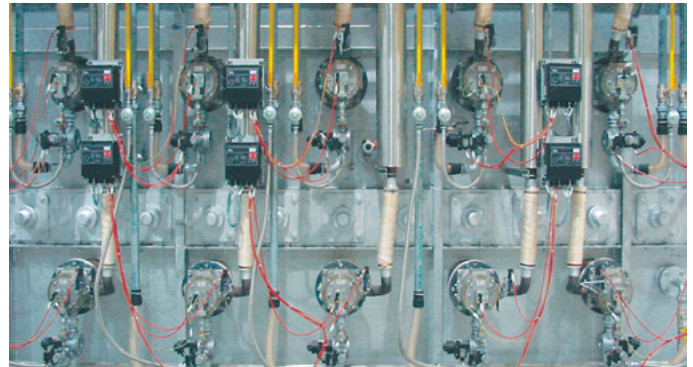




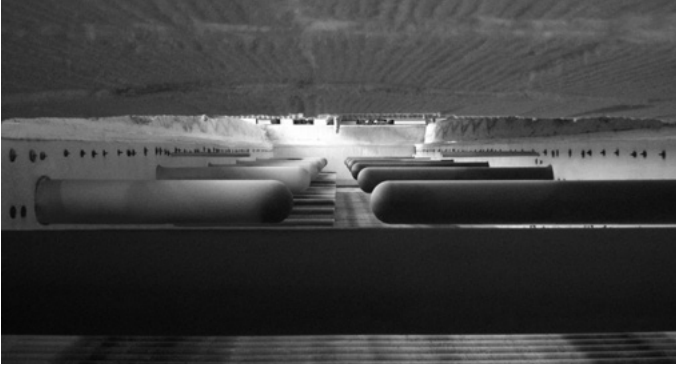
## 1.1 Application examples



*The ceramic radiant tube SER-C with patented flange connection is gas-tight.*



*Roller hearth furnace for steel tube production*



*Ceramic radiant tubes SER-C in roller hearth furnace during installation work*

## 2 Selection

The ceramic radiant tube SER-C has dimensions suitable for use with the ceramic self-recuperative burner ECOMAX-(LE)..C.

### Standard combinations

#### ECOMAX

Radiant tube	Burner	Segmented flame tube
SER-C 100/088	ECOMAX 0C	SICAFLEX 100/088/084
SER-C 142/128*	ECOMAX 1C	SICAFLEX 142/127/123
SER-C 162/148*	ECOMAX 2C	SICAFLEX 162/147/143
SER-C 202/188*	ECOMAX 3C	SICAFLEX 202/186/182

#### ECOMAX LE

Radiant tube	Burner	Segmented flame tube	FlameCone**
SER-C 142/128	ECOMAX LE 1C	SICAFLEX 142/127/123	FlameCone ECO-LE-1C-129-135-550-H
SER-C 162/148*	ECOMAX LE 2C	SICAFLEX 162/147/143	FlameCone ECO-LE-2C-149-155-550-H
SER-C 202/188*	ECOMAX LE 3C	SICAFLEX 202/186/182	FlameCone ECO-LE-3M/C-185-207-550-H

\* Versions with flange connection for smaller burners are available – see selection table.

\*\* FlameCone for horizontal installation

A special design is available for applications with a large hydrogen content (> 40%) in the protective atmosphere.

## 2.1 Selection table

Options	SER-C 100/088	SER-C 142/128	SER-C 162/148	SER-C 202/188
Length [mm]	-W1000 to -W2600	-W1500 to -W2600	-W1500 to -W3000	-W1500 to -W3000
Flange connection for ECO-MAX..C	-Eco 0C	-Eco 0C*, -Eco 1C	-Eco 0C*, -Eco 2C	-Eco 0C*, -Eco 1C*, -Eco 2C*, -Eco 3C
Connection dimensions different from standard	-X	-X	-X	-X
For hydrogen	-Y	-Y	-Y	-Y
Special version**	-Z	-Z	-Z	-Z

\* Additional flue gas guide tube FGT set required.

\*\* Further information on request.

## Order example

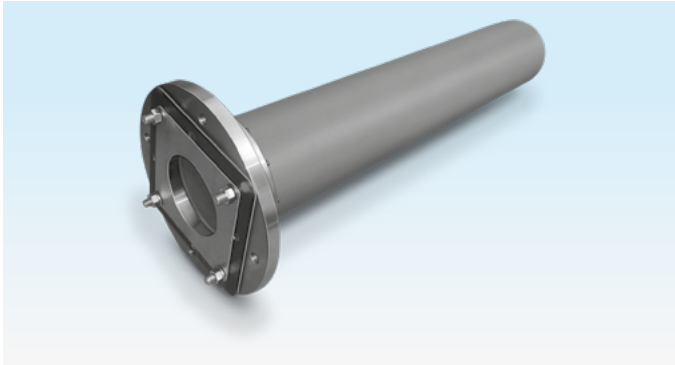
SER-C 142/128-W1500-Eco 1C

## 2.1.1 Type code

<b>SER-C</b>	Ceramic radiant tube
<b>100/088-202/188</b>	External/internal diameter [mm]
<b>W1000-3000</b>	Length [mm]
<b>Eco 0C-Eco 3C</b>	Flange connection for ECOMAX..C
<b>-X</b>	Connection dimensions deviate from standard
<b>-Y</b>	For hydrogen
<b>-Z</b>	Special version

## 3 Project planning information

### 3.1 Scope of delivery/delivery of items



Ceramic radiant tube with fitted flange connection including burner gasket, threaded bolts, nuts and washers for burner attachment.

The mounting gasket for installation between SER-C and the furnace flange is supplied.

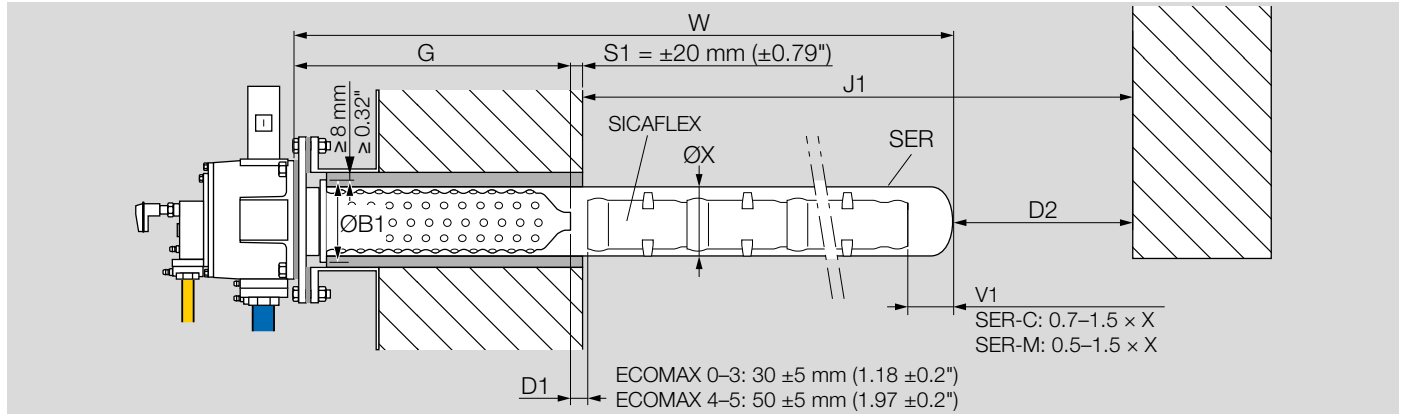
Before delivery, all radiant tubes undergo non-destructive testing for possible capillary cracks. On receiving the delivery, check that the shock sensors on the packaging are intact. A liquid inside a glass tube turns irreversibly red upon heavy impact during transportation.





## 3.2 Radiant tube length

### ECOMAX



The length **W** of the radiant tube SER-C depends on the clear furnace width (furnace height) **J1** and the burner length **G**.

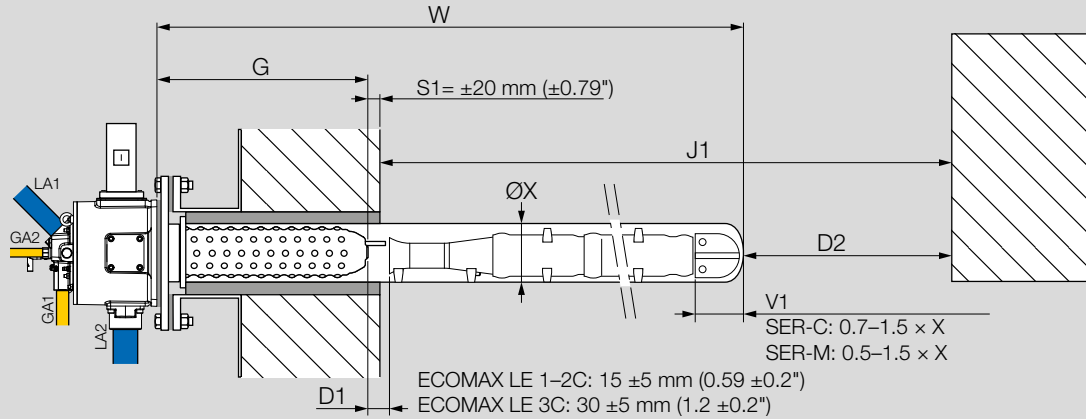
$$W \leq J1 + G + S1 - D2 \quad (D2 \geq 40 \text{ mm})$$

The minimum length of the radiant tube depends on the burner length **G** and the flame length.

$$W > G + 2 \times \text{flame length}$$

When designing a radiant tube heating system, it must also be ensured that the permitted material temperatures of the radiant tube, flame tube and burner are not exceeded. Precise determination of these temperatures requires calculation of heat exchange.

#### ECOMAX LE

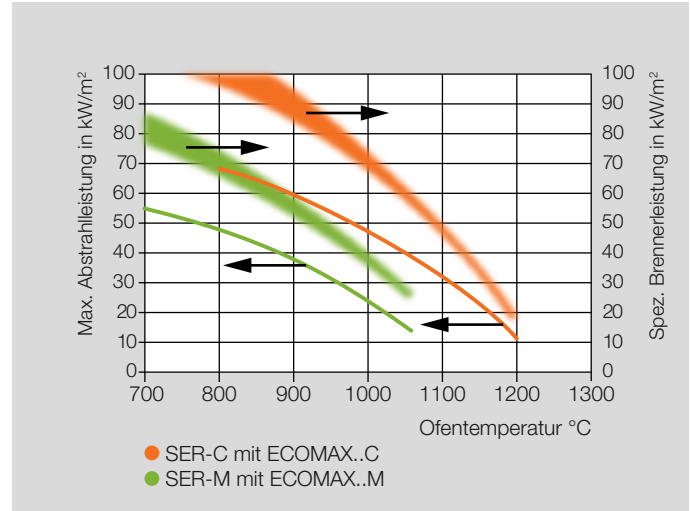


The length **W** of the radiant tube SER-C depends on the clear furnace width (furnace height) **J1** and the burner length **G**.

$$W \leq J1 + G + S1 - D2 \quad (D2 \geq 40 \text{ mm})$$

Minimum radiant tube length for ECOMAX LE: **W**  $\geq$  **1500 mm**

#### ECOMAX, ECOMAX LE



#### 3.3 Installation

Install the radiant tube shock-free and free of mechanical stress. Force must not be applied to the radiant tube by the furnace lining.

Ensure that there are threaded bolts on the furnace flange to attach the ceramic radiant tube to the furnace. The furnace flange must be level with and at right angles to the opening in the furnace wall  $\varnothing Y$ .

Ensure that there is an annular void  $R = (Y - X) / 2$  between the radiant tube and the furnace lining. Depending on the furnace lining and the type of expected movements in the furnace wall, the annular void must be at least 40 mm. Use a larger annular void if necessary.

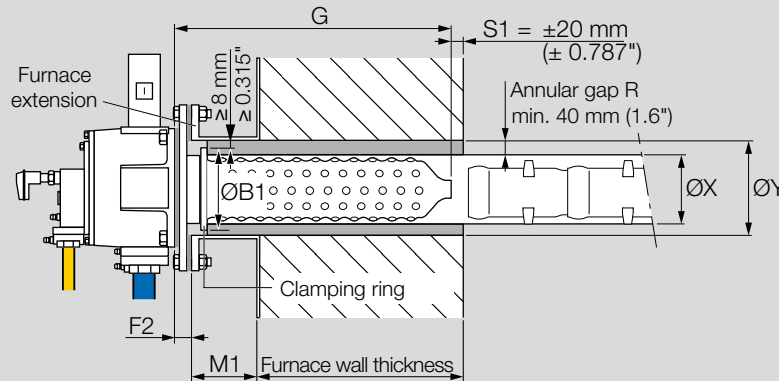
The flange thickness **F2** of the radiant tube including the burner gasket and mounting gasket is either 34 mm or 37 mm (1.34" or 1.46"), depending on the size.

Design the height of the furnace extension **M1** so that the front edge of the recuperator is flush with the interior furnace wall. Permitted tolerance: max.  $\pm 20$  mm ( $\pm 0.787$ ") for **S1**.

#### Calculation

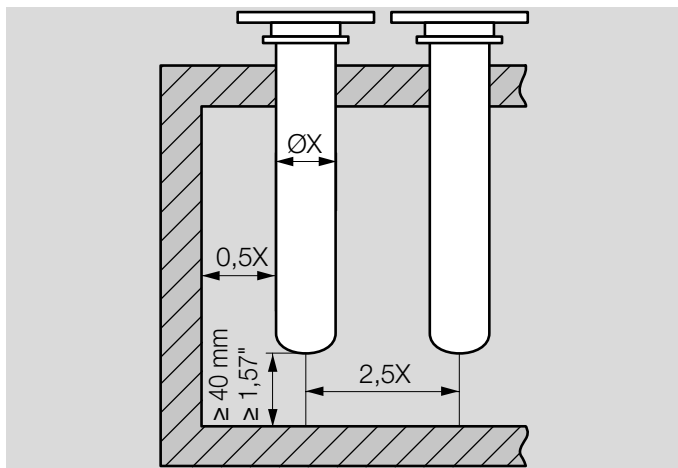
$$M1 = G - F2 - \text{furnace wall thickness}$$

When dimensioning the inside diameter of the furnace extension, note the diameter **B1** of the clamping ring. Loosely wrap and compress a ceramic fibre blanket around the radiant tube before installing it in the furnace.



Radiant tube	Clamping ring SER-C, ØB1		Ceramic radiant tube, ØX		Lining opening, ØY		F2	
	mm	inch	mm	inch	mm	inch	mm	inch
SER-C 100/088	160	6.3	100	3.94	> 180	≥ 7.1	34	1.3
SER-C 142/128	200	7.87	142	5.59	> 222	≥ 8.7	37	1.46
SER-C 162/148	220	8.66	162	6.38	> 242	≥ 9.5	37	1.46
SER-C 202/188	260	10.2	202	7.95	> 282	≥ 11.1	37	1.46

#### 3.4 Radiant tube distances



The centre to centre distance of the radiant tubes should be  $\geq 2.5 X$ . The distance of the radiant tube from the furnace wall, the furnace floor or the load to be heated should be  $0.5 X$  to the side of the radiant tube and  $\geq 40 \text{ mm}$  ( $1.57''$ ) to the end of the radiant tube.

#### 3.5 Resistance of SiSiC

The ceramic radiant tube SER-C consists of reaction-bound silicon carbide infiltrated with metallic silicon (SiSiC). During the manufacturing process, a protective layer made of  $\text{SiO}_2$  is formed on the surface, which ensures very good chemical resistance. When installing the tubes, it must be ensured that the protective layer on the ceramic surface is not damaged.

Once the tubes have been installed (and, where necessary, once the furnace has been tempered), annealing the radiant tubes for at least 72 hours in a moist air atmosphere at

maximum furnace temperature is recommended. The optimal humidity level for this is 50 to 70%. Only then should the furnace be purged and operated with a protective atmosphere.

A minimum humidity in the protective atmosphere is required in order to maintain the protective layer. Too low a humidity (or too low an  $\text{O}_2$  content) may lead to conversion of  $\text{SiO}_2$  to gaseous  $\text{SiO}$  and may thus result in gradual destruction of the protective layer and the radiant tube. In the case of high radiant tube temperatures ( $> 1150^\circ\text{C}$  or  $2100^\circ\text{F}$ ) or low dewpoints ( $< -40^\circ\text{C}$  or  $-40^\circ\text{F}$ ), corrosion of the SiSiC ceramics (white deposits, signs of erosion) cannot be ruled out, especially in hydrogenous protective atmospheres. In this case, a shorter service life is to be expected for the ceramics.

Impurities such as fluorine, chlorine or alkali compounds (e.g. with sodium or potassium) in the furnace atmosphere also lead to chemical attack and shorten the service life of the ceramic radiant tube SER-C. Dust deposits on the SER-C increase corrosion, thus reducing the service life.

In the case of sub-stoichiometric burner operation ( $\text{CO}$  concentration  $> 1000 \text{ ppm}$ ), white deposits can build up on the inside of the radiant tube on the SiSiC over a long period of time. The burners should be adjusted so that an excess air value of 1–5%  $\text{O}_2$  in the flue gas is reached.

## 3.6 Leakage rates

The leakage rate of the flue gas into the furnace chamber depends on the difference between the radiant tube internal pressure upon operation of the burner and the furnace pressure.

The patented radiant tube connection is free of shaped fibre parts or other parts which are likely to show significant compression-induced deformation with an associated reduction in tightness. Due to the joint being compressed with steel springs, the seals stay in place regardless of the stresses induced by temperature change when operating burners in intermittent mode. This has been proven in laboratory tests over several weeks. Constant compression and an unchanging sealing function can thus be expected for many years.

Radiant tube	Max. specific leakage at the flange connection	
	$(\text{dm}^3_{(n)})/(\text{mbar} \times \text{h})$	SCFH/"WC
SER-C 142	0.082	$7.76 \times 10^{-3}$
SER-C 162	0.094	$8.9 \times 10^{-3}$
SER-C 202	0.117	$11.1 \times 10^{-3}$

### Determining the leakage rate

An app for calculating the leakage rate is available at [www.adlatus.org](http://www.adlatus.org).

## 4 Accessories

### 4.1 Segmented flame tube SICAFLEX®

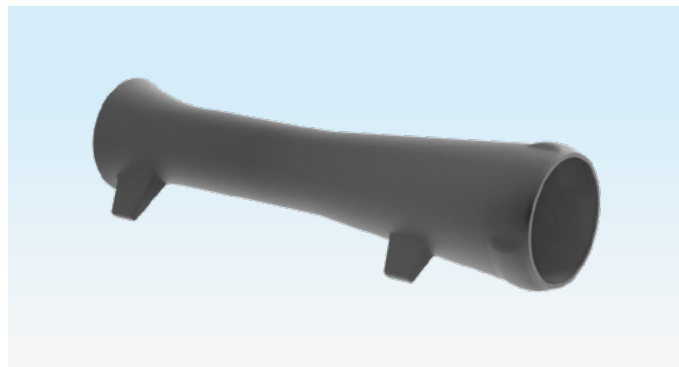


Segmented ceramic flame tubes SICAFLEX to guide hot flue gases in radiant tubes SER-C and SER-M.

For further information, see [Technical Information Segmented flame tube SICAFLEX](#).

Order No. on request.

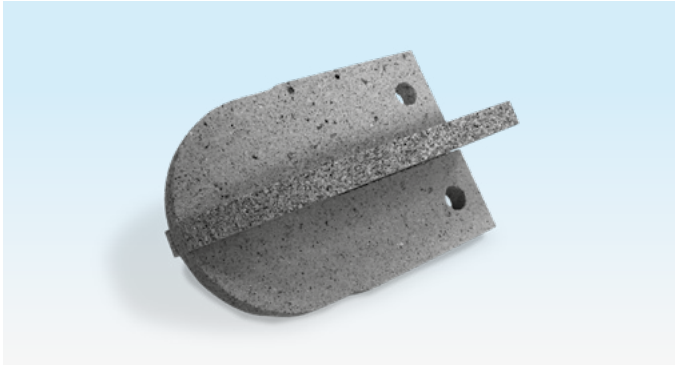
### 4.2 FlameCone



Designation	Order No.	SER-C
FlameCone ECO-LE-1C-129-135-550-H	34340812	SER-C 142/128
FlameCone ECO-LE-2C-149-155-550-H	34340813	SER-C 162/148
FlameCone ECO-LE-3M/C-185-207-550-H	34340800	SER-C 202/188

The FlameCone is required in the radiant tube for Flameless mode. It is connected to the SICAFLEX by a bayonet joint.

### 4.3 Cruciform spacer



*Refractory clay (for horizontal firing only)*



*SiSiC*

#### **ECOMAX**

For installation of the SICAFLEX segmented flame tube in vertical radiant tubes, see [TI SICAFLEX – SICAFLEX in vertically fitted single ended radiant tubes](#).

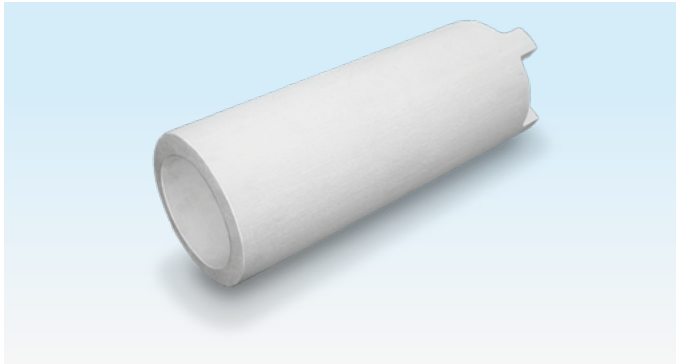
#### **ECOMAX LE**

SiSiC cruciform spacer required for horizontally and vertically fitted single ended radiant tubes.

The cruciform spacer ensures optimum sizing of the recirculation gap between the segmented flame tube and the burner.

Available on request in different sizes depending on the SICAFLEX sizes and different heights.

### 4.4 Flue gas guide tube FGT set



*Further FGT sets are available on request.  
FGT sets for ECOMAX LE on request.*

To guide the flue gases if smaller burners are used than those normally intended, see page 6 (2 Selection). The flue gas guide tube ensures sufficient heat exchange via the burner recuperator.

Material: shaped part made of vacuum-formed ceramic fibres (RCF).

Available in different sizes and versions suitable for the SER-C radiant tube and ECOMAX burner sizes.

Designation	Order No.
FGT-SET ECO 0C395-SER-C 142	22802270
FGT-SET ECO 0C475-SER-C 142	22104810
FGT-SET ECO 0C556-SER-C 142	22105204
FGT-SET ECO 0C636-SER-C 142	22106581
FGT-SET ECO 0C395-SER-C 162	22104287
FGT-SET ECO 0C556-SER-C 162	22105968
FGT-SET ECO 1C545-SER-C 162	22102113
FGT-SET ECO 1C593-SER-C 162	22105298
FGT-SET ECO 1C545-SER-C 202	22803158
FGT-SET ECO 1C593-SER-C 202	22801083
FGT-SET ECO 2C545-SER-C 202	22803949



## 5 Technical data

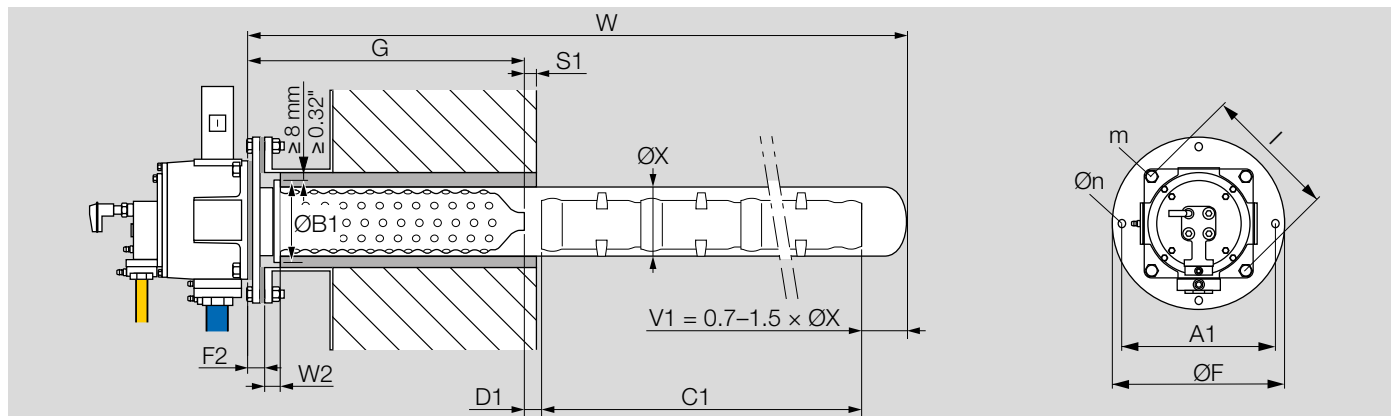
Material:

Radiant tube: SiSiC, max. application temperature 1350°C (2462°F).

Flange connection: heat-resistant steel, 1.0425 (H11).

Storage and transport temperatures: -20 to +40°C (-4 to +104°F).

## 5.1 Dimensions



mm

Type	$\varnothing X$	$W^{1)}$	$\varnothing B1$	$F2$	$S1$	$W2$	$A1$	$\varnothing F$	$l^{2)}$	$D1$	$m$	$\varnothing n$
mm												
SER-C 100/088	100	1000–2600	160	34	$0 \pm \text{max. } 20$	35	240	290	210	$30 \pm 5$	4 x M12	4 x 14
SER-C 142/128	142	1500–2600	200	37	$0 \pm \text{max. } 20$	50	280	330	290	$30 \pm 5$	4 x M16	4 x 19
SER-C 162/148	162	1500–3000	220	37	$0 \pm \text{max. } 20$	50	280	330	290	$30 \pm 5$	4 x M16	4 x 19
SER-C 202/188	202	1500–3000	260	37	$0 \pm \text{max. } 20$	50	325	385	330	$30 \pm 5$	4 x M16	4 x 19

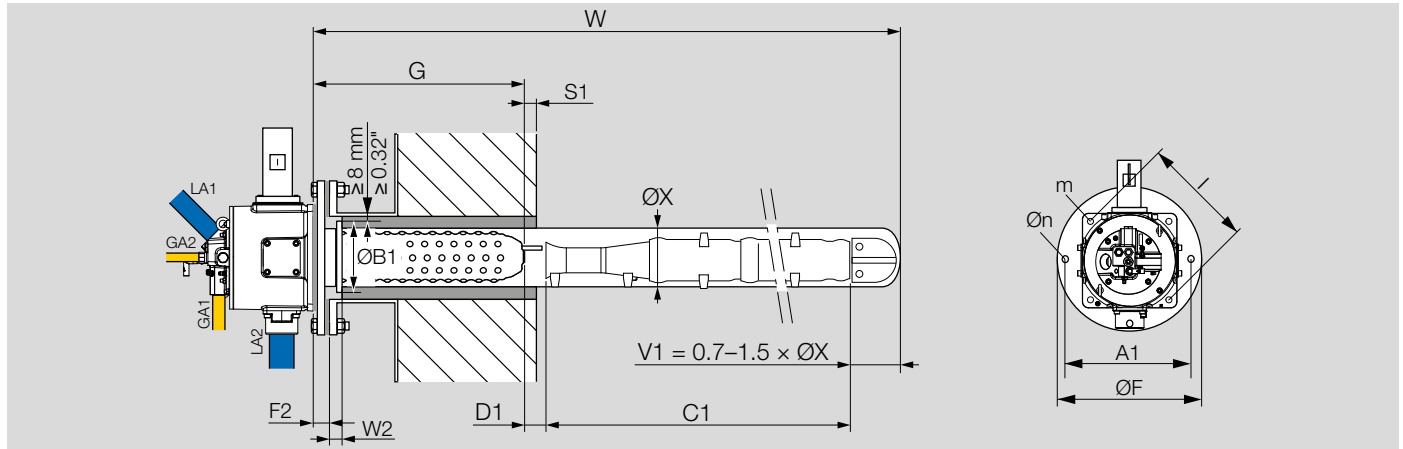
inch

Type	$\varnothing X$	$W^{1)}$	$\varnothing B1$	$F2$	$S1$	$W2$	$A1$	$\varnothing F$	$l^{2)}$	$D1$	$m$	$\varnothing n$
inch												
SER-C 100/088	3.94	39.4–102	6.3	1.34	$0 \pm \text{max. } 20$	1.38	9.45	11.4	8.27	$1.2 \pm 0.2$	4 x M12	4 x 0.55
SER-C 142/128	5.59	59.1–102	7.87	1.46	$0 \pm \text{max. } 20$	1.97	11	13	11.4	$1.2 \pm 0.2$	4 x M16	4 x 0.75
SER-C 162/148	6.38	59.1–118	8.66	1.46	$0 \pm \text{max. } 20$	1.97	11	13	11.4	$1.2 \pm 0.2$	4 x M16	4 x 0.75
SER-C 202/188	7.95	59.1–118	10.2	1.46	$0 \pm \text{max. } 20$	1.97	12.8	15.2	13	$1.2 \pm 0.2$	4 x M16	4 x 0.75

<sup>1)</sup> In 100 mm increments.

<sup>2)</sup> Applicable for standard flange connections, see page 6 (2 Selection).

## 5.2 SER-C for ECOMAX LE..C



mm

Type	ØX	W <sup>1)</sup>	Ø B1	F2	S1	W2	A1	Ø F	l <sup>2)</sup>	D1	m	Øn
mm												
SER-C 142/128	142	1500–2600	200	37	±20	50	280	330	290	15 ± 5	4 x M16	4 x 19
SER-C 162/148	162	1500–3000	220	37	±20	50	280	330	290	15 ± 5	4 x M16	4 x 19
SER-C 202/188	202	1500–3000	260	37	±20	50	325	385	330	30 ± 5	4 x M16	4 x 19

inch

Type	ØX	W <sup>1)</sup>	Ø B1	F2	S1	W2	A1	Ø F	l <sup>2)</sup>	D1	m	Øn
inch												
SER-C 142/128	5.6	59–102	7.9	1.5	±0.79	2	11	13	11.4	0.6 ± 0.2	4 x M16	4 x 19
SER-C 162/148	6.4	59–118	8.7	1.5	±0.79	2	11	13	11.4	0.6 ± 0.2	4 x M16	4 x 19
SER-C 202/188	8	59–118	10.2	1.5	±0.79	2	12.8	15.2	13	1.2 ± 0.2	4 x M16	4 x 19

<sup>1)</sup> In 100 mm (4") increments.

<sup>2)</sup> Applicable for standard flange connections, see page 6 (2 Selection).

## **6 Maintenance cycles**

At least twice per annum, visual inspection together with burner maintenance.

## For more information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschroder and Maxon. To learn more about our products, visit [ThermalSolutions.honeywell.com](https://ThermalSolutions.honeywell.com) or contact your Honeywell Sales Engineer.

Elster GmbH  
Strothweg 1, D-49504 Lotte  
T +49 541 1214-0  
[hts.lotte@honeywell.com](mailto:hts.lotte@honeywell.com)  
[www.kromschroeder.com](http://www.kromschroeder.com)

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