HEATFLAM

Low NO_X self-recuperative burner for gas EMX LE

TECHNICAL INFORMATION

- For radiant tube heating
- Economical, energy-saving operation by virtue of internal air preheating up to 850°C (1562°F)
- Uniform distribution of temperature by means of a high burner impulse
- Highly efficient with a ceramic burled tube recuperator or a cast steel ribbed tube recuperator.
- Low polluting level in Low NO_X mode at furnace temperatures from 850°C (1562°F) thanks to flameless combustion
- Safe flame control in Flame mode thanks to flame rod or UV sensor (optional) and reliable electrical ignition
- Maintenance-friendly thanks to modular design
- Length increments enable individual adjustment either to new systems or when modernizing existing systems

EAC

EN
Edition 01.25
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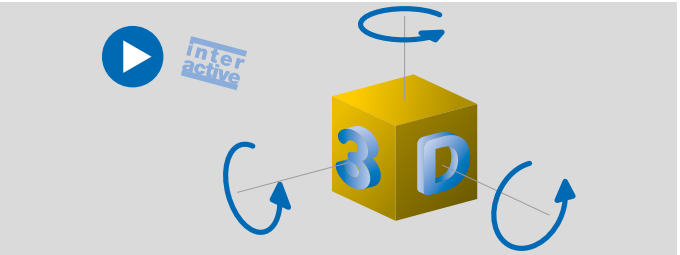
Contents

1 Application

EMX LE..C

EMX LE..M



The self-recuperative burners EMX LE are used for heating furnace systems in ON/OFF intermittent mode. The hot flue gases are fed through the ceramic or metallic heat exchanger integrated in the burner, heating the additional supply of cold combustion air flowing in the opposite direction. The maximum achievable air preheat temperature is approx. 850°C (1562°F), depending on the application.

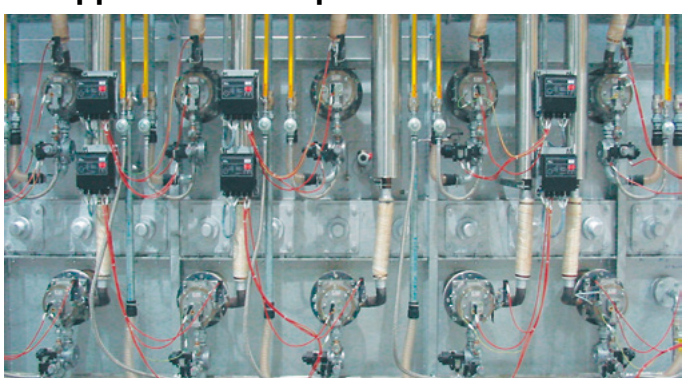
The burners are ignited by the spark electrodes and heat up the furnace in traditional Flame mode. To reduce NO_X emissions, the burner can be switched to Low NO_X mode with flameless combustion from a furnace temperature of > 850°C (1562°F).

Low NO_X mode is only possible in conjunction with (ON/OFF) cyclic control. In order to switch to Low NO_X mode, a special burner control unit BCU 465..D2 is required.

1.1 Radiant tube heating

Self-recuperative burners EMX LE are used in combination with metallic or ceramic radiant tubes, a special flame tube consisting of a FlameCone and segmented ceramic flame tubes SICAFLEX for radiant tube heating. Radiant tube heating systems are used if the combustion gases must be separated from the product, for example for heat treatment furnaces with an inert gas atmosphere in the steel industry or for the heat treatment of aluminium.

1.2 Application examples



Roller hearth furnace

Bogie hearth furnace

Tailored blank furnace

1.3 EMX LE in radiant tube heating

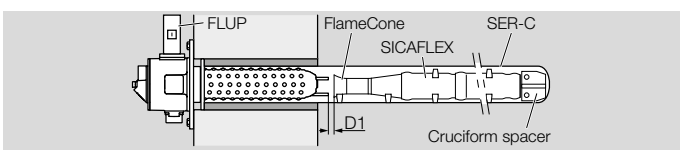
1.3.1 Single ended radiant tube

Indirect heating systems with the burner EMX LE may use a metallic radiant tube SER-M or a ceramic radiant tube SER-C. Within the radiant tube, the flue gases are guided in an internal flame tube made of the FlameCone and SICAFLEX elements. The flue gases are discharged through a flue gas connector FLUP.

The high outlet velocity of the flame recirculates the flue gases to achieve:

- a reduction in NO_X emissions
- a uniform radiant tube temperature

Low NO_X emissions can be achieved by switching to Flameless mode.



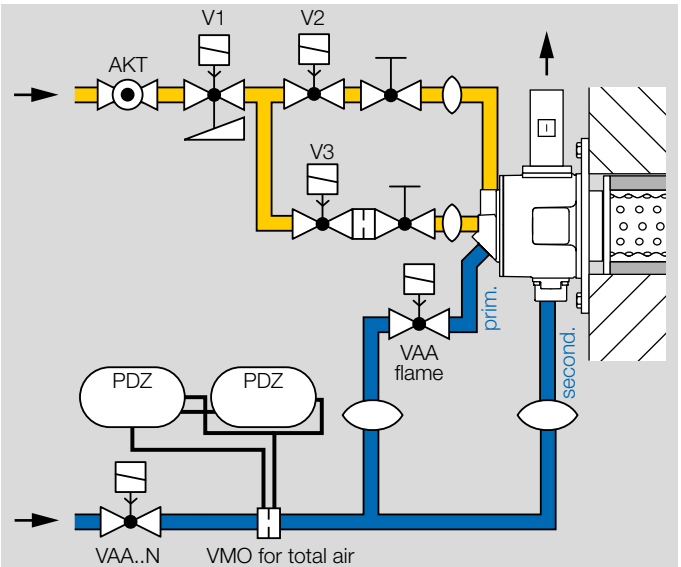
1.3.2 No pneumatic ratio control system

Slow opening gas valves and quick opening air control valves are to be used to ensure a safe burner start for radiant tube heating.

If no pneumatic ratio control system is used, the gas and air pressure in the supply lines must be controlled and monitored. Fluctuations in the supply pressure affect the burner capacity and the air index (lambda).

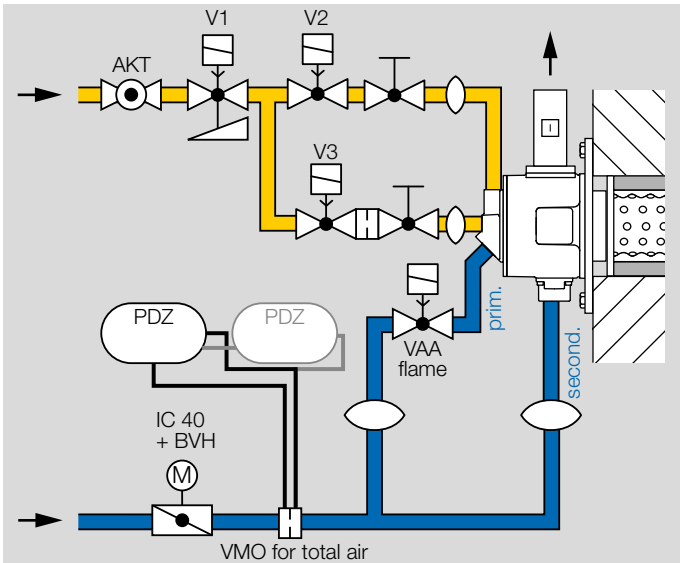
A system design with an air flow monitor is recommended to monitor the pre-purge and to act as a low air pressure protection device (pursuant to EN 746-2 and ISO 13577-2).

Control with 2 solenoid valves for air VAA (jump in capacity in Flame/Flameless mode)



The primary air valve is closed in Flameless mode. This results in a reduction of the air flow rate and the adjustable capacity. The rated capacity of the burner specifies the capacity in Flameless mode. The capacity in Flame mode is higher.

Control using butterfly valve BVH and actuator IC 40 (constant or variable capacity in Flame/Flameless mode)

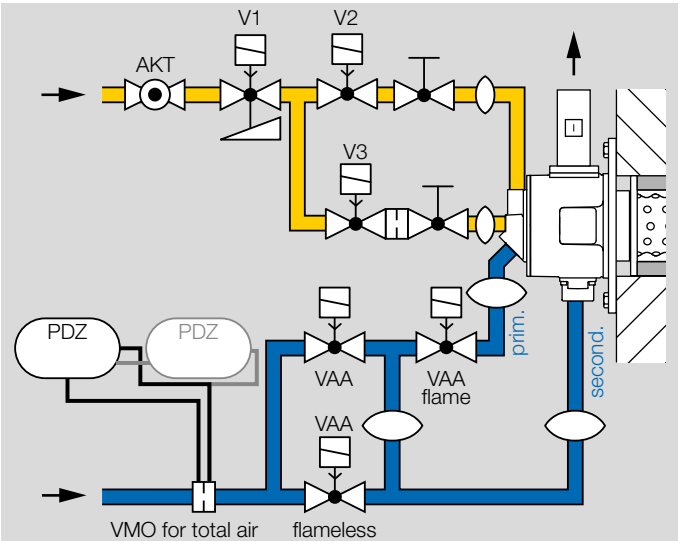


The jump in capacity can be compensated if the system is controlled using the IC 40. When the primary air valve is switched off, the BVH is opened more widely so as to compensate the reduction in capacity in Flameless mode.

The capacities for Flame mode and Flameless mode can be set independently of each other if the system is controlled with IC 40 and two pressure switches using the total air orifice.

1 pressure switch: constant capacity,
2 pressure switches: variable capacity

Control with 3 solenoid valves for air VAA (constant or variable capacity in Flame/Flameless mode)



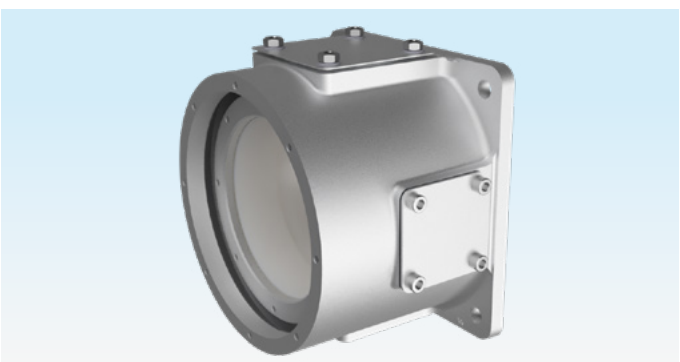
The capacities in Flame mode and Flameless mode can be set independently of each other if the system is controlled with three air valves and two pressure switches using the total air orifice. Only one pressure switch is required for the same capacity in Flame mode and in Flameless mode.

1 pressure switch: constant capacity,
2 pressure switches: variable capacity

3 Mechanical construction

The burner EMX LE is composed of four modules: burner body, recuperator, air guide tube and gas insert. The modular design facilitates adapting the burners to the respective application or integrating them into an existing furnace system. Maintenance and repair times are reduced, and existing furnace installations can easily be converted.

3.1 Burner body

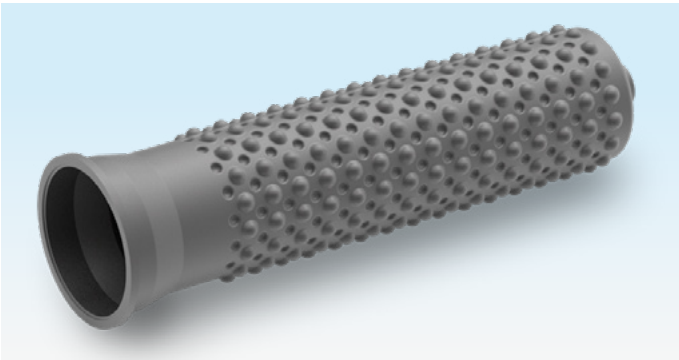


The burner body is made of cast aluminium, which means it has a low weight. The housing has a double-wall design. The combustion air is fed into the burner via the outer annular void. This cools the burner body and reduces emissions. On the flue gas side, there is a shaped part made of vacuum-formed fibres inserted in the housing to act as internal insulation.

3.2 Recuperator

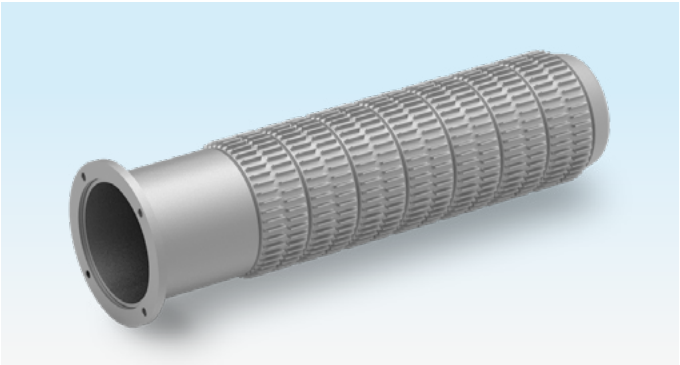
The burner EMX LE is available with a metallic ribbed tube recuperator or a ceramic burled tube recuperator.

3.2.1 Ceramic burled tube recuperator



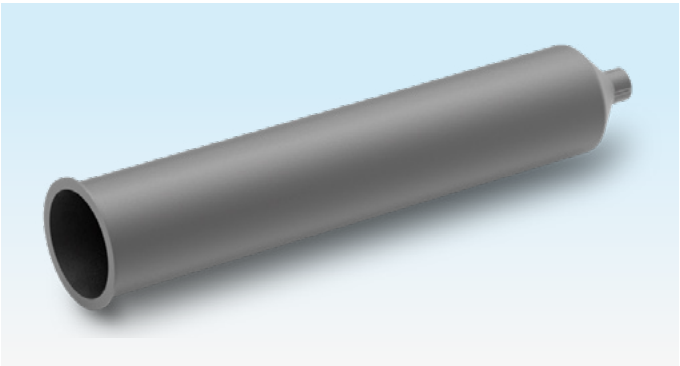
The surface of the ceramic recuperator, which is made of SiSiC for very high thermal stress, is burled in order to achieve high efficiency levels.

3.2.2 Metallic recuperator



The ribs on the cast steel ribbed tube recuperator create a large surface area, allowing it to achieve high efficiency levels even at low temperatures.

3.3 Air guide tube



Burners EMX LE are equipped with a ceramic air guide tube that also serves as the combustion chamber.

3.4 Gas insert

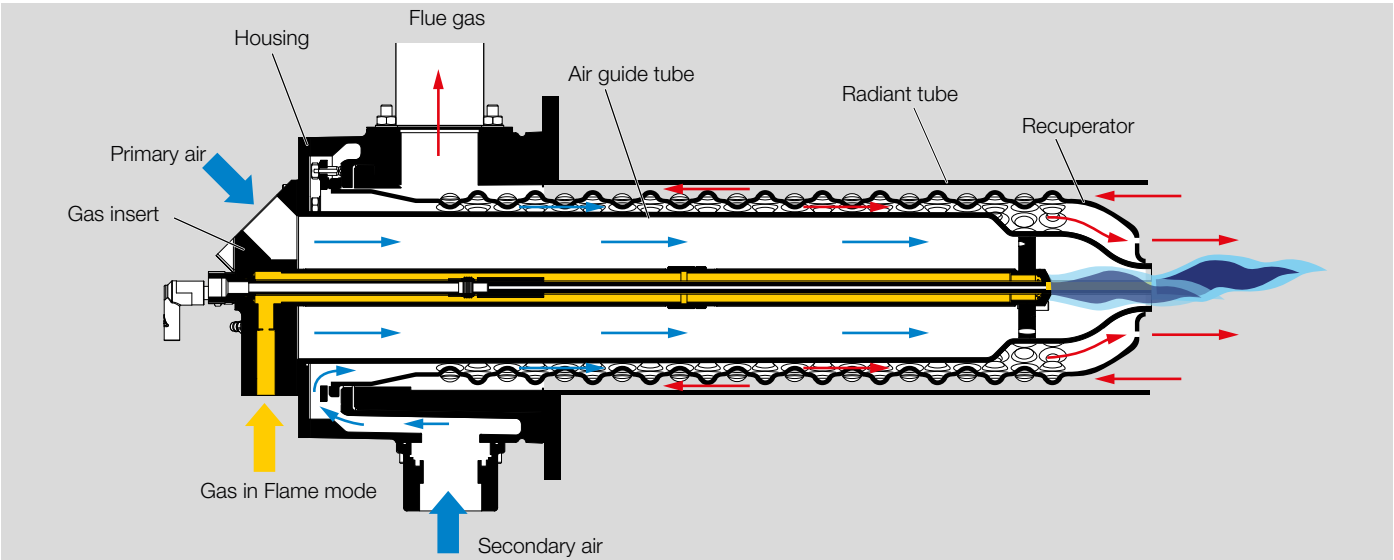
The gas insert consists of the gas flange, the gas connector with burner head and the spark electrode (also serves as monitoring electrode).
An integrated measuring orifice in the gas insert makes it possible to carry out a simple measurement of the gas flow rate in Flame mode. The orifice is designed to suit the gas type.

The gas insert has two purge air connections which purge the electrode and the “Flameless” gas lance.

A certain proportion of primary air will be permanently set on the gas insert using the primary air screw and spacer washers depending on the capacity in Flameless mode.

4 Function

Flame mode



The self-recuperative burner EMX LE uses the heat from the flue gases to preheat the combustion air. The heat exchanger (recuperator) required for this is part of the burner.

After entering the gap between the air guide tube and the recuperator, the secondary air flows towards the burner nozzle. Some of this air is fed via the primary air connection into the inside of the burner, where it is combusted in the first combustion stage.

The secondary air exits at high speed through the secondary air holes in the recuperator head so that it can be combusted in the second combustion stage. This process means that fewer pollutant emissions are produced. The hot flue gases, flowing in the opposite direction, leave the combustion chamber on the outside of the recuperator. Heat is exchanged between the hot flue gases and the cold combustion air through the recuperator wall.

Influence of furnace temperature

The pressure losses from the combustion air and flue gas in the recuperator rise with the furnace temperature. As the furnace temperature increases (at constant air supply pressure), the air mass flow (= standard air flow rate) drops while the gas flow rate remains almost unaffected. A system design without a pneumatic ratio control system does not compensate for any temperature-dependent pressure

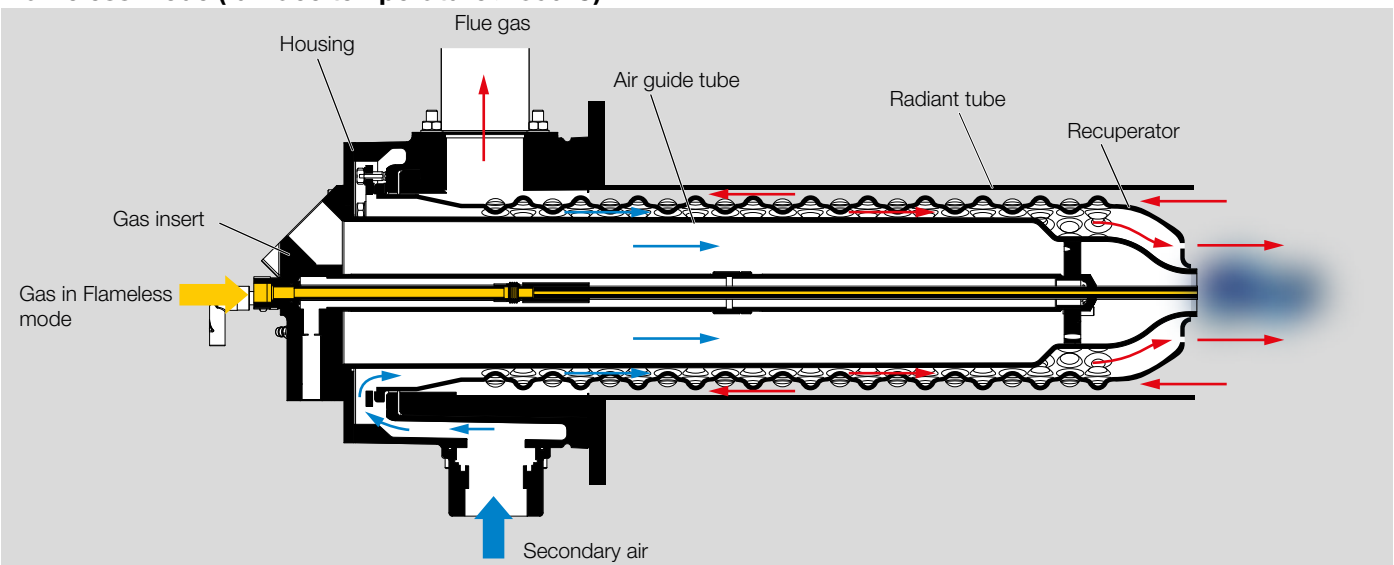
losses in the burner. The air index lambda is reduced as the furnace temperature increases.

Ignition and flame control

The burner is directly ignited.

The ignition and flame control takes place with a combined spark electrode/flame rod (single-electrode operation). Alternatively, UV control is also possible using a UV sensor.

Flameless mode (furnace temperature > 850°C)



When the system is switched to Flameless mode, the primary air valve is switched off so that no more primary air can flow through the primary air connection of the gas flange into the air guide tube. Depending on the burner capacity and air supply pressure, a small proportion of the secondary air will flow through the air guide tube via an internal bypass hole. The secondary air will continue to flow in the gap between the recuperator and air guide tube to the recuperator head, where it is fed into the combustion chamber through the holes in the recuperator head. The gas for Flameless mode is supplied via the central gas lance. The gas/air mixture diluted with flue gas reacts flamelessly in the furnace chamber. In Flameless mode, the burner is no longer monitored by the flame rod, but by the high temperature input of the BCU. The positioning of the thermocouple required for this purpose must be representative of the furnace temperature near the burner.

If the furnace temperature falls below 850°C, the burner is switched back to Flame mode.

Switching from Flame mode to Flameless mode results in a reduction in the combustion air volume. The gas volume in Flameless mode must be tailored to this reduced combustion air volume.

5 Selection

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5.2 Capacity data

As far as the capacity data are concerned, it should be noted that the capacities in kW and the energy densities in kWh/m^3 relate to the lower heating value LHV (H_i, H_u). Capacities quoted in BTU/h and energy densities in BTU/ft^3 relate to the higher heating value HHV (H_S, H_O).

Units	Relative to
kW	Lower heating value LHV
kWh/m^3	Lower heating value LHV
BTU/h	Higher heating value HHV
BTU/ft^3	Higher heating value HHV

5.3 Burner type

Selection is dependent on the type of heating and the furnace temperature. Details for selection, see page 18 (6.1 Heat design).

Burner	Max. flue gas temperature at recuperator inlet	
	°C	°F
EMX LE..C	1260	2300
EMX LE..M	1150	2100

5.4 Burner size

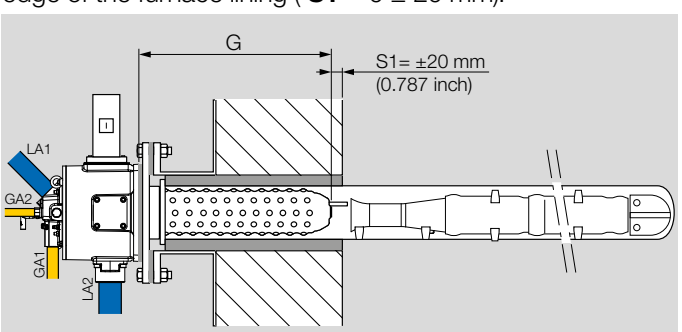
Burner size	Rated capacity in Flameless mode[1)]	
	kW	10^3 BTU/h
EMX LE 1	36	136
EMX LE 2	60	227
EMX LE 3	100	378

1) For operation with natural gas.

If the burners are used at geodetic altitudes of over 500 m above MSL, the possible capacity will be lower as a result of the reduced density of gas and air. Guide value 5% per 1000 m above MSL, details available on request.

5.5 Burner length

The recuperator length **G** and the furnace geometry should be coordinated so that the burner is flush with the inside edge of the furnace lining (**S1** = 0 ± 20 mm).



5.6 Burner head

Use	Burner head code letter
Low NO_X mode	F

5.6.1 Use

Burner EMX LE has a burner head for Flame mode and a central gas lance for Flameless mode (Low NO_X mode).

5.6.2 Gas type

Gas type	Code letter	Heating value range		Density ρ	
		kWh/m³(n)	BTU/scf	kg/m	lb/scf
Natural gas L and H quality	B	8–12	810–1215	0.7–0.9	0.041–0.053

5.7 Type of heating

Type of heating	Code letter	Explanation
Radiant tube heating	/R-	Burner head, optimized for radiant tube heating

5.8 Selection table

Option	EMX LE
Size	1, 2, 3
Recuperator	C, M
Recuperator length in mm	545, 595, 645, 695
Use	-F
Gas type	B
Type of heating	/48R-, /60R-, /R-
Burner head identifier	(1-99)
Construction stage	A-, B-…
Special version	Z

Order example

EMX LE 3C545-FB/R-(1)A-

5.8.1 Type code

EMX LE	Low NOx self-recuperative burner
1, 2, 3	Burner size
C	With ceramic burled tube recuperator made of SiSiC
M	With cast steel ribbed tube recuperator
545–695	Recuperator length [mm]
-F	Low NOx operation flameless
B	Natural gas
/nnR-	For radiant tube heating without eductor for nn kW
/R-	For radiant tube heating without eductor
(1-99)	Burner head identifier
A-, B-,...	Construction stage
Z	Special version

5.9 Selection table for flue gas connector FLUP

Option	FLUP ECO LE
Size	1, 2, 3
Nominal size	-40, -50, -65
Connection	D
Axis spacing K in mm	-Kxxx
Installation height M in mm*	-Myyy
Distance T in mm*	-Tzzz*
Analysis unit	-C, -A
High temperature version	-HT

** Special dimensions on request.*

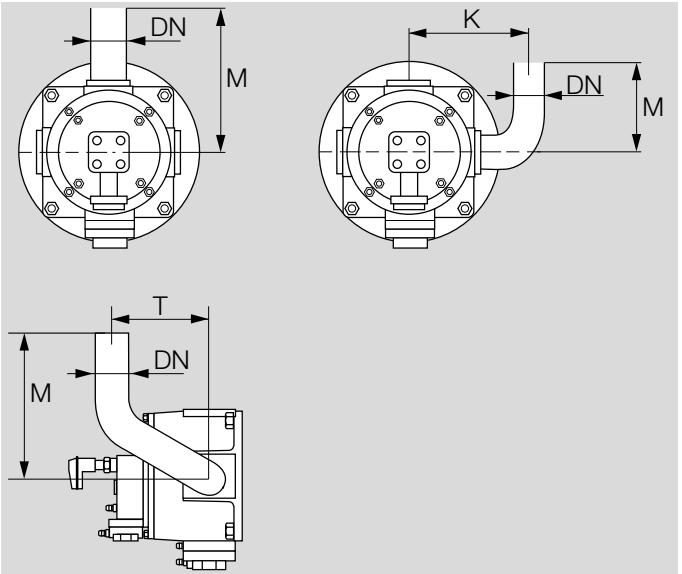
Order example

FLUP ECO LE 3-65D-M353-C

5.9.1 Type code

FLUP ECO LE	Flue gas connector
1, 2, 3	Size
-40, -50, -65	Nominal size
D	Pipe connector
-Kxxx	Axis spacing K in mm
-Myyy	Installation height M in mm
-Tzzz*	Distance T in mm
-C	Measuring port with sealing clip
-A	Threaded pressure tap with cap
-HT	High temperature version

** If "none", this letter is omitted.*



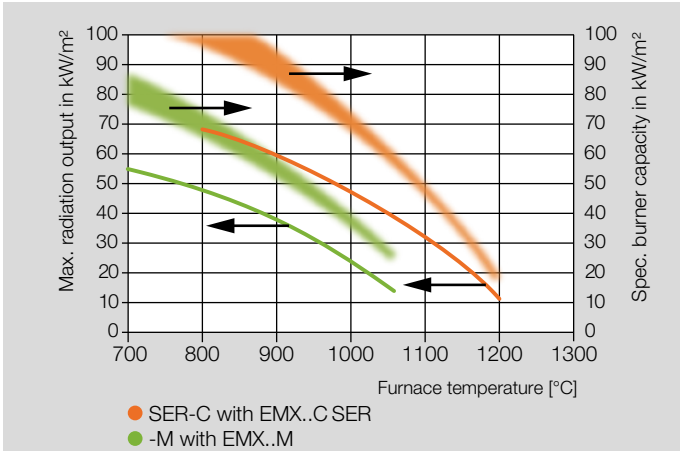
6 Project planning information

6.1 Heat design

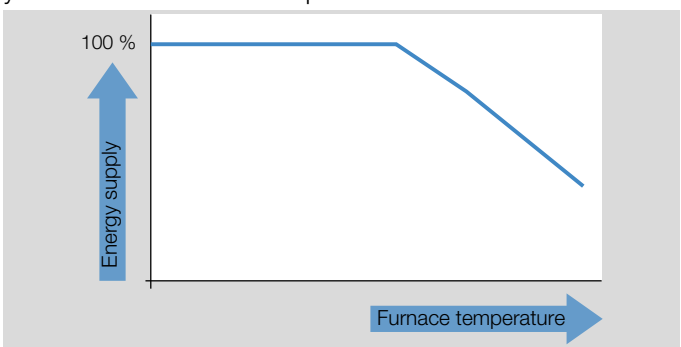
When designing a radiant tube heating system, it must be noted that the energy can be transferred to the combustion chamber through the surface of the radiant tube so that the maximum flue gas temperature at the burner's recuperator inlet is not exceeded.
In addition, it must be noted that the maximum material temperature of the radiant tube and the flame tube on single ended radiant tubes is not exceeded.

Burner	Max. flue gas temperature at recuperator inlet	
	°C	°F
EMX LE..C	1260	2300
EMX LE..M	1150	2100

The possible radiation output in the furnace depends on the combustion chamber temperature and the radiant tube surface as well as the material used for the radiant tube and burner.
The burner capacity is also dependent on the efficiency of the burner.
The heat exchange level must be calculated to design a radiant tube heating system correctly; please contact a sales executive.



Depending on the system configuration, it may be necessary to reduce the energy supply depending on the combustion chamber temperature, for example by reducing the duty cycle. This avoids thermal overload of the radiant tube. Calculated data relating to the duty cycle are available from your sales executive on request.



6.2 Radiant tubes

For EMX LE C ..

The burners EMX LE..C are designed for use in combination with ceramic radiant tubes SER-C.

See Technical Information SER-C.

Standard combinations:

Burner	Radiant tube	Segmented flame tube
EMX LE 1C*	SER-C 142/128	FlameCone ECO-LE-1C SICAFLEX 142/127 DC-C142/128
EMX LE 2C*	SER-C 162/148	FlameCone ECO-LE-2C SICAFLEX 162/147 DC-C162/148
EMX LE 3C	SER-C 202/188	FlameCone ECO-LE-3M/C SICAFLEX 202/186 DC-C202/188

** In the case of vertical radiant tube heating, EMX LE 1C and EMX LE 2C can only be used in the next larger SER-C.*

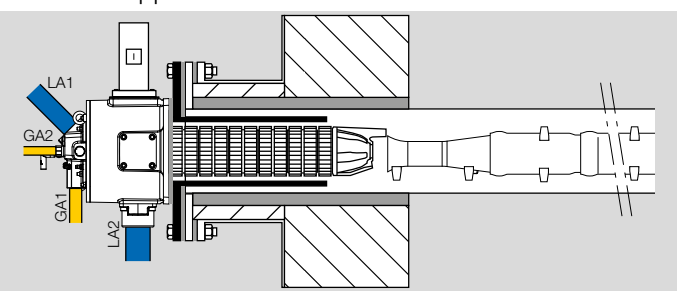
In special cases and by agreement, a burner with a ceramic recuperator EMX LE..C may be installed in a metallic radiant tube. However, external forces on the ceramic recuperator due to deformation of the radiant tube must be excluded.

For EMX LE M ..

Metallic radiant tubes are available in a variety of dimensions in either centrifugal casting or in welded form. The efficiency of the burner EMX LE..M is determined by the inside diameter$_d$ **i** of the radiant tubes in the vicinity of the burner. The following dimensions are recommended:

Burner	Minimum radiant tube inside diameter d_i [mm]	Flue gas guide tube FGT set is recommended from a radiant tube inside diameter d_i [mm]
EMX LE 1M	128	140
EMX LE 2M	147	164
EMX LE 3M	185	202

If the inside diameter of the radiant tube is significantly larger than the outside diameter of the recuperator, an additional flue gas guide tube FGT set should be used. Install the FGT set wrapped in a fibre blanket.

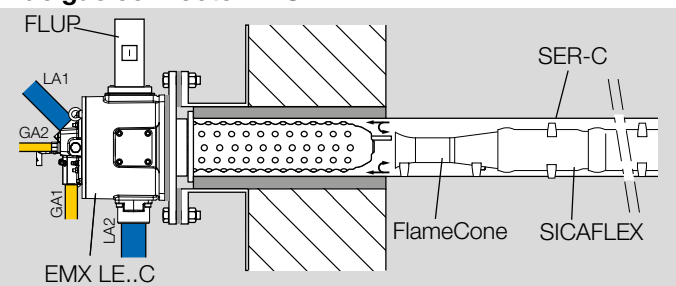


Depending on the geometry, additional adapter flanges may be required for radiant tubes.

6.3 Flue gas channelling

A flue gas connector FLUP is used as standard to remove the flue gases for radiant tube heating, and must be ordered separately.

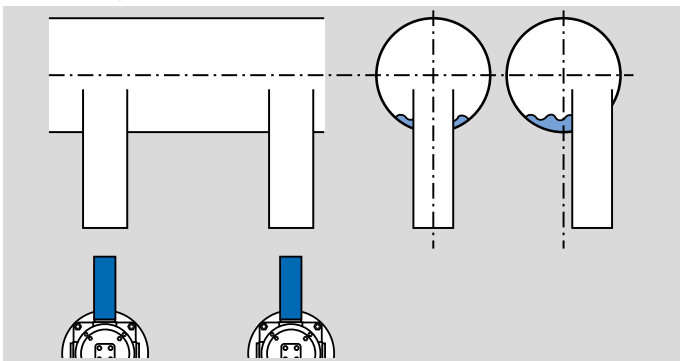
Flue gas connector FLUP



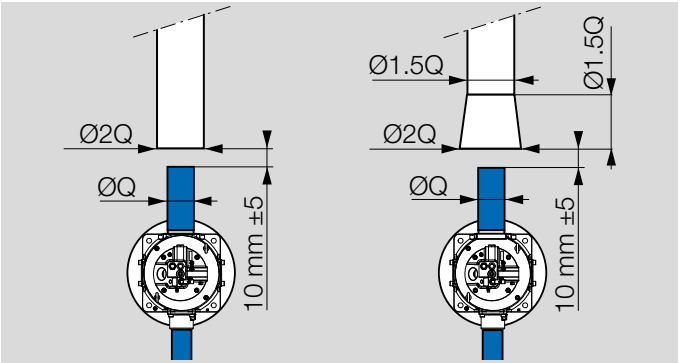
The flue gas connector FLUP is designed to discharge the flue gases into the flue gas system on the furnace and has an opening with a clip to connect flue gas analysis equipment.

6.4 Flue gas system on the furnace

A flue gas system must be fitted on the furnace as a means of guiding the flue gas to the chimney. In the flue gas system, there should be a low negative pressure thanks to the draught of the chimney or an exhaust fan.
The spur lines from the flue gas manifold on the furnace to the various burners should be designed so that condensate cannot drip backwards into the burner.



The spur lines to the burner should stop 10 mm away from the flue gas connector FLUP.
For radiant tube heating with flue gas monitoring kit DW and BCU 465, excessive negative pressure in the flue gas system or an excessively narrow flue gas pipe diameter on the furnace can cause problems with setting the switching point of the pressure switch.



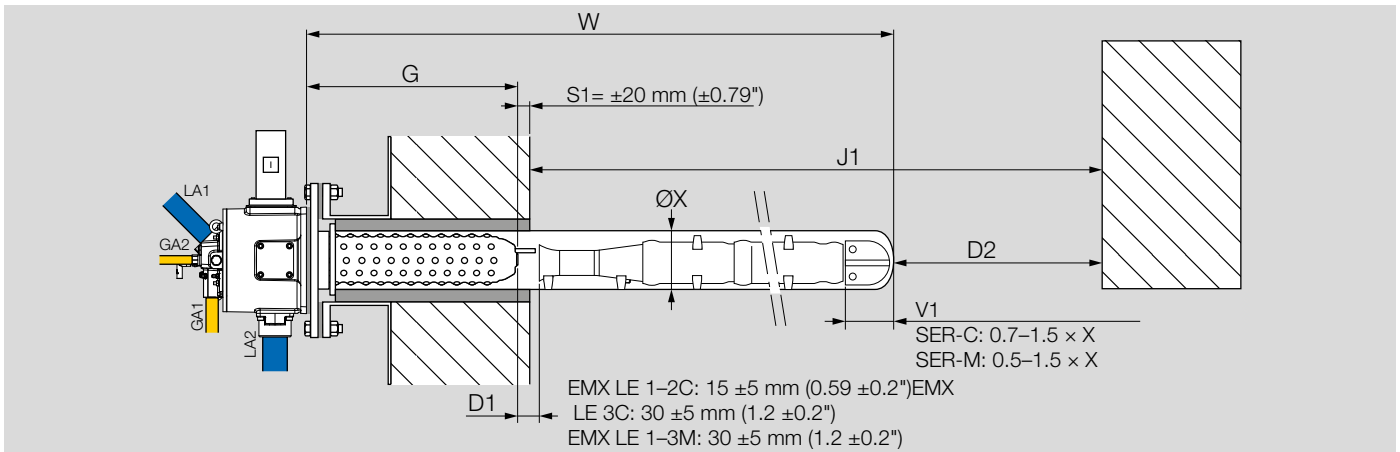
Burner	FLUP ØQ
EMX LE 1	DN 40
EMX LE 2	DN 50
EMX LE 3	DN 65

For sealed flue gas systems, a pressure regulator is to be fitted in the flue gas system. The gas and air flow rates depend on the total pressure differential between the supply and flue gas systems. If the pressure in the flue gas system fluctuates, the burner capacity will change and the lambda value may shift if the system is not equipped with air/gas ratio control.

6.5 Installation

Installation of burners with FLUP in the horizontal position. Ensure adequate distances between the radiant tubes and to the furnace wall to prevent local overheating, see Technical Information SER-C.

Leave a recirculation gap **D1** between the burner and FlameCone. The minimum recirculation gap D1 is maintained using spacers on the recuperator head. The deflector gap **V1** should be around 0.7 to 1.5 times (SER-C) or 0.5 to 1.5 times (SER-M) the diameter **X** of the radiant tube. Provide a cruciform spacer to match the selected length **V1**.



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

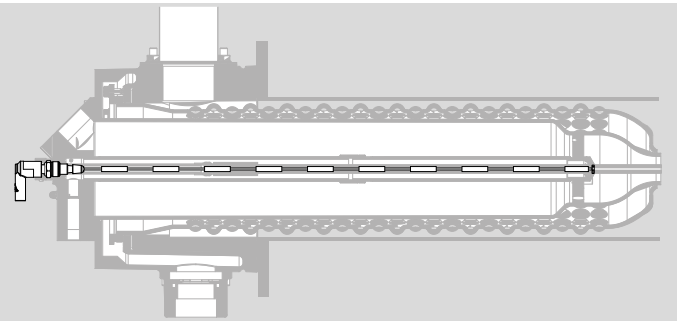
W ≤ J1 + G + S1 - D2 (D2 ≥ 40 mm)

Minimum radiant tube length for EMX LE: **W ≥ 1500 mm**

6.5.1 Heat guard

During operation, the burner body and flue gas connector can reach surface temperatures of over 80°C. The burner and flue gas connector must not be insulated as otherwise the material will overheat. We recommend that warning signs and a contact guard be fitted, for example made of perforated sheet metal.

6.6 Flame control



Burners EMX LE are equipped with a combined spark electrode/flame rod (single-electrode operation). The electrode is not in use in Flameless mode. It is purged via the purge air connection in the gas flange.

UV control is only required for gases with < 5% CH compounds; for example for natural gas and hydrogen mixtures which contain > 95% H_2 and for LCV gases such as blast furnace gas or converter gas.

UV sensor UVS with an integrated purge air connection is required for UV control, see page 39 (7.10 UV adapter set).

Size	UVS	Order No.
EMX LE 1	With lens	84315203
EMX LE 2	Without lens	84315202
EMX LE 3	Without lens	84315202
EMX LE 4	Without lens	84315202

6.7 Burner control units and ignition transformers

EMX LE burners are designed for ON/OFF operation. We recommend burner control units BCU 465..D2.

After a safety shut-down, air should always be supplied to purge the radiant tube (parameter 34 of BCU 465..D2).

If the burner EMX LE is used with additional cooling air, the additional cooling air valve can be actuated together with the air valve using the external process control system when the BCU is in standby.

EMX LE burners require an ignition transformer with 7.5 kV high voltage and an output current of 20 mA for ignition. An appropriate ignition transformer is already integrated in burner control units BCU.

For further information on burner control units and ignition transformers, see Technical Information BCU 465.

6.7.1 Configuration of burner control unit

Description	Parameter	Configuration				
Air control		2 air valves	3 air valves	3 air valves	Butterfly valve	Butterfly valve
Note on flame/capacity		Jump in capacity	Constant capacity in Flame/Flameless mode	Variable capacity in Flame/Flameless mode	Constant capacity in Flame/Flameless mode	Variable capacity in Flame/Flameless mode
BCU..		465	465	465	465	465
Mains voltage		230 V[4)]	230 V[4)]	230 V[4)]	230 V[4)]	230 V[4)]
With power module		F3	F3	F3	F1	F1
Ignition transformer		8	8	8	8	8
Flange plate		P2/P6[5)]	P2/P6[5)]	P2/P6[5)]	P2/P6[5)]	P2/P6[5)]
Connection plug		K1	K1	K1	K1	K1
Power supply		E1	E1	E1	E1	E1
Electrode operation		2[1)]	2[1)]	2[1)]	2[1)]	2[1)]
Burner control unit with PROFINET[6)]		88683978	88683995	88683978	88683980	88683982
Burner control unit with PROFIBUS[6)]		88683979	88684034	88683979	88683981	88683983
Valve proving system	F001	C0	C0	C0	C0	C0
High temperature operation	F002	D2	D2	D2	D2	D2
Sensor functions	F003	1	1	1	1	1
LDS start-up conditions	F004	0	0	0	0	0
Auxiliary gas function (V4)	F005	0	0	0	0	0
Flame control	I004	0	0	0	0	0
Air actuator	I020	5	5	5	2	2
Function of terminal 40	I073	-	-	-	7	7
Function of terminal 41	I074	-	-	-	8	8
Switch-off threshold 1	A001	2	2	2	2	2
Switch-off threshold 2	A002	2	2	2	2	2
Flame simulation check	A003	0	0	0	0	0
High temperature operation	A006	3	3	3	3	3
Combustion mode	A074	1	1	1	1	1
Flameless operation	A064	2	2	2	2	2
Burner application	A078	13	13	13	13	13
Restart	A009	1	1	1	1	1
Over-run	A043	0	0	0	0	0
Flame mode after cooling	A066	30	30	30	30	30
Burner 1 start-up attempts	A007	2	2	2	2	2

Description	Parameter	Configuration				
Pre-ignition time	A093	0	0	0	0	0
Safety time 1	A094	3	3	3	3	3
Flame proving period 1	A095	0	0	0	0	0
Low air pressure protection delay	A016	0	0	0	0	0
Air actuator control	A048	1	1	1	8	8
Active cooling outputs	A129	1	1	1	1	1
Pre-purge time	A034	6000[2)]	6000[2)]	6000[2)]	6000[2)]	6000[2)]
Pre-ventilation	A036	0	0	0	0	0
Pre-ventilation/flameless	A028	0	0	0	0	0
Running time selection	A041	-	-	-	0	0
Running time	A042	1	1	1	5[3)]	5[3)]
Controller enable delay	A044	-	-	-	0	0
Air actuator on start-up	A049	-	-	-	0	0
Cooling in the event of fault	A050	1	1	1	1	1
Safety time during operation	A019	1	1	1	1	1
Min. operating time	A061	10	10	10	10	10
Min. operation, flameless	A161	10	10	10	10	10
Min. pause time	A062	10	10	10	10	10
Min. pause, flameless	A162	10	10	10	10	10
Operating time in Manual mode	A067	1	1	1	1	1
Fieldbus communication	A080	2	2	2	2	2
Purge (bus)	A087	4	4	4	4	4
HT operation (bus)	A088	2	2	2	2	2
Function of sensor 1	A101	4	13	4	13	4
Function of sensor 2	A102	9	0	9	0	9
Function of sensor 3	A103	0	0	0	0	0
Proof of closure function test period	A060	-	-	-	-	-
Auxiliary gas function	A077	-	-	-	-	-

1) Rewiring required for single-electrode operation

2) May be adjusted by agreement using the calculation for 5 x combustion chamber volume/purge air flow rate (20% of lower explosion limit)

3) 5 s as the initial setting; may be adjusted locally using the times set in the IC 40 = t1 + t2 + t3

4) Version in 120 V possible by agreement

5) P2: with PROFINET/P6: PROFIBUS

6) Order a suitable bus module

6.8 Gas connection

6.8.1 Component selection

A slow opening gas valve must always be used to ensure a safe burner start for radiant tube heating.

The following gas valves and components are recommended for natural gas:

Indirect heating/Gas connection

Gas Flame	Gas Flameless
EMX LE 1	
VAS 115R/LW	
VAS 115R/NW	VAS 115R/NW
GEH 15	GEH 15
	VMO 115R
EMX LE 2	
VAS 115R/LW	
VAS 115R/NW	VAS 115R/NW
VMV 115R	GEH 15
	VMO 115R
EMX LE 3	
VAS 115R/LW	
VAS 115R/NW	VAS 115R/NW
VMV 115R	GEH 15
	VMO 115R

A bellows unit EKO should be installed between the burner and controls to rule out the possibility of force acting on the burner.

6.8.2 Gas pressure

The required gas pressure depends on the burner size, gas type and system design.

The required gas supply pressure must be 10 mbar higher than the fan air pressure (air pressure upstream of air control valve).

6.9 Air connection

6.9.1 Component selection

To be able to set a capacity in Flame mode which is independent of the capacity in Flameless mode, a BVH with actuator IC 40 must be installed in the total air line.

If an air valve VAA is installed in the total air line, the air volume will be reduced in Flameless mode. This will mean that the capacity in Flame mode is higher than in Flameless mode.

A quick opening air valve must always be used to ensure a safe burner start for radiant tube heating. The following air valves and butterfly valves are recommended:

EMX LE C ..

Size	Recuperator	Capacity in Flame/ Flameless mode	Air controls	Flame	Flameless	Main air valve	Flame	Flameless
1	C	Jump in capacity	2 air valves	40 kW	30 kW	VAA 125R/NW	VAA 125R/NW	
1	C	Constant or variable	3 air valves	40 kW	36 kW	VAA 125R/NW	VAA 125R/NW	VAA 240R/NW
2	C	Jump in capacity	2 air valves	66 kW	43 kW	VAA 240R/NW	VAA 125R/NW	
2	C	Constant or variable	3 air valves	66 kW	60 kW	VAA 125R/NW	VAA 125R/NW	VAA 240R/NW
2	C	Constant or variable	Air valve	66 kW	60 kW	BVH 40 + IC 40	VAA 125R/NW	
3	C	Jump in capacity	2 air valves	110 kW	90 kW	VAA 250R/NW	VAA 125R/NW	
3	C	Constant or variable	Air butterfly valve	110 kW	100 kW	BVH 50 + IC 40	VAA 240R/NW	

EMX LE M ..

Size	Recuperator	Capacity in Flame/ Flameless mode	Air controls	Flame	Flameless	Main air valve	Flame	Flameless
1	M	Jump in capacity	2 air valves	40 kW	30 kW	VAA 125R/NW	VAA 125R/NW	
1	M	Constant or variable	3 air valves	40 kW	36 kW	VAA 125R/NW	VAA 125R/NW	VAA 240R/NW
2	M	Jump in capacity	2 air valves	66 kW	43 kW	VAA 240R/NW	VAA 240R/NW	
2	M	Constant or variable	Air valve	66 kW	60 kW	BVH 40 + IC 40	VAA 240R/NW	
3	M	Jump in capacity	2 air valves	110 kW	74 kW	VR 65…N	VAA 240R/NW	
3	M	Constant or variable	Air valve	110 kW	100 kW	BVH 50 + IC 40	VAA 240R/N	

6.9.2 Air pressure

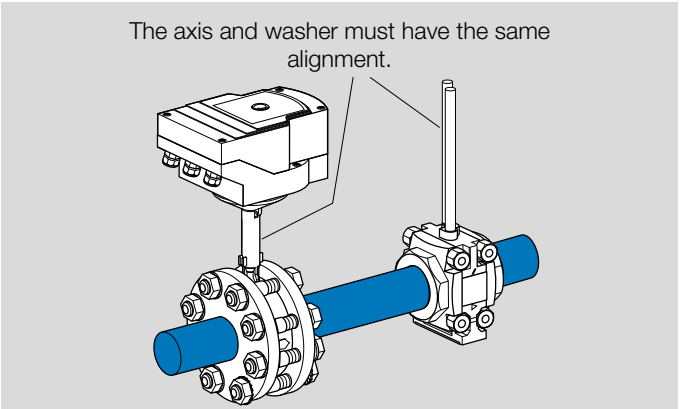
The required air pressure depends on the burner size, gas type and system structure.

The air supply pressure must be at least 90 mbar.

6.10 Air flow monitoring

A system design with an air flow monitor is recommended to monitor the pre-purge (pursuant to EN 746-2 and ISO 13577-2). It is achieved using a differential pressure switch at the total air orifice combined with a burner control unit BCU. An accessory set to monitor the air flow is available for this purpose, see page 33 (7.1 Air flow monitoring).

Note for using a butterfly valve:
To avoid the upstream butterfly valve having an excessive influence on the total air measuring orifice, the pressure tap of the measuring orifice must point in the same direction as the rotary axis of the butterfly valve; this is particularly the case if the installation space is tight and there is only a short barrel nipple between the butterfly valve and the orifice.
Good idea: long barrel nipple upstream of the orifice (with a butterfly valve or valve).

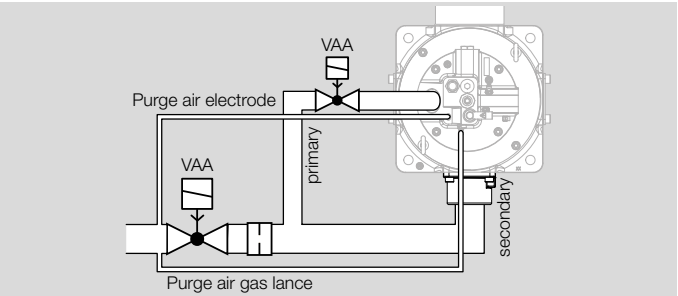


EMX LE 4

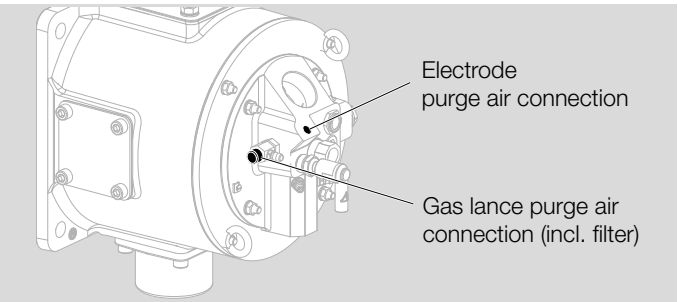
The air flow monitor is connected to the air measuring orifice on the burner.

6.11 Purge air and cooling air

Purge air



The purge air must be connected to the electrode and the "Flameless" gas lance on the burner EMX LE in order to ensure safe ignition and monitoring, and in order to avoid problems caused by condensation and/or overheating. The purge air volume on the electrode is also sufficient for purging an optional UV sensor. The connected purge air prevents the residual gas in the gas lance cracking by sending a small stream of air through the gas lance at all times. The required purge air volume is approx. 1–2 m^3/h.



The purge air is connected to the gas flange. The purge air is tapped upstream of the air control valve so that the purge air continues to flow even if the burner is switched off.

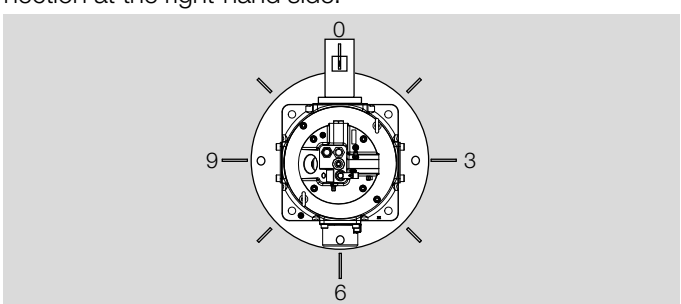
The volume of purge air for the gas lance and electrode is adjusted to the required air supply pressure by the nozzles in the burner.

6.12 Condition on delivery

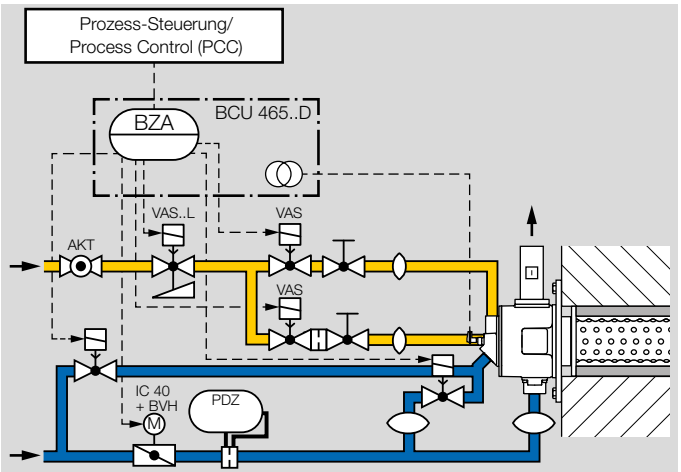
The gas and air connection and the flue gas connection can be aligned to suit the order based on the intended installation on the furnace. The positions of the connections are coded with numbers 0, 3, 6 and 9.

Identifier	Position of the connections
0	top
3	right-hand side
6	bottom
9	left-hand side

The identifiers for the positions of the connections are stated in the sequence flue gas – air – gas. If there is no specification, the burners are supplied as follows:
EMX LE../R for radiant tube heating with a connector position 063, in other words with the flue gas connection at the top, the air connection at the bottom and the gas connection at the right-hand side.



6.13 Increased furnace cooling

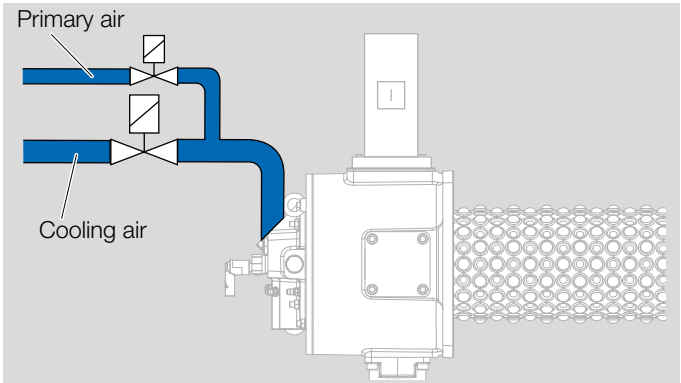


Depending on the process requirements, a two-level cooling system can be implemented.

The “normal” cooling system is activated by actuating the air valve for the burner. An additional cooling air valve can be activated using terminals 85/86/87 on the BCU. The additional cooling air valve is actuated separately by the process control system, see Technical Information BCU 460, 465.

If the BCU is in standby, the additional cooling air valve is activated together with the combustion air valve by the external air valve control.

6.14 Connection for additional furnace cooling



The air volume supplied to the burner in cooling mode can be increased using the primary air connection on the burner. We recommend that the cooling air is only supplied to the burner through the straight section of the tee and through elbows to reduce pressure losses.

The air supplied through the additional air connection flows in the centre of the burner inside the air guide tube. The volume is around twice the normal combustion air.

6.15 Build up of noise

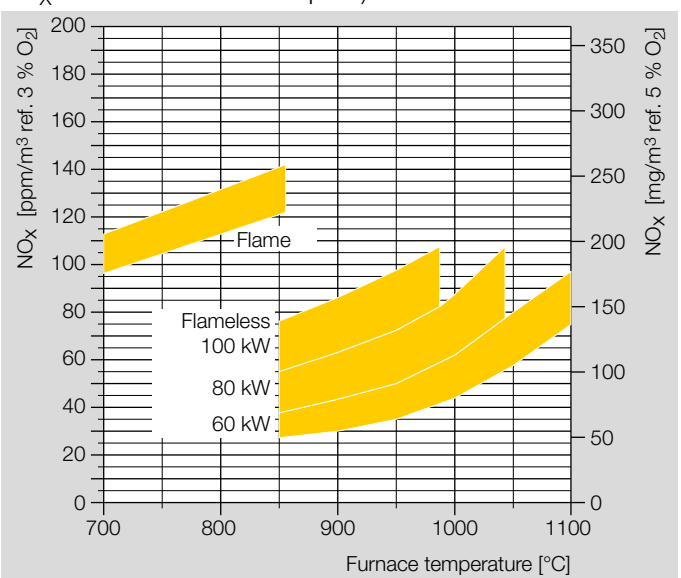
When the burner is installed, the sound pressure level of the individual burner which can be measured outside the furnace is generally between 75 and 85 dB(A). If the burner is controlled without an air valve, the increased capacity in Flame mode will result in a higher sound pressure level.

The measurable value on a furnace system depends on the capacity, excess air, flue gas extraction and flue gas temperature of the individual burners and on the burner layout and ambient influences (sound pressure level on request).

A cold start in the radiant tube may cause pulsation noise. These will disappear, however, after the burner has been operating for 2 to 3 minutes.

6.16 Emissions

The CO and NO_X values depend on the combustion chamber temperature, the size and length of the radiant tube, air preheating, burner type and burner settings (project-related NO_X values available on request).

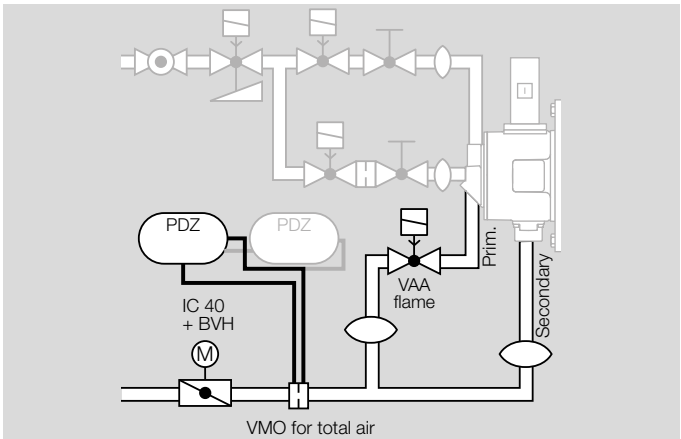


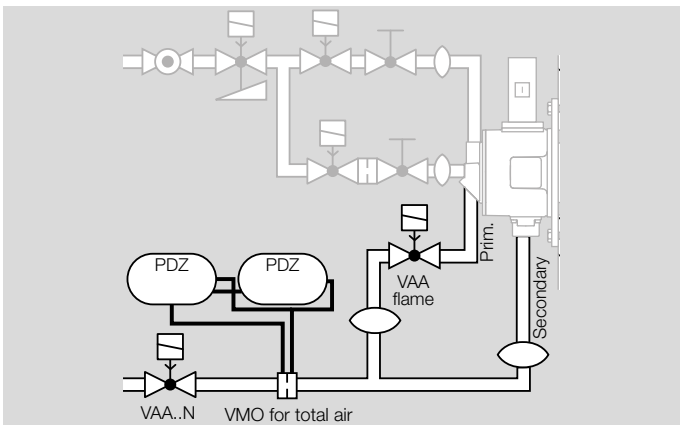
The diagram shows EMX LE 3M as an example.

7 Accessories

7.1 Air flow monitoring

Example:





The differential pressure switch to monitor the air flow is used for the automatic monitoring of the air flow on the burner EMX LE in conjunction with the burner control unit BCU 465. The differential pressure switch monitors the air fl ow during pre-purge and burner operation. If there is no air pressure, the burner is switched off or the burner is not enabled. The pressure switch switching point should be set to approx. 80% of the differential pressure in normal operation.

If the capacities in Flame and Flameless mode are set to be constant using the air butterfly valve, only one pressure switch is required. If the Flame and Flameless capacities are variable, two pressure switches are required for low air pressure protection.

Constant capacity

Designation	Order No.
DG 10U-6T2	84447329

Variable capacity/Jump in capacity

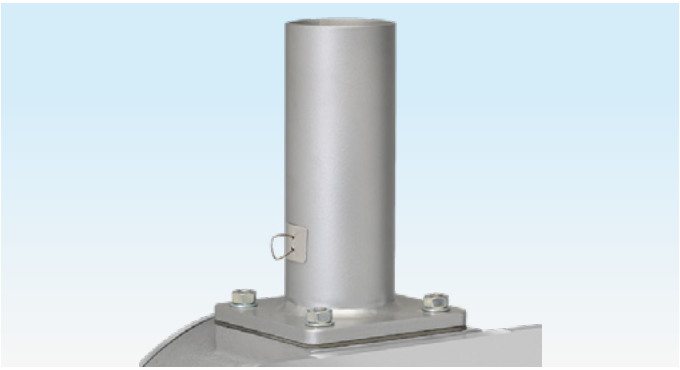
Designation	Order No.
DG 10U-6T2	84447329
DG 30U-6T	84447294

7.2 Purge air set

For purging the electrode and the gas lance for Flameless mode using 2 connections on the gas flange

Designation	Order No.	Purge
ES 6RA1000Z	35460037	Gas lance
Flat seal for ES 6RA (packaging unit = 10 items)	74928240	Gas lance
Hose ID 6/OD 8	22111753	Electrode

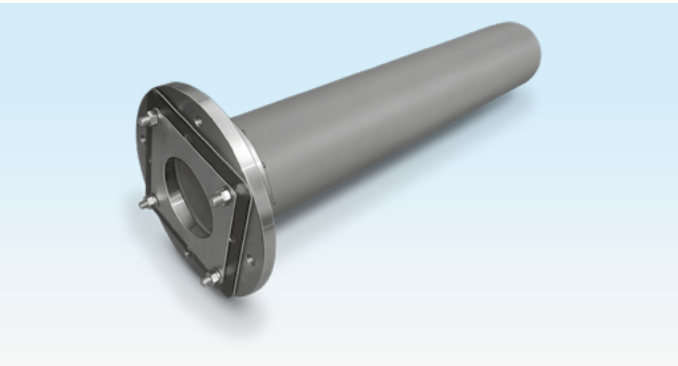
7.3 Flue gas connector FLUP



For indirect heating, the flue gas connector FLUP discharges the flue gases into the site flue gas system on the furnace.

Designation	Order No.
FLUP ECO LE 1-40D-M331-C	34340784
FLUP ECO LE 2-50D-M331-C	34340785
FLUP ECO LE 3-65D-M353-C	34340554

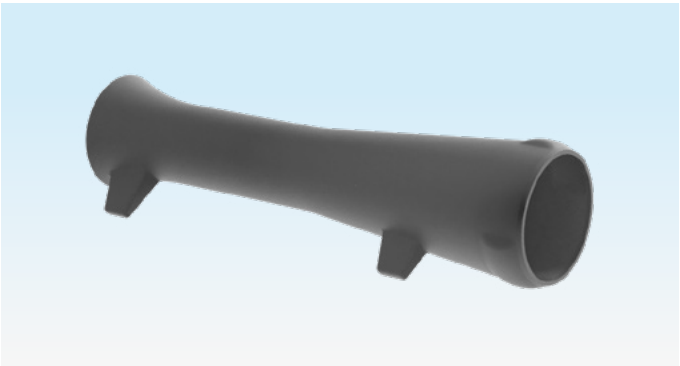
7.4 Ceramic radiant tube SER-C



For heat treatment processes in which combustion gases must be kept separate from the product. The patented flange connection is air-tight.
Material: SiSiC, max. application temperature: 1300°C.
For further information, see Technical Information Ceramic radiant tube SER-C.
Order No. on request.

7.5 FlameCone

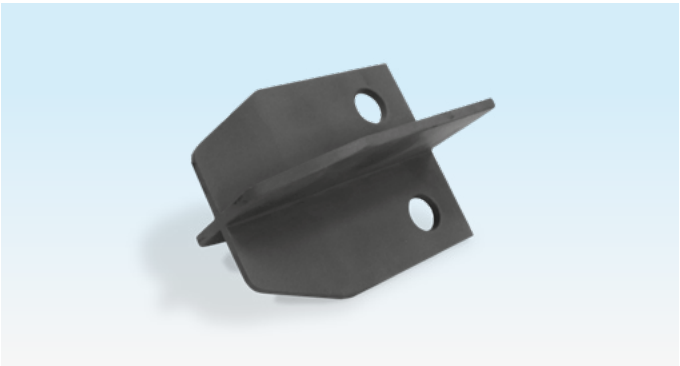
.



Designation	Order No	SER-C	SER-M di
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	
FlameCone ECO-LE-1M-128-140-550-H	34340801		128–140
FlameCone ECO-LE-1M-136-149-550-H	34340807		136–149
FlameCone ECO-LE-2M-147-161-550-H	34340802		147–161
FlameCone ECO-LE-2M-156-169-550-H	34340811		156–169
FlameCone ECO-LE-3M/C-185-207-550-H	34340800		185–207

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

7.7 Cruciform spacer



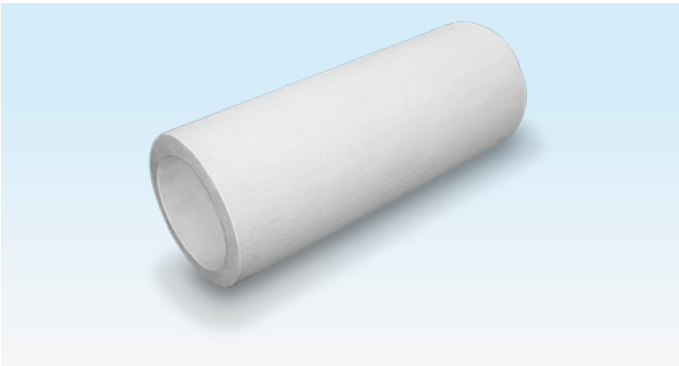
SiSiC

For installation of the SICAFLEXsegmented flame tube in radiant tubes.

The cruciform spacer ensures that a minimum deflector gap is maintained at the end of the radiant tube. Material: SiSiC.

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

7.8 Flue gas guide tube FGT set



To guide the flue gases if smaller burners are used than those normally intended. The flue gas guide tube ensures sufficient heat exchange via the burner recuperator.

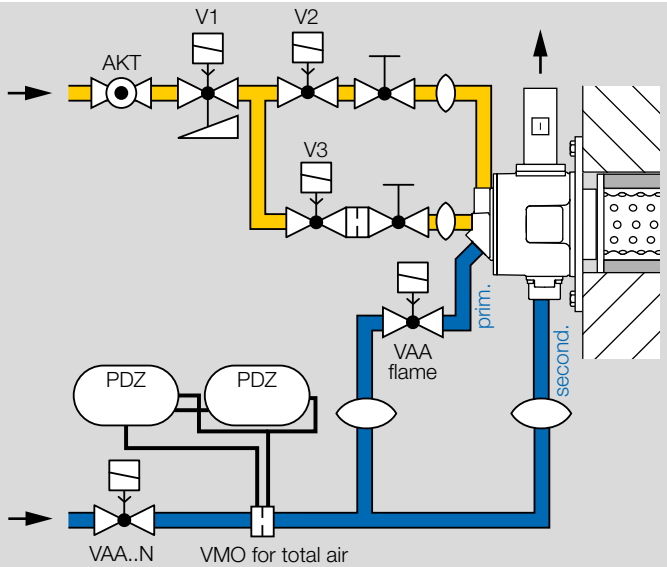
Material: shaped part made of vacuum-formed ceramic fibres (RCF).

Available on request in different sizes and versions suitable for the SER-C and EMX LE burner sizes.

7.9 Pipework

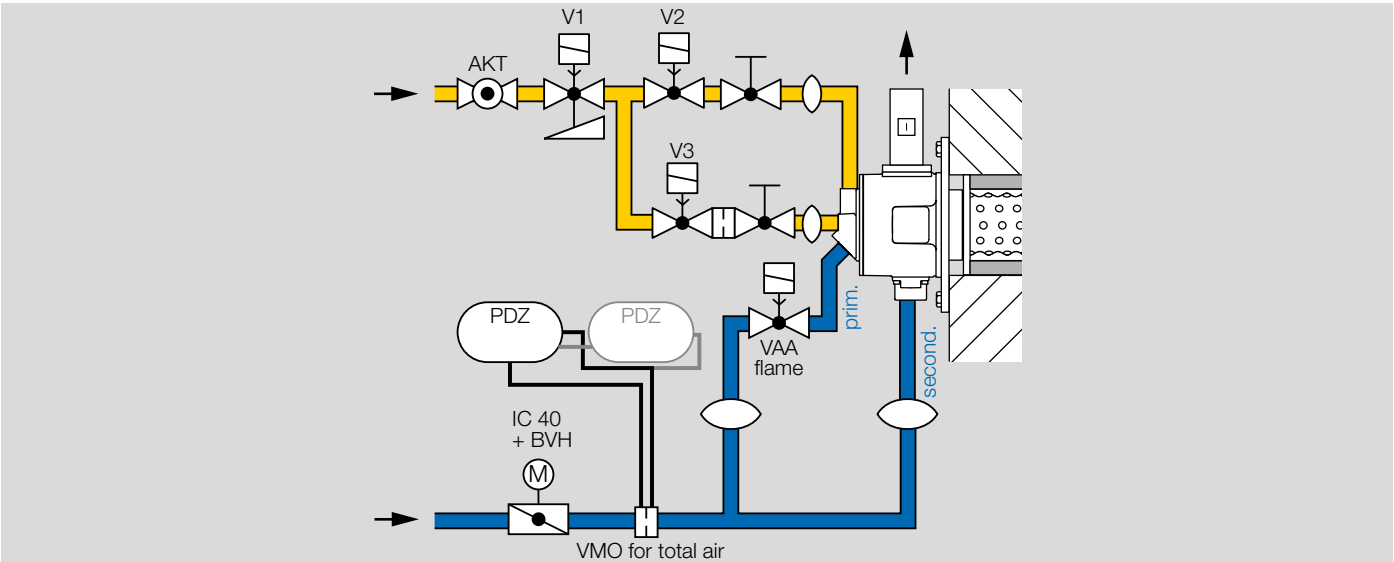
As an option, the burners can be supplied with ready-installed pipework for gas and air. We recommend that the pipework should be agreed with Technical Sales.

Control with 2 solenoid valves for air VAA (jump in capacity in Flame/Flameless mode)



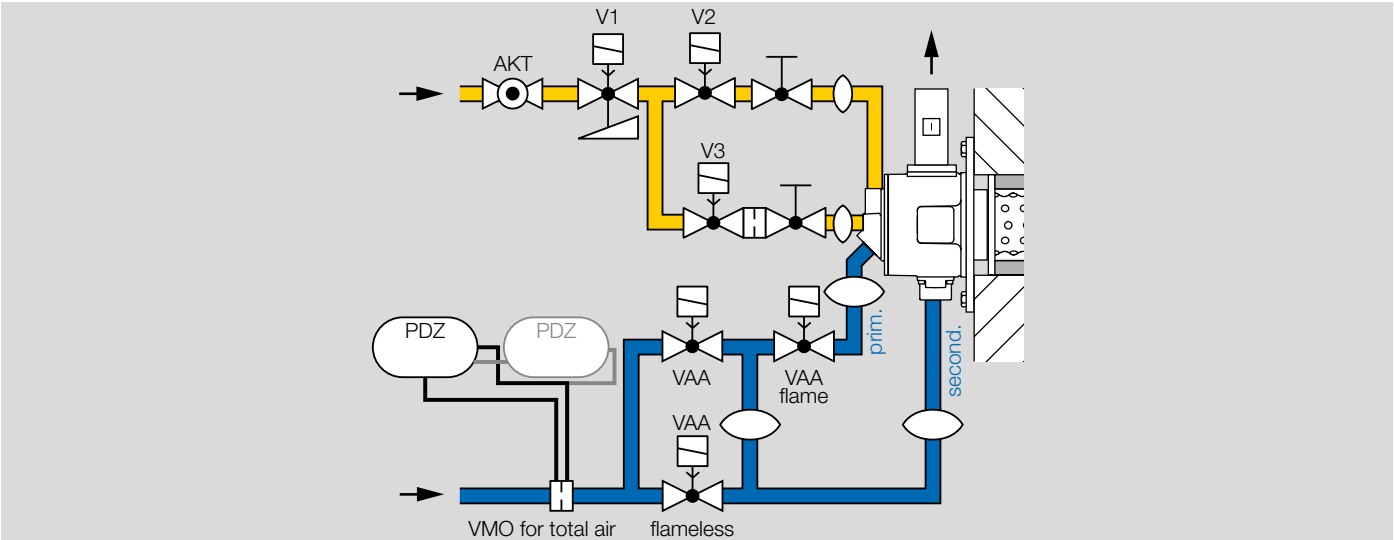
	EMX LE			Material No.	Designation	Combinations
Gas	1	C	M	86599177	GS 15R05-15R05-15R05-W-ECO LE 1	VAS..L + VAS..N + GEH + VAS..N + GEH + VMO
Gas	2	C	M	86599178	GS 15R05-15R05-15R05-W-ECO LE 2	VAS..L + VAS..N + VMV + VAS..N + GEH + VMO
Gas	3	C	M	86598336	GS 15R05-15R05-15R05-W-ECO LE 3	VAS..L + VAS..N + VMV + VAS..N + GEH + VMO
Air	1	C	M	86599538	L 40R-25R-40R-W-ECO LE 1	VMO + VAA..N + VAA..N (P Flameless ≤ 30 kW)
Air	2	C		86599553	L 40R-25R-40R-W-ECO LE 2	VMO + VAA..N + VAA..N (P Flameless ≤ 43 kW)
Air	2		M	86599762	L 40R-40R-40R-W-ECO LE 2	VMO + VAA..N + VAA..N (P Flameless ≤ 43 kW)
Air	3	C		86598337	L 50R-25R-50R-W-ECO LE 3	VAA..N + VMO + VAA..N (P Flameless ≤ 78 kW)

Control using butterfly valve BVH and actuator IC 40 (constant or variable capacity in Flame/Flameless mode)



	EMX LE			Material No.	Designation	Combinations
Gas	2	C	M	86599178	GS 15R05-15R05-15R05-W-ECO LE 2	VAS..L + VAS..N + VMV + VAS..N + VMO + GEH
Gas	3	C	M	86598336	GS 15R05-15R05-15R05-W-ECO LE 3	VAS..L + VAS..N + VMV + VAS..N + VMO + GEH
Air	2		M	86599702	L 50R-40R-40R-W-ECO LE 2	BVH + IC 40 + VMO + VAA..N
Air	2	C		86598726	L 50R-25R-40R-W-ECO LE 2	BVH + IC 40 + VMO + VAA..N
Air	3	C	M	86599604	L 65R-40R-50R-W-ECO LE 3	BVH + IC 40 + VMO + VAA..N

Control with 3 solenoid valves for air VAA (constant or variable capacity in Flame/Flameless mode)



	EMX LE			Material No.	Designation	Combinations
Gas	1	C	M	86599177	GS 15R05-15R05-15R05-W-ECO LE 1	VAS..L + VAS..N + GEH + VAS..N + VMO + GEH
Air	1	C	M	86599551	L 40R-25R-40R-W-ECO LE 1	VMO + VAA..N + VAA..N + VAA..N

7.10 UV adapter set

An adapter is required to install the UVS 10.

Designation	Order No.
Adapter set UVS 10 ECO LE 1-4	75459651

8 Technical data

Heating: indirect in radiant tube.

Control type: On/Off (or Low/High/Off for NFPA).

Adjusting range: 60 to 100%.

Flame velocity: approx. 130 to 170 m/s (430 to 560 ft/s).

Flame control: with flame rod (UV control as an option).

Ignition: direct spark ignition.

Burner	Recuperator	Max. flue gas temperature at recuperator inlet
EMX LE..C	Ceramic (SiSiC)	1260°C (2300°F)
EMX LE.. M	metallic	1150 °C (2100 °F)

Burner	Capacity [kW]	Flame length [mm]*
EMX LE 1	36	300
EMX LE 2	48	300
EMX LE 2	60	400
EMX LE 3	100	450

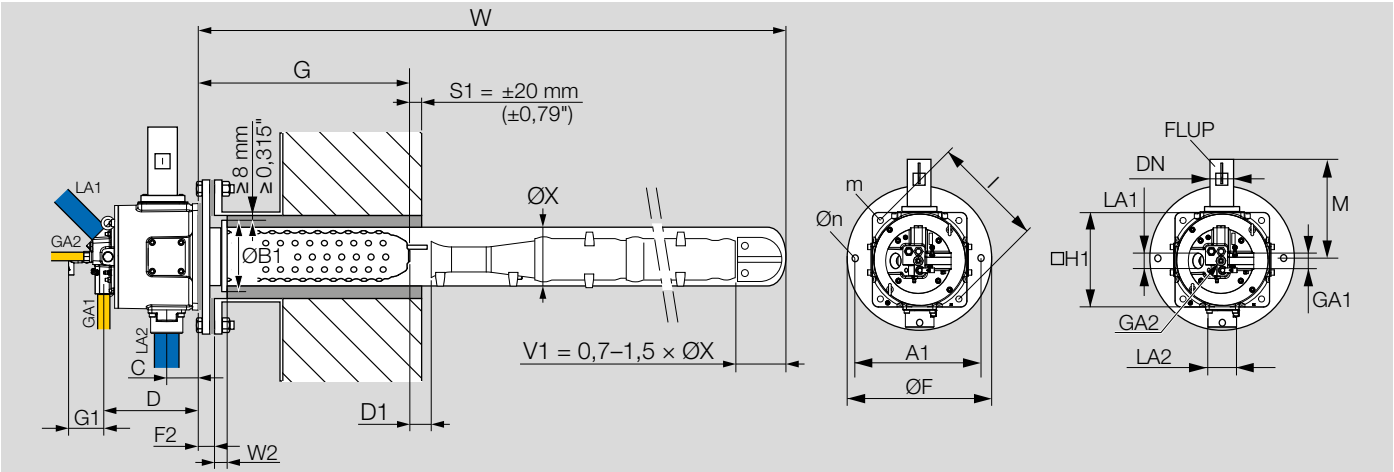
Burner	Capacity [kBTU/h]	Flame length [ft]*
EMX LE 1	136	1
EMX LE 2	182	1
EMX LE 2	227	1.3
EMX LE 3	378	1.5

** Visible range for natural gas operation in the open air, max. connection rating and air index 1.15.*

If the burners are used at geodetic altitudes of over 500 m (1645 ft) above MSL, the possible capacity will be lower as a result of the reduced density of gas and air. Guide value: 5% per 1000 m (3290 ft) above MSL.

8.1 Dimensions

8.1.1 EMX LE C ..



Typ	EMX LE									
	GA1	LA1	GA2	LA2	C[1)]	D[1)]	G1	G	H1	Weight
					mm					kg[2)]
EMX LE 1C	Rp ½	Rp 1½	Rp ½	Rp 1½	75	208	~90	545	236	~23
EMX LE 2C	Rp ½	Rp 1½	Rp ½	Rp 1½	75	208	~90	545	236	~25
EMX LE 3C	Rp ½	Rp 1½	Rp ½	Rp 2	83	250	~90	545	280	~31

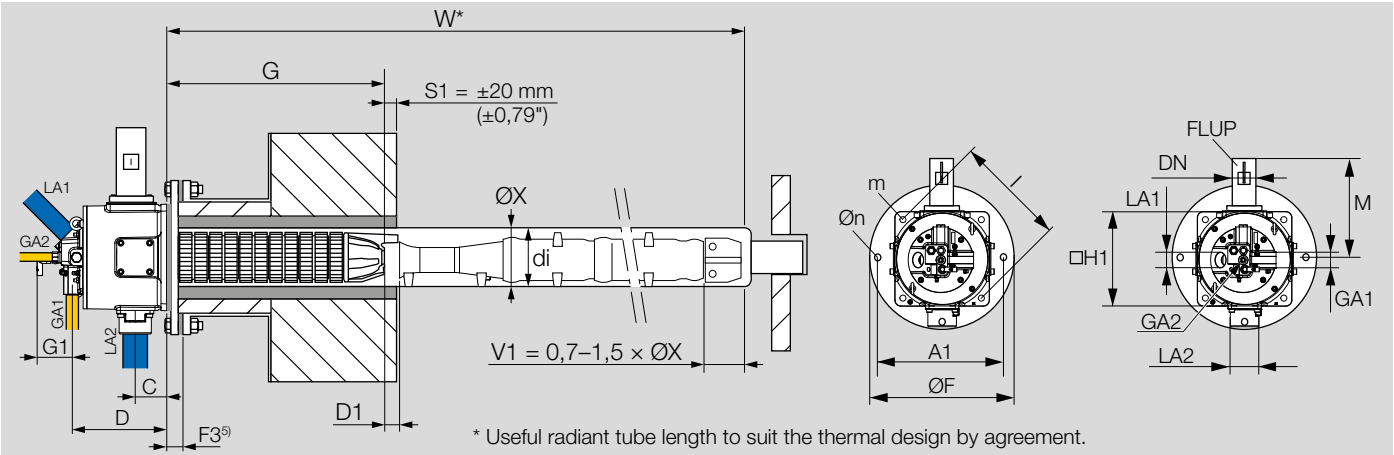
Typ	SER-C											FLUP	
	D1	F2	W2	ØB1	ØX	W[3)]	ØF	A1	Øn	l	m	DN	M
	mm									mm			mm
EMX LE 1C	15 ±5	~37	50	200	142	1500–2600	330	280	4x19	290	4xM16	40	331
EMX LE 2C	15 ±5	~37	50	220	162	1500–3000	330	280	4x19	290	4xM16	50	331
EMX LE 3C	30 ±5	~37	50	260	202	1500–3000	385	325	4x19	330	4xM16	65	353

[1)] Without seal (t = 1.3 mm)

[2)] Weight of the shortest length burner

[3)] Maximum burner capacity depending on radiant tube length

8.1.2 EMX LE M ..



* Useful radiant tube length to suit the thermal design by agreement.

Type	EMX LE									
	GA1	LA1	GA2	LA2	C[1)]	D[1)]	G1	G	H1	Weight
					mm					kg[2)]
EMX LE 1M	Rp ½	Rp 1½	Rp ½	Rp 1½	75	208	~90	545	236	~35
EMX LE 2M	Rp ½	Rp 1½	Rp ½	Rp 1½	75	208	~90	545	236	~39
EMX LE 3M	Rp ½	Rp 1½	Rp ½	Rp 2	83	250	~90	545	280	~53

Type	SER-M								FLUP	
	D1	di	ØX[3)]	ØF[4)]	A1[4)]	Øn[4)]	l	m	DN	M
	mm						mm			mm
EMX LE 1M	30 ± 5	≥ 128	di + 2s	330	280	4 x 19	290	4 x M16	40	331
EMX LE 2M	30 ± 5	≥ 147	di + 2s	330	280	4 x 19	290	4 x M16	50	331
EMX LE 3M	30 ± 5	≥ 185	di + 2s	385	325	4 x 19	330	4 x M16	65	353

1) Without gasket (t = 4 mm)

2) Weight of the shortest length burner

3 s = Wall thickness of radiant tube

4) On site, the details are suggestions.

5) F3 = burner gasket + SER-M radiant tube flange + SER-M radiant tube gasket (radiant tube flange and gasket to be provided by the customer)