

# Low NO<sub>x</sub> self-recuperative burner ECOMAX® LE for direct heating systems

## OPERATING INSTRUCTIONS

· Edition 05.23 · EN · 03251653



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## 1 SAFETY

### 1.1 Please read and keep in a safe place



Please read through these instructions carefully before installing or operating. Following the installation, pass the instructions on to the operator. This unit must be installed and commissioned in accordance with the regulations and standards in force. These instructions can also be found at [www.docuthek.com](http://www.docuthek.com).

### 1.2 Explanation of symbols

**1, 2, 3, a, b, c** = Action

→ = Instruction

### 1.3 Liability

We will not be held liable for damage resulting from non-observance of the instructions and non-compliant use.

### 1.4 Safety instructions

Information that is relevant for safety is indicated in the instructions as follows:

#### **⚠ DANGER**

Indicates potentially fatal situations.

#### **⚠ WARNING**

Indicates possible danger to life and limb.

#### **⚠ CAUTION**

Indicates possible material damage.

All interventions may only be carried out by qualified gas technicians. Electrical interventions may only be carried out by qualified electricians.

### 1.5 Conversion, spare parts

All technical changes are prohibited. Only use OEM spare parts.

## 2 CHECKING THE USAGE

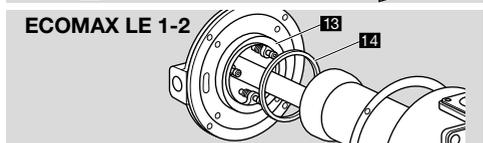
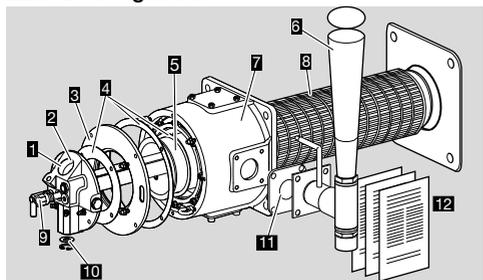
ECOMAX LE is a self-recuperative burner for gas with integrated recuperator for the indirect heating of furnace systems in intermittent mode. Combustion flue gases are separated from the product using metallic or ceramic radiant tubes and segmented ceramic flame tubes, This function is only guaranteed when used within

the specified limits – see page 15 (11 Technical data). Any other use is considered as non-compliant.

### 2.1 Type code

<b>ECOMAX LE</b>	Self recuperative burner
<b>1, 2, 3</b>	Burner size
<b>C</b>	With ceramic burled tube recuperator made of SiSiC
<b>M</b>	With cast steel ribbed tube recuperator
<b>545–695</b>	Recuperator length [mm]
<b>-F</b>	For flameless mode
<b>B</b>	Natural gas
<b>/D-</b>	For direct heating with eductor
<b>(1-99)</b>	Burner head identifier
<b>A-, B-,...</b>	Construction stage
<b>Z</b>	Special version

### 2.2 Part designations



- 1 Gas insert
- 2 Type label
- 3 Intermediate flange
- 4 Gaskets (set)
- 5 Air guide tube LFR (SiSiC)
- 6 Eductor EJEK (to be ordered separately)
- 7 Burner body with internal insulation
- 8 Burled tube recuperator (SiSiC) or cast steel ribbed tube recuperator
- 9 Gas lance set for Flameless mode
- 10 Gas orifice with circlip
- 11 Seal
- 12 Enclosed documentation (flow rate curves, operating instructions, spare parts list, spare parts drawing)

- 13 Pressure flange
- 14 Gasket cord

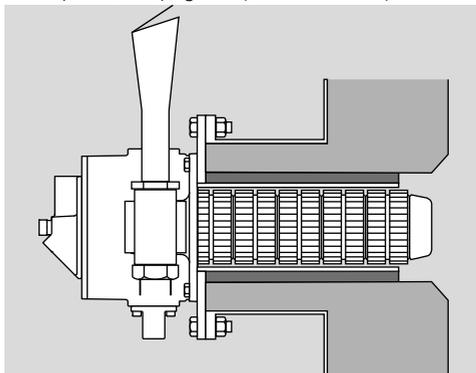
### 2.3 Type label

Maximum burner capacity, gas type – see type label.



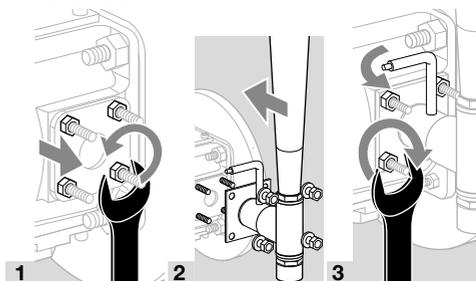
## 3 INSTALLATION

→ For a direct heating system, the flue gas guide tube FGT set..D and the eductor EJEK are required, see page 14 (10 Accessories).



→ Do not stress the FGT with forces from the furnace lining. Wrap the FGT in a fibre blanket before installing the burner. Complete the fibre wrapping to match the aperture in the furnace wall. Depending on the furnace lining and the type of expected movements in the furnace wall, the annular void must be at least 25 mm. Use a larger annular void if necessary. Wrap the cut-to-size fibre blanket around the FGT. Fasten the blanket over its entire length using conventional adhesive tape (compress it to around 50% of its thickness). After commissioning, the adhesive tape burns off and the fibre blanket expands evenly inside the annular void.

→ The eductor is mounted to the side of the burner.  
 → Align the eductor's pressure test point to the control side.



→ Use the correct torque so that the body is not damaged:

Type	Torque [Nm]
ECOMAX LE 1	26
ECOMAX LE 2	26
ECOMAX LE 3	30
ECOMAX LE 4	35
ECOMAX LE 5	35

→ After installing the eductor, connect the burner to the air and gas circuits.

### 3.1 Installation in the furnace

#### ⚠ CAUTION

Incorrect installation

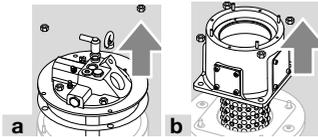
Please observe the following to ensure that the ECOMAX LE is not damaged during installation and operation:

- Dropping the device can cause permanent damage. In this event, replace the entire device and associated modules before use.
  - We recommend that lifting gear be used for installation due to the weight involved.
  - Avoid impacts when inserting the burner into the FGT set and placing on the stud bolts.
- The burner body features three connections to choose from for secondary air and one for flue gas. The primary air is connected to the gas insert. During installation, the burner must be aligned appropriately (flue gas upwards or to the side).
- On the ECOMAX LE, the ceramic air guide tube LFR and the gas lance set are supplied separately to protect them from transport damage.
- The ECOMAX LE is supplied with red notice flags which must be removed before the LFR is installed.
- The ECOMAX LE for direct heating is supplied with a flue gas guide tube FGT set. The FGT is metallic for metallic recuperators and metallic with a shaped fibre part for ceramic recuperators.

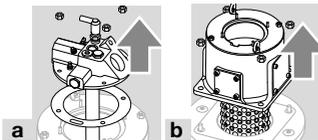
**1** Remove the transport safety device.

**2** Remove the gas insert:

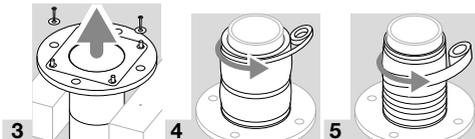
**For size 1 and 2, remove the intermediate flange, including the gas insert**



**For size 3, remove the gas insert without the intermediate flange**

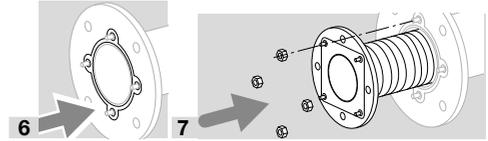


**Installing the flue gas guide tube FGT set**



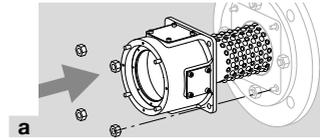
- Wrap the FGT (metallic) in a ceramic fibre blanket. The wrapping thickness should be around twice the size of the gap dimension. Wrap the fibre blanket in adhesive tape so that the diameter fits into the aperture in the furnace wall.

After commissioning, the adhesive tape burns off and the fibre blanket expands evenly inside the annular void.



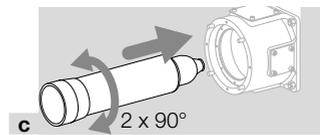
**8** Install the burner housing with recuperator:

**Sizes 1 and 2**



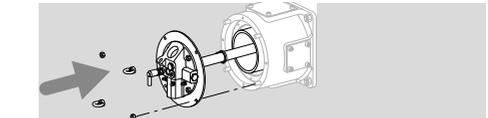
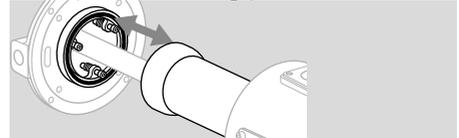
- Take care not to hit the sides as you insert the recuperator into the FGT set. Tighten the nuts in a crosswise fashion, torque: 46 Nm.
- When installing, ensure that the components are sealed tightly.

**b** Remove the transport safety device (3 x insulating tape) from the pressure flange (near the springs).



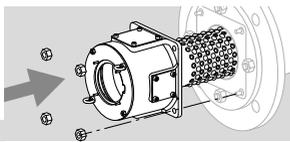
- Twist the recuperator as you insert it.

**d** Place the intermediate flange on the housing stud bolts and insert the LFR into the guide sleeve (intermediate flange).

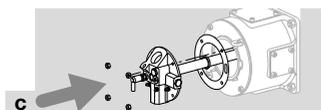
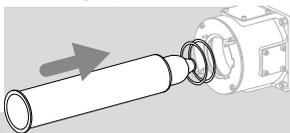


- e** Press the gas insert into position, secure the nuts by hand and then tighten them in a crosswise fashion using a torque of 20 Nm.

## Size 3



- Take care not to hit the sides as you insert the recuperator into the FGT set. Tighten the nuts in a crosswise fashion, torque: 46 Nm.
- When installing, ensure that the components are sealed tightly.



- Tighten the nuts crossways using a torque of 20 Nm.



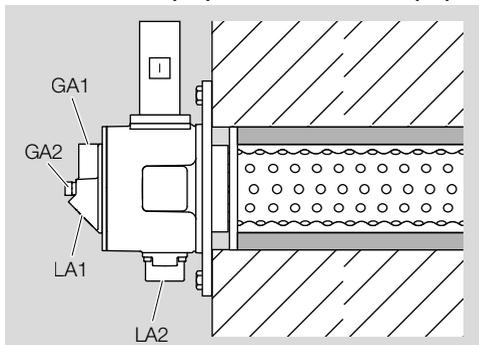
- Insert the "Flameless" gas lance using slow "rotary movements to and fro" and secure it using a torque of 40 Nm. There is a copper sealing ring under the gas lance adapter.

### 3.2 Heat guard

- During operation, the burner body and flue gas connector can reach surface temperatures of over 80°C (176°F).
- We recommend that warning signs and a contact guard be fitted, for example made of perforated sheet metal.
- Do not insulate the burner body and flue gas connector to prevent material overheating.

## 4 GAS AND AIR PIPES

### Gas connection (GA) and air connection (LA)



LA1: Primary air connection

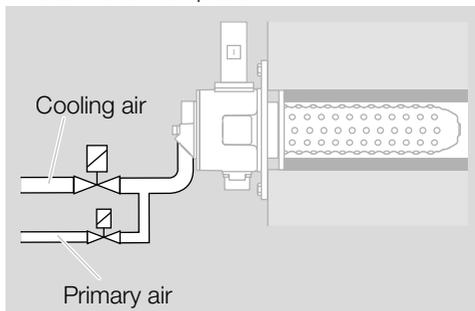
LA2: Secondary air

GA1: Gas connection for Flame mode

GA2: Gas connection for Flameless mode

### Cooling air connection using LA1

- To increase the air volume in Cooling mode if required.
- The primary air connection LA1 can be used as an option for an increased volume of cooling air.
- The cooling air is connected on the straight bore of a T-piece using an elbow to the burner (an angle would generate excessive pressure loss).
- The burner primary air is then connected to the side inlet of the T-piece.



### Table of threaded connections

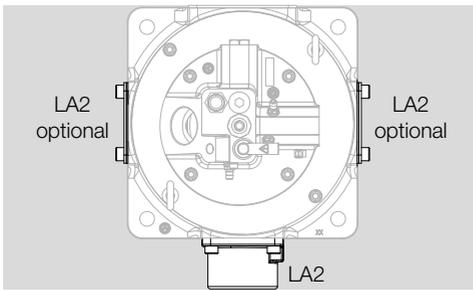
Burner	GA1	GA2	LA1	LA2
ECOMAX LE 1	Rp 1/2"	G 1/2"	Rp 1 1/2"	Rp 1 1/2"
ECOMAX LE 2	Rp 1/2"	G 1/2"	Rp 1 1/2"	Rp 1 1/2"
ECOMAX LE 3	Rp 1/2"	G 1/2"	Rp 1 1/2"	Rp 2"

- Install flexible tubes or bellows units to prevent mechanical stress or transmission of vibration.
- Ensure that the gaskets are undamaged.

### **⚠ DANGER**

Risk of explosion!

- Ensure the connection is air-tight.
- The gas insert together with the intermediate flange can be rotated in 90° increments if necessary.
- We recommend replacing all the gaskets that are removed to rotate the gas insert.
- If necessary, the secondary air connection may be repositioned. The burner has three secondary air connections, two of which are sealed with blind flanges.

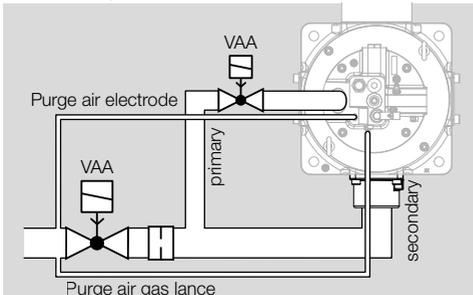


#### 4.1 Restrictors

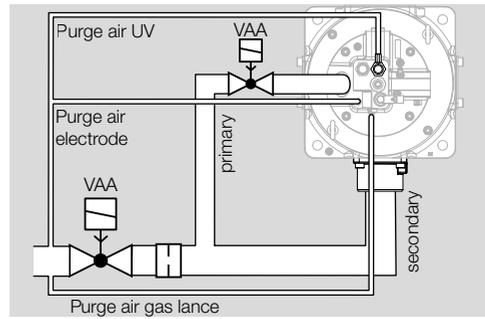
- The appropriate restrictors are to be fitted in the fuel gas supply lines (Flame mode and Flameless mode) to adjust the burner.
- The air volume flows (combustion air and eductor air) are adjusted on restrictors or directly on the air valves, depending on the air circuit. The purge air is supplied without an additional restrictor (purge air nozzles are integrated in the burner).

#### 4.2 Purge air connections

- The electrode and the gas lance must be cooled and purged with air.



- The purge air must be branched off upstream of the air control valve, for example at the inlet of the air solenoid valve. The gas lance for Flameless mode must be purged using a separate supply line.
- The purge air connections are located on the gas flange of the burner.
- The nozzle for electrode purge is integrated in the gas flange. The purge air nozzle for the "Flameless" gas lance is mounted on the outside of the gas flange. It is equipped with a filter and a pressure test nipple for checking for dirt (see Maintenance for further details). There is no need to set the purge air volumes.
- A UV sensor, if there is one, must be purged by a separate air supply line (see figure).

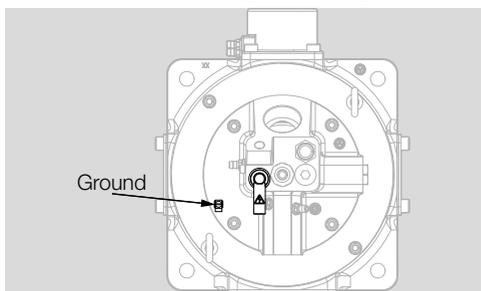
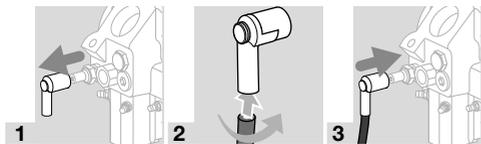


## 5 WIRING

### **⚠ DANGER**

Electric shocks can be fatal!

- Before working on possible live components, ensure the unit is disconnected from the power supply.
- The flame is monitored by a combined flame rod/spark electrode as standard on the burner ECOMAX LE.
- Flame control with a UV sensor is not necessary for the burner, but can be done if desired. In this case, we recommend a UV sensor UVS 10 with a lens and a purge air connection be used.
- An adapter set (Order No. 75459651), which must be ordered separately, is available for installing the UVS 10.
- For high temperature operation without flame control using ionization or a UV sensor, the air flow must be monitored by a pressure switch.
- We recommend an ignition transformer  $\geq 7.5$  kW,  $\geq 20$  mA.
- For the ignition/ionization cable, use (unscreened) high-voltage cable:
  - FZLSi 1/6 up to 180°C (356°F), Order No. 04250410, or
  - FZLK 1/7 up to 80°C (176°F), Order No. 04250409.
- Length of cable: max. 5 m, recommended  $< 1$  m.
- Lay cable individually and not in a metal conduit.
- Install cable well away from main cables and interference from electromagnetic sources.
- In particular, avoid external electrical interference when using ionization control.
- For UV control, route the ignition cable separately from the UV cable.



4 Connect the PE wire for grounding to the gas insert. Route the PE wire from the gas insert directly to the connection on the automatic burner control unit.

5 Bend the wire-end ferrule through 45° to prevent the PE wire from touching any hot surfaces.

### ⚠ WARNING

High-voltage risk!

– It is essential that a high-voltage warning label be attached to the ignition/ionization cable.

→ For more detailed information on how to wire the ignition/ionization cable, refer to the operating instructions and connection diagrams of the automatic burner control unit and ignition transformer.

→ For further information about using a UV sensor, refer to the relevant operating instructions.

## 6 PREPARING COMMISSIONING

### 6.1 Safety instructions

→ Agree on settings and commissioning of the burner with the system operator or manufacturer.

→ Check the entire system, upstream devices and electrical connections.

→ Note the operating instructions for individual controls.

### ⚠ DANGER

Risk of explosion!

– Gas pressure upstream of the burner gas valves (pressure in the gas pressure control system) must be **10 mbar** higher than the fan air pressure. This ensures that the slow ingress of air flow into the combustion gas is prevented in the event of a fault due to a blocked flameless gas lance.

– Please observe the appropriate precautions when igniting the burner.

- Pre-purge the furnace chamber or radiant tube with air (5 x volume) before every ignition attempt.
- Fill the gas line to the burner carefully and correctly with gas and vent it safely into the open air – do not discharge the test volume into the furnace chamber.

### ⚠ DANGER

Risk of poisoning!

- Open the gas and air supply so that the burner is always operated with excess air – otherwise CO will form in the furnace chamber. CO is odourless and poisonous! Conduct a flue gas analysis.
- The burner must only be commissioned by authorized trained personnel.

→ If the burner does not ignite even though the automatic burner control unit has been switched on and off several times: check the entire system.

### 6.2 Determining the gas and combustion air flow rates

$$Q_{\text{Gas}} = P_B / H_i$$

$$Q_{\text{Air}} = Q_{\text{Gas}} \cdot \lambda \cdot L_{\text{min}}$$

→  $Q_{\text{gas}}$ : Gas flow rate in m<sup>3</sup>/h (ft<sup>3</sup>/h)

→  $P_B$ : Burner capacity in kW (BTU/h)

→  $H_i$ : Gas heating value in kWh/m<sup>3</sup> (BTU/ft<sup>3</sup>)

→  $Q_{\text{air}}$ : Air flow rate in m<sup>3</sup>(n)/h (SCFH)

→  $\lambda$ : Lambda, air index

→  $L_{\text{min}}$ : Minimum air requirement in m<sup>3</sup>(n)/m<sup>3</sup>(n) (SCF/SCF)

→ Information on the gas quality supplied can be obtained from the gas supply company.

### Common gas qualities

Gas type	Heating value		
	$H_u$	$H_o$	$L_{\text{min}}$
	kWh/m <sup>3</sup> (n)	BTU/SCF	m <sup>3</sup> (n)/m <sup>3</sup> (n) (SCF/SCF)
Natural gas H	11.0	1114	10.6
Natural gas L	8.9	901	8.6
Propane	25.9	2568	24.4
Low calorific value gas	1.7–3	161–290	1.3–2.5
Butane	34.4	3406	32.3

→ Data in kWh/m<sup>3</sup>(n) refer to the lower heating value  $H_u$  and data in BTU/SCF refer to the higher heating value  $H_o$  (gross calorific value).

→ A minimum air excess of 20% ( $\lambda = 1.2$ ) should be set in a cold furnace for initial adjustment since the air volume falls as the temperature rises.

→ Fine adjustment should be carried out at max. furnace temperature and at as high a capacity demand as possible.

### 6.3 Notes on the flow rate curve

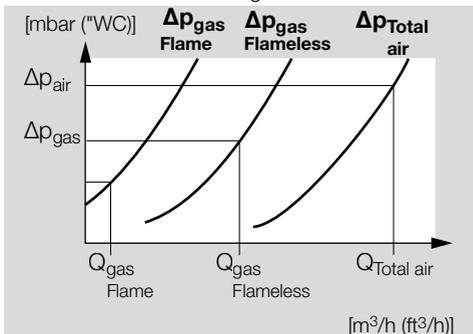
→ If the gas density in the operating state differs from that reflected in the flow rate curve, convert the pressures according to the local operating state.

$$p_B = p_M \cdot \frac{\delta_B}{\delta_M}$$

- $\delta_M$ : Gas density reflected in the flow rate curve in  $\text{kg/m}^3$  ( $\text{lb/ft}^3$ )
- $\delta_B$ : Gas density in operating state in  $\text{kg/m}^3$  ( $\text{lb/ft}^3$ )
- $p_M$ : Gas pressure reflected in the flow rate curve
- $p_B$ : Gas pressure in operating state

### 6.4 Determining the gas and combustion air settings

- In Flameless mode (Low NOx mode), the primary air supply is closed by closing the primary air valve. By reducing the total air volume, the capacity of the burner in Flameless mode is also reduced.
- In Flameless mode, the air flows into the burner through the secondary air connection.
- By using an air valve, the primary/secondary pressure levels change and the combustion air volume is reduced in Flameless mode.
- By using an air butterfly valve instead of an air valve, the capacity can be adjusted constantly or independently of the operating mode (Flame/Flameless).
- The burner features an orifice in the gas flange (GA1) for Flame mode.
- An orifice (VMO) is required in the total air supply line to measure the total air volume. An orifice (VMO) is also required to adjust the gas volume in Flameless mode.
- Adjustment is made on the basis of the flow rate-dependent pressure differential. The required pressure differentials for gas and air are shown in the burner diagram.



→ Ensure an undisturbed flow to the total air orifice VMO.

→ Elbows, angles or screw unions may be used in the gas flange of the gas circuit for Flame mode GA1.

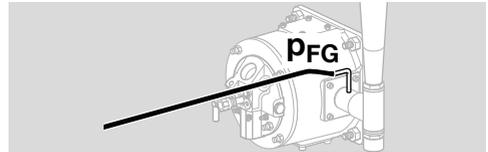
### **⚠ WARNING**

CO formation in combustion chamber  
Incorrect burner settings may result in sub-stoichiometric burner operation. CO is odourless and poisonous!

– A flue gas analysis should be conducted.

#### 6.4.1 Notes on motive air at the eductor

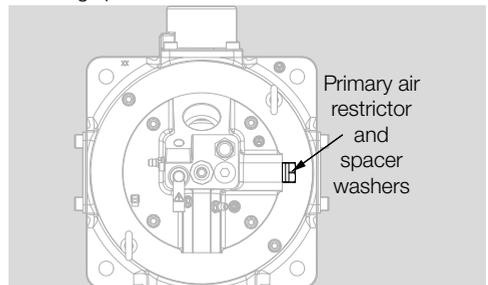
→ The motive air is set at the eductor by measuring the negative flue gas pressure  $p_{FG}$  between the burner and eductor.



- The required negative pressure is shown in the eductor diagram, see [www.docuthek.com](http://www.docuthek.com), on the basis of the maximum furnace temperature and burner capacity.
- If the gas flue extraction rate is 80–90% at maximum furnace temperature, a negative furnace pressure will generally be avoided even at a furnace temperature reduced by 400–500°C. In the case of heavily leaking furnaces, flue gas extraction must be reduced, where necessary, to avoid pulling in cold air due to negative pressure in the furnace chamber.
- During the commissioning procedure, the motive air setting must be optimized (maximization of flue gas extraction). The furnace pressure must remain slightly positive in all operating states (0.1 to 0.3 mbar). If the positive pressure exceeds approx. 0.3 mbar, increase the flue gas extraction rate to prevent the burner being damaged. If there is a negative pressure in the furnace chamber, reduce the flue gas extraction rate to avoid infiltrated air.

### 6.5 Coarse adjustment of the combustion air volume

→ The ECOMAX LE primary air restrictor on the gas flange is preset for the rated capacity on delivery using spacer washers.



→ If a different burner capacity is to be used, remove a spacer washer as shown in the table.

Size	Capacity in Flameless mode [kW]	Spacer washer [mm]
1	22–36	No washer
2	36–45	No washer
2	45.1–60	No washer
3	60–90	No washer
3	90.1–95	4.7
3	95.1–100	3 + 4.7

→ Air measuring nipple **L**, outside dia. = 9 mm (0.35").

### Measuring the differential air pressure

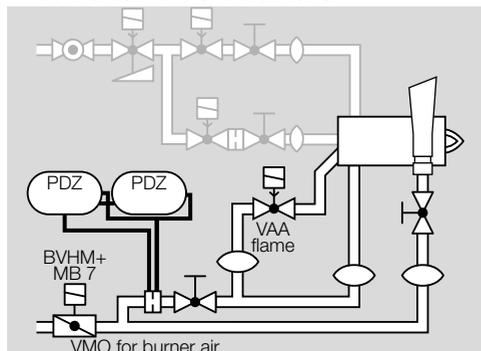
**1** Close the gas supply on the manual valve upstream of the gas valve group.

### ⚠ DANGER

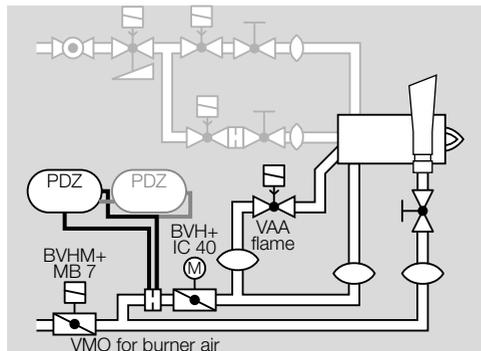
Risk of explosion!

– Prevent the uncontrolled flow of gas into the radiant tube.

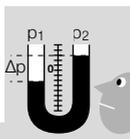
**2** Measure the differential pressure on the (primary and secondary) burner air measuring orifice VMO downstream of the total air valve.



Control with butterfly valve and primary air valve (jump in capacity)



Control with two butterfly valves and a primary air valve (constant or variable capacity)



**3**

**4** Switch the burner control unit to Manual mode.

**5** Start pre-purge.

→ Presetting of the primary air volume at the air valve (VAA): restriction as shown in the table.

Burner	Valve in Flame mode	Restriction [revolutions]
ECOMAX LE 1	VAA	4.5
ECOMAX LE 2	VAA	Fully open
ECOMAX LE 3	VAA	Fully open

→ Presetting of the total air volume for Flame mode at rated capacity, adjustment on the total air restrictor:

Burner	Differential pressure on the total air orifice [mbar]
ECOMAX LE 1	6
ECOMAX LE 2	5.5
ECOMAX LE 3	14

**6** End pre-purge.

**7** Check the purge air pressure at the gas insert. Make a note of the value and compare it with values from the initial commissioning procedure and/or the last maintenance process. In the event of a discrepancy: check purge air nozzles for blockages, see page 10 (8 Maintenance).



### 6.6 Preparing the gas pressure measurement

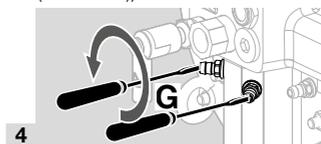
**1** Connect all measuring devices to the burner for later adjustment.

→ Leave the gas supply closed.

**2** Read the differential pressure for the required gas flow rate (Flame mode) from the enclosed flow rate curve.

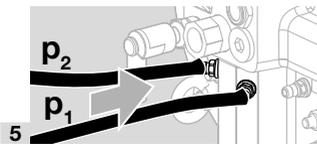
**3** p1: gas pressure upstream of the measuring orifice, p2: gas pressure downstream of the measuring orifice. Measuring range: select approx. 15 mbar.

→ Gas measuring nipple **G**, outside dia. = 9 mm (0.35 inch).



**4**

→ Loosen the screws 2 turns.



## 7 COMMISSIONING

### Igniting and adjusting the burner

#### **⚠ WARNING**

Risk of burning!

Outflowing flue gases and burner components are hot.

- Attach warning signs and a contact guard.
  - Ensure adequate ventilation of the combustion chamber before each burner start!
  - Wear ear protection to protect yourself from harmful noise.
- When heating up for the first time, vapours may be emitted from gaskets or paint coatings, for example, which may cause unpleasant odours.
- The gas inlet pressure must be 10 mbar higher than the fan air pressure.

#### Coarse adjustment with the furnace cold

→ Coarse adjustment of the air volumes, see page 6 (6 Preparing commissioning).

- 1 Limit the maximum gas volume.
- 2 The Flame mode gas restrictor is around half-open.
- 3 The Flameless mode gas restrictor must be fully closed.

#### **⚠ DANGER**

Risk of explosion and poisoning in case of burner adjustment with an air deficiency.

CO formation in the combustion chamber! CO is odourless and poisonous!

- Adjust the gas and air supply so that the burner is always operated with excess air.
  - Conduct a flue gas analysis.
- 4 Open the gas supply. (Manual valve upstream of the gas solenoid valve group)
  - 5 Ignite the burner in Flame mode.
- The safety time of the automatic burner control unit starts to elapse.
- 6 Check and adjust the Flame mode gas differential pressure.
  - 7 Check the furnace pressure and adjust the eductor setting so as to achieve a positive furnace pressure (0.1–0.3 mbar).
  - 8 Check and adjust the total air volume on the basis of the oxygen (cold start phase 4–5% O<sub>2</sub>). Make the adjustment using the air adjusting cock, the integrated restrictor in the total air valve or the total air butterfly valve.

- 9 If no flame is formed, reset the automatic burner control unit, purge the combustion chamber and ignite the burner again.

#### **⚠ CAUTION**

Material damage!

There must not be a combustible mixture in the combustion chamber.

- After a failed start or fault, pre-purge the combustion chamber and radiant tube with air (5 x volume) before attempting to ignite it again.
- The burner ignites and proceeds to normal operation.
- If no flame is formed after repeating the above steps multiple times – see page 13 (9 Assistance in the event of malfunction).

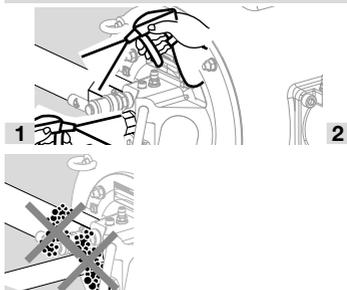
### 7.1 Tightness test

#### **⚠ DANGER**

Escaping gas!

Danger from a leakage at the gas connections.

- Check the gas connections on the burner for leaks immediately after commissioning the burner.



### 7.2 Adjustment with a hot furnace

→ The fine adjustment of the burner should be carried out at a high furnace temperature and high capacity demand.

- 1 Heat the furnace.
  - 2 Check the furnace pressure and adjust the eductor setting so as to achieve a positive furnace pressure (0.1–0.3 mbar).
- Monitor the O<sub>2</sub> value in the flue gas. Avoid sub-stoichiometric operation of the burner.
- If necessary, adjust the settings of the total air on the basis of the oxygen value in the flue gas (generally 3% O<sub>2</sub>).
- Flameless mode can only be adjusted if the furnace temperature is above 850°C (1560°F).

#### **⚠ CAUTION**

Risk of explosion!

Risk of explosion when starting Flameless mode in a cooled radiant heating tube (despite the high zone temperature).

- Do not purge the radiant tube before switching to Flameless mode.

→ If a burner is to be switched to Flameless mode after a cooling process, a waiting time for reaching a temperature balance or brief Flame mode to reheat the radiant tube is required if the furnace is sufficiently hot.

→ Switching to Flameless mode in Manual mode using the BCU is only possible using a laptop and BCSofT.

→ Fine adjustment can only be carried out by repeatedly switching between Flameless and Flame mode.

**3** Open the gas restrictor for Flameless mode around halfway.

**4** Switch the burner to Flameless mode using BCSofT.

**5** Check and adjust the Flameless mode gas differential pressure.

**6** Check the total air volume using the oxygen value in the flue gas and adjust the air volume again if necessary. The adjustment is made using the total air valve or the air butterfly valve. The primary air volume must not be changed.

**7** Switch off the burner.

**8** Start the burner in Flame mode.

**9** The capacity in Flame mode must be adjusted using the oxygen value in the flue gas. To do so, alter the Flame mode gas flow rate using the restrictor, while checking the furnace pressure and the oxygen value in the flue gas and adjusting it as required (generally 3% O<sub>2</sub>).

**10** The air volume in Flame mode has now been changed compared to Flameless mode. Do not change the adjustment on the total air valve for Flame mode.

**11** Watch the furnace pressure at high capacity demand and various furnace temperatures to optimize the motive air setting.

→ The furnace pressure should be slightly positive in all operating states (0.1–0.3 mbar). If the positive pressure exceeds approx. 0.3 mbar, increase the flue gas extraction rate to prevent the burner being damaged. If there is a negative pressure in the furnace chamber, reduce the flue gas extraction rate to avoid infiltrated air.

**12** If adjustment of the burner is not possible with the existing air pressure, use a thicker spacer washer (see page 7 (6.5 Coarse adjustment of the combustion air volume)) or change the capacity in Flame or Flameless mode, see page 7 (6.4 Determining the gas and combustion air settings).

**13** Adjust the pressure switches of the air flow detector set for Flame and Flameless mode.

### 7.3 Pressure switches

→ The Air flow detector-Set ECO LE for total air control with valve includes a pressure switch for Flame mode and a pressure switch for Flameless mode due to the change in capacity when switching over.

→ The switching point when the burner is set to 3% O<sub>2</sub> should be set to around 80% of the differential pressure for the combustion air.

### 7.4 Blocking and recording the settings

**1** Produce a setting and maintenance report.

**2** Remove the measuring devices and close off the test nipples – tighten the grub screws.

**3** Block and seal the adjusting elements.

**4** Induce a flame failure in Flame mode by closing the manual gas shut-off valve upstream of the gas valves. The flame failure fault must be detected and result in the gas valves being closed.

**5** Stop the combustion air supply (without changing the flow adjustment) to check the air pressure switch function in **Flame mode**. The air pressure switch must switch and issue a fault signal which leads to the gas valves being closed.

**6** Stop the combustion air supply (without changing the flow adjustment) to check the air pressure switch function in **Flameless mode**. The air pressure switch must switch and issue a fault signal which leads to the gas valves being closed.

**7** Reset the burner control unit and switch on the burner again.

**8** Check the O<sub>2</sub> value.

**9** Switch off the burner.

**10** Switch off Manual mode at the burner control unit.

**11** The furnace control unit will take over control of the burner.

### DANGER

Risk of explosion in case of CO being formed in the combustion chamber! CO is odourless and poisonous!

An incorrect change of the burner settings may change the gas/air ratio and lead to unsafe operating conditions:

– All interventions may only be carried out by qualified gas technicians.

## 8 MAINTENANCE

→ Maintenance and function check every six months. If the media are highly contaminated, this interval should be reduced.

### DANGER

Risk of explosion!

– Please observe the appropriate precautions when igniting the burner.

– Maintenance work on the burner must be carried out by authorized trained personnel only.

### DANGER

Risk of poisoning!

- Open the gas and air supply so that the burner is always operated with excess air – otherwise CO will form in the combustion chamber. CO is odourless and poisonous! A flue gas analysis should be conducted.

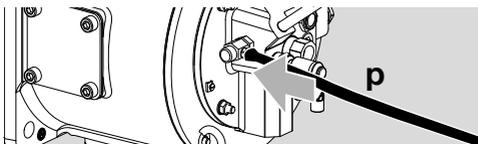
## **⚠ DANGER**

Risk of burning!

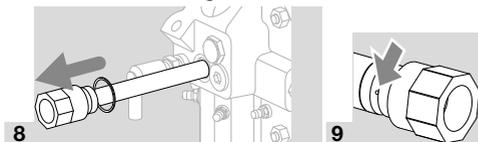
- Outflowing flue gases and burner components are hot.
- We recommend that all the gaskets removed during maintenance work be replaced. The appropriate gasket set is available separately as a spare part.
- 1** Check the cable to the electrode.
- 2** Measure the ionization current.
- The ionization current in Flame mode must be at least 5 µA and must not vary.
- Read off the ionization signal on the burner control unit.

### Checking the purge air

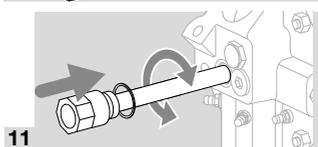
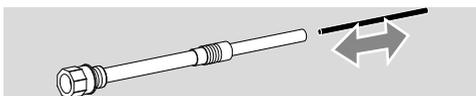
- 3** Switch off the burner.
- 4** Measure the purge air pressure at the purge air nozzle.



- 5** Make a note of the value and compare it with values from the initial commissioning procedure and/or the last maintenance process.
- If the pressure is lower at the purge air measuring nipple, this indicates that a purge air measuring nipple or filter is blocked. In this case: replace the filter and conduct a visual inspection of the purge air nozzle for blockages; if necessary, remove the purge air nozzles and remove the contamination. For mounting the purge air nozzle, use DVGW-approved sealant on the external thread which is screwed into the gas flange.
- If the pressure is higher at the purge air measuring nipple: gas lance for Flameless mode is blocked.
- 6** Switch off the burner control unit.
- 7** Shut off the gas and air supply – do not change the restrictor settings.

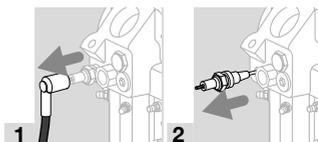


- 10** If a borehole on the gas lance for Flameless mode is blocked, you must expect soot deposits in the “Flameless” gas lance. In this case, check the “Flameless” gas lance and clean it if necessary.
- Carefully clear the gas lance with a pricking tool.

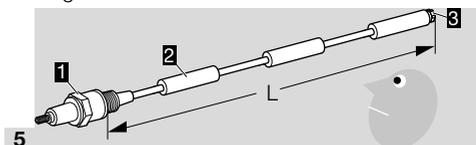


- Install a new copper sealing ring under the gas lance adapter.
- Insert the “Flameless” gas lance using slow “rotary movements to and fro” and secure it using a torque of 40 Nm.

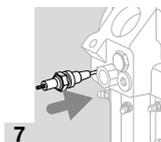
### 8.1 Checking and replacing the spark electrode/flame rod



- Ensure that the electrode length does not change.
- 3** Remove dirt from electrode or insulator.
- 4** Replace the electrode if the tip **3** or insulator **2** is damaged.
- Before changing the electrode, measure the total length **L**.

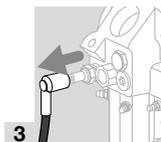


- 6** Adjust spark plug and electrode rod to the measured total length **L**.



### 8.2 Checking the burner head and gas lance

- The complete gas insert must be removed to check the burner head.
- 1** Disconnect the gas and primary air lines from the gas insert.
- 2** Disconnect the grounding cable.



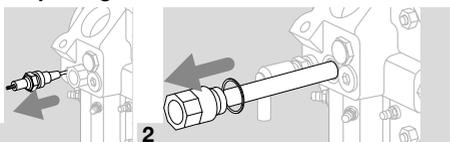
- 4** Pull the gas insert **very slowly** and carefully out of the burner, see page 3 (3.1 Installation in the furnace).

→ Do not bang the gas insert against the internal ceramic air guide tube LFR during the removal process.

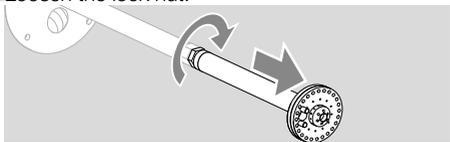
5 Place the gas insert in a safe place.

6 Check the burner head for dirt, wear and thermal damage and cracks; clean or replace if necessary.

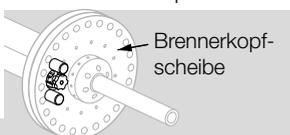
### 8.3 Replacing the burner head



3 Loosen the lock nut.

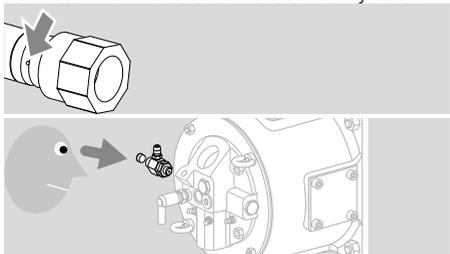


4 Follow the reverse procedure when reassembling.

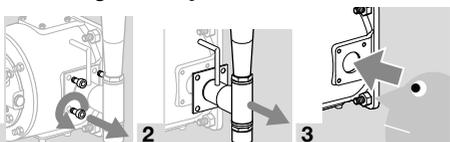


5 → Finally, align the first insulator on the electrode with the burner baffle plate.

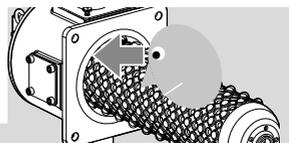
6 Check the interior of the ceramic gas lance for soot deposits. Visually and using suitable tools: insert tool into the ceramic part of the gas lance by a length of > 150 mm. Clean the purge air nozzles which have become blocked by soot.



### 8.4 Checking the body insulation

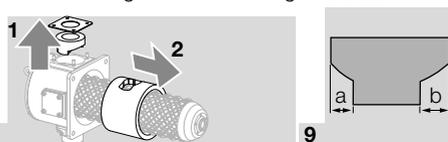


4 If possible, carefully check the body insulation from the front for signs of damage. To do this, carefully remove the gas insert, air guide tube and burner.



5  
6 If the insulation is worn or damaged, it must be replaced.

7 Remove the gas insert and air guide tube.



8  
10 Ensure that the flue gas insulation is installed in the correct position.  $a < b$

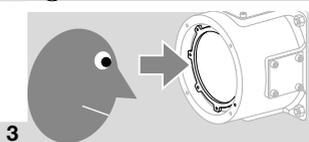
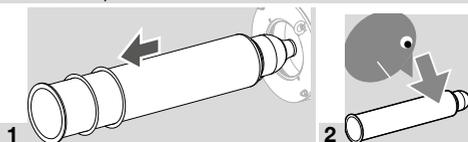
11 Follow the reverse procedure when reassembling.

### 8.5 Checking/replacing the air guide tube LFR and recuperator

#### ⚠ CAUTION

Risk of breakage.

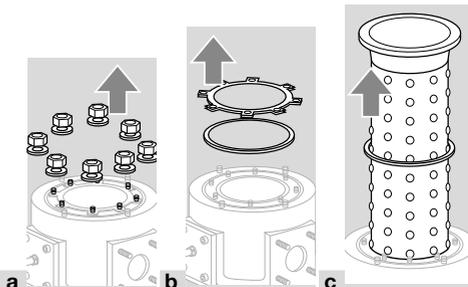
– For components made of ceramic material – avoid impacts.



→ To check the body insulation carefully and to replace the recuperator, remove the burner and suspend it vertically, e.g. on two beams.

4 Remove the recuperator:

#### Ceramic recuperator



d Check the recuperator for damage.

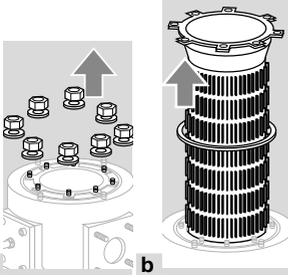
→ If any ceramic components are damaged, they must be replaced.

e Follow the reverse procedure when reassembling.

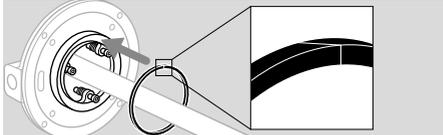
→ Ensure that the cup springs are installed facing the correct direction (curve towards the nut).

- f** Tighten the nuts in a crosswise fashion, torque: 5 Nm.

### Metallic recuperator



- a** Check the recuperator for damage.
- b** Follow the reverse procedure when reassembling.
- Ensure that the cup springs are installed facing the correct direction (curve towards the nut).
- e** Tighten the nuts in a crosswise fashion, torque: 8–10 Nm.
- 5** Test the compression springs. It must be possible to push the pressure flange towards the gas flange with force. Replace the springs if necessary. Then tighten the screws with a torque of 10 Nm.
- 6** Before assembly, place a new gasket cord in the pressure flange. The ends of the gasket cord must lie flat on each other.



- 7** Assemble the burner, see page 3 (3.1 Installation in the furnace)
- 8** Connect the ignition cable.
- 9** Connect the grounding cable.
- 10** Connect the gas line to the gas insert.
- 11** Connect voltage to the system.
- 12** Check for tightness, see page 9 (7.1 Tightness test).
- 13** Open the gas and air supply.
- 14** Start the burner, see page 9 (7 Commissioning).

### **⚠ DANGER**

Risk of explosion and poisoning in case of burner adjustment with insufficient air!

- Adjust the gas and air supply so that the burner is always operated with excess air – otherwise CO will form in the combustion chamber. CO is odourless and poisonous! Conduct a flue gas analysis.

- 15** Produce a maintenance report.

## 9 ASSISTANCE IN THE EVENT OF MALFUNCTION

### **⚠ DANGER**

Electric shocks can be fatal!

- Before working on possible live components, ensure the unit is disconnected from the power supply.

### **⚠ DANGER**

Risk of injury!

Burner heads have sharp edges.

- Burner inspection must only be performed by authorized trained personnel.

- If no issues are found when checking the burner, proceed to the automatic burner control unit and check for faults in accordance with the relevant operating instructions.

### **? Fault**

#### **!** Cause

- Remedy

### **? Burner does not function.**

#### **!** Valves do not open.

- Check the voltage supply and wiring.

#### **!** Gas inlet pressure is too low.

- Check the filter for dirt.
- Check the gas supply.

#### **!** Air inlet pressure is too low.

- Check the fan and air supply.

#### **!** Gas and air pressures on the burner are too low.

- Check the restrictors.
- Check/adjust the start rate setting, see operating instructions for solenoid valve.

#### **!** Automatic burner control unit does not function correctly.

- Check the device fuse.
- Note the automatic burner control unit operating instructions.

#### **!** Short-circuit of the UV sensor.

- Replace the UV sensor.
- Note the UV sensor operating instructions.

#### **!** Automatic burner control unit signals a fault.

- Check the ionization cable.
- Check the ionization current. The ionization current must be at least 5  $\mu\text{A}$  – stable signal.
- Check whether the burner is adequately grounded.
- Note the automatic burner control unit operating instructions.

#### **!** No ignition spark is created.

- Check the ignition cable.
- Check the voltage supply and wiring.
- Check whether the burner is adequately grounded.

- Check the electrode – see page 10 (8 Maintenance).

**!** Defective insulator on the electrode, ignition spark jumps over incorrectly.

- Check the electrode.

**!** The ignition spark may jump over incorrectly if there is inadequate electrode purge air.

- An adequate flow of purge air is audible from the noise at the electrode installation point in the gas flange when the electrode has been removed; if this noise is not clearly audible: remove the electrode purge air supply line, check the purge air outlet from the now open purging hose and clean any dirt in the internal purge air hole in the gas flange if required (clear the purge air hole  $d = 2.5 \text{ mm}$  using a suitable tool).

**? No gas in Flame mode.**

**!** Valve plugs for gas in Flame mode and gas in Flameless mode reversed.

→ Non-combusted gas gets into the radiant tube when the burner starts. Conduct a purge after incorrect ignition.

**? No air in Flameless mode.**

**!** Total air and primary air valve plugs reversed.

**? Burner performs a fault lock-out after operating faultlessly in normal operation.**

**!** Incorrect gas and air flow rate settings.

- Check the differential pressures for gas and air.

**!** Automatic burner control unit signals a fault.

- Check the ionization cable.
- Check the ionization current. The ionization current must be at least  $5 \mu\text{A}$  – stable signal.

**!** Burner head is dirty.

- Clean gas and air bore holes and air slots.
- Remove deposits.

**!** Excessive pressure fluctuations in the combustion chamber.

- Ask Honeywell Kromschröder for control concepts.

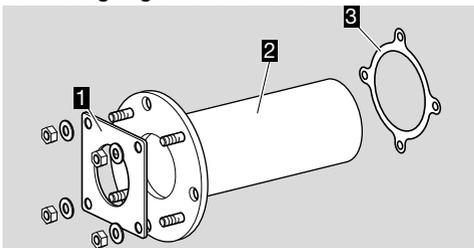
**? Furnace cools down in Flameless mode.**

**!** Gas lance for Flameless mode blocked.

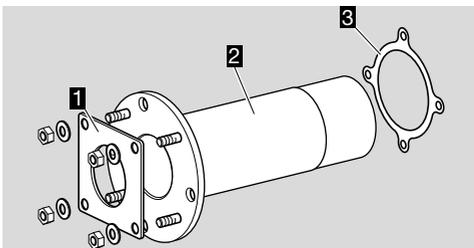
- Remove gas lance and check it; clean or replace it as necessary, see page 10 (8 Maintenance).

## 10 ACCESSORIES

### 10.1 Flue gas guide tube FGT set..D



ECOMAX LE..M



ECOMAX LE..C

**1** Burner gasket

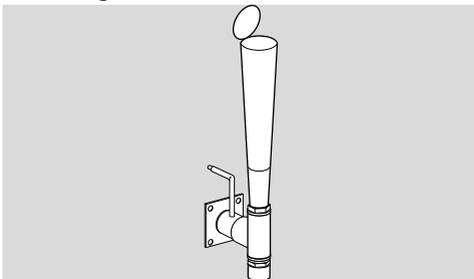
**2** Flue gas guide tube FGT

**3** Mounting gasket

For a direct heating system, a flue gas guide tube FGT is required.

The FGT set..D is not supplied with the ECOMAX LE must be ordered separately. If the FGT set..D is ordered with the ECOMAX LE, it will be supplied ready-fitted on the burner.

### 10.2 Flue gas eductor EJEK



The eductor generates a negative pressure with a centrally positioned nozzle and thus draws the flue gases through the burner's heat exchanger.

The EJEK is not supplied with the burner and must be ordered separately.

### 10.3 Adapter set UVS 10

Burner	Designation	Order number
ECOMAX LE 1-3	Adapter set UVS 10 ECO LE 1-3	75459651

## 11 TECHNICAL DATA

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

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

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

Burner	Capacity [kBTU/h]	Flame length [ft]*
ECOMAX LE 1	136	1
ECOMAX LE 2	227	1.3
ECOMAX 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.

## 12 LOGISTICS

### Transport

Protect the unit from external forces (blows, shocks, vibration).

Transport temperature: see page 15 (11 Technical data).

Transport is subject to the ambient conditions described.

Report any transport damage on the unit or packaging without delay.

Check that the delivery is complete.

### Storage

Storage temperature: see page 15 (11 Technical data).

Storage is subject to the ambient conditions described.

Storage time: 6 months in the original packaging before using for the first time. If stored for longer

than this, the overall service life will be reduced by the corresponding amount of extra storage time.

### Packaging

The packaging material is to be disposed of in accordance with local regulations.

### Disposal

Components are to be disposed of separately in accordance with local regulations.

## 13 DISPOSAL

Devices with electronic components:

### WEEE Directive 2012/19/EU – Waste Electrical and Electronic Equipment Directive



At the end of the product life (number of operating cycles reached), dispose of the packaging and product in a corresponding recycling centre. Do not dispose of the unit with the usual domestic refuse. Do not burn the product.

On request, old units may be returned carriage paid to the manufacturer in accordance with the relevant waste legislation requirements.

## 14 DECLARATION OF INCORPORATION

according to 2006/42/EC, Annex II, No. 1B

The product “Burner for gas ECOMAX® LE 3C” is a partly completed machine pursuant to Article 2g and is designed exclusively for installation in or assembly with another machine or other equipment.

The following essential health and safety requirements in accordance with Annex I of this Directive are applicable and have been fulfilled:

Annex I, Articles 1.1.3, 1.1.5, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.8, 1.5.2, 1.5.4, 1.5.10, 1.7.3, 1.7.4

The relevant technical documentation has been compiled in accordance with part B of Annex VII and will be sent to the relevant national authorities on request as a digital file.

The following (harmonized) standards have been applied:

- EN 746-2:2010 – Industrial thermoprocessing equipment; Safety requirements for combustion and fuel handling systems
- EN ISO 12100:2010 – Safety of machinery – General principles for design – Risk assessment and risk reduction (ISO 12100:2010)

The partly completed machine may only be commissioned once it has been established that the machine into which the product mentioned above is to be incorporated complies with the provisions of the Machinery Directive 2006/42/EC. Elster GmbH

**Einbauerklärung**

nach 2006/42/EG, Anhang II, Nr. 18

**/ Declaration of Incorporation**

/ according to 2006/42/EC, Annex II No. 18

Folgendes Produkt / The following product:

Bezeichnung / Brenner für Gas  
 Beschreibung / Brenner für Gas  
 Typenbezeichnung / Typ: **ECOMAX LE 1-3C, ECOMAX LE 1-3M**  
 Merkmalname / Branding: **krom/schroder**

ist eine vollständige Maschine nach Artikel 2g und ausschließlich zum Einbau in oder zum Zusammenbau mit einer anderen Maschine oder Ausrüstung vorgesehen.  
 is a fully completed machine pursuant to Article 2g and is designed exclusively for installation in or assembly with another machine or other equipment

Folgende grundlegende Sicherheits- und Gesundheitsanforderungen gemäß Anhang I dieser Richtlinie können zur Anwendung zum besten Ermessen:  
 The following essential health and safety requirements in accordance with Annex I of this Directive are applicable and have been in full

Anhang I, Artikel / Annex I Article  
 1.1, 1.1.1, 1.2, 1.3, 1.3.1, 1.3.1.1, 1.3.1.2, 1.3.1.3, 1.3.1.4, 1.5.10, 1.7.3, 1.7.4

Die wesentlichen technischen Unterlagen gemäß Anhang VI b sind nur den Herstellern und weiteren der zuständigen nationalen Behörden auf Verlangen in elektronischer Form übermittelt.  
 The relevant technical documentation has been compiled in accordance with part B of Annex VI and will be sent to the relevant national authorities on request in a digital file

Folgende (harmonisierte) Normen wurden angewandt: / The following (harmonized) standards have been applied  
 EN 1242:2010 – Industrielle Thermoprozessanlagen: Sicherheitsanforderungen an Feuerungs- und Brennvorbereitungssysteme  
 – Industrial thermoprocessing equipment: Safety requirements for combustion and fuel handling systems  
 EN ISO 12100:2010 – Sicherheit von Maschinen – Risikoprüfungsmethoden – Risikoanalyse und Risikoreduzierung (ISO 12100:2010)  
 – Safety of machinery – General principles for design – Risk assessment and risk reduction (ISO 12100:2010)

Folgende EU-Richtlinien werden erfüllt: / The following EU directives are fulfilled  
 RatRL 9 (2011/65/EU)  
 RatRL 8 (2015/853/EU)

Die unveränderte Maschine darf erst dann in Betrieb genommen werden, wenn festgelegt wurde, dass die Maschine, in der die oben beschriebene Produkt eingetauscht werden soll, die Bestimmungen der Richtlinie für Maschinen (2006/42/EC) entspricht.  
 The partly completed machine may only be commissioned once it has been established that the machine into which the product mentioned above is to be incorporated complies with the provisions of the Machinery Directive 2006/42/EC

Lotte (Stirn)

13.01.2023  
 Datum / Date

S. Rundo / S. Escher sind berechtigt, die wesentlichen technischen Unterlagen gemäß Anhang VI b zusammenzustellen.  
 S. Rundo / S. Escher are authorized to compile the relevant technical documentation according to Annex VI B.

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**15 CERTIFICATION**

**15.1 Eurasian Customs Union**



The products ECOMAX LE meet the technical specifications of the Eurasian Customs Union.

**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](http://ThermalSolutions.honeywell.com) or contact your Honeywell Sales Engineer.  
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Translation from the German  
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