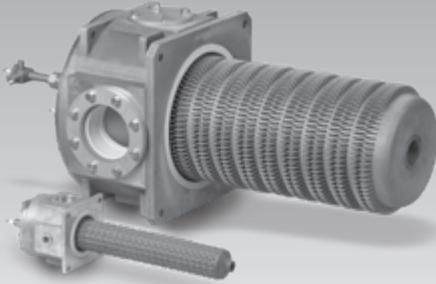


Operating instructions
Self-recuperative burner
ECOMAX®



Contents

Self-recuperative burner ECOMAX® 1

Contents 1

Safety..... 1

Checking the usage..... 2

Installation 3

 ECOMAX® for direct heating systems 3

 ECOMAX® for indirect heating systems 4

Connecting the gas and air pipes 5

Wiring 6

Preparing commissioning..... 7

Commissioning..... 9

 Igniting and adjusting the burner 9

 Coarse adjustment with the furnace cold 9

 Fine adjustment with a hot furnace 10

Maintenance 10

Assistance in the event of malfunction ... 15

Accessories 16

 Flue gas eductor EJEK 16

 Flue gas connector FLUP..... 17

 Air connection set 17

 Flue gas guide tube FGT for SER-C 17

 Segmented flame tube SICAFLEX® 17

 Purge air/cooling air nozzles 17

Technical data 18

Logistics 18

Declaration of Incorporation..... 19

Certification 19

Contact 20

Safety

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.

Explanation of symbols

■, 1, 2, 3... = Action
> = Instruction

Liability

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

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.

Conversion, spare parts

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

Checking the usage

Intended use

Self-recuperative burner ECOMAX® for gas with integrated recuperator for the direct and indirect heating of furnace systems in intermittent mode.

Direct heating

Flue gases are returned using an eductor.

Indirect heating

Combustion flue gases are separated from the product using metallic or ceramic radiant tubes and ceramic segmented flame tubes.

This function is only guaranteed when used within the specified limits – see page 18 (Technical data). Any other use is considered as non-compliant.

Type code

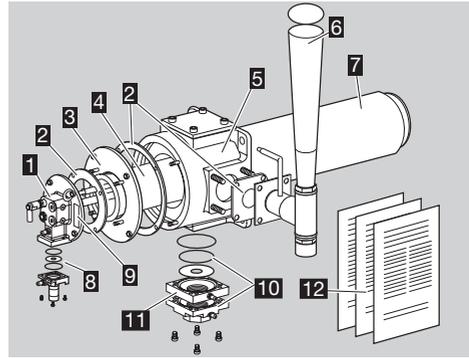
Code	Description
ECOMAX®	Self-recuperative burner for gas
0 to 6	Burner size
C	Ceramic burlud tube recuperator (SiSiC)
M	Cast steel ribbed tube recuperator
P	Cast steel ribbed tube recuperator for P radiant tube
F	Flat tube recuperator, metallic
395 to 695	Recuperator length in mm
-S	Standard flame
-M ¹⁾	menox low NO _x operation
B	natural gas
D	coke oven gas
G	LPG
L ¹⁾	LCV gas
/D-	For direct heating with eductor
/R-	For radiant tube heating without eductor
/V-	For radiant tube heating with VAH
/E-	Burner with customized orifices
/nnn-	Burner construction stage X for nnn kW
/N-	Burner without orifices
(1 to 99)	Burner head identifier
X, A, B ...	Construction stage
-	The following features differ from the standard version:
K	Additional cooling air connection for increased furnace cooling
A	Electrode made of Kanthal APM
T	NPT connections
S	SICAFLEX spacer
W	Air connection without intermediate flange
Z	Special version

1) On request.

2) Other gas types on request.

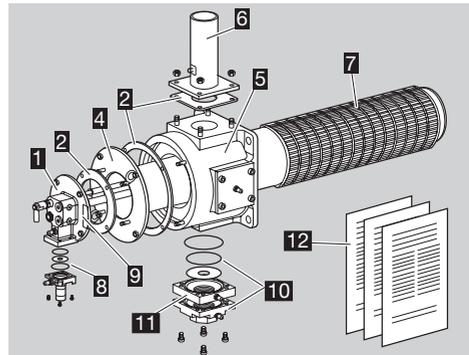
Part designations

ECOMAX® direct



- 1** Gas insert
- 2** Gaskets (set)
- 3** Intermediate flange
- 4** LFR unit (air guide tube)
- 5** Body with internal insulation
- 6** Eductor EJJEK (to be ordered separately)
- 7** Recuperator
- 8** Gas flange set
- 9** Type label
- 10** Air flange set
- 11** Intermediate flange
- 12** Enclosed documentation (flow rate curves, operating characteristic diagrams, spare parts list, spare parts drawing)

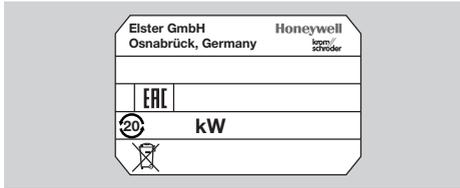
ECOMAX® indirect



- 1** Gas insert
- 2** Gaskets (set)
- 4** LFR unit (air guide tube)
- 5** Body with internal insulation
- 6** Flue gas connector FLUP (to be ordered separately)
- 7** Recuperator
- 8** Gas flange set
- 9** Type label
- 10** Air flange set
- 11** Intermediate flange
- 12** Enclosed documentation (flow rate curves, operating characteristic diagrams, spare parts list, spare parts drawing)

Type label

Maximum burner capacity, gas type – see type label.



Installation

! CAUTION

We recommend that lifting gear be used for installation due to the weight involved.

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

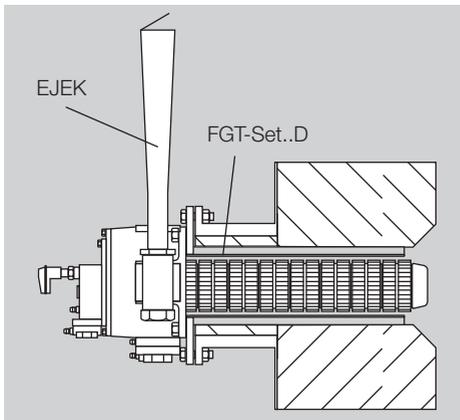
- ▷ Dropping the device can cause permanent damage. In this event, replace the entire device and associated modules before use.
- ▷ With the ECOMAX® 0 to 3C, to prevent transport damage, the ceramic air guide tube LFR is supplied separately or is fitted with extra transport protection. See enclosed documentation.

Installation on the furnace

- ▷ The burner has three air connections and one flue gas connection. During installation, the burner must be aligned appropriately (flue gas upwards or to the side).

ECOMAX® for direct heating systems

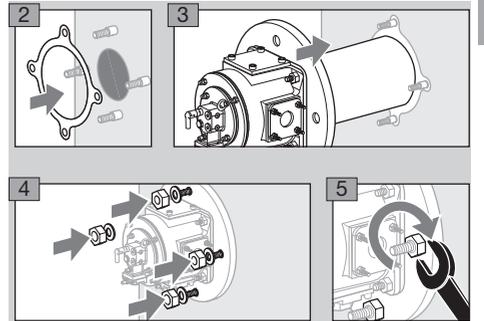
- ▷ For a direct heating system, the flue gas guide tube FGT set..D and the eductor EJEK are required, see page 16 (Accessories).



- 1 Remove the transport safety device.
- ▷ The installation opening in the furnace wall must be greater than the outside diameter of the FGT.
 - ▷ 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.

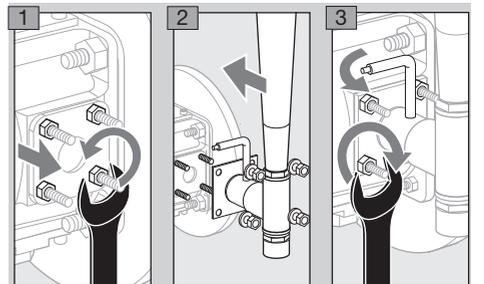
- ▷ Slide the FGT over the recuperator if it has not yet been installed.



- ▷ Tighten the nuts in two cycles in a crosswise fashion, torque: 46 Nm.
- ▷ When installing, always ensure that when the burner is mounted, it is sealed tightly on the furnace.

Installing the eductor

- ▷ 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:

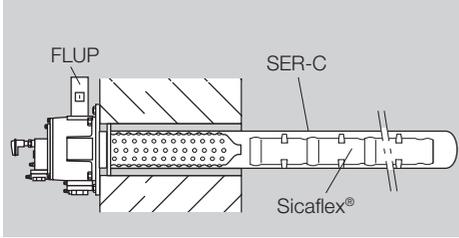
Type	Torque
ECOMAX® 1	26 Nm
ECOMAX® 2	26 Nm
ECOMAX® 3	30 Nm
ECOMAX® 4	35 Nm
ECOMAX® 5	35 Nm

- ▷ After installing the eductor, connect the ECOMAX® to the air and gas circuits.

ECOMAX® for indirect heating systems

- ▷ For an indirect heating system, the radiant tube SER, the segmented flame tubes SICAFLEX® and the flue gas connector FLUP are required, see page 16 (Accessories).

With ceramic radiant tube (SER-C)



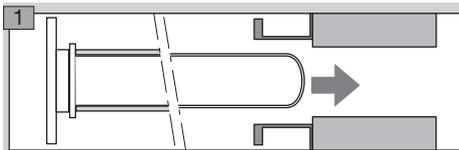
- ▷ The ceramic radiant tube (SER-C) must be correctly installed on the furnace before the burner is installed, see www.docuthek.com → Thermal Solutions → Products → 07 Industrial burners → 07b Self-recuperative and radiant tube burners → Radiant tube SER-C.
- ▷ Installation of the internal segmented flame tubes SICAFLEX®, see www.docuthek.com → Thermal Solutions → Products → 07 Industrial burners → 07b Self-recuperative and radiant tube burners → Segmented flame tube SICAFLEX.
- ▷ Depending on the installation situation and radiant tube diameter, a flue gas guide tube FGT may be required, see page 16 (Accessories).

Installation of SER-C

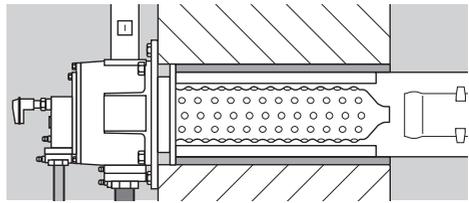
! CAUTION

Please observe the following to ensure that the ceramic radiant tube SER-C is not damaged during installation and operation:

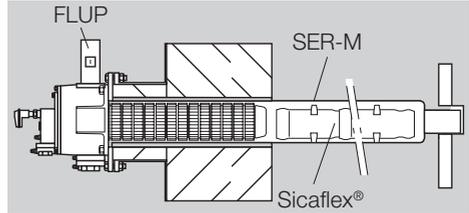
- ▷ Open packaging carefully and without using force.
- ▷ Insert into the furnace chamber without any impacts or scratches to avoid damage and breakage. Depending on the furnace atmosphere during operation, damage to the protective oxide layer on the surface of the radiant tube can cause corrosion and thus reduce the service life.
- ▷ We recommend that someone be inside the furnace chamber to receive the radiant tube. Note: for detailed information, refer to SER-C operating instructions.



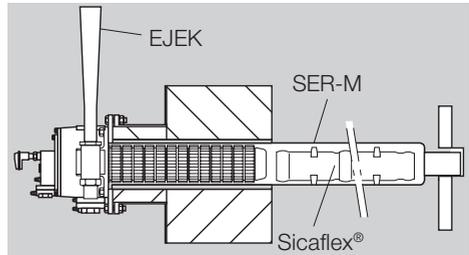
- ▷ Depending on the installation situation, a flue gas guide tube FGT-set...SER-C may be required.



With metallic radiant tube (SER-M)



With metallic radiant tube (SER-M) and eductor

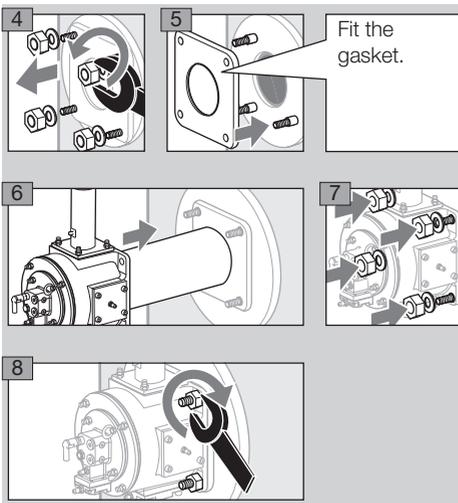


- ▷ The metallic radiant tube (SER-M) must be correctly installed on the furnace before the burner is installed. Ensure there is a good seal between the burner and SER-M.
- ▷ Installation of the internal segmented flame tubes SICAFLEX®, see www.docuthek.com → Thermal Solutions → Products → 07 Industrial burners → 07b Self-recuperative and radiant tube burners → Segmented flame tube SICAFLEX.
- ▷ Depending on the installation situation, a flue gas guide tube FGT set..D or an adapter flange may be required (available on request as accessories).

! CAUTION

Risk of breakage. Avoid impacts when inserting the burner into the ceramic radiant tube and placing on the stud bolts.

- 1 Remove the transport safety device.
- 2 Slide the FGT over the burner recuperator if it has not yet been installed.
- 3 Wrap a ceramic fibre blanket over the entire length of the FGT. Compress the fibre blanket to half its original thickness.



Fit the gasket.

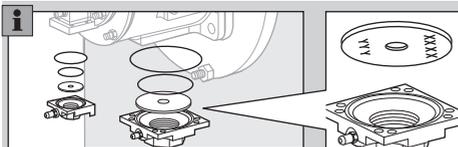
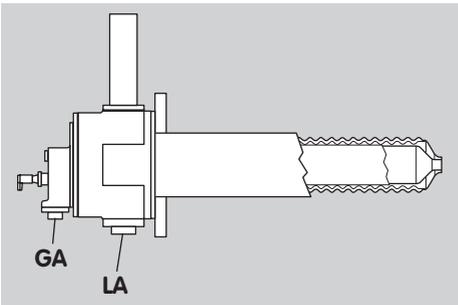
- ▷ Tighten the nuts in two cycles in a crosswise fashion, torque: 46 Nm.
- ▷ When installing, ensure that the components are sealed tightly.
- ▷ Ensure that no lateral forces act on the burner recuperator.

Heat guard

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

Connecting the gas and air pipes

Gas connection (GA) and air connection (LA)



Cooling air connection (KA)

- ▷ Optional intermediate flange with an additional cooling air connection on the burner.
- ▷ To increase the air volume in cooling mode.

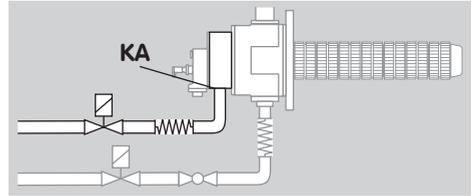


Table of threaded and flanged connections

- ▷ Threaded connection to ISO 7, flange dimensions to ISO 7005, PN 16.

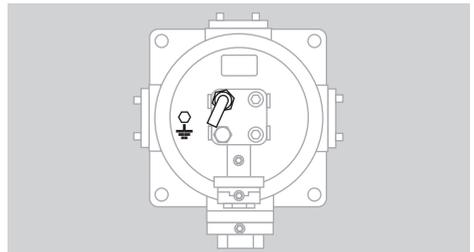
Type	GA*	LA	KA
ECOMAX® 0	R 1/2"	Rp 1"	Rp 1"
ECOMAX® 1	R 1/2"	Rp 1"	Rp 1 1/2"
ECOMAX® 2	R 1/2"	Rp 1 1/2"	Rp 1 1/2"
ECOMAX® 3	R 1/2"	Rp 2"	Rp 1 1/2"
ECOMAX® 4	R 3/4"	Rp 2"	Rp 2"
ECOMAX® 5	R 1"	Rp 2"	Rp 2"
ECOMAX® 6	R 1 1/2"	Rp 3"	N/A

- * On the ECOMAX®..L for LCV gas, connections may differ depending on the project specifications.
- ▷ 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 can be rotated in 90° steps if necessary.
- ▷ We recommend that all the gaskets that are removed to rotate the gas insert be replaced.
- ▷ The electrode must remain in its position at the top left when the gas insert is rotated. The mixing device (gas lance) must be rotated for this purpose, see page 11 (Replacing the gas lance).



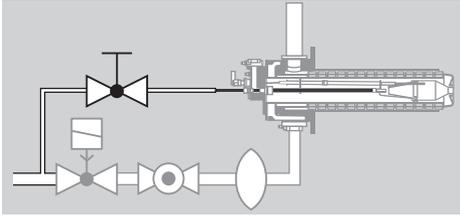
- ▷ If necessary, another air connection may be used. The burner has three air connections, two of which are sealed with blind flanges.
- ▷ Ensure undisturbed flow to the orifices in the air and gas connections. The ECOMAX® is delivered with a connection set for gas. In the air circuit, we also recommend the use of a connection set for air, see page 16 (Accessories).

Restrictors

- ▷ The appropriate restrictors are to be fitted in the supply lines for fuel gas, combustion air and motive air for the eductor to adjust the burner.

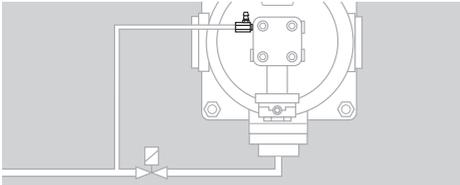
Central air connection for LPG operation

- ▷ The LPG version of the burner has an additional central air lance.
- ▷ The gas lance must be cooled to prevent the gas cracking and soot forming inside the burner.
- ▷ The connection is made with an Ermeto pipe.
- ▷ The purge air connection must be located in the air supply line to the burner upstream of the air control valve, for example at the inlet of the air solenoid valve.
- ▷ Open the adjuster in the central air lance fully; on ECOMAX® 1, the adjuster must be restricted to 45° or 50%.

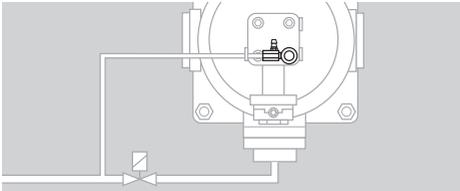


Purge air connections for electrode and UV sensor

- ▷ The electrode and the UV sensor should be cooled and purged with air.
- ▷ The air must be branched off upstream of the air control valve, for example at the inlet of the air solenoid valve.
- ▷ Connect the purge air to the gas flange next to the electrode.



- ▷ In the case of UV control, use the purge air connection of the UV sensor.



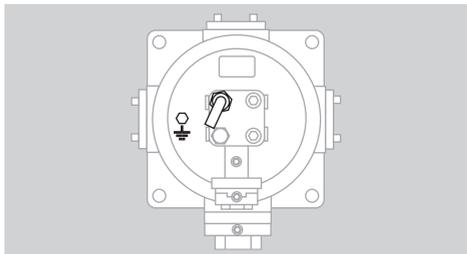
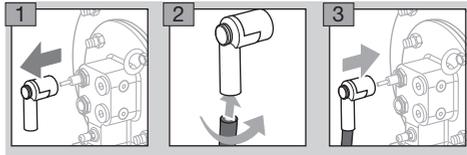
- ▷ The nozzles are adapted to the relevant burner, see page 16 (Accessories). The nozzles do not need any adjustment.

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®.
- ▷ Flame control with a UV sensor is necessary if a furnace temperature of 1050°C is exceeded for direct heating or 950°C for indirect heating. In this case, we recommend a UV sensor UVS 10 with a purge air connection be used.
- ▷ An adapter set (Order No. 21800791), which must be ordered separately, is available for installing the UVS 10. If the adapter set has been ordered with the burner, it is fitted to the burner on delivery and the UV sensor can be screwed on to it.
- ▷ 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 ≥ 7.5 kW, ≥ 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 mains cables and interference from electro-magnetic 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.

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.

Preparing commissioning

Safety instructions

- ▷ Agree settings and commissioning of the burner with the system operator or manufacturer.
- ▷ Check the entire system, upstream devices and electrical wiring/connections.
- ▷ Note the operating instructions for individual controls.

DANGER

The burner must only be commissioned by authorized trained personnel.

Risk of explosion! Please observe the appropriate precautions when igniting the burner.

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! A flue gas analysis is to be conducted.

CAUTION

- ▷ Pre-purge the furnace chamber or radiant tube with air (5 x volume) before every ignition attempt.
- ▷ If the burner does not ignite although the automatic burner control unit has been switched on and off several times: check the entire system.

DANGER

Risk of explosion! 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.

Determining the gas and combustion air flow rates

$$Q_{\text{gas}} = P_{\text{B}}/H_i$$

$$Q_{\text{air}} = Q_{\text{gas}} \cdot \lambda \cdot L_{\text{min}}$$

- ▷ **Q_{gas}**: Gas flow rate in m³/h (ft³/h)
- ▷ **P_B**: Burner capacity in kW (BTU/h)
- ▷ **H_i**: Gas heating value in kWh/m³ (BTU/ft³)
- ▷ **Q_{air}**: Air flow rate in m³(n)/h (SCFH)
- ▷ **λ**: Lambda, air index
- ▷ **L_{min}**: Minimum air requirement in m³(n)/m³(n) (SCF/SCF)
- ▷ Information on the gas quality supplied can be obtained from the competent gas supply company.

Common gas qualities

Gas type	Heating value		L _{min} m ³ (n)/m ³ (n) (SCF/SCF)
	H _i kWh/m ³ (n)	H _s (BTU/SCF)	
Natural gas H	11	1114	10.6
Natural gas L	8.9	901	8.6
Propane	25.9	2568	24.4
Town gas	4.09	425	3.67
Butane	34.4	3406	32.3

- ▷ Data in kWh/m³(n) refer to the lower heating value H_i and data in BTU/SCF refer to the higher heating value H_s (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.

Notes on the flow rate curve

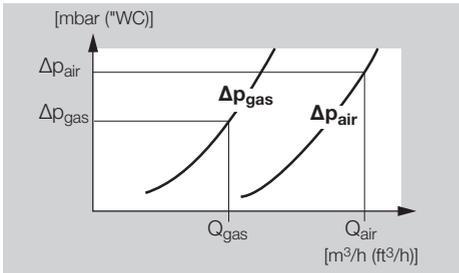
- ▷ If the gas density in the operating state differs from that reflected in the flow rate curve, convert the pressures according to the local operating state.

$$P_{\text{B}} = P_{\text{M}} \cdot \frac{\delta_{\text{B}}}{\delta_{\text{M}}}$$

- ▷ **δ_M**: Gas density reflected in the flow rate curve [kg/m³ (lb/ft³)]
- ▷ **δ_B**: Gas density in operating state [kg/m³ (lb/ft³)]
- ▷ **P_M**: Gas pressure reflected in the flow rate curve
- ▷ **P_B**: Gas pressure in operating state

Determining the gas and combustion air settings

- ▷ Orifices are installed in the gas and combustion air connections on the burner.
- ▷ 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.



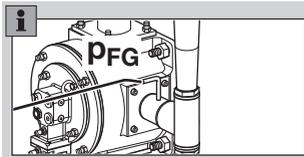
- ▷ Ensure an undisturbed flow to the orifice. The ECOMAX® is delivered with a connection set for gas. In the air circuit, we also recommend the use of a connection set for air, see page 16 (Accessories).
- ▷ If pipe elbows and angles, reducing fittings, couplings, etc. are used in the immediate vicinity of the burner connection, differences from the flow rate curves will occur which may result in incorrect burner settings.

⚠ WARNING

Incorrect burner settings may result in substoichiometric burner operation. CO formation in furnace chamber! CO is odourless and poisonous! A flue gas analysis is to be conducted.

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.docutek.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).

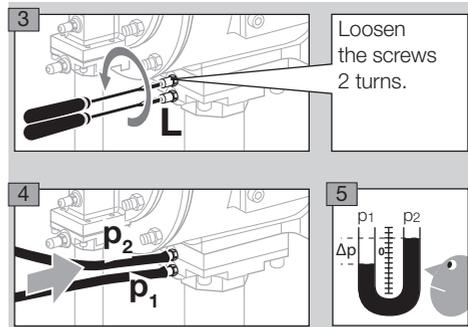
If the positive pressure exceeds approx. 0.3 mbar, increase the flue gas extraction rate to prevent the burner being damaged.

If there is a negative pressure in the furnace chamber, reduce the flue gas extraction rate to avoid infiltrated air.

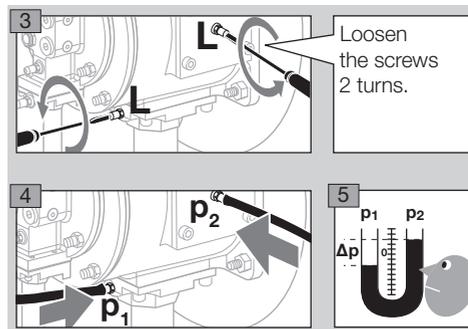
Coarse adjustment of the combustion air volume

- 1 Close the gas supply.
 - 2 Start pre-purge.
- ▷ To adjust the air volume, especially for direct heating, use the differential pressure measurement facility in the air circuit.
 - ▷ Air measuring nipple **L**, outside dia. = 9 mm (0.35").

Measuring the differential air pressure



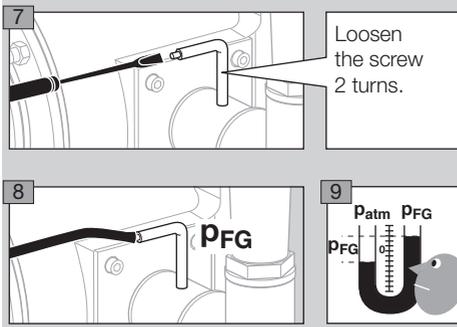
Measuring the differential air pressure with version W without an intermediate flange



- 6 Set the required air pressure differential on the air restrictor.

Coarse adjustment of motive air at the eductor

- ▷ The settings of the air volume and the motive air at the eductor affect each other. Coarse adjustment should be carried out at the same time during pre-purge.



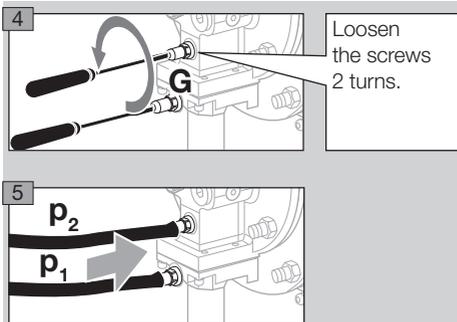
- ▷ Measure the negative flue gas pressure p_{FG} against atmospheric pressure p_{atm} .
- 10** Set the required negative flue gas pressure on the motive air restrictor. Use the values from the eductor diagram, see www.docuthek.com.

Pressure switch

- ▷ If the burner is equipped with an air flow detector set ECO/E, the switching point should be set to approx. 80% of the pressure differential for the combustion air.
- ▷ Set the DW set for monitoring the flue gas flow to the required pressure shown in the enclosed documentation.

Preparing the gas pressure measurement

- 1** Connect all measuring devices to the burner for later adjustment.
- ▷ Leave the gas supply closed.
- 2** Read off the differential pressure for the required gas flow rate from the enclosed flow rate curve.
- 3** p_1 : gas pressure upstream of the measuring orifice, p_2 : gas pressure downstream of the measuring orifice. Measuring range: select approx. 15 mbar.
- ▷ Gas measuring nipple **G**, outside dia. = 9 mm (0.35").



Commissioning

Igniting and adjusting the burner

⚠ WARNING

Ensure adequate ventilation of the furnace chamber before each burner start!
Risk of burning! Outflowing flue gases and burner components are hot.
Wear ear defenders 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.

- 1** All valves of the installation must be checked for tightness before ignition.

Coarse adjustment with the furnace cold

- ▷ Coarse adjustment of the air volumes, see page 7 (Preparing commissioning).
- 2** Limit the maximum gas volume.
- ▷ Open the restrictor around halfway.
- 3** Open the gas supply.
- 4** Ignite the burner.
- ▷ The safety time of the automatic burner control unit starts to elapse.
- 5** Check and adjust the gas and air pressures.
- 6** If no flame is formed, reset the automatic burner control unit, purge the combustion chamber and ignite the burner again.

! CAUTION

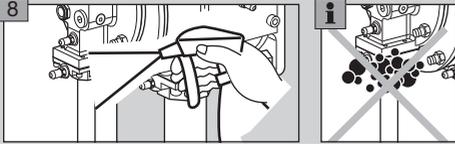
Pre-purge the furnace chamber or radiant tube with air (5 x volume) before every ignition attempt.

- ▷ The burner ignites and proceeds to normal operation.
- ▷ If no flame is formed after repeating steps **5** and **6** multiple times – see page 15 (Assistance in the event of malfunction).
- 7** Check the differential pressures Δp_{gas} and Δp_{air} and the negative flue gas pressure p_{FG} , and set them to their desired values.
- ▷ The gas, air and motive air settings affect each other. We recommend reading these pressures at the same time.
- ▷ Check the settings by conducting a flue gas analysis (in the flue gas connector in the case of an indirect heating system or in the furnace in the case of a direct heating system). Ensure that the furnace pressure is positive for a direct heating system to avoid falsification of the measurements by infiltrated air.

Leak test

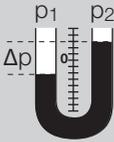
⚠ DANGER

To ensure that there is no danger resulting from a leak, check the gas connections on the burner for leaks immediately after the burner has been put into operation.



Fine adjustment with a hot furnace

- ▷ Final adjustment of the burner should be carried out at maximum furnace temperature and high capacity demand.
- 9** Heat the furnace.
- 10** Watch the furnace pressure and O_2 value in the furnace atmosphere. Avoid negative pressure and sub-stoichiometric operation of the burner. If necessary, adjust the settings of the combustion air and motive air.
- 11** Check the differential pressures Δp_{gas} and Δp_{air} and the negative flue gas pressure p_{FG} at max. furnace temperature, and adjust them using the appropriate restrictor.



- ▷ Check the settings by conducting a flue gas analysis (in the flue gas connector or eductor in the case of an indirect heating system or in the furnace in the case of a direct heating system). Ensure that the furnace pressure is positive for a direct heating system to avoid falsification of the measurements by infiltrated air.

⚠ DANGER

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

- 12** 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 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.

Blocking and recording the settings

- 13** Produce a measurement report.
- 14** Remove the measuring devices and close off the pressure taps – tighten the grub screws.
- 15** Block and seal the adjusting elements.
- 16** Induce a flame failure, e.g. by pulling the terminal boot off the flame rod. The flame detector must close the gas safety valve and signal a fault.
- 17** Switch the system on and off several times while monitoring the automatic burner control unit.
- 18** Produce an acceptance report.

⚠ DANGER

An incorrect change of the burner settings may change the gas/air ratio and lead to unsafe operating conditions: risk of explosion in case of CO being formed in the furnace chamber! CO is odourless and poisonous!

Maintenance

We recommend a function check every six months. If the media are highly contaminated, this interval should be reduced.

⚠ DANGER

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

Risk of explosion! Please observe the appropriate precautions when igniting the burner.

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! A flue gas analysis is to be conducted.

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 must be at least 5 μA and must not vary.
- ▷ Read off the ionization signal on the burner control unit.
- 3** Disconnect the system from the electrical power supply.
- 4** Shut off the gas and air supply – do not change the restrictor settings.
- 5** Disconnect the gas line from the gas insert.
- 6** Disconnect the grounding cable.

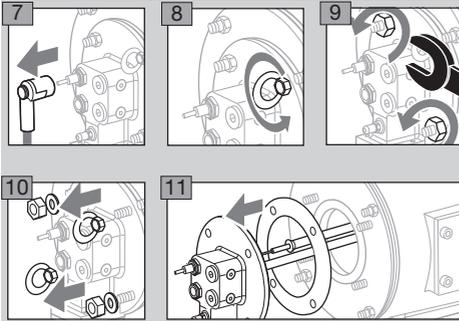
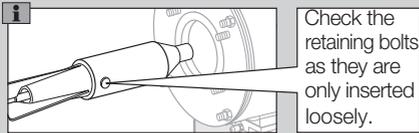
Checking the spark electrode and mixing device

- ▷ The complete gas insert must be removed to check the spark electrode and mixing device.

! CAUTION

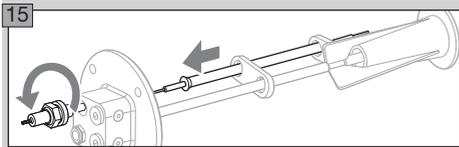
On the ECOMAX®..C, do not allow the mixing funnel to strike the ceramic air guide tube fitted in the burner. Risk of breakage.

- ▷ On ECOMAX®..M, ECOMAX®..F and ECOMAX®..P of sizes 1 – 3, ensure that the retaining bolts for the combustion chamber do not fall out.

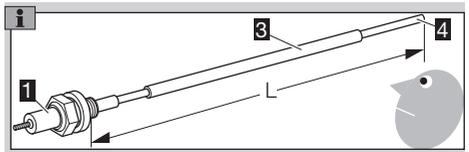


- 12 Place the gas insert in a safe place.
- 13 ECOMAX®..M, ECOMAX®..F, ECOMAX®..P: remove the retaining bolts for the combustion chamber and remove the combustion chamber.
- 14 Check the electrode, mixing device (gas lance) and insulator for dirt, wear and thermal damage and cracks; clean or replace if necessary.

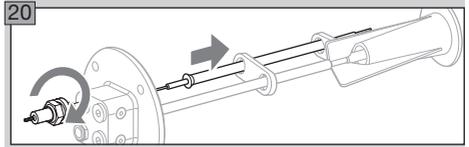
Checking and replacing the spark electrode/ flame rod



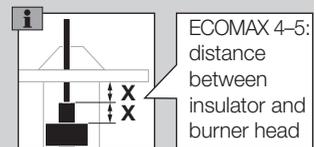
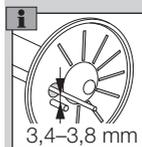
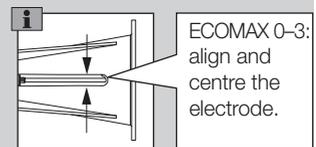
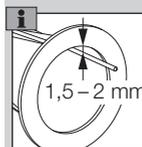
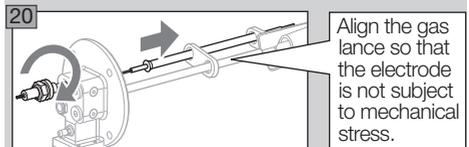
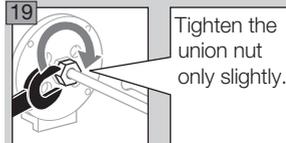
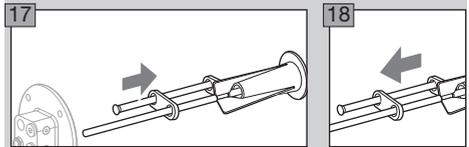
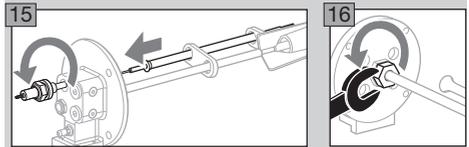
- ▷ Ensure that the electrode length does not change.
- 16 Remove dirt from electrode or insulator.
- 17 Replace the electrode if the tip 4 or insulator 3 is damaged.
- ▷ The electrode rod can also be replaced on its own.
- ▷ Before changing the electrode, measure the total length L.

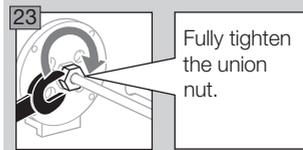
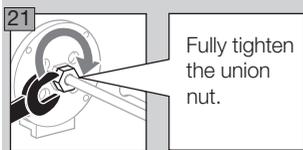


- 18 Connect the new electrode rod to the spark plug 1.
- 19 Adjust spark plug and electrode rod to the measured total length L.

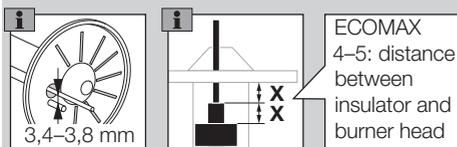
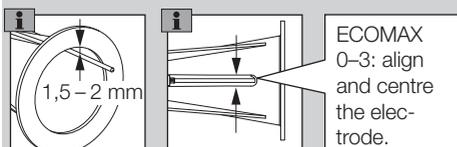
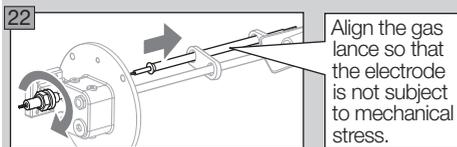
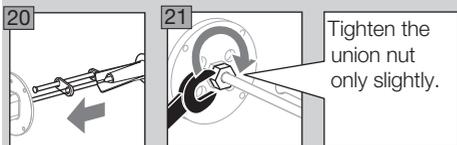
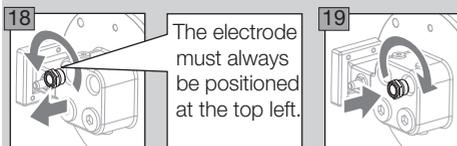
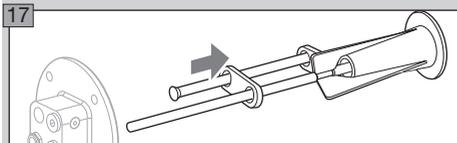
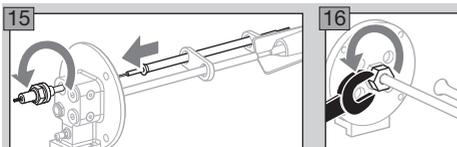


Replacing the gas lance

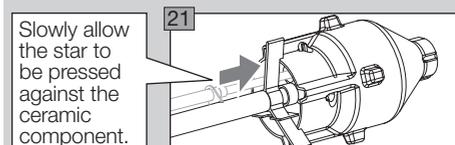
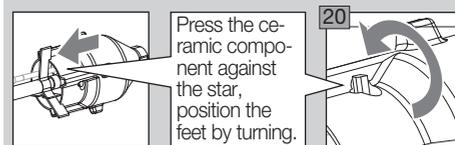
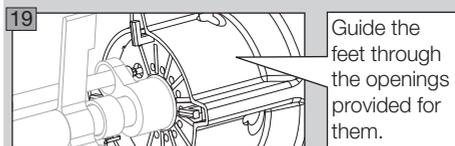
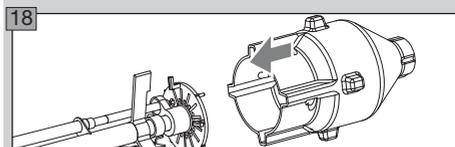
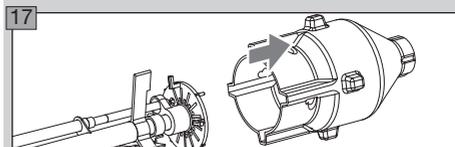
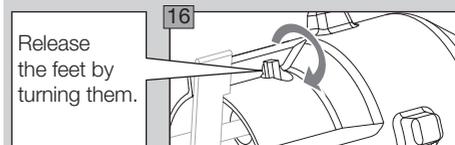
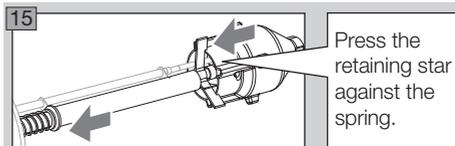




Rotating the gas insert

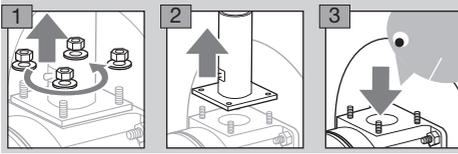


Replacing the combustion chamber on ECOMAX® 4 - 5

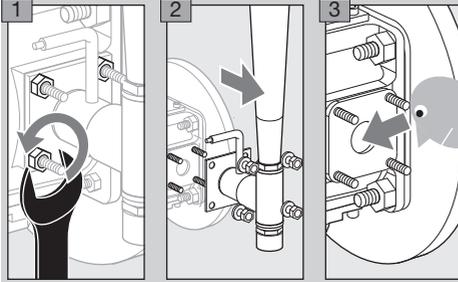


Checking the body insulation

Burner with flue gas connector FLUP



Burner with eductor



4 Follow the reverse procedure when reassembling.

- ▷ If possible, carefully check the body insulation from the front for signs of damage.



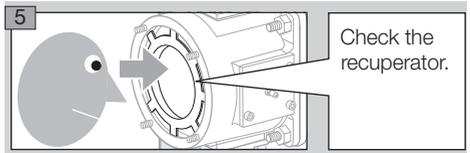
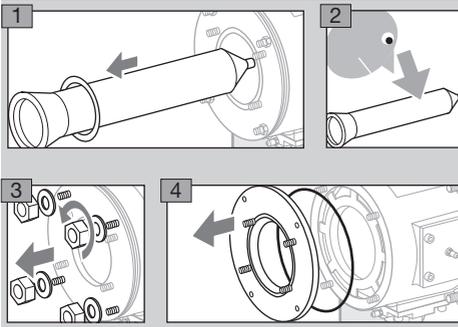
5 If the insulation is worn or damaged, it must be replaced.

Checking/replacing the air guide tube LFR and recuperator

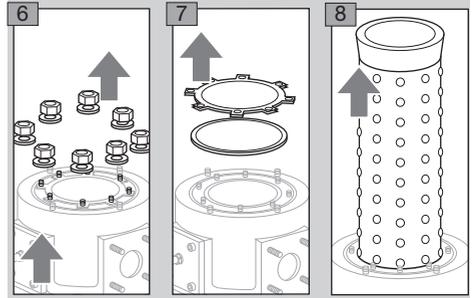
ECOMAX®..C

! CAUTION

Risk of breakage. The air guide tube and recuperator in the ECOMAX®..C are made of ceramic material.

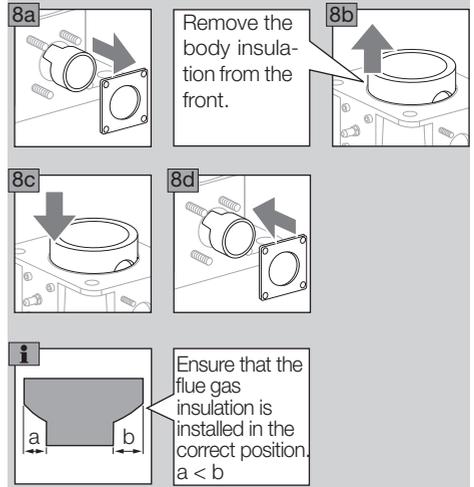


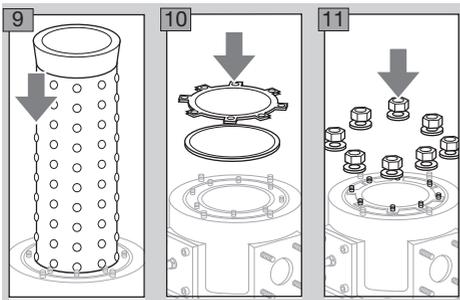
- ▷ If any ceramic components are damaged, they must be replaced.
- ▷ To check the body insulation carefully and replace the recuperator, remove the burner and suspend it vertically, e.g. on two beams.



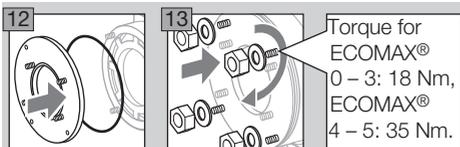
Checking the insulation

- ▷ If the insulation is worn or damaged, it must be replaced.

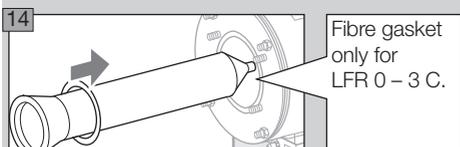




▷ Tighten the nuts in a crosswise fashion, torque: 3.5 Nm.

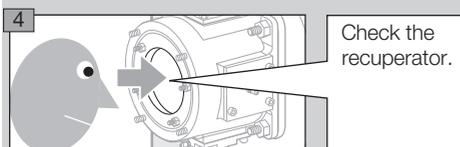
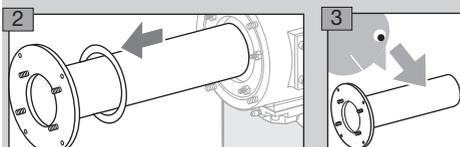
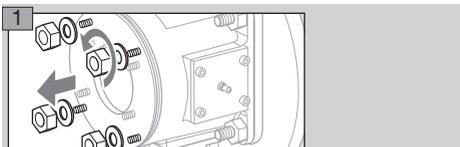


Torque for
ECOMAX®
0 – 3: 18 Nm,
ECOMAX®
4 – 5: 35 Nm.



Fibre gasket
only for
LFR 0 – 3 C.

ECOMAX®..M, ECOMAX®..P, ECOMAX®..F



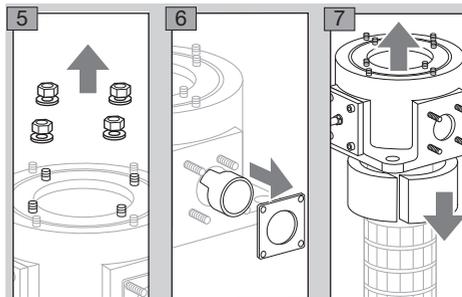
Check the
recuperator.

⚠ WARNING

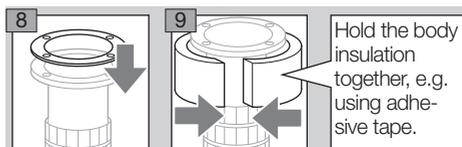
The body insulation is made of ceramic fibres (RCF). Wear protective equipment. Safety data sheet available on request.

▷ To replace the recuperator, remove the burner, place it vertically and secure it to prevent it falling over. The gas insert must be removed to avoid breaking the ceramic combustion chamber when placing the burner.

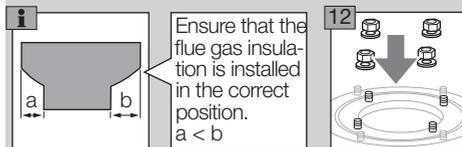
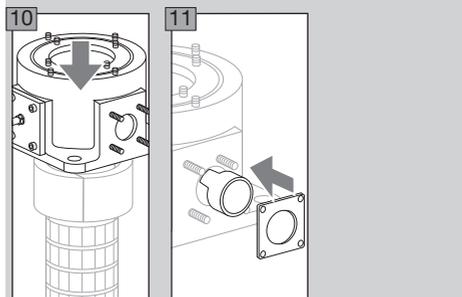
▷ We recommend that the body insulation be replaced when fitting a new recuperator.



▷ Place the new recuperator vertical and secure it to prevent it falling over.

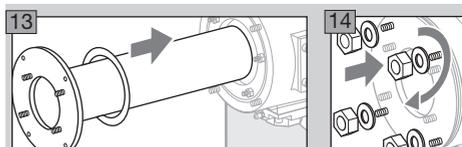


Hold the body
insulation
together, e.g.
using adhe-
sive tape.



Ensure that the
flue gas insula-
tion is installed
in the correct
position.
 $a < b$

▷ Tighten the nuts in two cycles in a crosswise fashion, torque: 3.5 Nm.



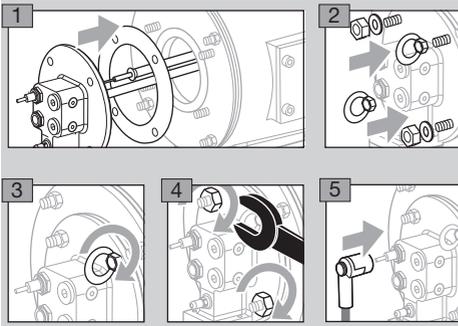
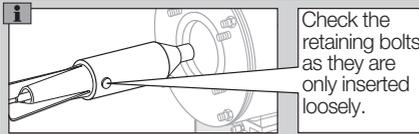
▷ Tighten the nuts in two cycles in a crosswise fashion. Torque for ECOMAX® 1 – 3: 18 Nm, ECOMAX® 4 – 5: 35 Nm.

Installing the gas insert

! CAUTION

ECOMAX®..C: do not strike the mixing funnel against the ceramic air guide tube. Risk of breakage.
ECOMAX®..M: the gas insert must be slid into the air guide tube with no resistance. External forces may damage the ceramic combustion chamber.

- ▷ ECOMAX®..M, ECOMAX®..F and ECOMAX®..P, sizes 1 – 3: install the combustion chamber using ceramic retaining bolts. During installation, ensure that the retaining bolts do not fall out.



- ▷ Tighten the nuts in two cycles in a crosswise fashion. Torque for ECOMAX® 0 – 3: 18 Nm, ECOMAX® 4 – 5: 35 Nm.
- 6** Connect the grounding cable.
- 7** Connect the gas line to the gas insert.
- 8** Connect voltage to the system.
- 9** Open the gas and air supply.
- 10** Check for tightness, see page 10 (Leak test).
- 11** Start the burner, see page 9 (Commissioning).

! DANGER

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

- 12** Produce a maintenance report.

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.

Risk of injury! Burner heads have sharp edges. Fault-clearance must only be undertaken by authorized trained personnel.

- ▷ If no fault is detected when checking the burner, proceed to the automatic burner control unit and check for faults in accordance with the relevant operating instructions.

? Faults

! 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 μ 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 (Maintenance).

- ! Defective insulator on the electrode, ignition spark jumps over incorrectly.
- Check the electrode – depending on the burner construction stage.

? Burner flame ignites with a loud bang?

- ! Incorrect electrode adjustment.
- Check the electrode – depending on the burner construction stage – see page 10 (Maintenance).

- ! Incorrect burner adjustment – air volume too low or too high.
- Correct the burner adjustment – see page 7 (Preparing commissioning).

- ! Incorrect burner adjustment – gas volume released too quickly, defective or incorrectly set damping unit on the solenoid valve.

- Check the solenoid valve.
- Reduce the start gas rate.
- Adjust the damping speed, see Operating instructions VAS, VCS, VAS..L.
- ECOMAX® 0C: if the burner still ignites with a loud bang after the damping speed has been adjusted, set pre-ventilation to 0.5 s using the BCU (parameter 37).

- ! Excessive central air volume for LPG operation.
- Carefully restrict the central air at the adjusting cock. Excessive restriction may cause soot formation.

? Burner performs a fault lock-out after burning faultlessly in normal operation?

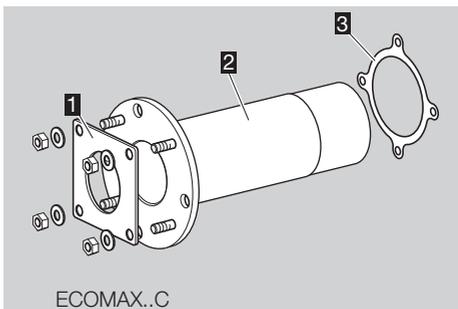
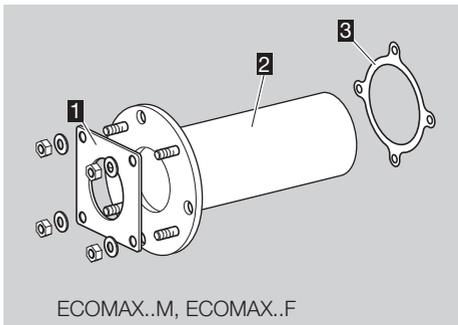
- ! Incorrect gas and air flow rate settings.
- Check the gas and air pressures.
- ! Automatic burner control unit signals a fault.
- Check the ionization cable.
- Check the ionization current. The ionization current must be at least 5 µA – stable signal.

- ! Mixing device or swirl plate soiled.
- Clean gas and air bore holes and air slots.
- Remove deposits from mixing funnel or swirl plate.

- ! Excessive pressure fluctuations in the furnace chamber.
- Ask Honeywell Kromschroder for control concepts.

Accessories

Flue gas guide tube FGT set..D

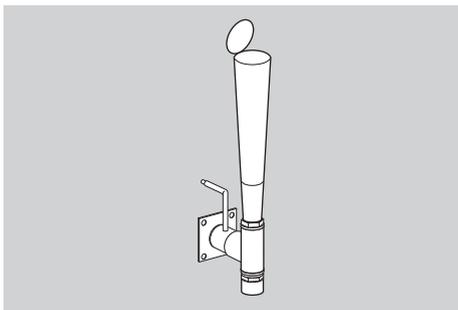


- 1 Burner gasket
- 2 Flue gas guide tube FGT
- 3 Mounting gasket

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

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

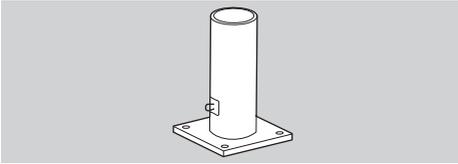
Flue gas eductor EJEK



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 included in the delivery and must be ordered separately.

Flue gas connector FLUP



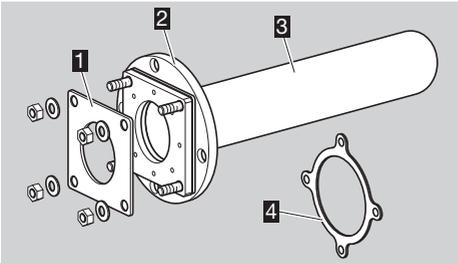
The FLUP is not supplied with the ECOMAX® and must be ordered separately.

If the FLUP is ordered with the ECOMAX®, it will be supplied ready-fitted on the burner.

Air connection set

Specially machined barrel nipple which ensures a reliable, correct measurement at the orifices installed in the burner. The /E version is installed when the burner is supplied.

Ceramic radiant tube SER-C



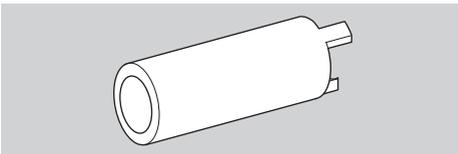
- 1 Burner gasket
- 2 Flange connection
- 3 Radiant tube (SiSiC)
- 4 Mounting gasket

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.

The SER-C is not supplied with the ECOMAX® and must be ordered separately.

Flue gas guide tube FGT for SER-C

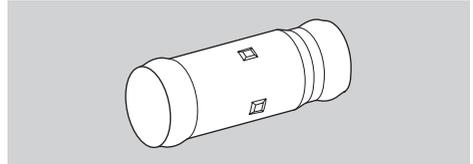


To guide the flue gases if smaller burners are used than are standard for the radiant tube diameter.

Material: vacuum moulded pulp.

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

Segmented flame tube SICAFLEX®

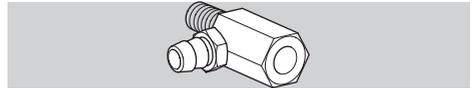


Segmented ceramic flame tubes to guide hot flue gases in radiant tubes.

Material: SiSiC.

The SICAFLEX® is not supplied with the ECOMAX® and must be ordered separately.

Purge air/cooling air nozzles



Nozzles to limit the volume of purge air in order to achieve safe ignition and monitoring of the ECOMAX® and to avoid condensation and overheating.

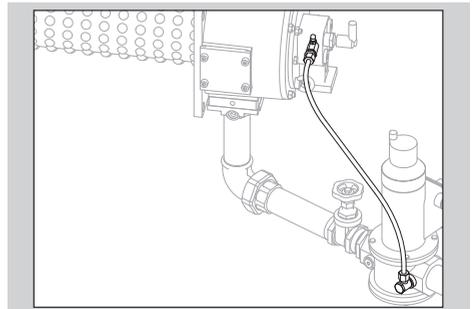
Nozzle for electrode purge

Burner	Designation of nozzle	Order number
ECOMAX® 0	nozzle electrode ECO 0 G 1/4 D=2.5 /E	21802944
ECOMAX® 1-3	nozzle electrode ECO 1-3 G 1/4 D=2.5 /E	21802945
ECOMAX® 4-6	nozzle electrode ECO 4-6 G 1/4 D=4.0 /E	21802946

UV sensor purge air nozzle

Burner	Designation of nozzle	Order number
ECOMAX® 0-3	nozzle UV ECO 0-3 G 1/4 D=2.5 /B	21802989
ECOMAX® 4-6	nozzle UV ECO 4-6 G 1/4 D=4.0 /B	21802990

Purge air connection set



To connect the purge air for the spark electrode or UV sensor.

Designation	Order number
PURGE AIR-SET 1/4-8/6 ECO PTFE-1M	21803332
PURGE AIR-SET 1/4-8/6 ECO PTFE-2M	21803645

Technical data

Heating: direct with eductor or indirect in radiant tube.

Control type: On/Off.

Adjusting range: 60% to 100%.

Flame velocity: approx. 130 to 170 m/s.

Flame control: direct ionization control (UV control as an option).

Ignition: direct spark ignition.

Burner	Recuperator	Max. flue gas temperature at recuperator inlet
ECOMAX®..C	Ceramic (SiSiC)	1250°C*
ECOMAX®..M/ ECOMAX®..P	Cast steel	1150°C
ECOMAX®..F	Metallic	1050°C

* We advise against using this in forging and heating furnaces in which raw material is heated.

Burner	Capacity [kW]	Flame length [mm]*
ECOMAX® 0	25	300
ECOMAX® 1	36	300
ECOMAX® 2	60	400
ECOMAX® 3	100	450
ECOMAX® 4	180	800
ECOMAX® 5	250	800
ECOMAX® 6	500	1000

* 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 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.

WARNING

Information pursuant to REACH Regulation No. 1907/2006, Article 33.

Insulation contains refractory ceramic fibres (RCF)/aluminium silicate wool (ASW).

RCF/ASW are listed in the Candidate List of the European REACH Regulation No. 1907/2006.

- ▷ Information on the safe handling of products containing ceramic fibres can be found in the safety data sheets.
- ▷ Safety data sheets are available on request.

Logistics

Transport

Protect the unit from external forces (blows, shocks, vibration). On receipt of the product, check that the delivery is complete, see page 2 (Part designations). Transport the product in dry, clean conditions. Report any transport damage immediately.

Storage

Store the product in a dry and clean place.

Storage temperature: see page 18 (Technical data).

Storage time: 2 years 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.

Declaration of Incorporation

according to 2006/42/EC, Annex II, No. 1B
The product "Self-recuperative burner for gas ECOMAX®" 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, 1.3.4, 1.5.2, 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

Certification

Eurasian Customs Union



The product ECOMAX® meets the technical specifications of the Eurasian Customs Union.

Conformity certified under Technical Regulations TR CU 010/2011

CE



Einbauerklärung

nach 2006/42/EG, Anhang II, Nr. 1B

/ Declaration of Incorporation

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

Folgendes Produkt: /The following product:

Bezeichnung: /Description
Typenbezeichnung: /Type

Rekuperatorbrenner für Gas
Self-recuperative burner for gas
ECOMAX...

Markenname: /Branding:

Honeywell

ist eine unvollständige Maschine nach Artikel 2g und ausschließlich zum Einbau in oder zum Zusammenbau mit einer anderen Maschine oder Ausrüstung vorgesehen.
is a partly 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 Gesundheitsschutzanforderungen gemäß Anhang I dieser Richtlinie kommen zur Anwendung und wurden erfüllt:
The following essential health and safety requirements in accordance with Annex I of this Directive are applicable and have been fulfilled:

Anhang I Artikel: /Annex I, Article
1.1.3, 1.1.5, 1.3.2, 1.3.4, 1.5.2, 1.5.10, 1.7.4

Die speziellen technischen Unterlagen gemäß Anhang VII B werden erstellt und werden der zuständigen nationalen Behörde auf Verlangen in elektronischer Form übermittelt.
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.

Folgende (harmonisierte) Normen wurden angewandt: /The following (harmonized) standards have been applied:
EN 746-2:2010 – Industrielle Thermoprocessinganlagen: Sicherheitsanforderungen an Feueranlagen und Brennstoffversorgungssysteme
Industrial thermoprocessing equipment: Safety requirements for combustion and fuel handling systems
EN ISO 12100:2010 – Sicherheit von Maschinen – Allgemeine Gestaltungsgrundsätze – Risikobeurteilung
and Riskreduzierung (ISO 12100:2010)
– Safety of machinery – General principles for design – Risk assessment
and risk reduction (ISO 12100:2010)

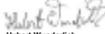
Folgende EU-Richtlinien werden erfüllt: /The following EU directives are fulfilled:
Richtl II (2011/65/EU)
Richtl III (2011/65/EU)

Die unvollständige Maschine darf erst dann in Betrieb genommen werden, wenn festgestellt wurde, dass die Maschine, in der das oben bezeichnete Produkt eingebaut werden soll, den Bestimmungen der Richtlinie für Maschinen (2006/42/EG) 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.

Wsperrtal

03.07.2019
Datum: /Date


Hubert Wunderlich
Konstrukteur / Designer

Hubert Wunderlich ist bevollmächtigt, die speziellen technischen Unterlagen gemäß Anhang VII B zusammenzustellen.
Hubert Wunderlich is authorized to compile the relevant technical documentation according to Annex VII B.

Elster GmbH
Postfach 20 00
D-62018 Chriesbach
Stuttgarter 1
D-62004 Lohr (Bayer)
Tel. +49 (0)41 12 14-0
Fax +49 (0)41 12 14-370
mailto:form@elster.com
www.elster.com

Contact

If you have any technical questions, please contact your local branch office/agent. The addresses are available on the Internet or from Elster GmbH.

We reserve the right to make technical modifications in the interests of progress.

Honeywell

**krom//
schroder**

Elster GmbH
Strotheweg 1, D-49504 Lotte (Büren)
Tel. +49 541 1214-0

Fax +49 541 1214-370

hts.lotte@honeywell.com, www.kromschroeder.com