

Installation- and maintenance instruction **BG400 M**

Before installing and using the burner, please read the instruction carefully.



Table of contents

1. General Information	4
2. Technical data	7
2.1 Burners are intended for use at:	7
2.2 Dimensions	7
2.3 Description BG400	10
3. General instructions	11
3.1 General instructions	11
3.2 Installation and maintenance instructions	11
3.3 Instructions	11
3.4 Inspection and maintenance	11
3.5 Start up	11
3.6 Commissioning of installation	11
4. Installation	12
4.1 Delivery check	12
4.2 Preparations for installation	12
4.3 Gas supply	12
4.4 Electric connection	12
4.5 Skeleton diagrams	13
4.6 Mounting on the oven	14
4.7 Installation example	14
4.8 Inspection of gas nozzle before commissioning	15
4.9 Gas nozzle	16
4.10 Solenoid valve..	17
5. Setting the burner	19
5.1 Setting the air pressure switch	22
5.2 Setting the min. gas pressure switch	23
5.3 Recommended excess air when using default setting	24
5.4 Determining the gas quantity for the system	24
5.5 Calculating the quantity of gas supplied	26
5.6 Flame monitoring and ionization current check	27
5.7 UV-Detector	28
6. Handing over of the installation	29
7. Fault location, functional troubles	29
8. Electric equipment	30
8.1 Safety system	30
8.2 Wiring diagram LOG	31
8.3 List of components	32
9. Troubleshooting	33
10. General instructions for gas burners	37

1. General Information

This Installation and Maintenance manual:

- is to be regarded as part of the burner and must always be kept near the installation site
- is intended for use by authorized personnel
- must be read prior to installation
- must be observed by all who work with the burner and associated system components
- work with the burner may only be carried out by certified installers/ personnel

we are not liable for any typographical errors and reserves the right to make design changes without prior notice.

Safety instructions

- The burner may only be used for its intended purpose in accordance with the product's technical data.
- The burner may only be installed and operated by authorized personnel.
- The product is packaged to prevent damage from occurring during handling. Handle the product with care. Lifting equipment must be used to lift larger packages.
- The products must be transported/stored on a level surface in a dry environment, max. 80% relative humidity, no condensation. Temperature -20 to +60 °C.
- Check that the burner is compatible with the oven's output range.
- All components must be installed without being bent, twisted or subjected to mechanical or thermal forces which can affect the components.
- The burner must be installed so that it complies with local regulations for fire safety, electrical safety, and fuel distribution.
- The gas outlet from the pressure regulator shall be configured in accordance with applicable regulations and lead to a safe area.
- Make sure when installing the equipment that there is enough space to service the burner.
- Permitted temperature during operation -10 to +60 °C. Max 80% relative humidity, no condensation.
- The installer must ensure that the room has adequate air supply.
- The room must comply with local regulations pertaining to its intended use.
- The installation site must be free of chemicals.
- Burner pipes, fan wheels and air dampers may contain sharp edges.
- The surface temperature of the burner's components can exceed 60°C.
- Caution: The burner has moving parts, and there is risk of crushing injuries.



- The electrical installation must be professionally carried out in accordance with applicable high voltage regulations, as per instruction's recommendations.
- Before servicing, shut off the fuel supply and turn off the power to the burner.
- Seal inspections must be performed during installation and servicing to prevent gas leakage.
- Care should be taken by the installer to ensure that no electrical cables or fuel lines are crushed or otherwise damaged during installation or servicing.
- If the oven is equipped with an access hatch, this must be equipped with a hatch opening switch connected to the burner's safety system.
- When in operation, the burner's noise level can exceed 85 dBA. Use hearing protection.
- The burner must not be put into operation without proper safety and protection devices.
- A Class BE fire extinguisher is recommended.
- It is forbidden to alter the design or use accessories which have not been approved.
- Prior to operation, the following points must be checked:
 - fitting and installation work has been completed and approved
 - electrical installation has been correctly performed
 - flue gas ducts and combustion air ducts are not blocked
 - all actuators and control and safety devices are in working order and correctly set



Actions to take if you smell gas

Turn off the equipment and the oven. Open windows and doors. Prevent open flames or sparking, e.g. do not turn lights on or off, do not use any electrical appliances, do not use mobile phones. Open windows and doors. Close the gas ball valve. Warn residents; do not use doorbells. Evacuate the building. Notify the installer or gas supplier once the building has been evacuated.

Burner servicing schedule

Servicing must be carried out once a year or after 3000 hours of operation

Burner	1 year	3000 hrs
Inspection of electrical installation	1 year	3000 hrs
Leakage check	1 year	3000 hrs
Filter	1 year replacement at $\Delta p > 10$ mbar	3000 hrs replacement at $\Delta p > 10$ mbar
Electrodes	Replacement/Cleaning 1 year	Replacement/Cleaning 3000 hrs
Brake disc	Replacement/Cleaning 1 year	Replacement/Cleaning 3000 hrs
Motor	1 year	3000 hrs
Fan wheel	1 Year Replacement when cleaning needed/ imbalance	3000 h Replacement when cleaning needed/ imbalance

Component replacement intervals

Control system	10 years	250,000 starts
Valve control system	10 years	250,000 starts
Pressure switch	10 years	250,000 starts
Ignition system with flame guard	10 years	250,000 starts
UV flame sensor	10000 hrs	N/A
Gas pressure regulators	15 years	N/A
Gas valve without seal testing	10 years	250,000 starts
Gas valve with seal testing	Replacement upon fault detection	N/A
Gas pressure switch	10 years	250,000 starts
Safety blow-off system	10 years	N/A
Damper motor	N/A	500,000 starts
Contactors	10 years	500,000 starts



The burner and its components must be recycled according to applicable regulations.

Delivery check

- Make sure everything is delivered and the goods have not been damaged during transit.
- If something is wrong with a delivery, report it to the supplier.
- Transport damage must be reported to the shipping company.

2. Technical data

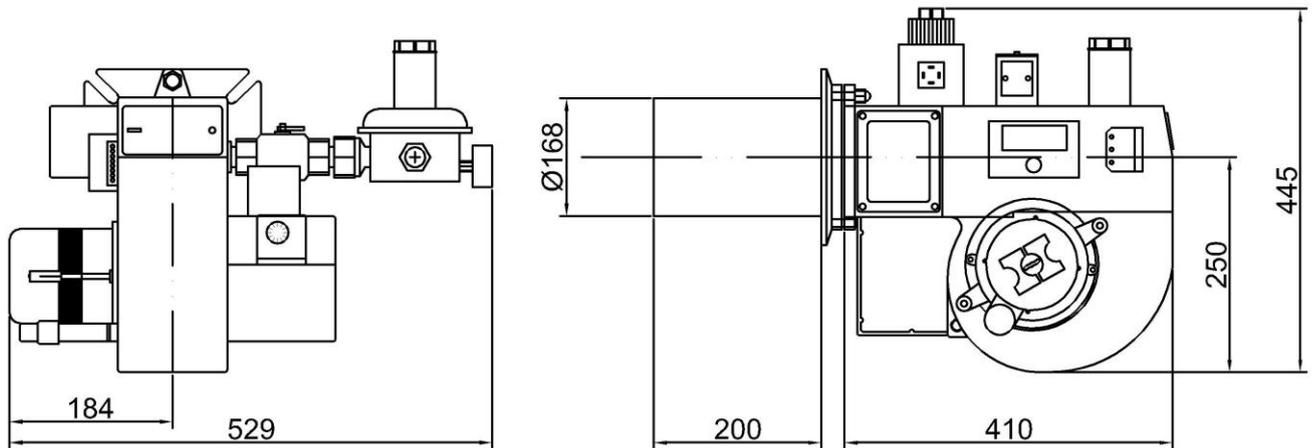
2.1 Burners are intended for use at:

- Continuously operating air-heated ovens. Cannot be used in boilers.

If you need burners suitable for boilers, please contact the supplier.

2.2 Dimensions

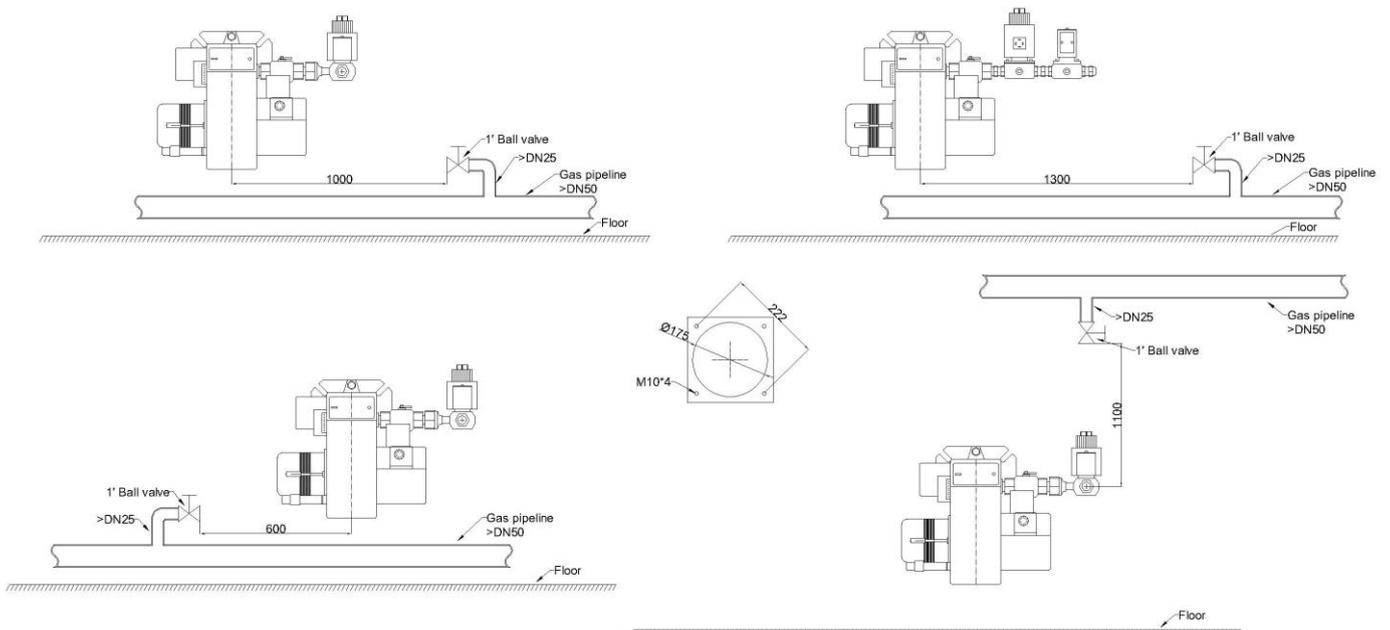
Gas connection 3/4-1 1/4"



2.2.1 Heat generator connection dimensions

*The above dimensions are max. measurements. Depending on the components used, the measurements may vary.

** Min. recommended distance to floor.



2.2.2 Capacity range

Capacity kW	Gas quantity at min. power Nm ³ /h ¹)	Gas quantity at max. power Nm ³ /h ¹)	Max. connection pressure mbar	Min connection pressure mbar
BG 400				
G20 30-325	6.1	34.2	800	200
G25 25-310	7.6	37.8	800	
G30 30-340	1.9	10.4	800	
G31 61-350	2.5	14.2	800	
Lower heat value Hu at normal state 15°C and 1013.25 mbar EN676				
Grade of gas	kWh/Nm ³	MJ/Nm ³	kcal/Nm ³	
Natural gas G20	9.5	34.02	8126	
Natural gas G25	8.2	29.25	6986	
Butane G30	32.5	116.09	27728	
Propane G31	24.6	88.00	21019	

Gas quantity and capacity vary according to grade of gas and connection pressure.

2.2.3 Gas categories, approved gases

Only dry gas is permitted for use

Geräte Kategorien Appliance categories	Versorgungsdrücke Supply pressures	Bestimmungsländer Countries of destination
II _{2R/3R}	200-800mBar	BG, CZ, DE, EE, ES, FR, GR, HU, IS, IT, LU, LV, NO, PT, SI, All countries
II _{2H3B/P}	200-800mBar	AT, CH, CY, DK, FI, LT, RO, SE, SK
II _{2H3P}	200-800mBar	GB, IE,
II _{2L3B/P}	200-800mBar	NL, RO
II _{2E3B/P}	200-800mBar	PL
I _{2E(R)B}	200-800mBar	BE
I _{3P}	200-800mBar	BE

2.2.5 Working field

BG 400

G20	30-325 kW
G25	30-310 kW
G30	30-340 kW
G31	30-350 kW

 Do not exceed working field

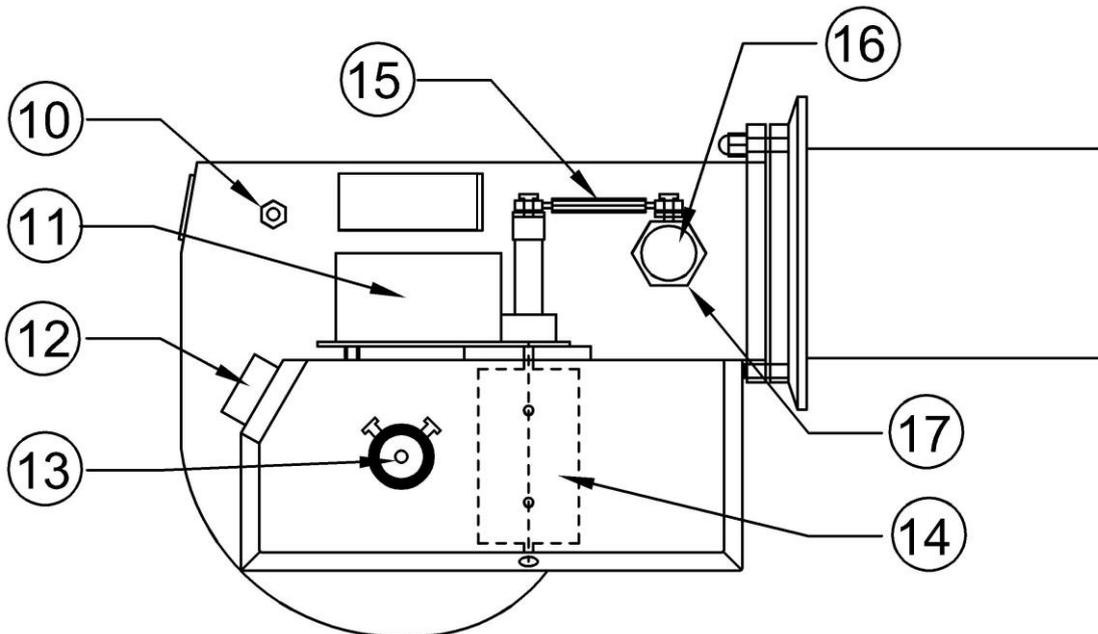
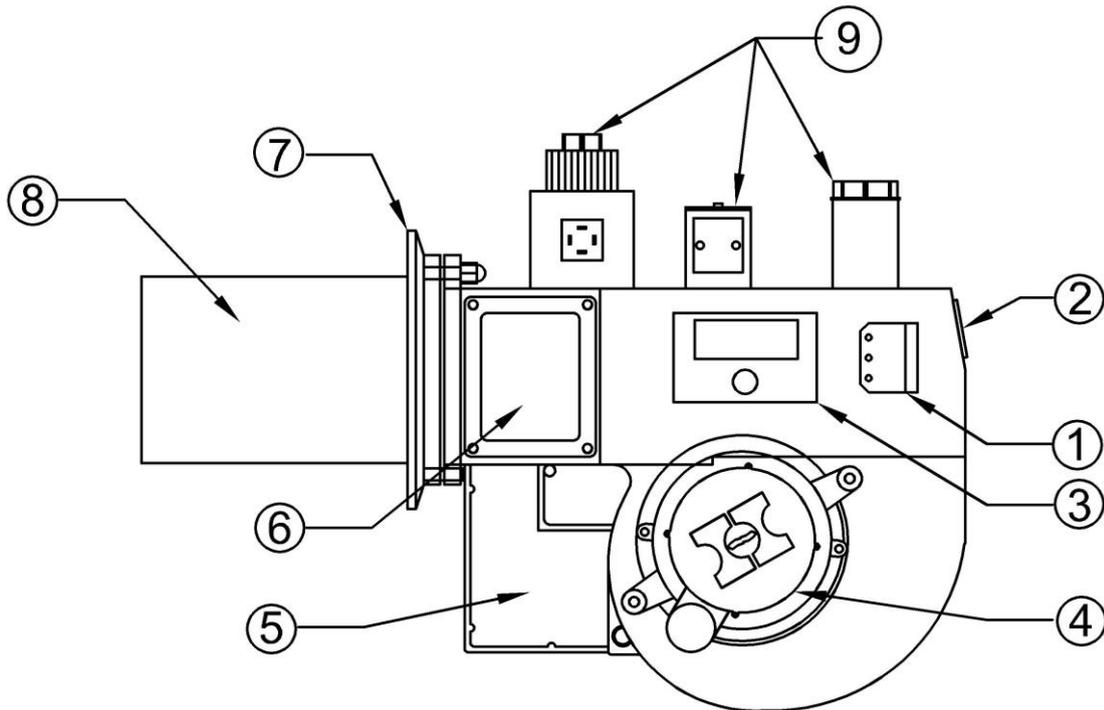
2.2.4 Burner correspond to IP20

Type	BG 400
Motor	250W, 1,7A, 230V, 50Hz, 8uf
The recommended main fuse motor	C10A
Control power	230V1F~2,5A
Sound	85 dBA ± 0,5 dBA

Alt.1 The sound level of the burner can be reduced by equipping the burner with silencer. Installation must be done so it does not prevent air supply to the burner.

Alt.2 The burner's noise level can be reduced by connecting the burner's air intake to the air duct that opens into an appropriate location. Installation must be done so it does not prevent air supply to the burner.

2.3 Description BG 400



Components

1.	Wiring socket	7.	Flange	13.	Low air pressure connection
2.	Cover, inspection glass	8.	Flame tube	14.	Air damper
3.	Control box	9.	Solenoid valve	15.	Air-fuel ratio adjustment lever
4.	Motor	10.	High air pressure connection	16.	Linear valve
5.	Air inlet filter	11.	Damper actuator	17.	Solenoid valve quick connector
6.	Ignition transformer	12.	Air pressure switch		

3. General instructions

3.1 General instructions

The installation of the gas burner must be carried out in accordance with current regulations and standards. The installers of gas burners should therefore be acquainted with all regulations and ensure that the installation complies with the requirements. The installation, mounting and adjustment should be made with the greatest care and only the correct gas should be used.

3.2 Installation and maintenance instructions

The maintenance instructions supplied with the burner must be kept at an easily accessible location in the workshop.

3.3 Instructions

The user should be thoroughly in-structed in the function of the gas burner and the whole installation. The supplier must instruct the user.

3.4 Inspection and maintenance

See service schedule.

3.5 Start up

After the burner has been fitted to the oven and the electric connection, the leakage control, the venting and the electric function test have been carried out, the burner will be ready for start-up.

However, study the sections dealing with adjustments of multi-bloc, combustion air and combustion head. Open the ball valve and switch on the main switch. If the burner starts the actual adjustment can be made.

3.6 Commissioning of installation

Control of the combustion. The combustion quality is checked by means of a flue gas analysis device. Adjust the burner to appr. 20%

excess air in accordance with the table. Check the flue gas temperature. Calculate the efficiency. Check also the actual gas volume on the gas meter so that the correct input is achieved.

4. Installation

4.1 Delivery check

Check that all has been delivered and that the goods have not been damaged during transport. If that is not the case, please notify the delivery company. Transport damages should be reported to the forwarding agency.

4.2 Preparations for installation

Check that the measurements and capacity range of the burner are compatible with the oven. The power ratings on the type plate refer to the min. and max. power of the burner.

4.3 Gas supply

For good operating safety, it is important that the gas supply system is installed correctly.

Consider the following:

1. Check that the burner is approved for the gas quality of the installation. If not, please contact the supplier.
2. Check that the gas components of the burner are approved for indicated gas pressure.
3. The gas supply system should be installed in accordance with current standards.
4. Pipe lines should be run so that service on oven and burner is facilitated.
5. Pipe lines should be run so that eventual contaminants cannot come into contact with the gas components.
6. Gas discharge system must be installed prior to local regulations.

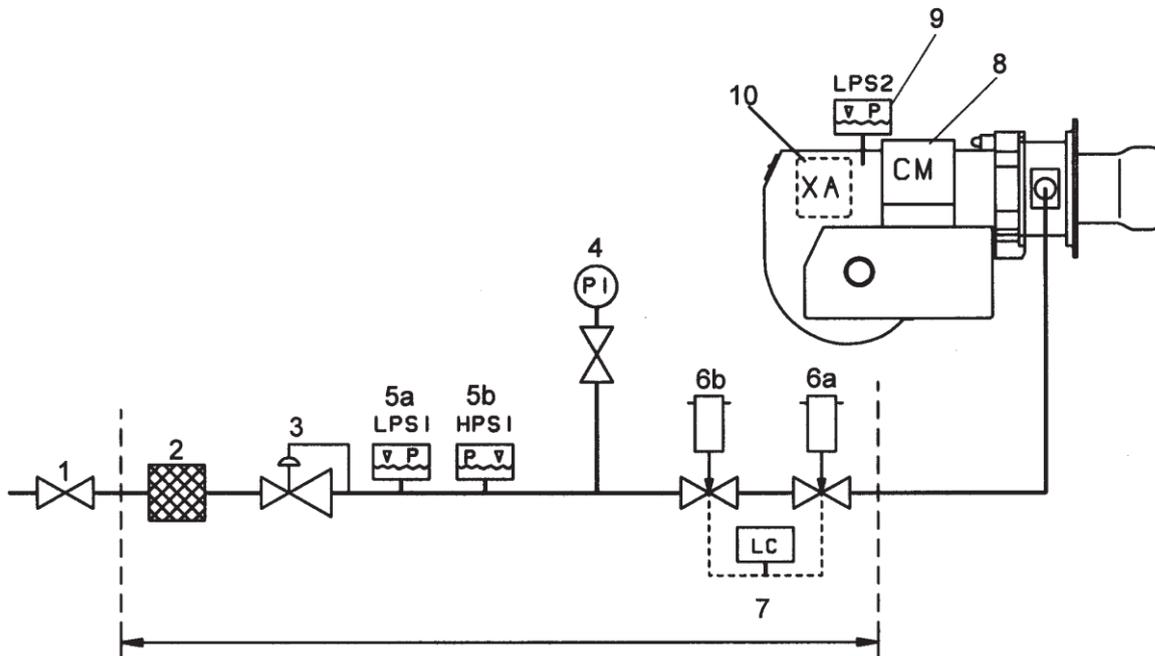
4.4 Electric connection

Before starting the electric installation, the main switch must be turned off. If the oven has a 7-pole and a 4-pole connector, these usually fit directly to the burner. If not, use the connectors included.
(Refer to connection under Electric equipment)



If an electric connection other than the one recommended is used, a risk of damage and injury can arise.

4.5 Skeleton diagrams



1. Ball valve
2. Filter
3. Governor
4. Pressure gauge with shut-off cock
- 5a. Gas pressure switch, mini
- 5b. Gas pressure switch, maxi
- 6a. Main valve, 2-stage. When modulating operation is required this valve is equipped with controls for variable opening.
- 6b. Safety valve
- 1)7. Valve proving system
9. Air pressure switch
10. Gas burner control

Pos. 5b, 7: Components not required according to EN 676.

- 1) Required over 1200 kW according to EN 676.hhh

4.6 Mounting on the oven

Fit the enclosed flange and gasket to the oven. If new fixing holes must be drilled, use the fixing flange as a pattern. Use fixing screws M8-M10.

The gas armature is from the factory mounted in a horizontal position. The connection of the incoming gas line is made from the right side. Should it for some reason be necessary to make the gas connection in any other direction the armature can be turned 180° to the left and upwards. It is also possible to connect the gas to the multi-bloc straight backwards. The armature can also be extended so that it comes outside the oven if there is not enough room. Ensure that the distance between the inner assembly and the gas armature is not too long. If the distance is too long there will not be time for the burner to light.

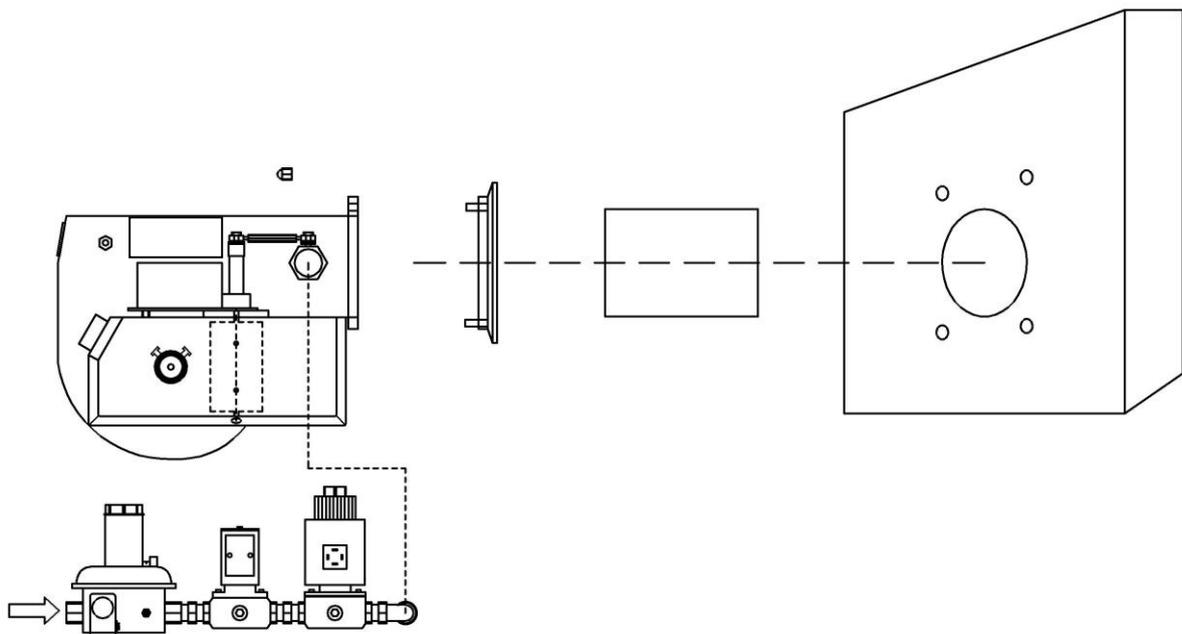
4.7 Installation example

Connect the gas to the burner by means of the ball valve. To facilitate service a union nut is used between the gas supply system and the ball valve.

Ensure that the union nut, ball valve and tubing make it easy to remove the burner for inspection and service.



Check the gas tightness.



4.8 Inspection of gas nozzle before commissioning

General rules

Care should be taken by the installer to ensure that no electrical cables or fuel/gas pipes are trapped or damaged during installation or service/maintenance.

Inner assembly

Check that the ignition and ionization electrodes are correctly set. In the figure (see the gas nozzle chapter), the dimensions are specified for adjustment of the ignition and ionization electrodes.

Gas quality

Ensure that the burner head is meant for the gas quality to be used (see chapter gas nozzle).

De-aerating

De-aerating of the gas line is conducted, for example, by unscrewing the screw on the measuring nipple for the connection pressure. Connect a plastic hose and release the gas in a safe place. Once de-aerating is completed, be sure to refit the screw on the measuring nipple.

Leakage control

When making a leakage control of the gas supply system the solenoid valve should be closed. Connect a pressure gauge to the test nipple Pa, see fig. The test pressure in the system should be 1,5x max. inlet pressure or min. 150 mbar. If any leakage, locate the source by means of soapy water or a leak location spray. After tightening repeat the test.

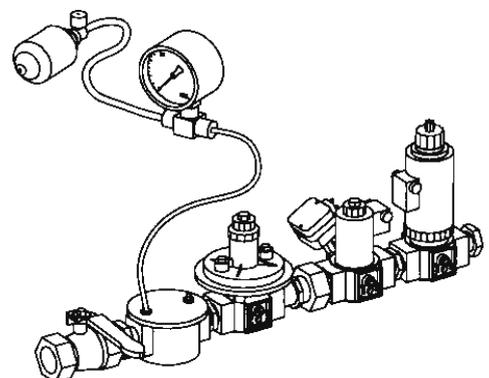
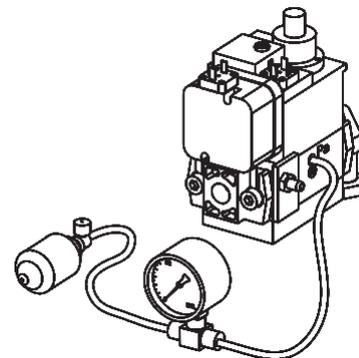
Electric function test:

Ensure that phase and neutral are not reversed. The gas shut-off cock should be closed. To prevent the gas pressure switch from locking out it should be linked temporarily.

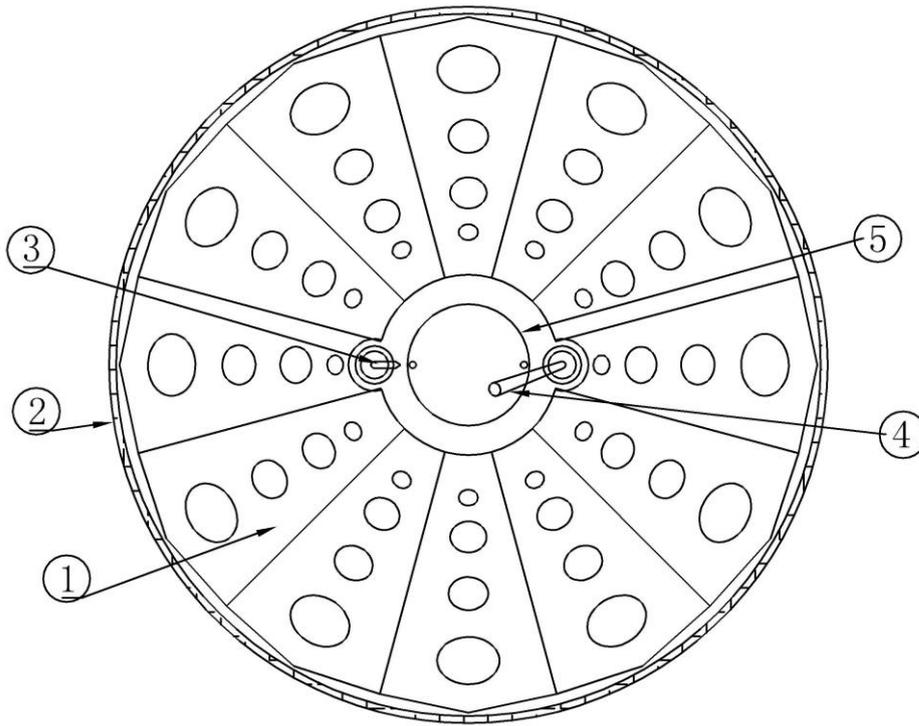
After the main switch has been switched on and the thermostats have been adjusted the pre-purging period begins (3-5sec.). At the end of this period the pre-ignition period starts (0,5-2,5 sec. dependent on the design of the gas control). The gas valve is energized and opens and flame is established. At the end of the safety time (2-3 sec.) the gas control locks out. The solenoid valve and the motor will be "dead". Remove the link from the gas pressure switch after the test is finished.

Note on 2-stage and modulating burners that during the pre-purging period the damper opens to the set value for air on stage 2 and just before the end of the pre-purging period it goes down to the air setting for stage 1. On some burners under 350kW the pre-purging mainly takes place with the air damper set for stage 1.

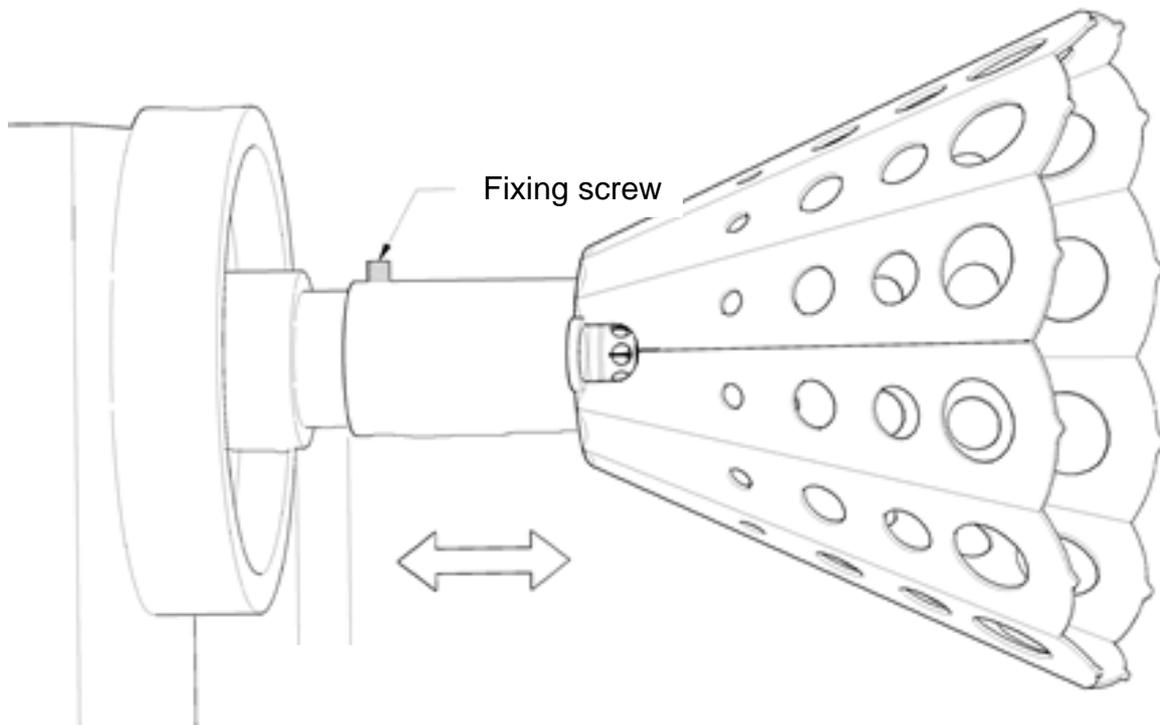
! If the burner is directly connected, ensure that all components on the burner are without power.



4.9 Gas nozzle

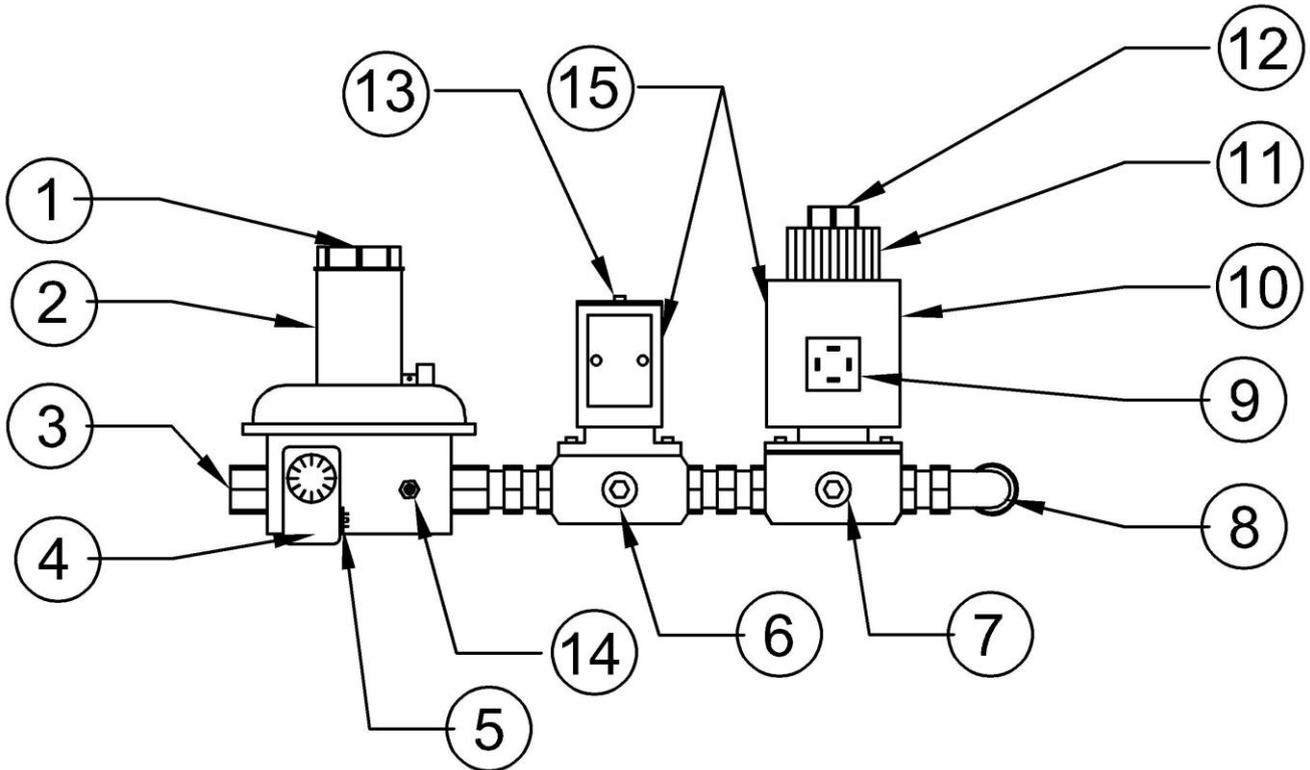


- (1) Combustion chamber (2) Flame tube (3) Ignition electrode
(4) Ionization electrode (longer) (5) Gas nozzle



4.10 Solenoid valve

! All gas-line components shall be assembled and mounted without bending, torque and other



- | | |
|--|--|
| (1) Pressure adjustment screw | *(9) Solenoid valve socket |
| (2) Regulator valve | (10) Slow opening valve |
| (3) Filter cotton (built-in) | (11) Solenoid valve output adjustment (output flow adjustment) |
| (4) Low air pressure switch | ** (12) Protection valve (start air volume adjustment) |
| *(5) Low-pressure protection switch socket | (13) Quick opening valve |
| (6) Pressure test interface | (14) Pressure test interface |
| (7) Pressure test interface | (15) Solenoid valve coil |
| (8) Quick connector | |

Flow adjustment

Loosen the fixing screw a. Turn the hydraulic device b:
to the right = the gas flow is reduced
to the left = the gas flow is increased

Do not forget to tighten the fixing screw again.

The flow adjustment can also be made by means of the governor. Adjust the outlet pressure to a value giving the desired gas flow on the fully open valve. At small capacities (gas flows) it is also necessary to adjust as above.

Adjustment of governor

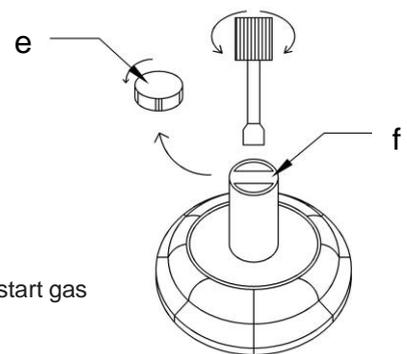
Adjust outlet pressure from governor by means of a screw .

Remove the protective cover e.

Turn the adjusting screw f to adjust the pressure.

Turn to the right = the outlet pressure is increased

Turn to the left = the outlet pressure is reduced



Adjustment of start gas flow

Remove the protective cover c.

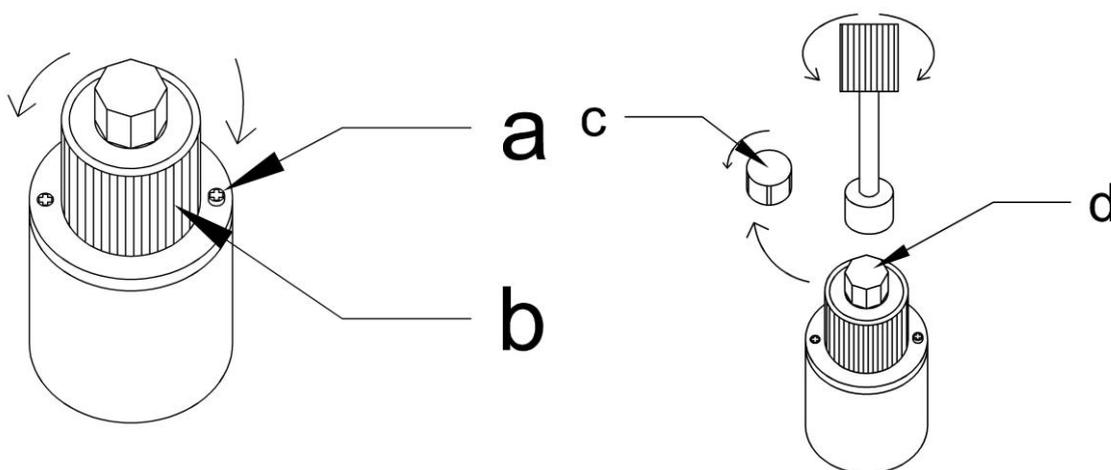
Turn the adjustment knob d to the desired start gas flow. Turn to the right = the start gas flow is reduced

Turn to the left = the start gas flow is increased

Experience: two turns to the left

Max. inlet pressure: 800 mbar.

Solenoid valve: Slow opening valves with adjustable start load and max. flow.



Adjustment of governor

Adjustment of start gas flow

5. Setting the burner

Adjustment of burner

The burner is from the factory pre-set to an average value that must then be adjusted to the oven in question.

All burner adjustments must be made in accordance with oven manufacturers instructions. These must include the checking of flue gas temperatures, average water temperature and CO₂ or O₂ concentration

General instructions

The installation of the gas burner must be carried out in accordance with current regulations and standards. The installers of gas burners should therefore be acquainted with all regulations and ensure that the installation complies with the requirements. The installation, mounting and adjustment should be made with the greatest care and only the correct gas should be used.

Operating instructions

The operating instructions accompanying the burner should be left in a prominent position in the workshop.

Instructions

The user should be thoroughly instructed in the function of the gas burner and the whole installation. The supplier must instruct the user.

Inspection and maintenance

Daily inspection is advisable.

Service

Service should only be carried out by qualified personnel. Replacement parts should be of the same make and approved by the same authorities as the original. If the burner is converted to fire another gas quality it must be re-commissioned. If town gas is to be fired the combustion head must be converted and the gas train adjusted to suit, (e.g. larger gas armature or a different spring in the governor may be required).

Start up

After the burner has been fitted to the oven and the electric connection, the leakage control, the venting and the electric function test have been carried out, the burner will be ready for start-up.

However, study the sections dealing with adjustments of multi-bloc, combustion air and combustion head.

Open the ball valve and switch on the main switch. If the burner starts the actual adjustment can be made.

Air adjustment

The minimum damper of the burner has been adjusted to the best position before leaving the factory, and generally does not need to be adjusted. During the operation of the burner, the air and gas are automatically adjusted by the actuator.

Adjustment of burner head

Loosen the fixing screw on the burner head and manually move the burner head back and forth to a suitable position, then tighten the fixing screw on the burner head again.

Which position to use depends on input and overpressure in the oven.

A general rule is that the lower capacity the smaller the opening between brake plate and combustion device.

Control of burner head

To check the burner head, brake plate and electrodes proceed as follows:

Remove the cover. Loosen the union nut between inner assembly and multi-bloc. Loosen the burner from the flange and withdraw the burner from the oven. If it is necessary to remove the burner tube, loosen the two Allen screws, turn and withdraw the burner tube.

Commissioning of installation

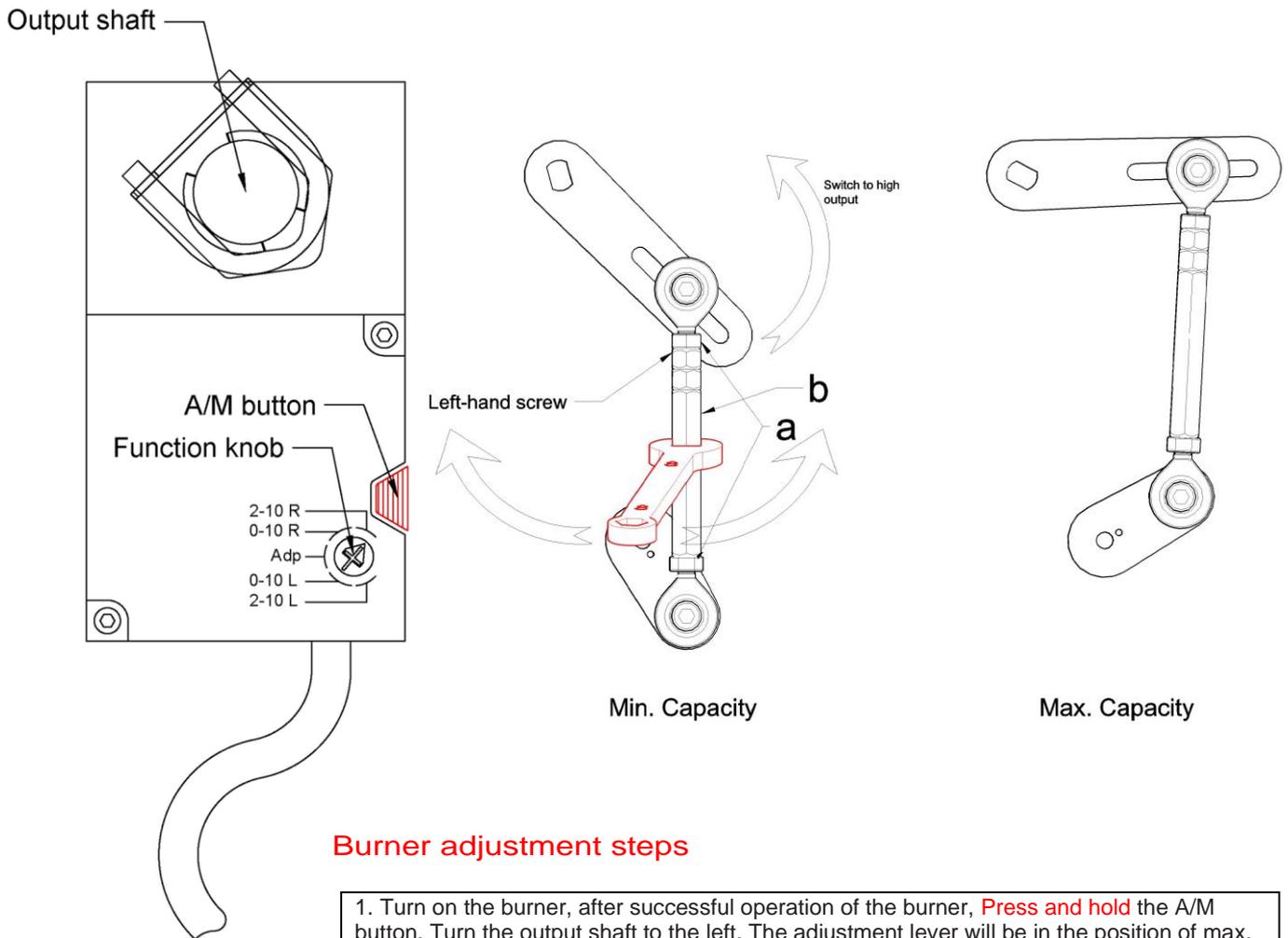
Control of the combustion. The combustion quality is checked by means of a flue gas analysis device. Adjust the burner to appr. 20% excess air in accordance with the table. Check the flue gas temperature. Calculate the efficiency. Check also the actual gas volume on the gas meter so that the correct input is achieved.

Actuator

Press and hold the A/M button to manually rotate the actuator output shaft.
Rotating counterclockwise is the small capacity output direction, and clockwise is the large capacity output direction.
The actuator will rotate 90° from the minimum capacity to the maximum capacity, and it takes about 20s.
Do not turn the function knob.

Gas adjusting lever

The adjustment lever on the front right of the burner is used to adjust the gas flow in the minimum capacity state.
Loosen a, adjust b with a wrench, and tighten a again after adjustment.
Turn to the right = the min. gas flow is reduced
Turn to the left = the min. gas flow is increased



Burner adjustment steps

1. Turn on the burner, after successful operation of the burner, **Press and hold** the A/M button, Turn the output shaft to the left. The adjustment lever will be in the position of max. capacity.
2. Adjust outlet pressure (on page 17 "Adjustment of governor"), the outlet pressure can be read on the pressure gauge on the solenoid valve. Adjust the outlet pressure to 1-2kpa. The flame length is about 0.6-0.8m. The high flame is adjusted.
3. **Press and hold** the A/M button, Turn the output shaft to the right. The adjustment lever will be in the position of min. capacity. Loosen a and turn b with a wrench (on page 21 "Gas adjusting lever"). Press and hold the reset button for 3 seconds (on page 10), the burner will restart. If the burner can restart smoothly and operate stably, then the minimum gas flow is appropriate. The flame length is about 0.1m. The low flame is adjusted. Do not forget to tighten a again.
4. Release the A/M button and the flame of the burner will be automatically controlled by the actuator.

5.1 Setting the air pressure switch

The air pressure switch should block the burner if the air quantity supplied for combustion is insufficient. The air pressure switch must be set so that, if there is a defective air supply at the burner's max. or min. capacity, it reacts before the monitored pressure falls so much that it results in poor combustion.

Inställningsområde ca:

LGW 10	1-10	mbar
LGW 50	2,5-50	mbar

Setting for air pressure switch

1. Remove the protective cover, screw (Y).

! Be careful when adjusting the air pressure switch; it contains a live component.

2. Start the burner.
3. Carefully turn the scale on the air pressure switch clockwise until the air pressure switch stops the burner. **Is the tolerance on the scale for the min. air pressure switch approx. $\pm 15\%$?**
4. Try to find the pressure at which the burner stops for both the minimum and maximum input power by turning the scale. Make a note of the values and then set the air pressure switch on the basis of the highest pressure noted at which the burner stopped.
5. The air pressure switch should be set to a pressure approx. 10–15% lower than the highest noted pressure at which the burner stopped.
6. After setting the air pressure switch, perform repeated starts and run through the burner's set output range several times. This is to ensure the reliable function of the burner. If breakdowns or interruptions occur, the air pressure switch is probably set to a too narrow position.
7. Fit the protective cover, screw (Y).



5.2 Setting the min. gas pressure switch

The min. gas pressure switch should react to a burner connection pressure that is too low and in such cases, prevent the burner from starting. If the connection pressure to the burner is too low during operation, the min. gas pressure switch should stop the burner. The burner can start again once the connection pressure has risen above the pressure set for the min. gas pressure switch.

Setting for min. gas pressure switch

1. Remove the protective cover, screw (Y).
2. Open the pressure outlet (X) and connect a manometer to measure the connection pressure.
3. Start the burner.
4. Measure and make a note of the connection pressure to the burner during normal operation at the highest input power.
5. Based on the desired connection pressure set, determine the connection pressure at which the gas pressure switch should stop the burner. Set the connection pressure at which the burner is stopped at a level where the burner is stopped before poor combustion occurs.
6. Set the min. gas pressure switch to this value by turning the scale.
7. Check the setting by carefully closing the ball valve while measuring the connection pressure.
8. When the min. gas pressure switch stops the burner, the value measured should then approximately correspond to the setting on the min. gas pressure switch. The tolerance on the scale for the min. gas pressure switch is approx. $\pm 15\%$.
9. Open the ball valve.
10. Remove the pressure gauge and close the pressure outlet (X).

 Check the gas tightness.

11. Fit the protective cover, screw (Y).



5.3 Recommended excess air when using default setting

Grade of gas	Excess air flue gases		Max. % CO ₂
	% O ₂	% CO ₂ Lambda 1.2	
Natural gas	3–5	≈10	11.9
Propane	3–5	≈11.5	13.9
Butane	3–5	≈11,5	14,1
Liquefied petroleum gas (LPG)	3–5	≈11	13,8

5.4 Determining the gas quantity for the system

The heat values indicated are normal values; the heat value varies according to the origin of the gas. For more exact information on values, contact the gas distributor.

Lower heat value Hu at normal state 15°C and 1013.25 mbar EN676				
Grade of gas		kWh/Nm ³	MJ/Nm ³	kcal/Nm ³
Natural gas	G20	9.5	34.02	8126
Natural gas	G25	8.2	29.25	6986
Propane	G31	24.6	88.00	21019
Butane	G30	32.5	116.09	27728

5.4.1 Example of how to calculate the gas quantity (natural gas G20):

$V_o =$	Desired quantity of gas	[Nm ³ /h]
$Q =$	Oven output	[kW]
$H_u =$	Gas heat value	[kWh/Nm ³] or [MJ/Nm ³] or [kcal/Nm ³]
$\eta =$	Oven efficiency	[%]

Calculation example:

$$Q = 50 \text{ kW}$$

$$H_u = \text{Example A: } 34020 \text{ MJ/Nm}^3$$

$$\text{Example B: } 9.5 \text{ kWh/Nm}^3$$

$$\text{Example C: } 8126 \text{ kcal/Nm}^3$$

$$\eta = 90\%$$

$$\text{Example A} = \frac{Q \cdot 3600}{H_u \cdot \eta} = \frac{50 \cdot 3600}{34020 \cdot 0.90} \approx 5.9 \text{ Nm}^3/\text{h}$$

$$V_{oA} = \frac{Q}{H_u \cdot \eta} = \frac{50}{34020 \cdot 0.90}$$

$$\text{Example B} = \frac{Q}{H_u \cdot \eta} \approx \frac{50}{9.5 \cdot 0.90} \approx 5.8 \text{ Nm}^3/\text{h}$$

$$V_{oB} = \frac{Q}{H_u \cdot \eta} = \frac{50}{9.5 \cdot 0.90}$$

$$\text{Example C} = \frac{Q}{H_u \cdot \eta} = \frac{50}{8126 \cdot 0.00116 \cdot 0.90} \approx 5.9 \text{ Nm}^3/\text{h}$$

$$V_{oC} = \frac{Q}{H_u \cdot 0.00116 \cdot \eta} = \frac{50}{8126 \cdot 0.00116 \cdot 0.90}$$

If the barometer reading (altitude), pressure and temperature of the gas deviate significantly from normal values, this must be taken into account as follows:

$$T = \text{Temperature of gas at the gas meter} \quad [^{\circ}\text{C}]$$

$$B = \text{Barometer reading} \quad [\text{mbar}]$$

$$P = \text{Pressure of gas at the gas meter} \quad [\text{mbar}]$$

$$f = \text{Factor calculated for multiplication with flow in Nm}^3/\text{h to arrive at actual flow in Nm}^3/\text{h}.$$

$$V = \text{Actual flow} \quad [\text{m}^3/\text{h}]$$

$$f = \frac{273}{273+T} \cdot \frac{B+P}{1013.25}$$

Calculation example:

$$T = 15^{\circ}\text{C}$$

$$B = 945 \text{ mbar}$$

$$P = 15 \text{ mbar}$$

$$f = \frac{273}{273+15} \cdot \frac{945+15}{1013.25} \approx 0.90 \text{ Nm}^3/\text{h}$$

This means that the quantity of gas read from the gas meter should actually be read off as 1.11 . the calculated flow in a normal state.

$$\begin{aligned} V &= V_0 \cdot f \\ V_A &= V_{0A} \cdot f = 5.9 \cdot 0.90 \approx 5.2 \text{ m}^3/\text{h} \\ V_B &= V_{0B} \cdot f = 5.8 \cdot 0.90 \approx 5.2 \text{ m}^3/\text{h} \\ V_C &= V_{0C} \cdot f = 5.9 \cdot 0.90 \approx 5.3 \text{ m}^3/\text{h} \end{aligned}$$

5.5 Calculating the quantity of gas supplied

The quantity of gas supplied can be calculated if the system is equipped with a gas flow meter of some type. The procedure here is usually to measure how long it takes for the burner to consume a certain quantity of gas.

To measure:

t = Time for a certain quantity of gas consumed by the burner. [h]

M = Quantity of gas consumed. [m³]

V = Actual gas flow [m³/h]

$$V = \frac{M}{t} \text{ [m}^3/\text{h]}$$

Calculation example:

$$t = 1 \text{ min } 10 \text{ s}$$

$$M = 100 \text{ dm}^3 \text{ (litre)}$$

$$\begin{aligned} M &= \frac{100}{1000} = 0.1 \text{ m}^3 \\ t &= \frac{1}{60} + \frac{10}{3600} = 0.0194 \text{ h} \\ V &= \frac{M}{t} = \frac{0.1}{0.0194} \approx 5.1 \text{ m}^3/\text{h} \end{aligned}$$

5.6 Flame monitoring and ionization current check

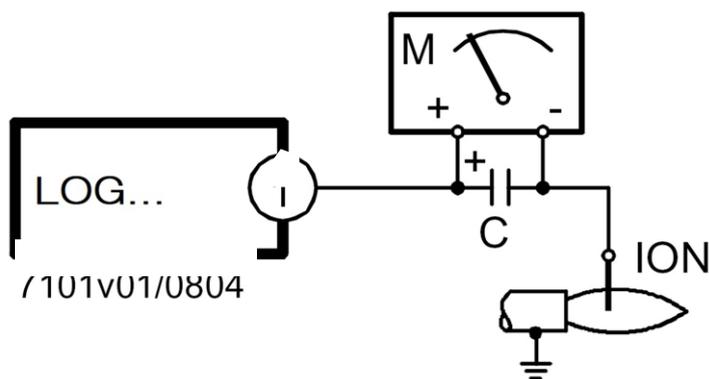
The standard version of the burner is monitored according to the ionization principle. The ionization current should be checked on initial start-up and at each service visit.

The reason for low ionization current can be leakage current, poor connection to earth, fouling or incorrectly positioned ionization electrode in the combustion head. Occasionally, an incorrect gas/air mix may result in poor ionization current. Ionization current is measured using a microammeter (μA) connected in series with the ionization electrode and gas burner control. Connect the μ ammeter according to the diagram. The minimum required ionization current is shown in the table. In practice, this current must be significantly higher, preferably more than $10 \mu\text{A}$. Connection of the μA instrument is made easier by the fact that all gas burners are equipped with a divisible ionization cable.

Technical data

For continuous operation!

Idle voltage at ION-terminals	AC 115-230 V
 Protect the ionization electrode from electric shock!	
Short-circuit current	Max. AC 100-300 mA
Min. current for flame detection	Min. DC $1.5 \mu\text{A}$
Required current to ensure detection	Min. DC $3 \mu\text{A}$
Possible detection current	Max. DC $20 \mu\text{A}$
Operational indicator lamp flashes green	$<5 \mu\text{A DC}$
Operational indicator lamp shines green	$>5 \mu\text{A DC}$



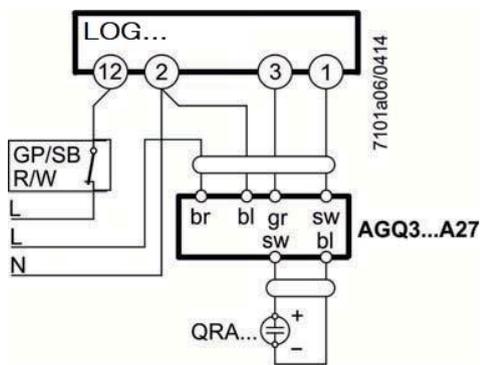
5.7 UV-Detector

DC current detector signals with flame detector QRQ...	Min. required	Max. possible
Measurement at the flame detector QRA...	200 μ A	500 μ A

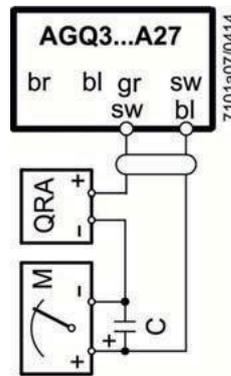
Ancillary unit AGQ3...A27

In connection with burner controls LMExx.xxx2, use of UV ancillary unit AGQ3...A27 is mandatory. Correct functioning of aged UV cells can be checked as UV test with a higher supply voltage across the UV cell after controlled shutdown until terminal 3 ON.

Connection diagram



Measuring circuit for measuring the UV flame current



Measurement made at the flame detector QRA...

6. Handing over of the installation

- Make repeated start attempts to ensure that the adjustments function.
- Close the ball valve during operation to check that the gas switch switches off at the set value.
- Remove the hose for the air pressure switch to check that the burner locks out.
- Check that all protective covers and measurement nipples are mounted and fastened.
- Fill out necessary test reports.
- Instruct the persons in charge of the operation on the service and maintenance of the installation and what to do should any troubles occur.
- Inspection and service must be carried out by authorized personnel.



Review and service should be performed by authorized personnel only

7. Fault location, functional troubles

Trouble free operation is dependent on three factors: electricity, gas and air supply. Should there be any changes in the ratio between these three factors there is a risk of break downs. It has been proved that most break downs are caused by simple faults. Before calling the service engineer, the following should therefore be checked:

- Is the gas cock open?
- Are all fuses in order and the current switched on?
- Are the thermostats correctly set?
- Are press stats, overheating protection etc. in operating position and not locked-out?
- Is the gas pressure sufficient?
- Is the gas burner control in start position?
- Has the gas control or the motor protector locked out? - Reset.
- Is the circulation pump in operation?
- Is there a supply of fresh air to the installation?
- If integral components are of a different make from what is stated in this manual, see the enclosed loose-leaf.

8. Electric equipment

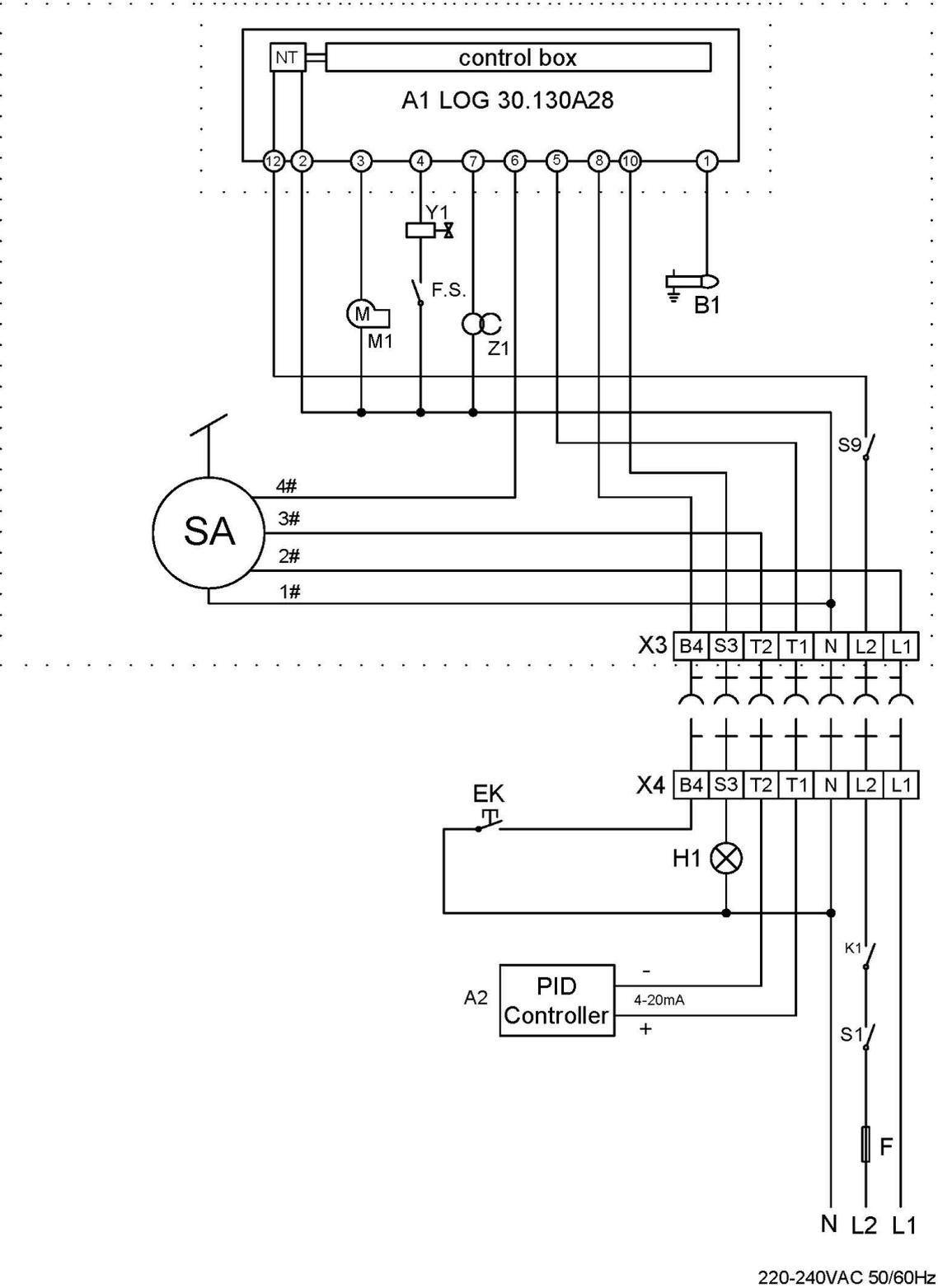
8.1 Safety system

Safety systems must be installed in accordance with regulations that are applicable for the appliance. This may differ according to the process burner are installed in to. Se local regulations for information.

Safety system cables must be run in separate cables outgoing signal must not come in same cable as incoming signal. Signals must be in different harnesses for safety reasons.

Safety system as door switches, water level, pressure, temperature and other safety limiters must be installed in safety loop according to process.

8.2 Wiring diagram LOG



8.3 List of components

A1	Gas burner control	F.S.	Air pressure switch
A2	PID Controller	S9	Gas pressure switch
B1	Ionization electrode	Z1	Ignition transformer
F	Fuse	X3	Plug-in contact, burner
H1	Alarm, 230V	X4	Plug-in contact, oven
M1	Burner motor	Y1	Solenoid valve 1
S1	Main switch	K1	Over temperature alarm (NO)
SA	Actuator		

8.3.1 Function LOG...

1.	Operating switch ON-Thermostat ON-Gas pressure switch ON A check that the air pressure switch does not indicate fan pressure is carried out
2.	Burner motor starts A check that the air pressure switch indicates sufficient fan pressure is carried out
3.	The ignition spark is created
4.	The gas solenoid valve is open The gas is ignited. The ionization electrode now indicates a flame
5.	The safety time expires The ignition spark ceases. The safety period ceases. If the spark is missing or it disappears after this time limit, the gas burner control is blocked
6.	Operating position
7.	Stop The operation of the burner can now be stopped with the control switch or PID controller
	If the gas burner control is blocked Red light in the gas burner control is lit. The burner is restarted by pushing the reset button

9. Troubleshooting

Gas Burner

Conditions favorable to disruption-free operation of the system can only be guaranteed through the interaction between three factors – electricity, gas flow and combustion air. A change in any of these factors may cause disruptions.

It has been shown that a large proportion of disruptions can be attributed to relatively small things. Therefore, before requesting servicing, you should ascertain the following:

1. Are the system's gas taps open?
2. Are the fuses intact and is the power on?
3. Are control devices (room thermostat, oven thermostat, etc.) correctly set?
4. Is gas pressure to the burner sufficient?
5. Are the burner controls on standby and not locked?
6. Is air supply to the burner adequate?

To facilitate troubleshooting, we have created a table of the most common faults that may arise in a gas burner system and how they should be rectified.

Cause of fault	Action
Burner does not start	
No gas	Make sure all gas taps are open
No power	Check the fuse, thermostat and electrical connections
Burner motor does not start	Motor protection has tripped. Motor faulty.
Burner control faulty	Replace
Burner motor running, no ignition spark at the end of pre-aeration	
No power in the terminals	Check the connector. Replace faulty burner controls
Ignition electrodes in contact with each other or earth	Adjust
Ignition electrode porcelain damaged	Replace the electrodes
Poor connection to cable connectors	Adjust connection
Ignition cables damaged	Replace
Transformer damaged, no power to secondary winding	Replace the transformer
Ignition cable and ionization cable swapped around	Reconnect
No flame propagation	
Gas solenoid valve faulty	Replace
Gas solenoid valve does not open despite having power	Replace solenoid valve terminals, or entire valve
No power to solenoid valve	Check the connection
No electrical connection through air pressure gauge	Check the air pressure gauge's settings and functions
Ignition load incorrectly set	Increase/decrease gas supply Reduce airflow

Cause of fault	Action
Burner control faulty	Replace
Air pressure gauge incorrectly set or faulty	Check the settings and reset, or replace
No acknowledgement signal due to incorrect adjustment or misalignment of the control motor cams.	Check the settings and realign.
Burner trips after safety time limit despite flame propagation	
No ionization current or UV cell incorrectly positioned	Adjust ionization electrode and UV cell Check cables and connectors
Burner control monitor faulty	Replace burner control
Voltage lower than 185 V	Contact an electrician
Ignition electrodes disrupting ionization current	Adjust ignition electrodes. Re-polarize the transformer
Poor earth connection	Ensure adequate earth connection
Phase and neutral swapped around	Check wiring diagram and change accordingly
Burner trips during pre-aeration.	
Air sensor faulty or incorrectly set	Increase/decrease air setting. Reduce air volume
Ignition load incorrectly set	Increase/decrease gas supply Reduce airflow
Gas pressure too low	Increase pressure. If necessary, contact gas supplier
Pulsations at start-up	
Ignition electrodes incorrectly set	Adjust
Gas pressure too high	Check and adjust using pressure gauge and pressure control valve
Flue gas side blocked	Check the chimney flue
Burner pulsates during operation	
Burner incorrectly set	Adjust
Burner dirty	Clean the burner
Incorrect chimney	Check and modify dimensions if necessary
Burner functioning properly but with occasional blockage	
Ionization current too low	Check. Must be at least 6 μA , but should ideally lie between 8 and 20 μA
UV cell incorrectly positioned	Adjust
Voltage drop at certain times	Must not drop below 15% of rated voltage. Contact an electrician if necessary
Incorrectly set or faulty air sensor	Check the settings and reset, or replace
Ignition electrode overload	Replace
Burner control ambient temperature too high	Insulate for heat, Max. 60 °
Ignition spark too weak	Check the transformer
Poor combustion	
Poor draught conditions	Check the chimney

Cause of fault	Action
Flue gas temperature too high	Oven overloaded Decrease the gas volume, sweep the chimney if necessary
CO ₂ content too low	Choke the air supply. Check the oven for any leakages. Choke the draught if too high
CO content too high	
Surplus air when using natural gas and liquefied petroleum (propane, butane)	Choke the air supply
Poor air supply	Open the air supply. Check flue gas damper
Holes in gas nozzle clogged.	Clean
Poor fresh air intake	Check and increase
Flame at incorrect angle due to combustion head out of position	Check the combustion head and readjust
Condensation build up in oven and chimney	
Flue gas temperature too low or gas volume too low	Raise the flue gas temperature by increasing gas volume Insulate the chimney

10. General instructions for gas burners

10.4.1 Installation

1. Follow standards and instructions applicable to the installation of gas burners
2. Ensure that the electric installation is made in accordance with existing regulations
3. Check that the fresh air intake of the oven room is sufficiently dimensioned
4. Check by studying the data plate that the efficiency of the burner is adapted to the oven output
5. Check that the burner is adapted to the gas quality in question
6. Check that the input pressure of the gas is correct
7. Check that the dampers of the oven are open
8. Check that there is water in the system
9. Check that thermostats etc. are correctly adjusted
10. Read the instructions and follow the directions given for the burner as to starting-up and service

10.4.2 Maintenance

General instructions

1. Keep the burner filter clean
2. Ensure that the fresh air intake of the workshop is not restricted
3. Switch off the current and shut off the gas supply if the burner must be withdrawn from the oven
4. Do not use the oven for burning paper and waste if there is no special arrangement (fire room) for this

Normal operation

1. Ensure that the air supply to the burner is not obstructed by dust and dirt
2. Have the installer make a yearly overhaul of the installation so that safety is not jeopardized
3. Have the installer at the yearly overhaul also adjust the burner to ensure optimal combustion economy
4. Check periodically that there is water in the system (fill up if necessary) and that thermostats etc. are normally adjusted
5. Ensure that there is no water or dampness in contact with the burner

10.4.3 If the burner has stopped

1. Press the reset button of the relay
2. Check that the max. thermostat has not cut out
3. Check other thermostats for example room thermostat, if any
4. Check that the gas pressure to the burner is sufficient
5. Check that the electric fuses have not blown
6. Make a new attempt to start the burner and check the counter of the gas meter to find out whether the solenoid valve opens
7. If the burner does not start in spite of repeated starting attempts call the installer

10.4.4 Shut-Off

1. Switch off the current with the main switch
2. Shut-off the gas supply with the shut-off cock on the burner

10.4.5 Warning

1. Never keep your face in front of the fire room door when starting up the burner
2. Do not use naked flame when inspecting the fire room

