



Providing sustainable energy solutions worldwide

Installation- and maintenance instruction
STG 146/2



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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 authorised 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

Enertech AB is 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 authorised 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 boiler'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 Enertech'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 boiler 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 by Enertech in writing.
- 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 boiler. 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.

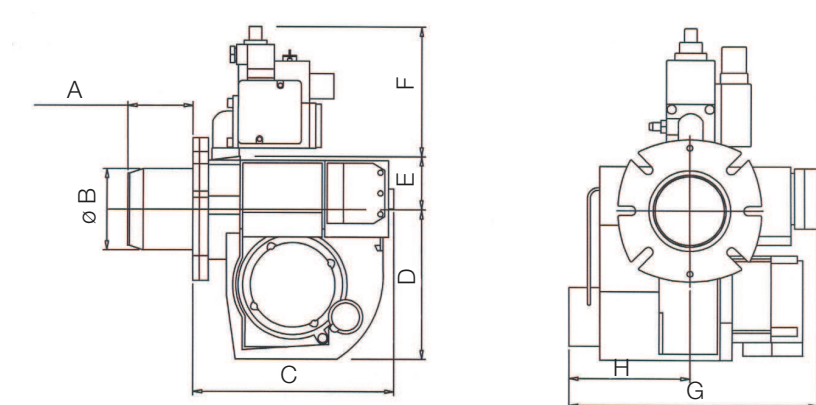
2. Technical data

2.1 Burners are intended for use at:

- Hot water boilers in intermittent operation

2.2 Dimensions

Gas connection $\frac{3}{4}$ -1 $\frac{1}{4}$ "



| Type | | Length of burner tube | Flange measure A | Burner tube measure B |
|------------------|------------|-----------------------|------------------|-----------------------|
| STG 146/2 | Standard 1 | 145 | 122 | ø104 |
| | Standard 2 | 245 | 222 | ø104 |

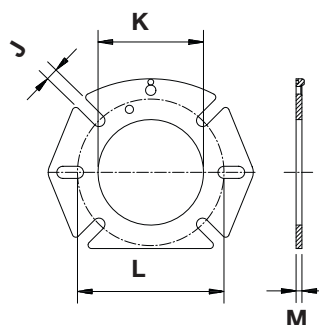
| | C | D | E | F | G | H | **I |
|----------------|-----|-----|----|------|------|-----|-----|
| STG 146 | 244 | 192 | 61 | *202 | *290 | 139 | 200 |

2.2.1 Heat generator connection dimensions

| | J | K | L | M |
|----------------|-----|-------|-----------|------|
| STG 146 | M10 | Ø 110 | Ø 140-170 | 12,5 |

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

** Min. recommended distance to floor.



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2.2.2 Capacity range

| Capacity kW | Gas quantity at min. power Nm³/h ¹) | Gas quantity at max. power Nm³/h ¹) | Max. connection pressure mbar | Min connection pressure mbar | MB-Bloc |
|------------------|---|---|--|---------------------------------|---------------------------------------|
| STG 146/2 | | | | | |
| G20 41-133 | 4,1 | 13,3 | 360 360 360 | 25 30 20 | MBC 120 MB 405 MB 407 |
| G25 41-133 | 5,1 | 16,7 | 360 360 360 | 35 35 20 | MBC 120 MB 405 MB407 |
| G30 47-144 | 1,4 | 4,3 | 200 360 200 360 | 30 30 30 30 | MBC 65 MBC 120 MB 403 MB 405 |
| G31 47-144 | 1,8 | 5,4 | 200 360 200 360 | 30 30 30 30 | MBC 65 MBC 120 MB 403 MB 405 |

| | | | | |
|---|-----|---------|--------|----------|
| Lower heat value Hu at normal state 15°C and 1013.25 mbar EN676 | | | | |
| Grade of gas | | kWh/Nm³ | MJ/Nm³ | kcal/Nm³ |
| 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 |

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

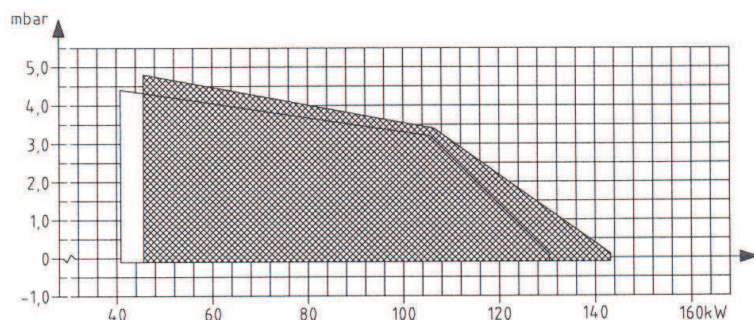
| Geräte Kategorien Appliance categories | Versorgungsdrücke Supply pressures | Bestimmungsländer Countries of destination |
|---|---------------------------------------|---|
| II _{2R/3R} | 20-360mBar | BG, CZ, DE, EE, ES, FR, GR, HU, IS, IT, LU, LV, NO, PT, SI, All countries |
| II _{2H3B/P} | 20-360mBar | AT, CH, CY, DK, FI, LT, RO, SE, SK |
| II _{2H3P} | 20-360mBar | GB, IE, |
| II _{2L3B/P} | 20-360mBar | NL, RO |
| II _{2E3B/P} | 20-360mBar | PL |
| I _{2E(R)B} | 20-360mBar | BE |
| I _{3P} | 20-360mBar | BE |

2.2.5 Working field

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G20,G25 41-133 kW

G30,G31 47-144 kW



! Do not exceed working field

2.2.4 Electric Specification EN 60335-2-102

Burner correspond to IP20

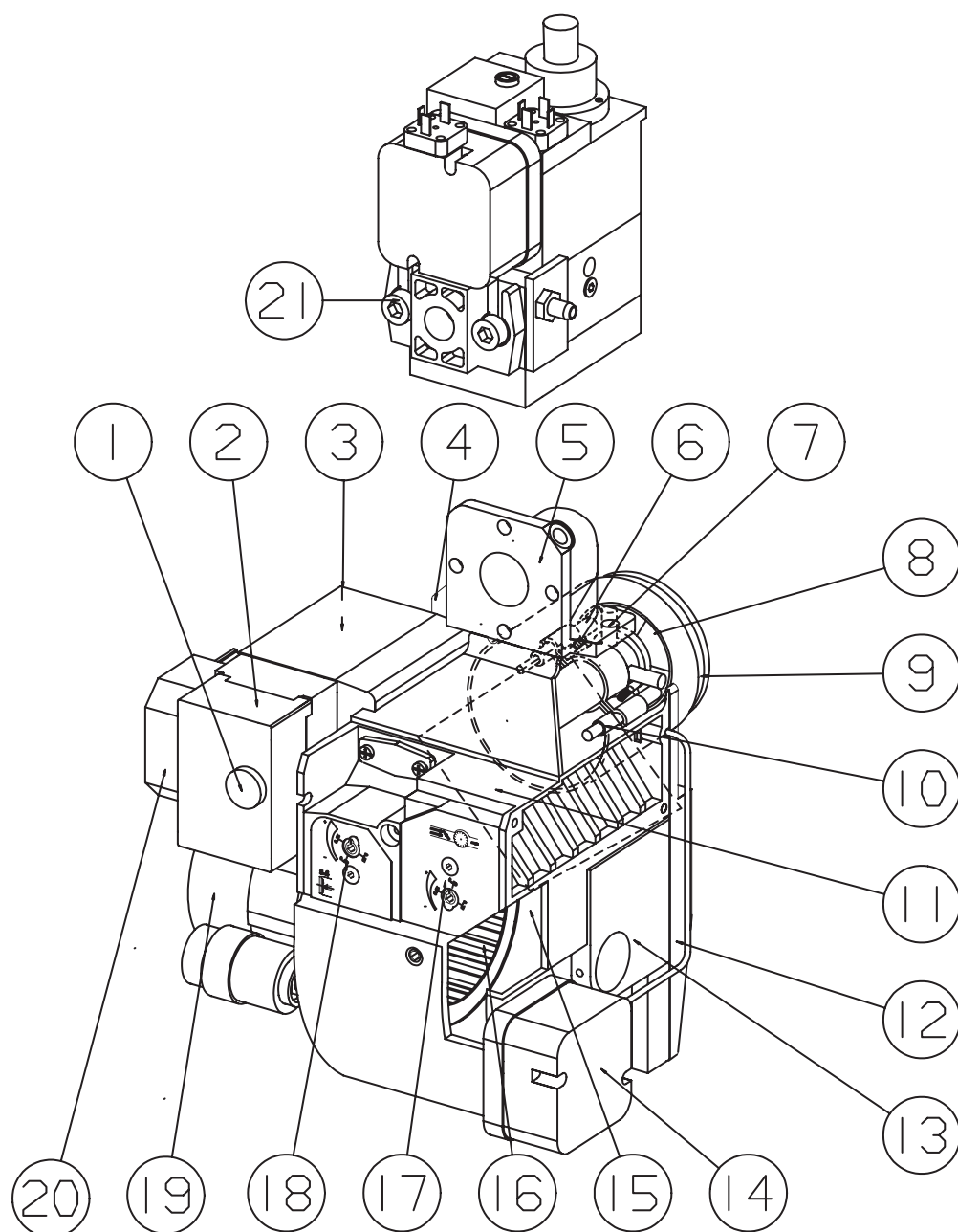
| Type | STG 146 |
|---------------------------------|----------------------------------|
| Motor | 125W, 0,95A, 230V, 50Hz, 2750rpm |
| The recommended main fuse motor | 6,3 A |
| Control power | 230V1F~2,5A |
| Sound | 79 dBA ± 0,5 dBA |

Measurements according to EN 3746: 2010

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 STG 146



Components

- | | | |
|-------------------------|---------------------------------------|-------------------------------|
| 1. Reset button | 9. Burner tube | 16. Fan wheel |
| 2. Gas burner control | 10. Ignition electrode | 17. Air adjustment |
| 3. Transformer | 11. Air damper | 18. Inner assembly adjustment |
| 4. Fixing flange | 12. Front part fan housing | 19. Motor |
| 5. Connection MultiBloc | 13. Rear part fan housing | 20. Electric connection |
| 6. Ionisation electrode | 14. Air pressure switch | 21. MultiBloc |
| 7. Inner assembly | 15. Shielding arrangement fan housing | |
| 8. Brake plate | | |

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 boiler room.

3.3 Instructions

The user should be thoroughly instructed 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 boiler 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 boiler. 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 boiler 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.

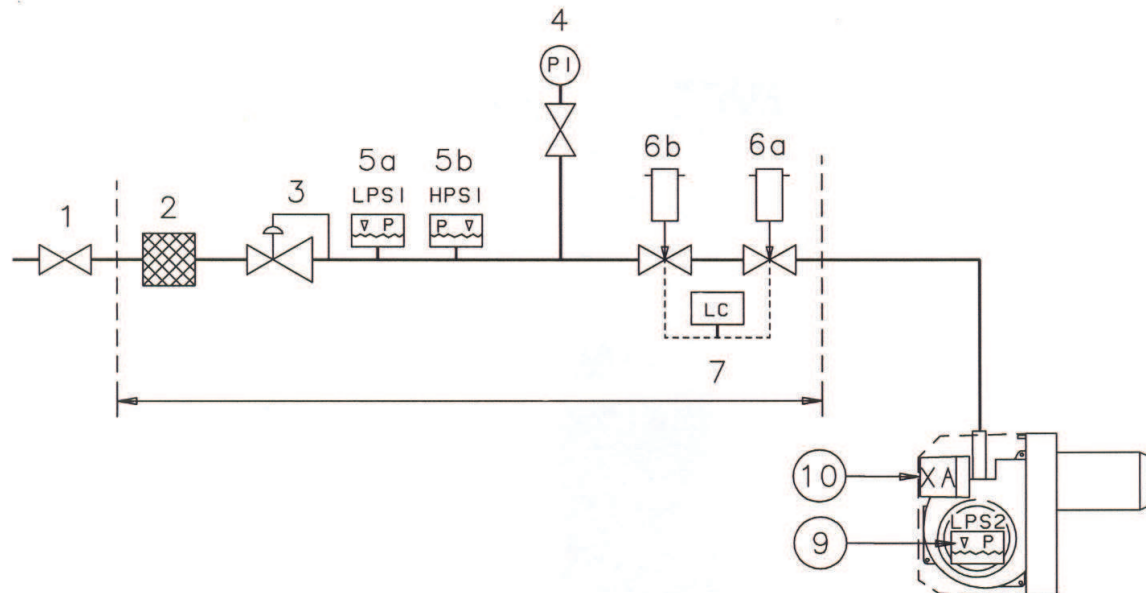
4.4 Electric connection

Before starting the electric installation, the main switch must be turned off. If the boiler has a 7-pole and a 4-pole Eurostecker 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 by Enertech 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
- 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.

4.6 Mounting on the boiler

Fit the enclosed flange and gasket to the boiler. 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 boiler 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.

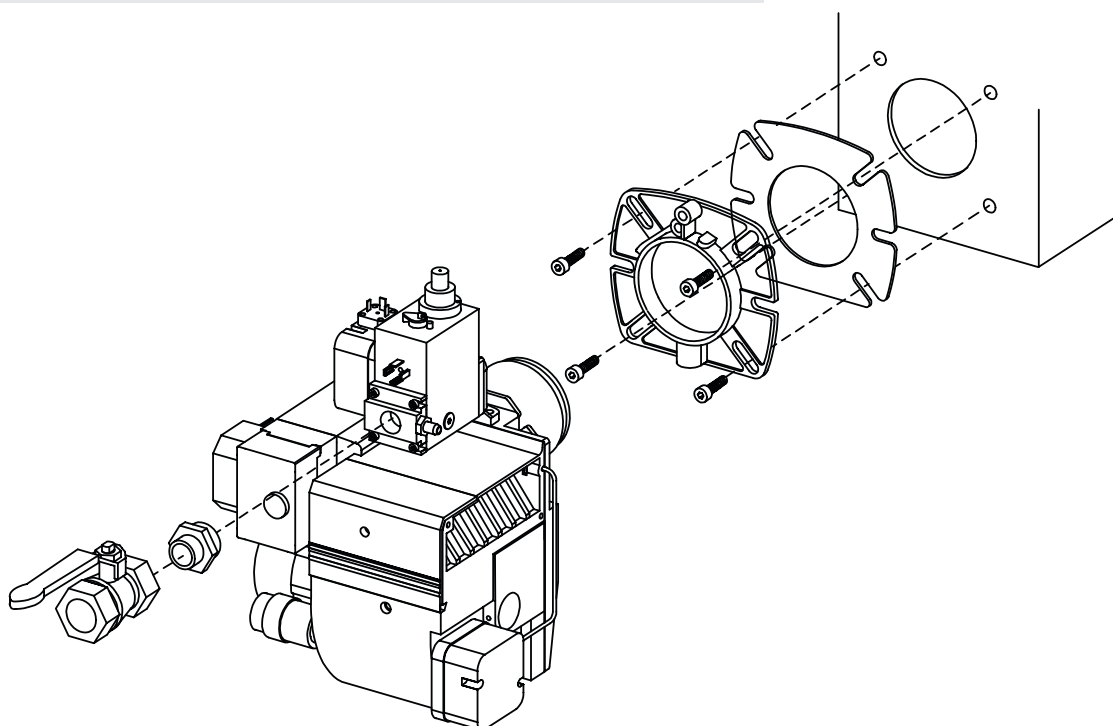
4.7 Installation example

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

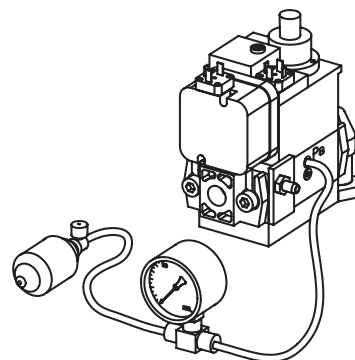
When making a leakage control of the gas supply system the solenoid valve should be closed. Connect a pressure gauge to the test nipple Pa, see fig. The test pressure in the system should be 1,5x max. inlet pressure or min. 150 mbar. If any leakage, locate the source by means of soapy water or a leak 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 (30-35sec.). 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.

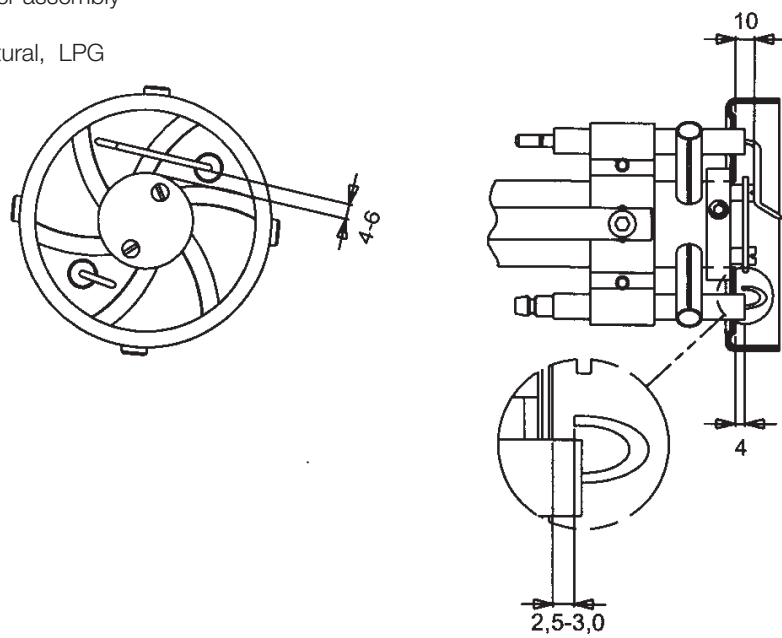
! If the burner is directly connected, ensure that all components on the burner are without power.



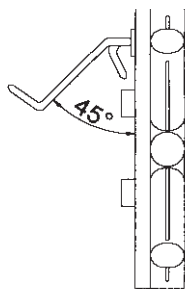
4.9 Gas nozzle

Inner assembly

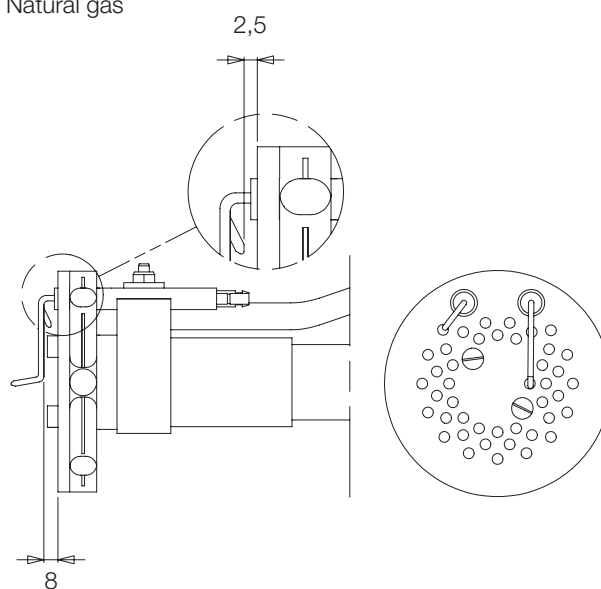
Natural, LPG



LPG

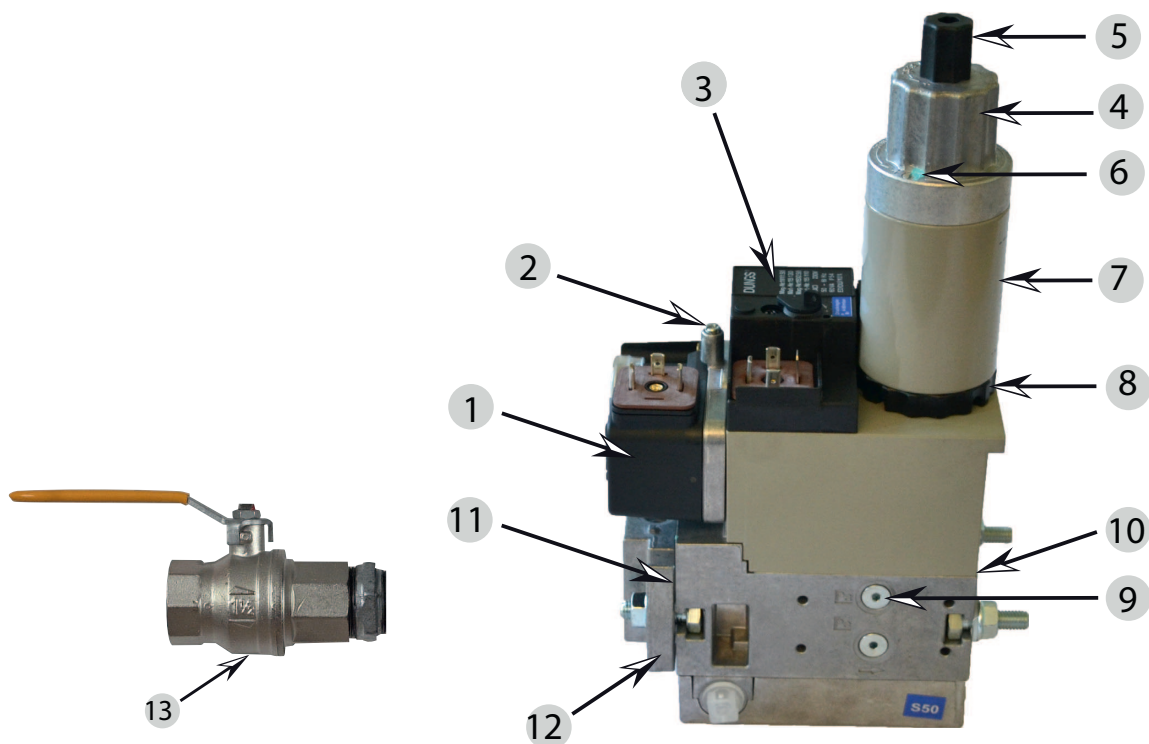


Natural gas



5.4 Multiblock MB-ZRDLE 405-412

! All gasline components shall be assembled and mounted without bending, torque and outhr mechanical or thermal stress.



1. Gas pressure switch
2. Inlet pressure
3. Governor with pressure adjustment
4. Hydraulic device, adjustment of stage 2
5. Protective cover, start gas adjustment
6. Lock screw for flow adjustment
7. Main valve
8. Knob for adjustment of stage 1
9. Test nipple, pressure after governor
10. Test nipple for nozzle pressure
11. Filter
12. Fixing flange
13. Ball valve

Max. inlet pressure: 360 mbar.
Adjustable governor pressure:
405 - 412 S50 = 4 - 50 mbar
415 - 420 S20 = 4 - 20 mbar
415 - 420 S50 = 20 - 50 mbar

Solenoid valve: Slow opening valves with adjustable start load, stage 1 and stage 2.

Turn to the left = the start gas flow is increased.

Flow adjustment 2-stage design

For stage 1, loosen the lock screw a. Turn the hydraulic device e:

to the right = the gas flow is reduced

to the left = the gas flow is increased

For stage 2, 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 lock screw again.

Adjustment of governor

Adjust outlet pressure from governor by means of a screw driver. Min. and max. outlet pressures correspond to appr. 60 turns of the spring. It is not possible to change pressure springs in order to change the outlet pressure.

Turn to the right = the outlet pressure is increased

Turn to the left = the outlet pressure is reduced

Adjustment of start gas flow

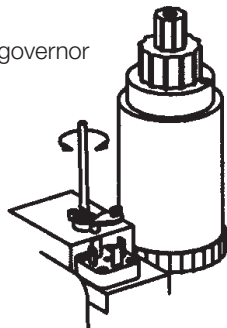
Remove the protective cover c.

Turn the adjustment knob d (use the protective cover as a tool) to the desired start gas flow.

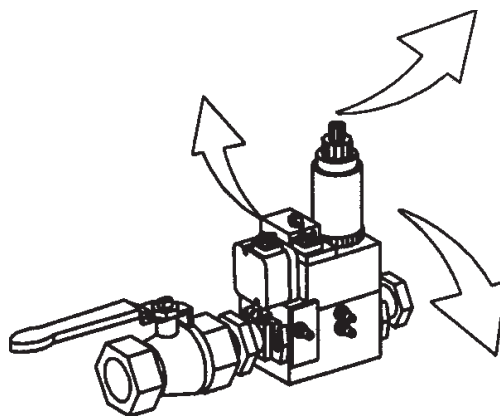
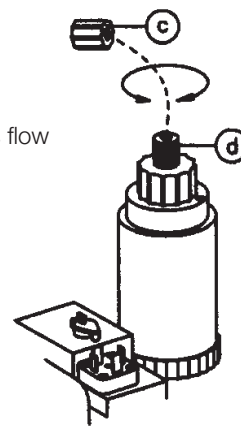
Turn to the right = the start gas flow is reduced

Turn to the left = the start gas flow is increased

Adjustment of governor

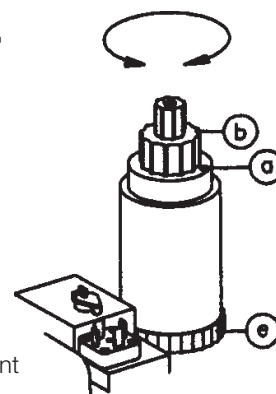


Adjustment of start gas flow



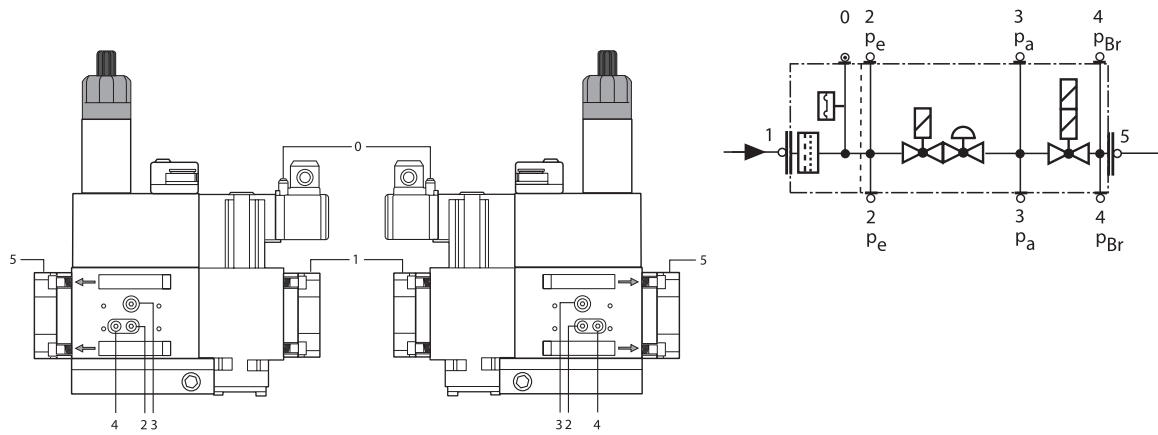
Multi-bloc MB-ZRDLE 405-420

Flow adjustment



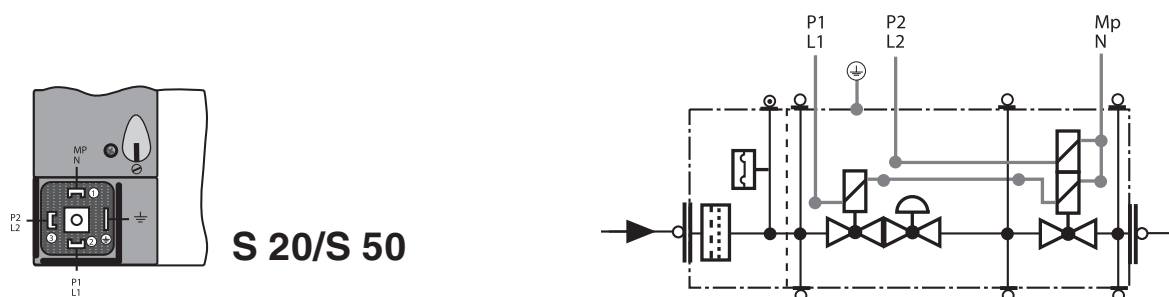
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5.4.1 Pressure taps



1,2,3,4,5 1/8 screwed sealing plug

5.4.2 Electrical connection



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 boiler in question.

All burner adjustments must be made in accordance with boiler 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 boiler room.

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 personell. 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.a larger gas armature or a different spring in the governor may be required).

Start up

After the burner has been fitted to the boiler 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.

Hower, 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

On all burners the air adjustment can be made with or without the cover fitted. Final fine adjustment must be made with the cover on.

Adjustment of burner head

The burners are equipped with an adjustment device changing the position of the brake plate in the burner head. This is used to adjust the correct pressure drop over the combustion device and thereby obtain a good pulsation free combustion.

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

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

Adjustment of brake plate

- Turn by means of an allen key the screw in the desired direction.

STG120/1, STG120/2, STG146/1

- To reduce the opening: turn the screw to the left.
- To increase the opening: turn the screw to the right.

STG146/2

- To reduce the opening: turn the screw to the right.
- To increase the opening: turn the screw to the left.

The adjustment of the position of the brake plate affects the air flow. It is therefore always necessary to make a fine adjustment of the air by means of the adjustment device of the burner.

Control of burner head

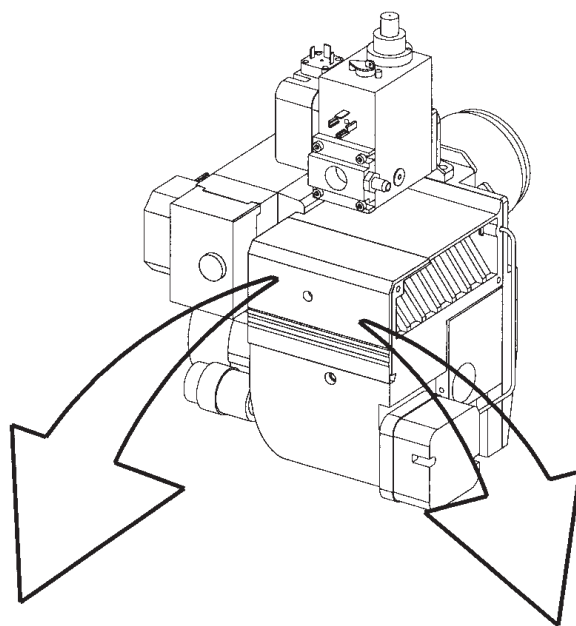
To check the burner head, brake plate and electrodes proceed as follows:

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 boiler. If it is necessary to remove the burner tube, loosen the two allen screws, turn and withdraw the burner tube.

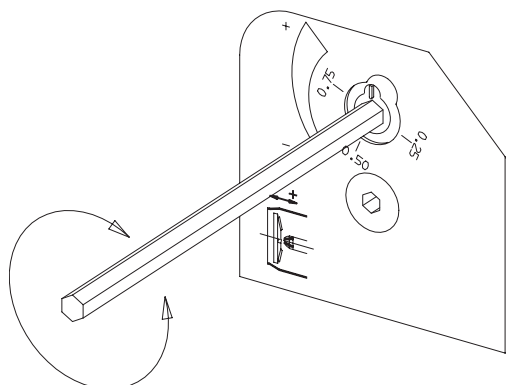
Commissioning of installation

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.

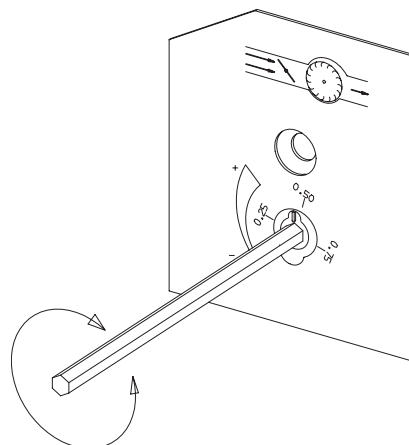
| Gas quality | CO ₂ % lambda 1,2 | O ₂ % | max. CO ₂ % |
|-------------|---------------------------------|------------------|------------------------|
| Natural gas | 10,0 | 3,5 | 11,9 |
| LPG | 11,5 | 3,5 | 13,9 |



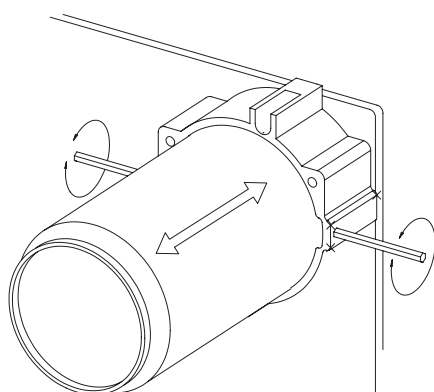
Adjustment of inner assembly



Air adjustment



Control of burner head



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):

| | | |
|----------|-------------------------|--|
| $V_0 =$ | Desired quantity of gas | [Nm ³ /h] |
| $Q =$ | Boiler output | [kW] |
| $H_u =$ | Gas heat value | [kWh/Nm ³] or [MJ/Nm ³] or [kcal/Nm ³] |
| $\eta =$ | Boiler efficiency | [%] |

Calculation example:

$Q =$ 50 kW

$H_u =$ Example A: 34020 MJ/Nm³

Example B: 9.5 kWh/Nm³

Example C: 8126 kcal/Nm³

$\eta =$ 90%

$$\begin{aligned}
 \text{Example A} \quad V_{0A} &= \frac{Q \cdot 3600}{H_u \cdot \eta} = \frac{50 \cdot 3600}{34020 \cdot 0.90} \approx 5.9 \text{ Nm}^3/\text{h} \\
 \text{Example B} \quad V_{0B} &= \frac{Q}{H_u \cdot \eta} \approx \frac{50}{9.5 \cdot 0.90} \approx 5.8 \text{ Nm}^3/\text{h} \\
 \text{Example C} \quad V_{0C} &= \frac{Q}{H_u \cdot 0.00116 \cdot \eta} = \frac{50}{8126 \cdot 0.00116 \cdot 0.90} \approx 5.9 \text{ Nm}^3/\text{h}
 \end{aligned}$$

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

| | | |
|-------|--|---------------------|
| $T =$ | Temperature of gas at the gas meter | [°C] |
| $B =$ | Barometer reading | [mbar] |
| $P =$ | Pressure of gas at the gas meter | [mbar] |
| $f =$ | Factor calculated for multiplication with flow in Nm ³ /h to arrive at actual flow in Nm ³ /h. | |
| $V =$ | Actual flow | [m ³ /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:

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

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

$$M = \frac{100}{1000} = 0.1 \text{ m}^3$$

$$t = \frac{1}{60} + \frac{10}{3600} = 0.0194 \text{ h}$$

$$V = \frac{M}{t} = \frac{0.1}{0.0194} \approx 5.1 \text{ m}^3/\text{h}$$

7.5 Flame monitoring and ionisation current check

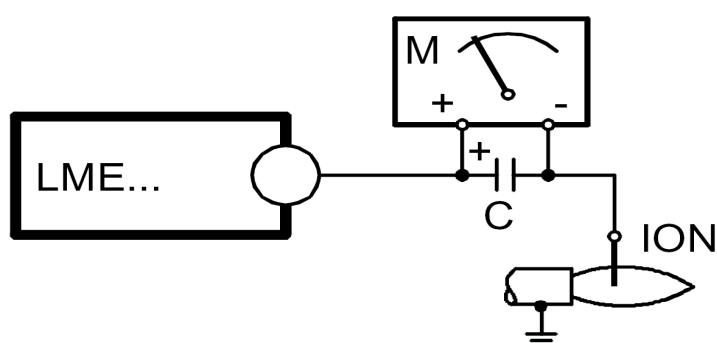
The standard version of the burner is monitored according to the ionisation principle. The ionisation current should be checked on initial start-up and at each service visit.

The reason for low ionisation current can be leakage current, poor connection to earth, fouling or incorrectly positioned ionisation electrode in the combustion head. Occasionally, an incorrect gas/air mix may result in poor ionisation current. Ionisation current is measured using a microammeter (μA) connected in series with the ionisation electrode and gas burner control. Connect the μ ammeter according to the diagram. The minimum required ionisation 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 ionisation cable.

Technical data

For continuous operation!

| | |
|--|---------------------------|
| Idle voltage at ION-terminals | AC 115-230 V |
| <div style="display: flex; align-items: center;"> <div style="font-size: 2em; margin-right: 10px;">!</div> <div>Protect the ionisation electrode from electric shock!</div> </div> | |
| 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 | $>5 \mu\text{A DC}$ |



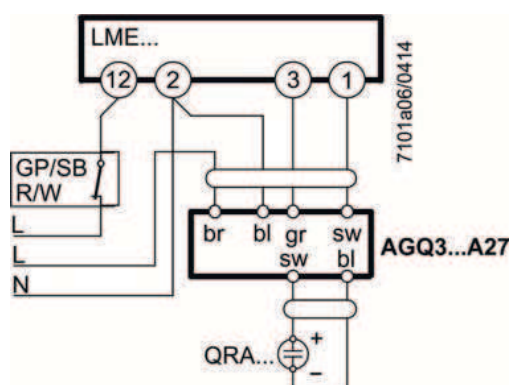
7.6 UV-Detector

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

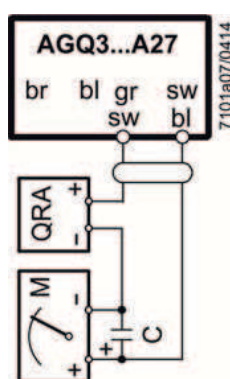
Ancillary unit AGQ3...A27

In connection with burner controls LMExx.xxxx2, 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...

7. 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 authorised personnel only

8. 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 pressostats, 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

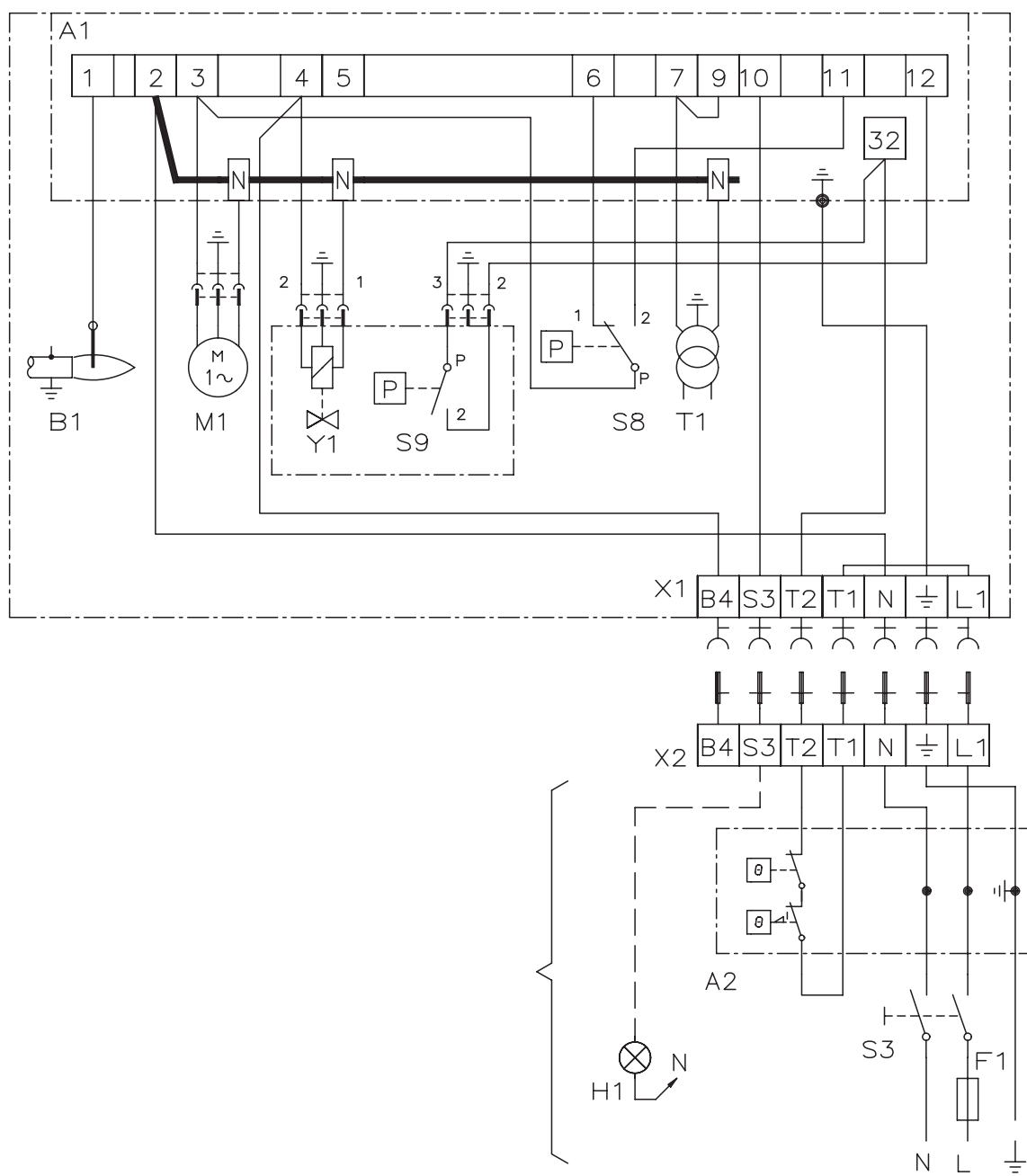
8.1 Safety system

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 LME



8.3 List of components

| | | | |
|----|----------------------|----|---------------------------|
| A1 | Burner control | S8 | Air pressure switch |
| A2 | Power control | S9 | Gas pressure switch |
| B1 | Ionization electrode | T1 | Ignition transformer |
| F1 | Operating fuse | X1 | Connection terminal board |
| H1 | Operating lamp | X2 | Earth terminal |
| M1 | Burner motor | Y1 | Solenoid valve 1 |
| S3 | Control thermostat | | |

8.3.1 Function LME...

| |
|---|
| 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 ionisation 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 thermostat |
| 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 |

8.4 Control program at faults; fault mode indicator LME

8.4.1 Colour codes

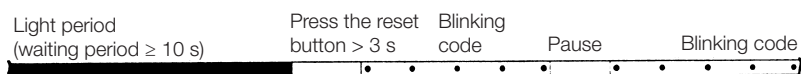
| Table colour codes for multi-coloured signal light (LED) | | |
|--|---------------|-----------------|
| Status | Colour codes | Colours |
| Waiting period «tw», other waiting periods | ○..... | Off |
| Ignition phase, ignition controlled | •○ •○ •○ •○ • | Blinking yellow |
| Normal operation | □..... | Green |
| Operation, poor flame signal | □○□○□○□○□○ | Blinking green |
| Illegal flame signal during start-up | □▲□▲□▲□▲□▲ | Green-Red |
| Undervoltage | ●▲●▲●▲●▲●▲ | Yellow-Red |
| Fault, alarm | ▲..... | Red |
| Blinking code for fault codes | ▲○ ▲○ ▲○ ▲○ | Blinking red |
| Interface diagnostics | ▲▲▲▲▲▲▲▲ | Red flicking |

| | |
|-------|------------|
| | Continuous |
| ○ | Off |
| ▲ | Red |
| ● | Yellow |
| □ | Green |

8.4.1.1 Diagnosing alarm causes

After alarm disconnection, the red alarm signal light is lit continuously.

The diagnosing of the alarm cause can be read according to the following sequence:



8.4.1.2 Limiting of starting repetitions

LME 11... has a function with start repetition if the flame is not created at start or disappears during operation.. LME 11... allows max. three repetitions during continuous starting cycle.

8.4.1.3 Alarm code table

| Red blinking code on signal lamp (LED) | Possible causes |
|--|--|
| Blinking 2 x .. | No flame creation at End of "TSA" - defective or fouled flame monitoring - defective or fouled fuel valves - poor burner setting - defective firing device |
| Blinking 3 x ... | "LP" defective - No air pressure switch signal after "t10" - "LP" is welded in open position |
| Blinking 4 x | Illegal flame signal during start-up |
| Blinking 5 x | Time out "LP" - "LP" is welded in open position |
| Blinking 6 x | Free |
| Blinking 7 x | Too many flame disappearances during operation - poor burner setting - defective or fouled fuel valves - defective or fouled flame monitoring |
| Blinking 8 x | Free |
| Blinking 9 x | Free |
| Blinking 10 x | Connection fault or internal fault, outgoing contacts or other faults |
| Blinking 14 x | CPI contact not closed |

During the diagnosing of the alarm cause, the control outputs are voltage-free.

- The burner is disconnected
- Exception, alarm signal «AL» at board 10
- Reconnection of the burner happens after resetting only.
- Press the reset button 0.5...3 s

8.4.1.4 Interface diagnostics

To change to interface mode, press and hold the reset button longer than 3 s. To go back to the normal position, press and hold the reset button longer than 3 s. If the gas burner control is in the alarm position, it is reset by pressing the reset button 0.5...3 s.

10. Troubleshooting

Gas Burner

Conditions favourable 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, boiler 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 ionisation 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 ionisation current or UV cell incorrectly positioned | Adjust ionisation 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 ionisation current | Adjust ignition electrodes. Re-polarise 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 | |
| Ionisation 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 | Boiler overloaded Decrease the gas volume, sweep the chimney if necessary |
| CO ₂ content too low | Choke the air supply. Check the boiler 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 boiler and chimney | |
| Flue gas temperature too low or gas volume too low | Raise the flue gas temperature by increasing gas volume Insulate the chimney |

11. General instructions for gasburners

11.4.1 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 boiler room is sufficiently dimensioned
4. Check by studying the data plate that the efficiency of the burner is adapted to the boiler 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 boiler 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

11.4.2 Maintenance

General instructions

1. Keep the boiler room clean
2. Ensure that the fresh air intake of the boiler room is not restricted
3. Switch off the current and shut off the gas supply if the burner must be withdrawn from the boiler
4. Do not use the boiler 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

11.4.3 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

11.4.4 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

11.4.5 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

Authorized installer::

Address:

Telephone:



Service- and inspection card

| | | | |
|---------------|--|--------|----------------|
| Installation | | Boiler | |
| Name: | | Type: | Efficiency kW: |
| Address: | | Burner | |
| | | Type: | Efficiency kW: |
| Installed by: | | Date: | |

| Date | | Governor | | CO ₂ | CO | Fluegas temp | Ionisation current | Pressure | | Efficiency |
|------|-----------------------|----------|-------|-----------------|----|--------------|--------------------|-----------|---------|------------|
| | Nm ³ gas/h | | | | | | | Fire room | Chimney | |
| | | Before | After | % | % | °C | μ A | mbar | mbar | % |
| | Small Flame | | | | | | | | | |
| | Large Flame | | | | | | | | | |
| | Measures | | | | | | | | | |

| Date | | Governor | | CO ₂ | CO | Fluegas temp | Ionisation current | Pressure | | Efficiency |
|------|-----------------------|----------|-------|-----------------|----|--------------|--------------------|-----------|---------|------------|
| | Nm ³ gas/h | | | | | | | Fire room | Chimney | |
| | | Before | After | % | % | °C | μ A | mbar | mbar | % |
| | Small Flame | | | | | | | | | |
| | Large Flame | | | | | | | | | |
| | Measures | | | | | | | | | |

| Date | | Governor | | CO ₂ | CO | Fluegas temp | Ionisation current | Pressure | | Efficiency |
|------|-----------------------|----------|-------|-----------------|----|--------------|--------------------|-----------|---------|------------|
| | Nm ³ gas/h | | | | | | | Fire room | Chimney | |
| | | Before | After | % | % | °C | μ A | mbar | mbar | % |
| | Small Flame | | | | | | | | | |
| | Large Flame | | | | | | | | | |
| | Measures | | | | | | | | | |

EU Declaration of conformity

Bentone Gasburners



| Certificate No. | Type | Certificate No. | Type |
|-----------------|---------|-----------------|--------|
| CE-0123CT1269 | BFG 1 | CE-0123CT1326 | BG 550 |
| CE-0123CT1270 | STG 120 | CE-0123CT1337 | BG 600 |
| CE-0123CT1281 | STG 146 | CE-0123CT1348 | BG 650 |
| CE-0123CT1292 | BG 300 | CE-0123CT1359 | BG 700 |
| CE-0123CT1304 | BG 400 | CE-0123CT1360 | BG 800 |
| CE-0123CT1315 | BG 450 | CE-0123CT1371 | BG 950 |

This declaration of conformity is issued under the sole responsibility of the manufacturer. The object of the declaration described above is in conformity with:

Gas Appliance Regulation 2016/426/EU

Machinery Directive 2006/42/EC

EMC 2014/30/EU

Restriction of the use of certain hazardous substances (RoHS) Directive 2011/65/EU

References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

EN 676+A2:2008

(excluded Annex J/K)

Automatic forced draught burners for gaseous fuels

Additional information can be downloaded at:
www.bentone.com

Enertech AB
Box 309
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Ljungby February 15th, 2018

Håkan Lennartsson
Managing Director
Enertech AB



