baltur

TECNOLOGIE PER IL CLIMA

CE

en

- Instructions for industrial Natural Gas burners:

TS 0 G
TS 1 G
TS 2 G
TS 3 G
TS 4 G

Cod. 0006080048

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Manufacturer's declaration

We hereby declare that our gas, light oil, heavy oil, and combination (gas/light oil or gas/heavy oil) burners are manufactured in conformance with current CE, CEI and UNI standards.

- BALTUR guarantees the "CE" certification provided that the burner is coupled to the "CE" gas train supplied by BALTUR and the "CE" gas line accessories (on request).

NOTE: this declaration is not valid with regard to EC or UNI Standards for gas burners or the gas part of duel-fuel burners (gas/light oil or gas/heavy oil) when such burners have been ordered in non-compliance with the EC Standard or Italian UNI Standard because they are to be used for special purposes not provided for in the above-mentioned standards.

0006080197 Rev.1

L' Amministratore delegato
Dott. Ricoardo Fava

- **Read careffuly the instructions before starting the burner and service it.**
- **The works on the burner and on the system have to be carried out only by competent people.**
- **The system electric feeding must be disconnected before starting working on it.**
- **If the woeks are not carried out correctly it is possible to cause dangerous accidents.**

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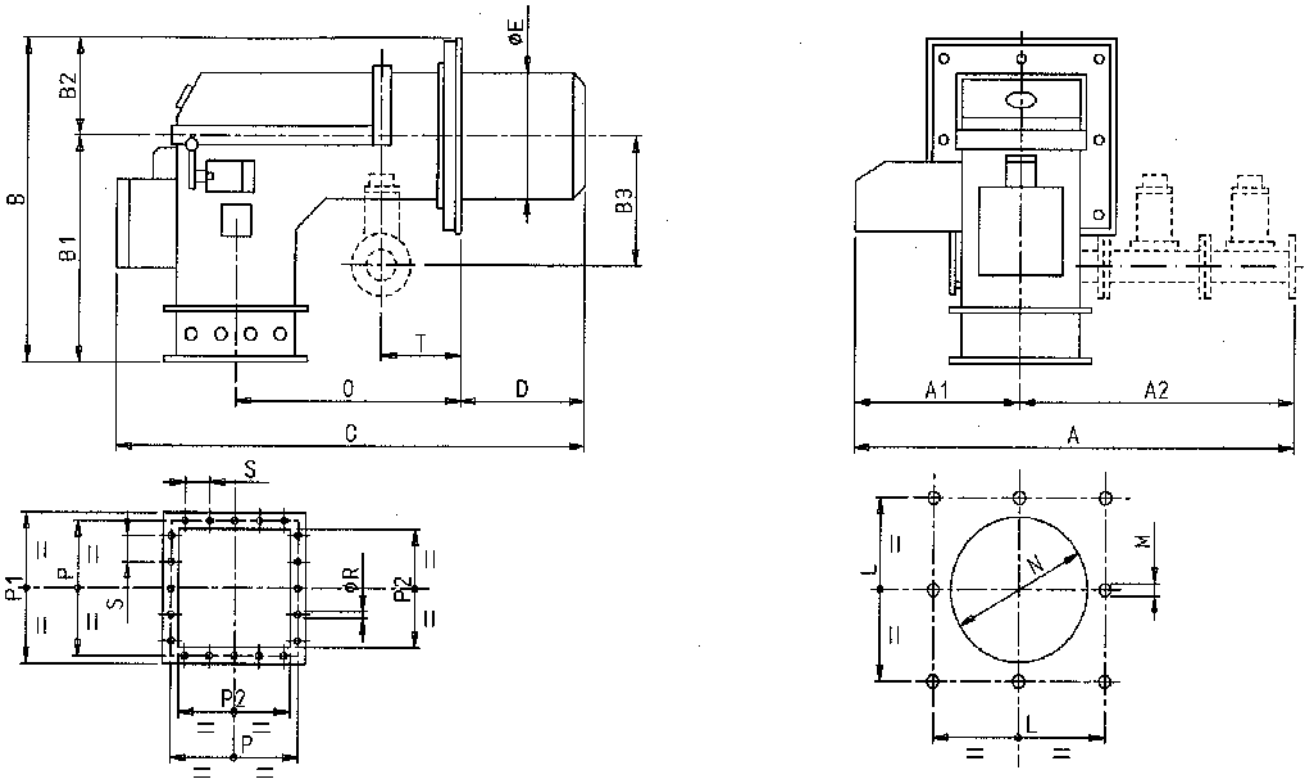
DIMENSIONI DI INGOMBRO
BRUCIATORI MODELLO "TS"
BURNER MODEL "TS"
OVERALL DIMENSIONS



Model	A	A1	A2	B	B1	B2	B3	C	D	E ø	L	M ø	N ø	O	P	P1	P2	R ø	S	T
TS 0 L	750	525	225	660	430	230	-	1095	265	285	390	M12	300	465	295	330	260	10	80	-
TS 1 L	**853**	**568**	**285**	**870**	**580**	**290**	**-**	**1525**	**385**	**320**	**490**	**M16**	**330**	**723**	**400**	**435**	**365**	**10**	**80**	**-**
TS 2 L	853	568	285	870	580	290	-	1515	375	400	490	M16	410	723	400	435	365	10	80	-
TS 3 L	**920**	**595**	**325**	**910**	**580**	**330**	**-**	**1700**	**455**	**450**	**570**	**M18**	**460**	**750**	**455**	**490**	**420**	**10**	**95**	**-**
TS 4 L	1025	645	380	1085	700	385	-	2115	580	550	680	M18	560	1040	555	590	520	10	120	-
TS 0 N	**750**	**525**	**225**	**660**	**430**	**230**	**-**	**1095**	**265**	**285**	**390**	**M12**	**300**	**465**	**295**	**330**	**260**	**10**	**80**	**-**
TS 1 N	853	568	285	870	580	290	-	1525	385	320	490	M16	330	723	400	435	365	10	80	-
TS 2 N	**853**	**568**	**285**	**870**	**580**	**290**	**-**	**1515**	**375**	**400**	**490**	**M16**	**410**	**723**	**400**	**435**	**365**	**10**	**80**	**-**
TS 3 N	920	595	325	910	580	330	-	1700	455	450	570	M18	460	750	455	490	420	10	95	-
TS 4 N	**1025**	**645**	**380**	**1085**	**700**	**385**	**-**	**2115**	**580**	**550**	**680**	**M18**	**560**	**1040**	**555**	**590**	**520**	**10**	**120**	**-**
TS 0 G	1165	525	640	660	430	230	350	1095	265	285	390	M12	300	465	295	330	260	10	80	165
TS 1 G	**1248**	**568**	**680**	**870**	**580**	**290**	**398**	**1525**	**385**	**320**	**490**	**M16**	**330**	**723**	**400**	**435**	**365**	**10**	**80**	**238**
TS 2 G	1328	568	760	870	580	290	388	1515	375	400	490	M16	410	723	400	435	365	10	80	238
TS 3 G	**1395**	**595**	**800**	**910**	**580**	**330**	**420**	**1700**	**455**	**450**	**570**	**M18**	**460**	**750**	**455**	**490**	**420**	**10**	**95**	**295**
TS 4 G	1605	645	960	1085	700	385	520	2115	580	550	680	M18	560	1040	555	590	520	10	120	375

DESCRIPTION "TS" Series INDUSTRIAL BURNERS (stripped head)

The "**TS**" burner consists of separately-supplied units. These must be connected together on the chosen site for the burner in accordance with directions issued by **BALTUR**.

A - Combustion head

B - Control panel

C - Liquid-fuel pumping unit

Should heavy oil be utilised, this unit also includes an electric preheater for the heavy oil. In addition, an auxiliary preheater is available upon request.

D - Gas-valve assembly for burners that utilise gaseous fuel (normally methane).

E - Electric fan for combustion air.

These burners are available in various different versions according to the type of fuel to be utilised:

- **GAS** (Methane) version **TS...G**
- **LIGHT OIL** version **TS...L**
- **HEAVY OIL** (viscosity rating 60°E at 50°C) version **TS...N**
- **GAS** (Methane) / **HEAVY OIL** (viscosity rating 60°E at 50°C) version **TS...GN**
- **GAS** (Methane) / **LIGHT OIL** version **TS...GL**

We would advise that burners **TS...GL** and **TS...GN** are designed for alternating use with methane or liquid fuel.
The nominal fuel delivery and thermal power of these burners, in the various versions, is as indicated by the following table.

MODEL	kg/h	Nm³/h	kW
TS 0 G	-	58 ÷ 292	584 ÷ 2920
TS 0 L	82 ÷ 245	-	973 ÷ 2920
TS 0 N	87 ÷ 260	-	973 ÷ 2900
TS 1 G	-	94 ÷ 468	930 ÷ 4650
TS 1 L	131 ÷ 392	-	1550 ÷ 4650
TS 1 N	130 ÷ 416	-	1550 ÷ 4650
TS 2 G	-	140 ÷ 702	1396 ÷ 6980
TS 2 L	196 ÷ 588	-	2327 ÷ 6980
TS 2 N	208 ÷ 625	-	2327 ÷ 6980
TS 3 G	-	233 ÷ 1167	2320 ÷ 11600
TS 3 L	326 ÷ 978	-	3867 ÷ 11600
TS 3 N	346 ÷ 1039	-	3867 ÷ 11600
TS 4 G	-	352 ÷ 1760	3500 ÷ 17500
TS 4 L	492 ÷ 1475	-	5833 ÷ 17500
TS 4 N	523 ÷ 1568	-	5833 ÷ 17500

- **"TS"** series burners are modulating with a modulation range of 1÷ 5 for the gas versions.
  For the light oil and heavy oil versions the modulation range is 1÷3. A servomotor adapts to changing heat requirements by simultaneously regulating the amount of combustion air and fuel as indicated by the probe in the boiler.

- The burners are fitted with a device that automatically modifies the passage through which the combustion air flows by varying its diameter; this variation is proportional to the change in output.
  Such device allows optimum combustion under all output conditions, since it optimises the air-fuel mixture; as a result there is less excess air and improved combustion quality

Fan, control panel, preheater (if fitted) and gas train are manufactured and supplied in accordance with the particular needs of the Customer and the working conditions of the burner.

CONNECTION OF THE BURNER TO THE GAS PIPELINE

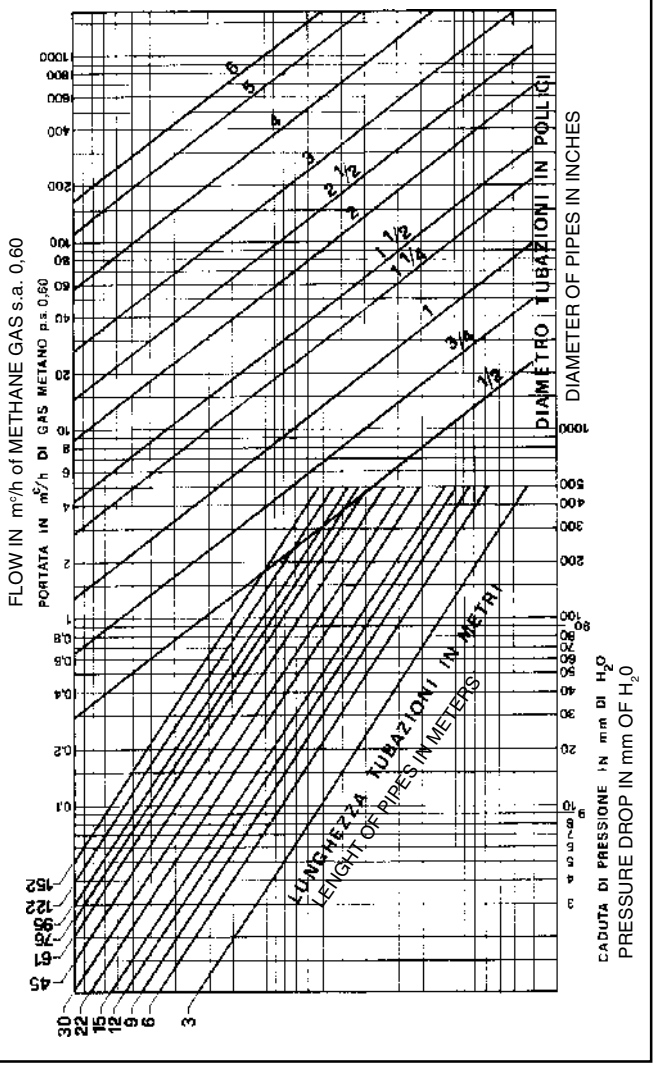
After fastening the burner to the boiler, make sure that the burner head enters the combustion chamber to the extent specified by the boiler manufacturer, and then proceed with connecting it to the gas pipeline.
We recommend installing on the pipeline, as near as possible to the burner, a three-piece fitting or a couple of flanges placed in such a way as to allow for the opening of the boiler's front door and/or disassembling of the burner.
Before closing this fitting, it is necessary to carry out a purge of the air contained in the pipeline.
Special care should be taken and all doors and windows opened.
Check the perfect tightness of the gas pipeline before the burner's final inspections.

GAS (METHANE) FEED SYSTEM FROM THE GAS PIPE NETWORK AND AVERAGE PRESSURE

(See BT 8530/1 and BT 8531/1)

When high delivery is required, the Gas Distributing Company requests the installation of a unit comprising a pressure reducer and a meter, and then connects the gas feed system to the gas pipe network at average pressure (a few bar).
This unit can be supplied by the Gas Distributing Company or by the user, but should be according to the Gas Company's precise instructions.
The unit's pressure reducer should be large enough to supply the maximum gas delivery required by the burner at the rate of pressure normally estimated for it.
From experience, we would recommend utilizing a large-sized reducer in order to attenuate the notable increase in pressure which occurs when the burner comes to a standstill, with a high delivery.
(Regulations require that the gas valves close in less than one second).
As an indication, we would advise using a reducer capable of producing a delivery (m^3/h) about double that of the maximum amount estimated for the burner.
If several burners are to be used, each one should have its own pressure reducer;
this will enable the gas feed pressure to the burner to be maintained at an almost constant level even if only one burner is operating at the time.
Consequently, it is possible to accurately regulate the delivery and therefore the combustion, and thus improve yield. The dimension of the gas pipeline should be in function with the quantity of gas it has to delivery. We advise maintaining the load loss at a low value, it should be kept in mind that the load loss is added to the pressure existing when the burner stops and therefore a subsequent start up will occur at a pressure that rises in accordance with an increase in the pipe's load loss.
Should the gas pressure reach unacceptable values when the burner stops (rapid closure of the gas valves), it is necessary to install between the reducer and the first valve of the burner an automatic overflow valve and relative conveying pipe, of suitable section, in the open air. The end of the conveying pipe in the open air should terminate in a suitable place, be protected from rain and have a flame trap.

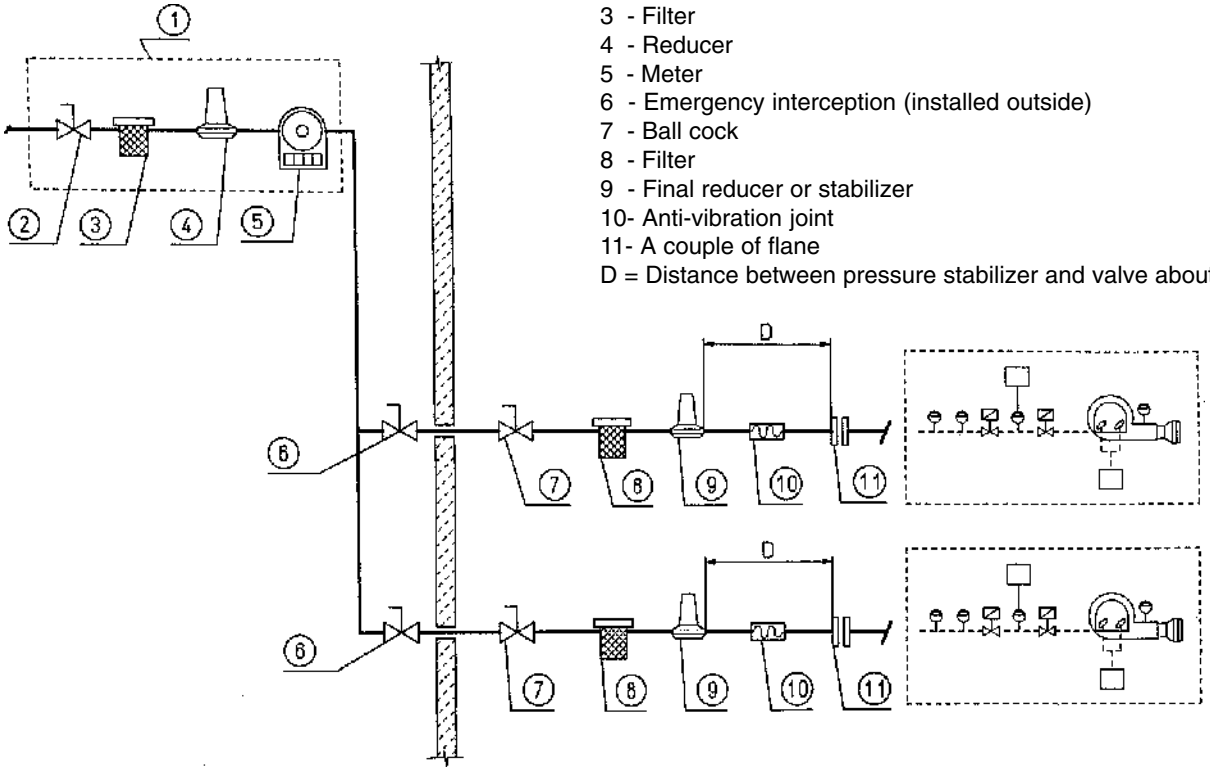
DIAGRAM FOR CALCULATING THE DIAMETER OF THE PIPES IN RELATION TO THEIR LENGTH AND GAS FLOW N° BT 8058



The overflow valve should be regulated in such a way as to completely unload excessive pressure.
See diagram for gas pipeline dimensions.

DIAGRAM OF CONNECTING MORE THAN ONE BURNER TO THE GAS PIPE NETWORK AT AVERAGE PRESSURE

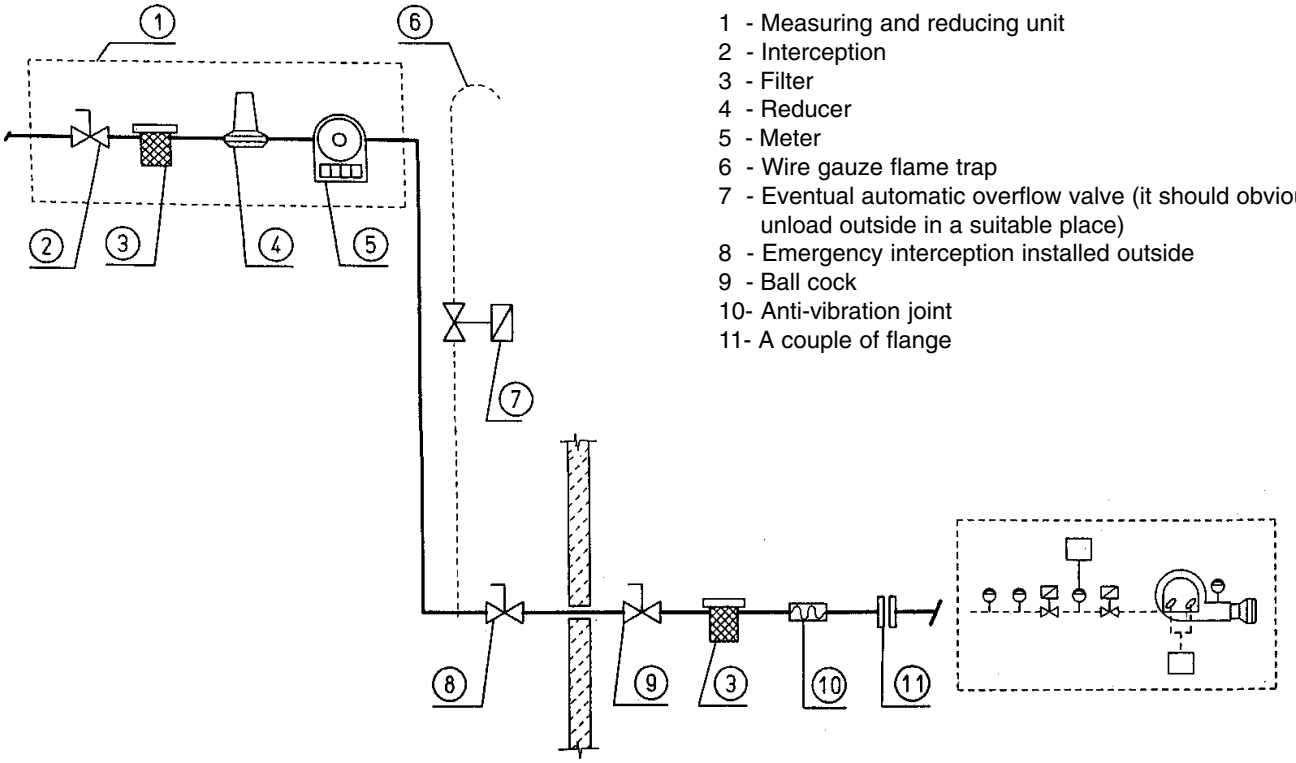
N° 8530-1



1 - Measuring and reducing unit
2 - Interception
3 - Filter
4 - Reducer
5 - Meter
6 - Emergency interception (installed outside)
7 - Ball cock
8 - Filter
9 - Final reducer or stabilizer
10- Anti-vibration joint
11- A couple of flane
D = Distance between pressure stabilizer and valve about 1,5 ÷ 2 m

DIAGRAM OF CONNECTING A BURNER TO THE GAS PIPE NETWORK AT AVERAGE PRESSURE

N° 8531-1



1 - Measuring and reducing unit
2 - Interception
3 - Filter
4 - Reducer
5 - Meter
6 - Wire gauze flame trap
7 - Eventual automatic overflow valve (it should obviously unload outside in a suitable place)
8 - Emergency interception installed outside
9 - Ball cock
10- Anti-vibration joint
11- A couple of flange

DESCRIPTION OF OPERATIONS WITH METHANE GAS (See BT 8810/2)

Control box Specifications

Control box & relative programmer	Safety Time in seconds	Pre-ventilation Time in seconds	Pre-ignition Time in seconds
LFL 1.333 Cyclic Relay	3	31,5	6
Post-ignition in seconds	Time between Opening Pilot valve and Opening Principle valve in seconds	Disconnection of Pilot valve after opening of Principle valve in seconds	Time between Opening Principle valve and Connection Modulation in seconds
3	12	3	12

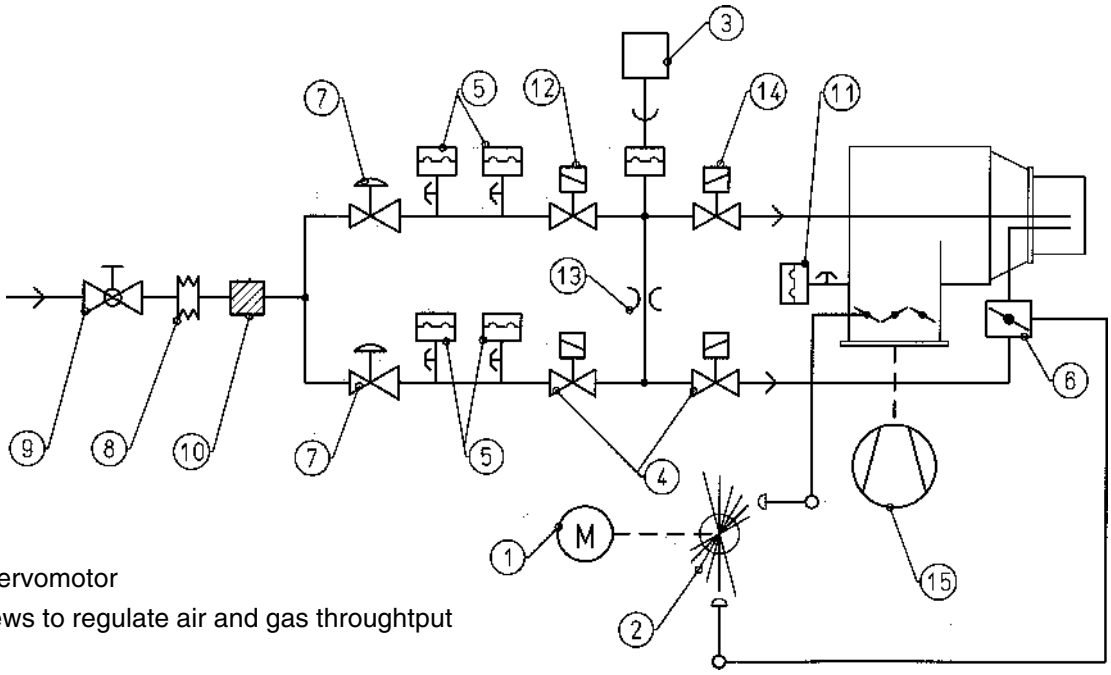
The through put rate variation range available is approximately from 1 to 1/5 in respect to the maximum throughput rate of the appliance. The burner is equipped with a limit microswitch which inhibits start-up if the flow regulator is not set to minimum. In accordance with safety standards, burner ignition is preceded by a pre-purge stage of the combustion chamber. During the pre-purge stage the air and gas supply regulating servomotor provides the maximum aperture, so that pre-purge, takes place with the maximum aperture for air intake.
From the above, the total pre-ventilation time is provided by:

air shutter opening time + pre-purge time + time for return of air shutter to minimum position .

If sufficient pressure is detected by the ventilation air pressurestat, the ignition transformer will cut in at the end of the ventilation phase and later the pilot flame valves will open.
The gas will now reach the combustion head, mix with the air delivered by the fan, and ignite.
Gas throughput is regulated by the flow regulator incorporated in one of the two pilot flame valves.
The ignition transformer disconnects after the pilot flame valves open. At the end of this sequence of events the burner will be running on pilot only. Pilot flame presence is monitored by the UV photocell.
At this point the programmer relay resets lockout position and supplies power to the main valves causing them to open.
The gas passes trough the main valves and flows out of the combustion head in the quantity permitted by the “minimum” setting of the flow regulator valve. The main flame of the burner is now ignited at the minimum setting.
The pilot circuit cuts out after the main valves open.
The modulator servo-motor cuts in after the main valves open, and on a consent signal from the modulating thermostat or pressurestat (assuming they are set a temperature or pressure value in excess of the temperature or pressure in the boiler), the servo-motor will start turning to provide a gradual increase in the supply of gas and combustion air until the maximum rated flow at which the burner has been set is obtained.
The burner continues to operate under maximum flow conditions until temperature or pressure reach a level that is sufficient to cause one of the modulation detectors to cut in; at this point the modulator servo-motor will turn in a reverse direction.
Reverse rotation of the servo-motor, and consequently reduction in throughput of gas and combustion air, is effected in a series of short steps.
By this method, the modulation system operates towards bringing into line the amount of heat supplied to the boiler and the heat that the boiler puts out to the service.
During operation of the burner, the modulating detector mounted on the boiler detects variations in the demand and automatically adjusts the supply of fuel and combustion air by causing the modulating servo-motor to turn in increase or decrease direction.
If even at minimum throughput the threshold value (temperature or pressure) setting of the shut down device is reached, the shut down device will operate and the burner will turn off.
When the temperature or pressure drops below the shut down device intervention threshold, the burner will cut in once again, following the sequence of events described above.
If a flame is not detected within the safeti time, the control equipment goes into “lockout” mode (complete shut down of the burner and illumination of the lockout indicator light).
To release the lockout condition, press the reset button.

BASIC DIAGRAM OF VALVE TRAIN BURNERS MOD. TS...G AND PYR...

N° BT 8810/2

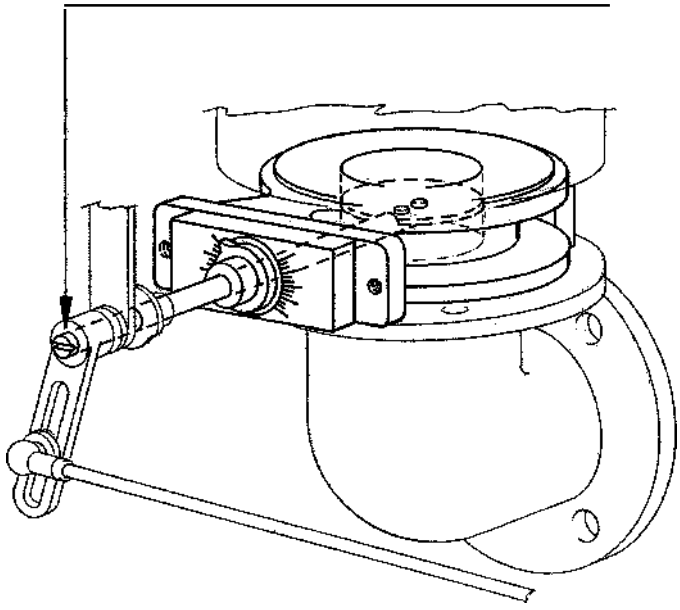


1 - Modulation servomotor
2 - Disk with screws to regulate air and gas throughtput (modulator)
3 - If fitted, valve seal control unit and relative pressurestat (DW)
4 - Main flame valves
5 - Min. and Max. gas pressurestats with pressure outlet ports
6 - Gas supply regulator valve
7 - Gas pressure reducers or stabilizers
8 - Vibration damping union
9 - Ball cock
10- Filter
11 - Air pressurestat
12 - Pilot flame valve
13 - If fitted, connection between pilot valve and main valves for valve seal control unit
14 - Pilot flame valve with flow regulator
15 - Fan

DETAIL OF BUTTERFLY VALVE DAMPER REGULATING GAS FLOW FOR TS... SERIES BURNERS

N° BT 8812

The slot on the end of the shaft indicates the position of the butterfly valve (damper)



MOUNTING BURNER TO BOILER

The burner must be fitted to the boiler's iron plate, interposing the heat protection flange supplied, where the stud bolts that are supplied with the unit have already been fitted in accordance with the drilling template.
The stud bolts be electrically welded to the inside of the plate to avoid extracting them with the unit's locking nuts should the burner be disassembled. When the plate is not fitted with heat insulation, it is necessary to fit a heat protection flange at least 10 mm. thick between the plate and the boiler.
Make sure that the combustion head projects into the combustion chamber to an extent as per the boiler manufacturer's specifications. The burner can be fitter with a standard length or an extra long combustion head on request.

ELECTRICAL CONNECTIONS

The burner's electrical connections are reduced to a minimum. It is advisable to make all connections with flexible electric wire. The electric lines should be at an adequate distance from hot parts.
Make sure that the electric line to which the unit will be connected has frequency and voltage ratings suitable for the burner. Check that the main line, the relevant switch fuses (essential) and the current limiter (if required) are capable of withstanding the maximum current absorbed by the burner.
For details, refer to the specific electric diagram for every burner.

READING GAS (METHANE) METER

When the burner is operating at maximum output, check that the quantity of gas delivered is necessary for the boiler's needs. The low calorific value for methane gas is about 8550 kcal/m^3.
To find out the low calorific values of other types of gas, contact the Gas Distributing Company.
Delivery per hour should be taken at the meter. When checking delivery make sure that gas is not being consumed by other users. If the gas delivery pressure at the meter is not above 400 mm.W.C., take into consideration the value indicated by the meter without correcting it.

For a first indication, turn on the burner and when it arrives at nominal delivery, measure the gas output in one minute exactly (the difference between the two readings should be one minute exactly from one to the other.
Multiply this value by 60 in order to obtain the output for 60 minutes (one hour). The output measured is considered the actual value if the meter reads a pressure not above 400 mm.W.C. If the pressure is more than 400 mm.W.C., the value read must be multiplied by a correction coefficient, as previously described.
Subsequently, multiply the delivery per hour (m^3/h) by the gas calorific value to obtain the potentiality delivered in Kcal/h; this should correspond or be very near to that requested for the boiler
(low calorific value for methane gas = 8550 kcal/m^3).
Do not allow the burner to operate for a long time (only a few minutes) if the output exceeds the maximum allowed for the boiler, to avoid possible damage to it; it would be timely to stop the burner immediately after having taken the two meter readings.

Correcting the value indicated by the meter
If the meter measurer the gas delivery at a pressure above 400 mm.W.C., it is necessary to multiply the value by a correction coefficient. As an indication, the correction coefficient values to be adopted in function with the gas pressure existing at the meter, can be determined in the following way:
Add to number 1 (one) the number which expresses the gas pressure value in bar, existing at the meter.

Example n° 1
Gas pressure at the meter = 2 bar, the multiplication coefficient is 1 + 2 = 3.
Therefore, if the meter reads a delivery of 100 m^3/h, multiply it by 3 to obtain the actual output which is
100 m^3/h x 3 = 300 m^3/h.

Example n° 2
Gas pressure at the meter = 1,2 bar, the multiplication coefficient is 1 + 1,2 = 2,2.
Therefore, if the meter reads a delivery of 100 m^3/h, multiply it by 2,2 to obtain the actual output which is
100 m^3/h x 2,2 = 220 m^3/h.

Example n° 3
Gas pressure at the meter = o,3 bar (3000 mm.W.C.), the multiplication coefficient is 1 + 0,3 = 1,3.
Therefore, if the meter reads a delivery of 100 m^3/h, multiply it by 1,3 to obtain the actual output which is 130 m^3/h.

Example n° 4
Gas pressure at the meter = 0,06 bar (600 mm.W.C.), the multiplication coefficient is 1 + 0,06 = 1,06.
Therefore, if the meter reads a delivery of 100 m^3/h, multiply it by 1,06 to obtain the actual output which is
100 m^3/h x 1,06 = 106 m^3/h.

STARTING UP AND REGULATION WITH METHANE GAS

1) If not already done at the moment of connecting the burner to the gas pipeline, it is indispensable to carry out a purge of the air contained in the pipeline. As a precaution, special care should be taken and doors and windows should be opened. Open the pipe union on the pipeline situated near the burner and then open a little the gas cut-off cock (or cocks).
When the characteristic odour of gas can be smelled, close the cut-off cock. Wait until the gas present in the room has dispersed, and then reconnect the burner to the gas pipeline.
Subsequently, re-open the gas cut-off cock.

2) Check that there is water in the boiler and that the system's gate valves are open.

3) Check, with absolute certainty that the discharge of combustion products can take place freely (boiler and chimney lock-gates should be open).

4) Make sure that the voltage of the electric line to which the burner is to be connected, corresponds to that required by the burner and that the electrical connections (motor or principle line) have been prepared to match the voltage rating available.
Also check that all the electrical connections carried out on the spot are in accordance with our electric wiring diagram.

5) Make sure that the combustion head is long enough to enter the furnace to the extent specified by the boiler manufacturer.

6) Remove the protection cover from the disk carrying the air and gas flow regulator screws and slacken the screws that block the regulator screws.

7) Check that the air regulator device on the combustion head is in correct position for the fuel throughput required (the air passage between the diffusor disk and the head must be small for low throughput and relatively wide when throughput is higher).
See "Combustion head airflow regulation" heading.

8) Fit a pressure gauge with suitable full scale (where the pressure level envisaged allows, a liquid manometer is preferable; do not use pointer gauges for low pressures) to the pressure outlet port on the gas pressurestat.

9) Open, as far as considered necessary, the flow regulator incorporated in the pilot flame valve(s).
Also check that the combustion airflow control shutter is sufficiently open; if necessary, alter the position by acting on the regulator screws on the regulator disk.

10) With the burner panel switch on "O" and the master switch in 'make', that the fan motor rotates in the correct direction.
If necessary, reverse two phases of the motor power supply line to change the direction.

11) Now switch the panel switch to "I" and turn the modulation switches to MIN (minimum) and MAN (manual).
With the control system receiving electrical power, the programmer will cause the burner to start up as described under the foregoing heading "Description of natural gas operation".
During pre-purge time, check for operation of the air pressurestat, the contacts of which should change from a pressure-zero 'make' to a pressure-positive 'make'. In the event that the pressure is sufficient and the pressurestat fails to respond, neither the ignition transformer nor the pilot flame gas valves will operate so the burner will shut down in lockout.

Note that lockouts during this first ignition sequence should be considered normal since the fuel supply line will still contain air which must be purged before a stable flame can be obtained.
Press the “reset” button to re-start.

UV Cell

If flame detection is carried out with the UV cell, the following should be taken into consideration.
Even the slightest greasiness will compromise the passage of the ultraviolet rays through the UV photoelectric cell bulb, thus preventing the sensitive internal element from receiving the quantity of radiation necessary for it to function properly.
Should the bulb be fouled by light oil, fuel oil, etc., it is indispensable to clean it thoroughly.
It should be pointed out that even by simply touching the bulb with the fingers, it is possible to leave a slight greasiness which could compromise the working of the UV photoelectric cell.
The UV cell does not “see” daylight or light from an ordinary lamp.
It is possible to verify its sensibility with a flame (or cigarette lighter or a candle) or with the electric spark that occurs between electrodes in an ordinary ignition transformer.
To ensure that the UV cell works properly, its current value should be sufficiently stable so as not to fall below the minimum value required for the specific control box.
It may be necessary to search experimentally for the best position by sliding (axial or rotation movement) the body that contains the photoelectric cell in respect to the fastening clamp.
An inspection can be carried out by inserting a microammeter, with an adequate scale, in series to one of the two UV photoelectric cell connection wires. It is obviously necessary to respect the polarity (+ e -).
The minimum cell current value, to ensure the correct operation of the control box, is shiwn on the wirung diagram.

12) As soon as the burner is ignited at low flame (main flame valve open and modulator on minimum) make a visual inspection of the strength and appearance of the flame, making any corrections required (adjust the gas or air regulator screws on the modulating disk).
The next step is to take a meter reading of the volume of gas put through the burner (see the “Meter Reading” section).
If necessary, a further correction in the gas flow may be made as described above.
Once fuel and air flow are satisfactorily regulated, a check must be made on combustion characteristics, using the appropriate instruments.
If the air/gas ratio is correct the level of carbon dioxide (CO_2) per unit of fuel put through should be approximately - in the case of natural gas - 8% at minimum burner output, rising to an optimum 10% at maximum output.
We recommend that the value of 10% should not be exceeded, as operation in too limited an excess of air can give rise to unacceptable carbon monoxide (CO) levels (due to variations in atmospheric pressure, or dust deposits in the air lines).
It is essential to verify, using the appropriate instrument, that the percentage of CO in flue gases does not exceed the maximum permissible level of 0,1%.

13) After having regulated gas throughput for the minimum flame setting, set the modulation switches to “MAN” (manual) and “MAX” (maximum).

14) The modulating servo-motor will now start up. wait until the modulator disk has moved through an angle of about 12° (corresponding to the space occupied by three screws) and then interrupt modulation by turning the switch back to “O”. Make a visual check on the flame and if necessary regulate gas and air throughput rates using the regulator screws on the modulator disk.
This procedure must be repeated throughout the whole modulation travel of the disk, making adjustments in air and gas throughput at 12° intervals.
It is important to check that the gas and air flows rates rise gradually and that maximum rates are obtained at the end of the modulation range.
This conditions is essential to ensure that the modulation provides smooth and gradual increase or decrease in burner output.If necessary, change the position of the screws controlling fuel throughput to obtain this result.

15) At this point, with the burner providing the maximum heat output required by the boiler, check combustion using the appropriate instruments and, if necessary, modify the previous setting made solely on the basis of visual inspection. (CO_2 max. = 10% which corresponds to an O_2 value of about 3% - CO max. = 0,1%).

16) It is very important to carry out an instrument assisted check on combustion and modify, where necessary, the initial visual setting, this must also be effected in a series of intermediate positions of the modulation range.

17) Now check that the modulation system is operating correctly by turning the AUT - O - MAN switch to “AUT” and the MIN - O - MAX switch to “O”.
With this setting the modulation function will cut in automatically only in response to requests from the boiler detector. Under normal conditions there will be no need to alter the internal adjustment of the RWF... controller; in case this should become necessary, however, instructions have been included under a separate heading in this manual.

18) The air pressurestat has the task of locking out the burner when air pressure is not within the planned range.
The pressurestat must therefore be set close (the contact is designed to be closed when the burner is operating) when the burner air pressure reaches the minimum permissible value.
The air pressurestat circuit features a self-test function and incorporates a contact that should be closed when the burner is in the “rest” mode (fan idle, zero air pressure in burner) :
ensure that this contact is made; if this is not the case the self-test and command circuit will not operate (the burner will not start).
Note that if the contact designed to be closed during operation fails to close (insufficient air pressure), the appliance goes through the ignition cycle but the ignition transformer remains inhibited and the gas pilot valves will not open; the burner will consequently shut down in lockout.
To check that the air pressurestat is operating correctly, steadily increase the pressurestat regulation value with the burner operating at minimum output until such a time as the pressurestat cuts in: the burner must immediately shut down in lockout.
Reset the burner by pressing the “reset” button and return the pressurestat setting to a value that enables it to detect the air pressure created during the pre-purge stage.

19) The gas pressurestats (minimum and maximum pressure) prevent the burner from operating when gas pressure is not within planned range.
Given the specific functions of these pressurestats, it follows that the minimum pressure control switch must utilize the contact that is closed when the switch detects pressure higher than its own setting.
The maximum pressure control switch, on the other hand, must utilize the contact that is closed when the switch detects pressure lower than its own setting.
Minimum and maximum gas pressurestats must be set during burner testing, in relation to the pressure values detected from time to time.
The pressurestats are connected in series, therefore operation (i.e. opening of the circuit) of either one of the switches does not consent switch-on of the equipment.
Correct gas pressurestat operation must be checked during burner testing.
By using the adjustment devices, it can be verified whether the pressurestat that must stop the burner (by opening the circuit) effectively operates.

20) Check that the flame supervision device (UV photocell) is operating correctly by sliding it out of its seat on the burner and checking that the burner effectively locks out.

21) Check that the boiler thermostats or pressurestats are operating correctly they must cause the boiler to shut down when they cut in).

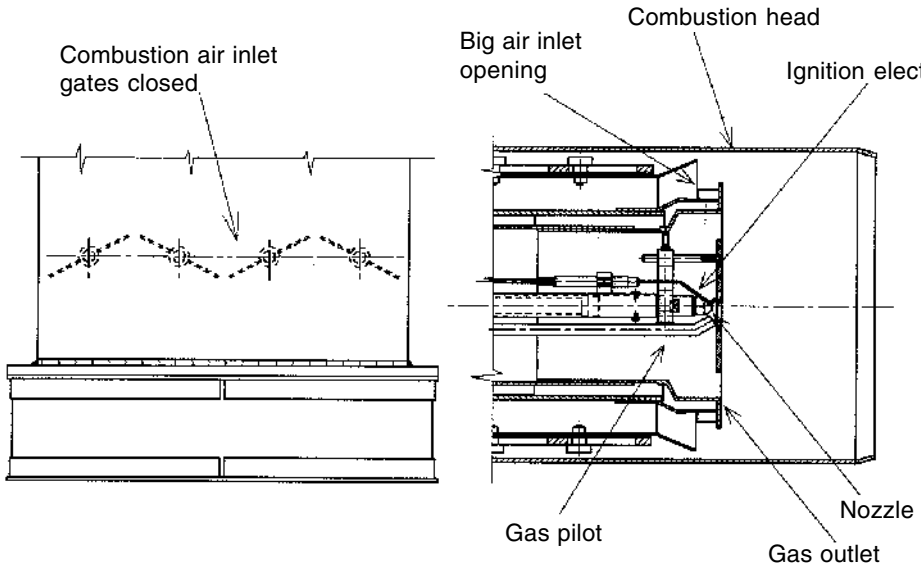
REGULATING COMBUSTION HEAD AIR FLOW

The combustion head is equipped with a device that automatically regulates the passage between the diffusor disk and the head, admitting combustion air to the head.
This passage can be restricted to obtain high pressure upstream of the diffusor disk, even with low fuel throughput, so that high velocity and turbulence ensure that the air penetrates the gas more thoroughly, giving an optimum fuel/air mixture and a stable flame.
With gas burners, it can be essential to have high air pressure on the diffusor inlet side if pulsation of the flame is to be prevented, especially where the burner operates in a high pressure combustion chamber, or in high thermal load conditions. Accordingly, the head must be adjusted in such a way that a substantially high pressure is always generated upstream of the diffusor. It is recommended that the passage of air allowed through to the head be restricted in such a way that there is a generous opening of the air shutter regulating the air flow supplied by the burner fan.
To achieve this, adjust the screws on the modulation disk.
When the regulation is complete, remember to tighten the screws locking the regulator screws.

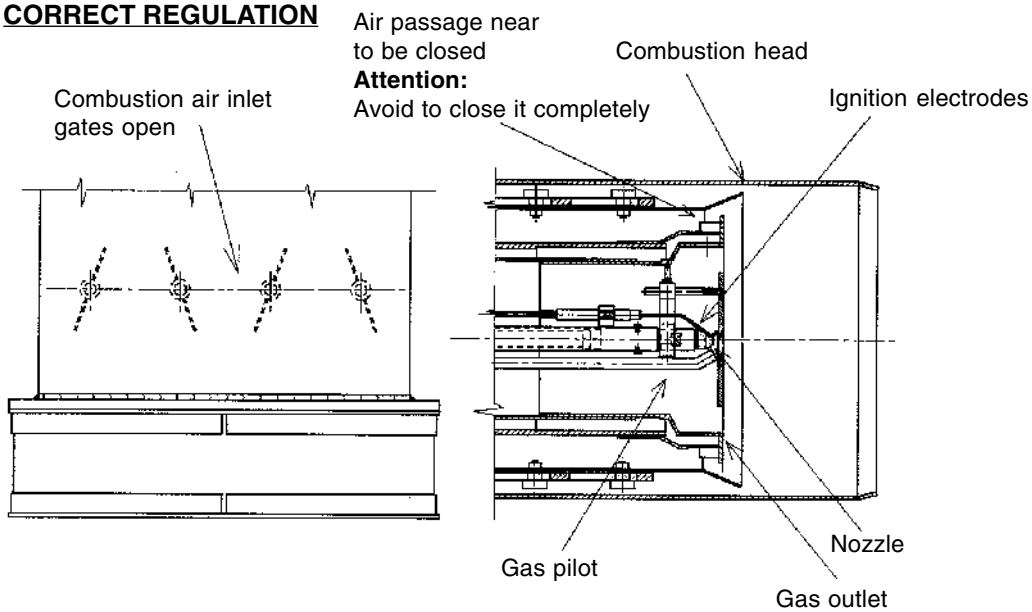
AIR REGULATION PRINCIPLE DIAGRAM

N° BT 8869/1

WRONG REGULATION



CORRECT REGULATION



USE OF THE BURNER

The burner operates fully automatically: it is activated by closing the main switch and the control board switch.
Burner operations are controlled by commend and control devices, as described in the chapter “Description of Operations”.
The “shut down” position is a safety position automatically taken up by the burner when a particular part of the burner or of the system is inefficient.
Therefore, it is good practice, before unblocking the burner and starting it up again, to check that there are no defects in the heating plant.
The length of time that the burner rests in the “shut down” position is without limit.
To unblock the control box, press the appropriate pushbutton.
“Shut down” can be caused by transitory flows (a little water in the fuel, air in the pipes, etc.); in these cases, if unblocked, the burner will start up normally.
When, however, shutdowns occur repeatedly (3 or 4 times), do not persist in trying to unblock the burner, first check that there is fuel in the tank and then call the local service to repair the defect.

SERVICING

The burners do not require particular servicing, it is good practice, however, that authorized personell performs the following operations, at least at the end of the heating season:

1) Clean to photocell

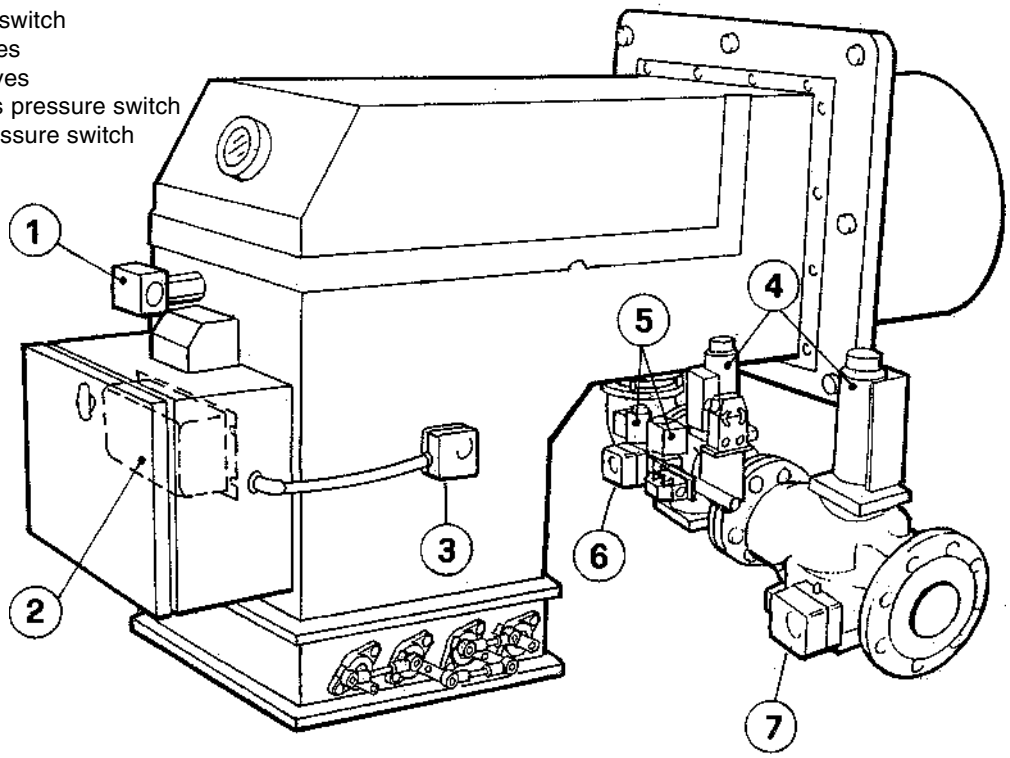
2) For gas burners, periodically check that the gas filter is clean.

3) Clean the combustion head by dismantling the blast pipe into its component parts.
Take care during reassembly that the ignition electrode is correctly positioned, checking that the spark jumps only between the electrode and the central drilled pilot flame disk.

DETAILS TS 1 - 2 - 3 - 4 G

N° 0002933550

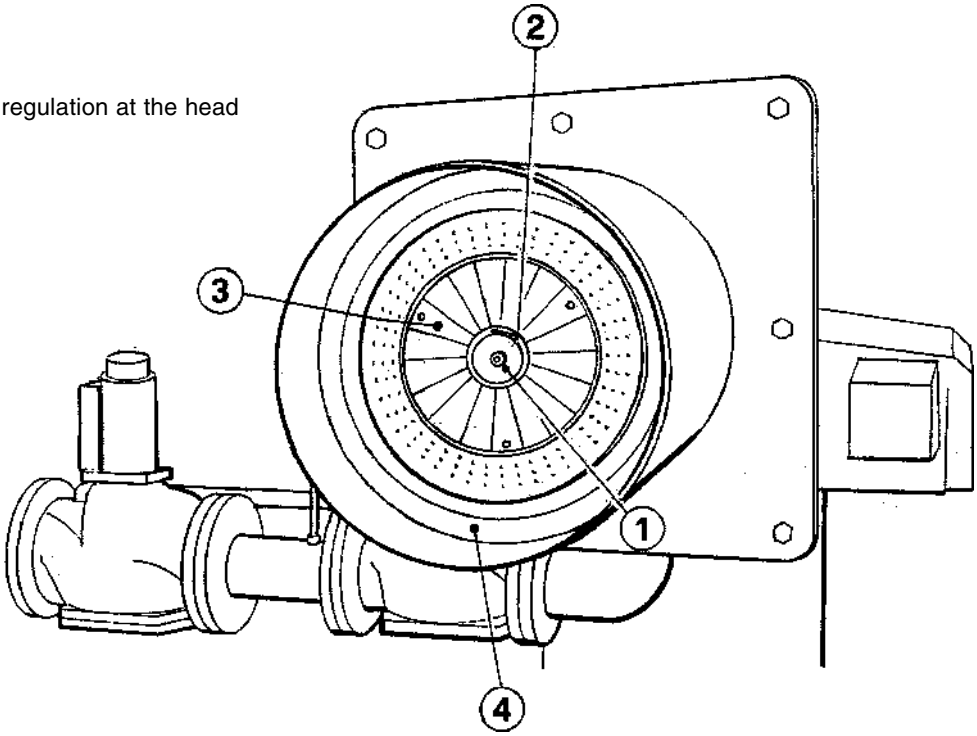
1 - UV Photocell
2 - Ignition transformer
3 - Air pressure switch
4 - Main gas vlves
5 - Pilot gas valves
6 - Min. pilot gas pressure switch
7 - Max. gas pressure switch



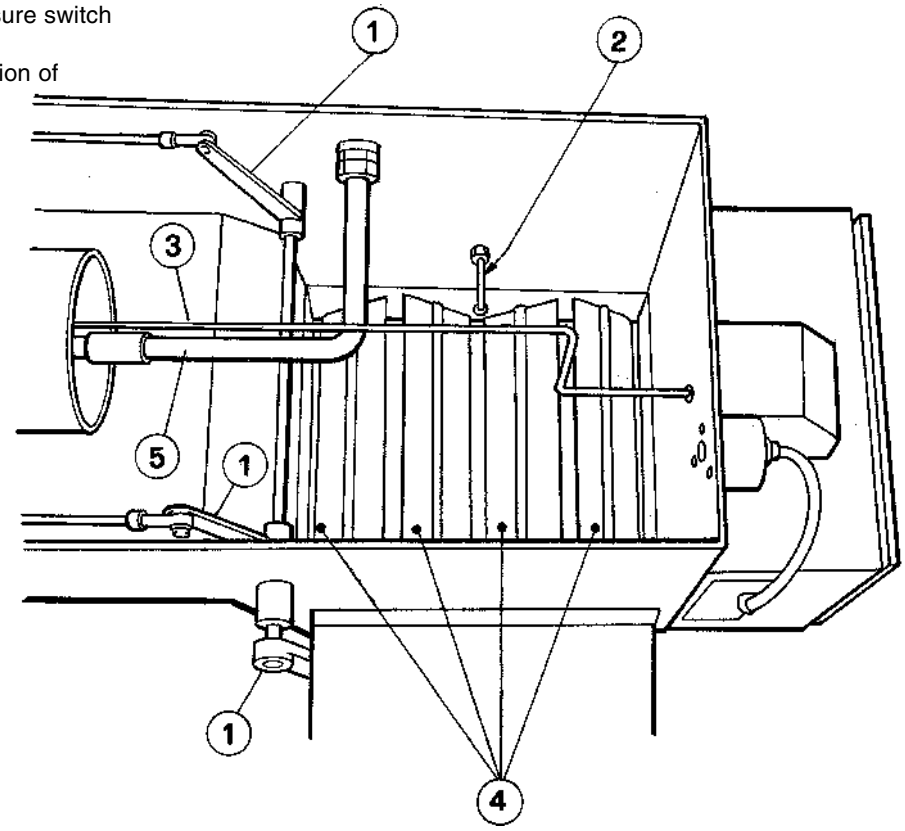
TS...G COMBUSTION HEAD

N° 0002933510

1 - Pilot flame
2 - Ignition electrode
3 - Flame disk
4 - Device for the air regulation at the head

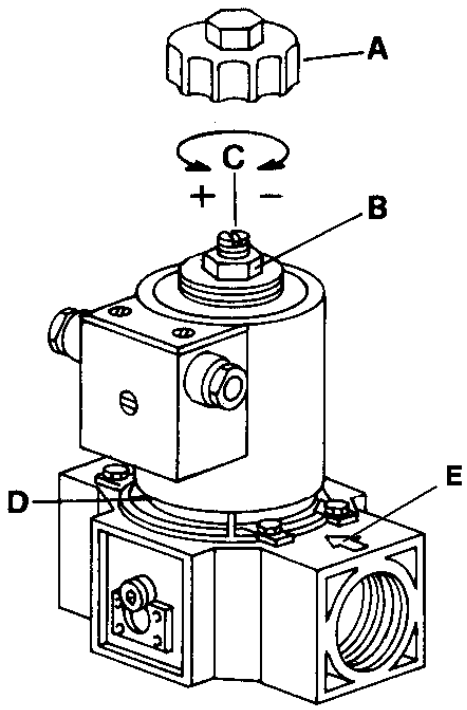


1 - Driving rod of the air adjustment device ai the head
2 - Pipe tap for air pressure switch
3 - Ignition electrode
4 - Gates for the regulation of the combustion air
5 - Pilot flame



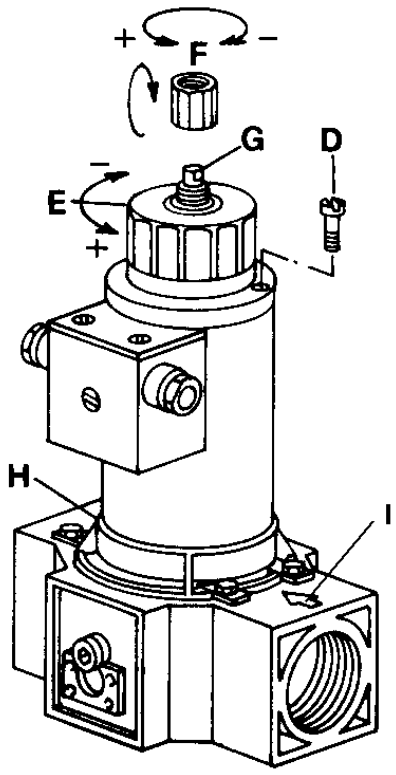
Mod. MVD....

8875.tif



D = Identification plate
E = Flow direction indicator

Mod. MVDLE....



H = Identification plate
I = Flow direction indicator

The MVD gas valves open and close rapidly.
To regulate the gas flow, unscrew and remove cap “A” and loosen nut “B”.
Then, using a screwdriver turn screw “C”. Unscrewing it increases the gas flow, tightening it decreases the flow.
After regulating, lock nut “B” in place and reposition cap “A”.

HOW THE VALVE FUNCTIONS mod. MVDLE

The gas valve has a rapid initial trip (opening can be adjusted from 0 to 40% using pin “G”). Full opening from that point on takes place slowly over approximately 10 seconds.

N.B. There will not be sufficient supply for ignition if the flow feed device “E” is set at its minimum position. Therefore, it is essential to open the maximum flow rate control device “E” sufficiently to ensure ignition.

Setting the initial rapid release trip

To set the initial rapid release, unscrew the protection cap “F” and use the back of this cap as a tool to turn pin “G”.
Turning clockwise decreases the gas flow, turning counter-clockwise increases it.
This done, return cap “F” to its original position.

Setting maximum gas flow

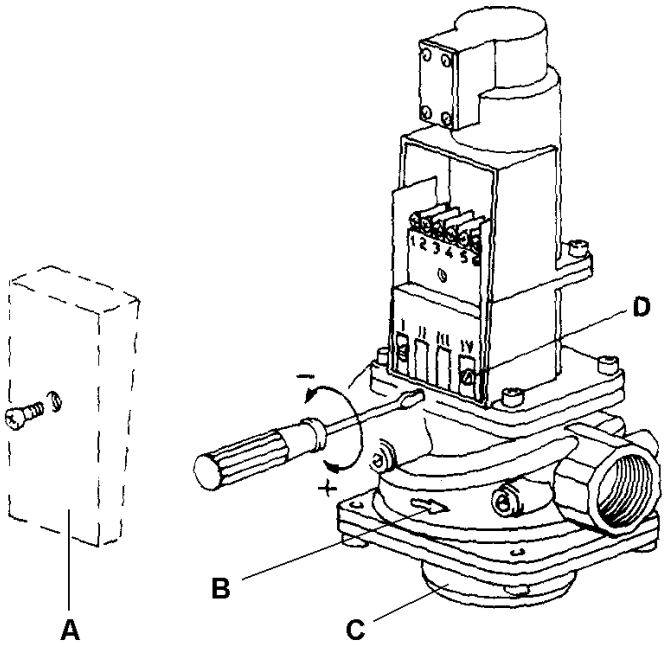
To adjust the gas flow rate, loosen screw “D” and turn knob “E”. Turning clockwise decreases the gas flow, turning counter-clockwise increases it.
This done, tighten screw “D”.

DESCRIPTION OF HOW THE VALVE OPERATES

Single-stage valves

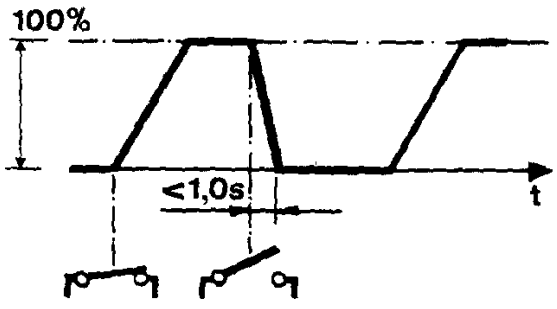
When the valve receives the signal to open, the pump cuts in and the magnetic valve closes. The pump transfers the oil from under the piston to above it, forcing the piston downward, which compresses the closure return spring with the rod and plate. The valve remains in the open position while the pump and magnetic valve remain powered.
When the unit receives the signal to close (or if power supply is cut off) the pump shuts down, the magnetic valve opens decompressing the chamber above the piston. The plate is closed both by the return spring and by gas pressure.
The flow rate for this valve is calculated to ensure full closure in less than one second.

This type of valve cannot regulate the gas flow rate (closure/opening).
Screw “D” on terminal “IV” sets the “clean contact” position which can be used for an outside signal.

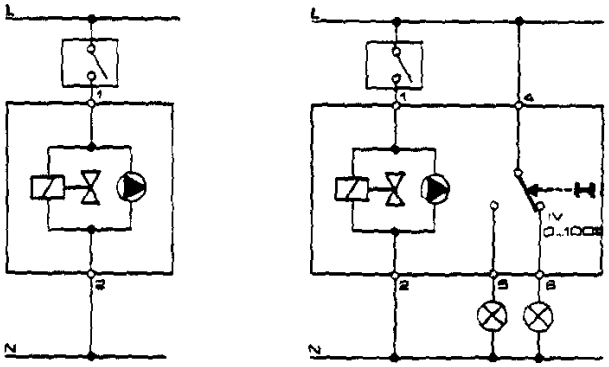


A = Driver identification plate
B = Flow direction indicator
C = Valve body identification plate

SKP 10.110B27-SKP 10.111B27



SKP 10.110B27 - SKP 10.111B27



DESCRIPTION OF HOW THE VALVE OPERATES

Servomotor

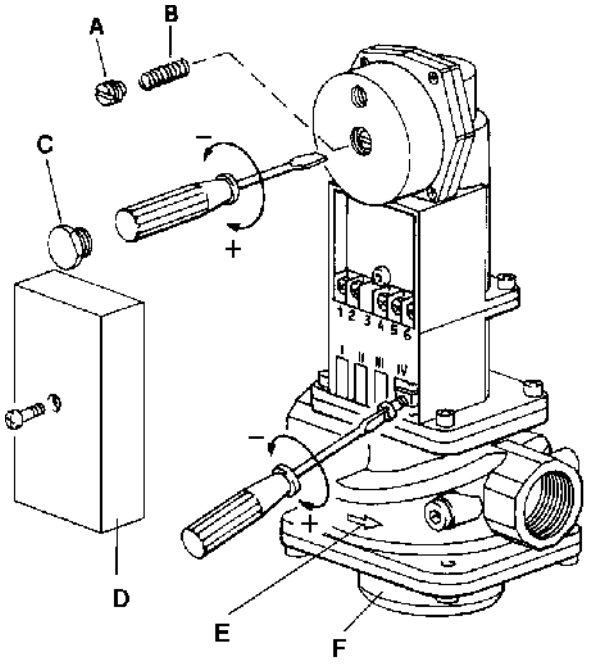
The hydraulic control system consist of a cylinder filled with oil and oscillating piston pump. There is also a solenoid valve between the intake chamber and the pump thrust chamber, to close the valve. The piston moves against a sealed joint inserted into the cylinder; in turn, this joint hydraulically separates the intake chamber from the delivery chamber. The piston transmits the stroke directly to the valve. A disk is secured to the valve shaft and can be seen through a slit in the valve, indicating the stroke.

PRESSURE REGULATOR

The pressure regulator consists of a diaphragm (there is also an additional safety diaphragm), a spring calibrated to a setpoint and an oscillating system to drive the ball valve located on the bypass between the hydualic system intake and delivery chambers (also see “Description of how the valve works”).
Operating range: 0...22 mbar or (subject to replacement of the spring) up to 250 mbar.
Regulation to the set value can be sealed. Gas pressure inlet connection starting at $^1/_4$”.
Thanks to the use of a safety diaphragm, no gas vent piping is required for inlet pressure up to 100 mbar. Under tightness testing, it can tollerate a vacuum pressure of up to 200 mbar.
The casing of the servomotor and the pressure regulator are in cast aluminum.

DESCRIPTION OF HOW GAS VALVES FITTED WITH PRESSURE REGULATOR OPERATE

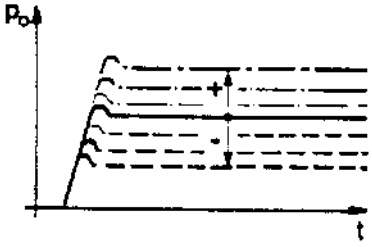
When a valve fitted with a pressure regulator is used, the valve outlet pressure presses against a spring-assisted diaphragm, acting as a reference value. The force of this spring can be adjusted and is set at the prescribed value. The diaphragm, activated by an oscillating piston system, presses against the ball bypass valve located between the lower and upper chambers of the servocontrol unit. If the reference value is lower than the setpoint, the bypass is closed so that the servocontrol can open the gas valve. On the contrary, if the reference value is higher than the setpoint, the bypass is open a degree enabling oil to return to the lower chamber.
The gas valve closes gradually until setpoint coincides with the gas reference pressure value. When this well-balanced position is reached, the bypass is open so that flow rate corresponds to pump flow rate.
In this way, the regulator operates as a proportional regulator over a very narrow range. Nevertheless, regulation remains stable because the speed at which the valve closes is reduced.

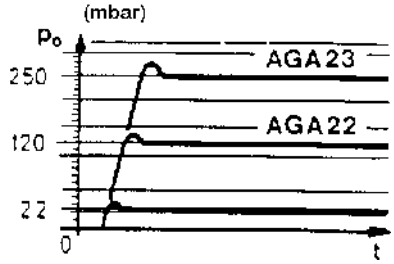


Remove screw cap cover “C” to access the pressure regulation screw “A”.
Tighten to increase the pressure, loosen to decrease the pressure.
Screw “D” in terminal “IV” regulates the position at which the “clean” contact is activated.
This can be used for an outside signal.

D = Driver identification plate
E = Flow direction indicator
F = Valve body identification plate

B (mm)	type	Po (mbar)	colour
1,0	--	< 22	bright
1,6	AGA22	< 120	yellov
1,6	AGA 23	< 250	red

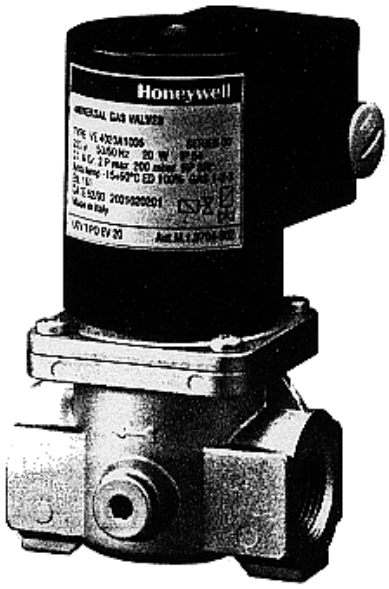




INSTRUCTIONS FOR HONEYWELL GAS VALVES UNIVERSAL GAS VALVES TYPE: VE 4000A1 (....A .... = Opening - Closure, rapid)

N° 0002910370

The VE 4000A1 valves are Class A solenoid valves, normally closed. They may be used as ON/OFF valves in the supply trains with Natural Gas, Manufactured Gas or GPL, on burners or combustion installations.
They are provided with M.I. and CE Approval for EN161.



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FEATURES

- Valves normally closed
- Without flow regulator
- Rapid opening and closing

INSTRUCTIONS FOR HONEYWELL GAS VALVES UNIVERSAL GAS VALVES TYPE: VE 4000B1 (....B.... = Opening - Closure, rapid. Flow regulator)

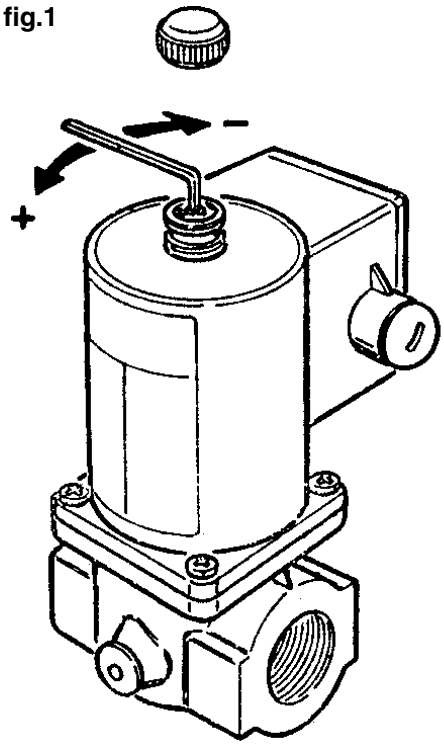
N° 0002910380

FEATURES

- Valve normally closed
- With flow regulator
- Rapid opening and closing

The VE4000B1 valves are Class A solenoid valves, normally closed. They may be used as ON/OFF valves in the supply trains with Natural Gas, Manufactured Gas or GPL, on burners or combustion plants.
They are provided with M.I. and CE Approval for EN 161.

fig.1



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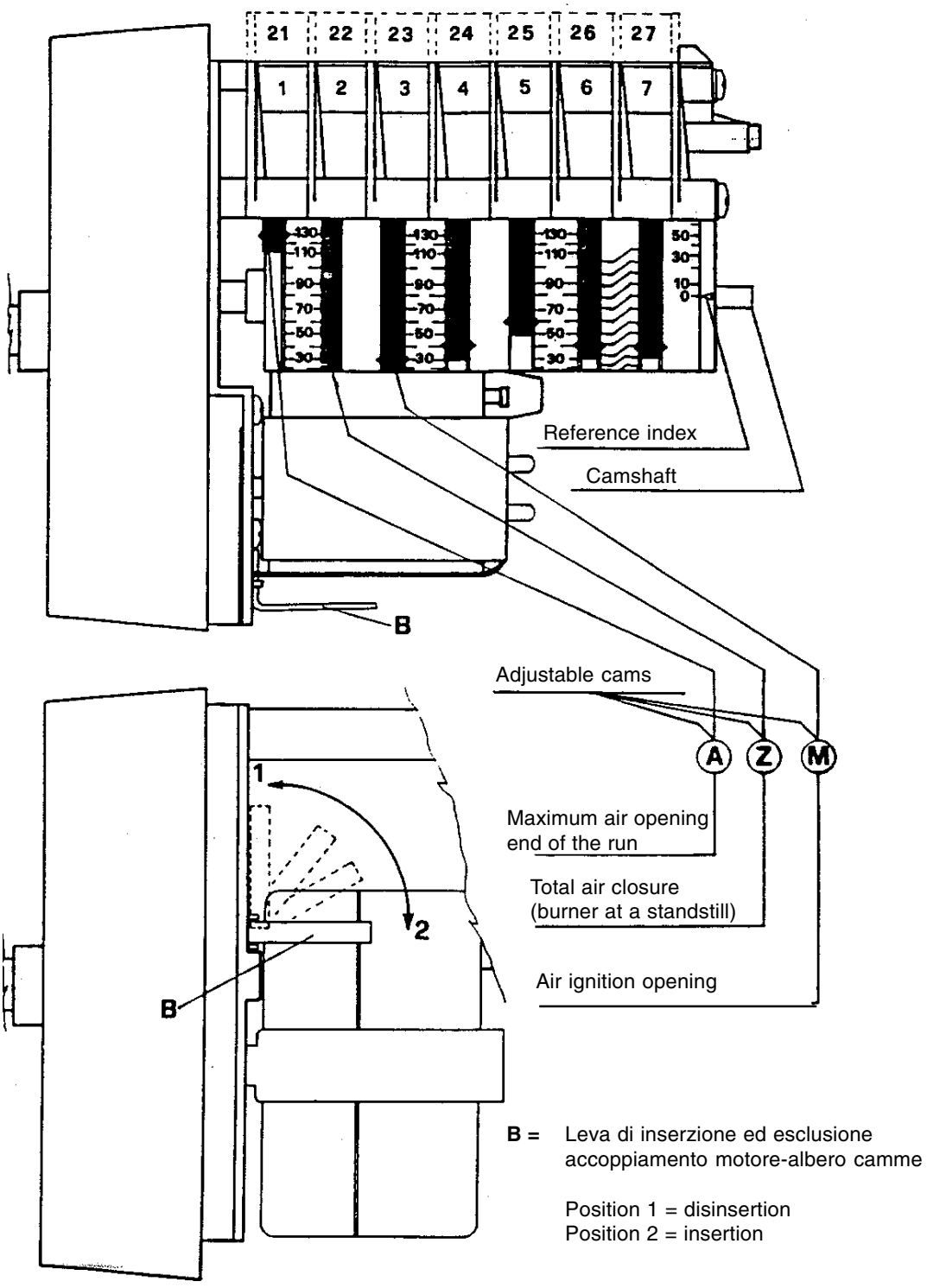
ADJUSTMENT
For models VE 4000B1 (see fig. 1)

Adjustment to the flow
- Remove the cover from the upper section of the coil.
- Insert a hexagonal Allen key into the central section at the top.
- Turn clockwise to decrease the flow or anti-clockwise to increase it.
- Replace the cover and tighten it.

ATTENTION
- The adjustment must only be carried out by qualified personnel.
- Per la chiusura della valvola è necessario che la tensione ai terminali della bobina sia 0 volt.
- The flow regulator of the VE 4100 valve series is situated in the lower section.

DETAILS OF THE MODULATION CONTROL MOTOR SQM 10 - SQM 20 FOR REGHULATION OF CAMS



B = Leva di inserzione ed esclusione accoppiamento motore-albero camme

Position 1 = disinsertion
Position 2 = insertion

To modify the regulation of the three cams utilized, operate the respective red rings (A - Z - M).
By pushing with enough force, in the direction desired, each red ring will rotate with respect to the reference scale.
The index of the red ring indicates on the respective reference scale the rotation angle taken up for each cam.

LDU 11.. GAS VALVE
TIGHTNESS CONTROL EQUIPMENT

Use

LDU 11 equipment is used to verify tightness of valves on natural gas burners.
The LDU 11 combined with a normal pressure switch automatically verifies tightness of natural gas burners valves, before every start up and immediately after each stop.
Tightness control is carried out by two-stage verification of gas circuit pressure in the section between the two burner valves.

Operation

During the first stage of the tightness control (TEST 1), the pipeline between the valves being checked must be at atmospheric pressure. In plant without atmospheric pressure setting pipes, this pressure is achieved by tightness control equipment. The latter opens the valve on the furnace side for 5 seconds during "**t4**" time.
When the 5 seconds are up, the furnace side valve is closed.
During the first phase (**TEST 1**) the control equipment ensures that atmospheric pressure in the pipes is kept constant. Surveillance is carried out by the "**DW**" thermostat.
If there is blow-by in the safety valve while closing, pressure increases and as a result the "**DW**" pressure switch operates. For this reason, in addition to indicating pressure, the equipment goes into fault state and the position indicator stops blocked in the "**TEST 1**" position (red pilot lamp lit).
Vice-versa, if pressure does not increase because there is no blow-by in the relief valve as it closes, the equipment immediately programmes the second stage "**TEST 2**".
Under these conditions, the relief valve opens for 5 seconds during "**t3**" time and introduces gas pressure into the pipeline ("filling operation"). During the second verification stage, this pressure must remain constant.
Should it drop, this means that the burner on the furnace side has a blow-by (fault) when closing.Therefore the "**DW**" pressure switch operates and the tightness control equipment prevents burner start-up and stops in blocked state (red pilot lamp lit). If second stage verification is positive, the LDU 11 equipment closes the internal control circuit between terminals **3** and **6** (terminal **3** - contact **ar2** - outer cross-connection for terminals **4** and **5** - contact **III** - terminal **6**).
This is the circuit that usually enables the equipment start-up control circuit. After circuit between terminals **3** and **6** has closed, the LDU 11's programmer returns to rest position and stops. This means it enables fresh verification without changing the position of the programmer's control contacts.

N.B. Adjust the "**DW**" pressure switch to about half the pressure of the gas supply network.

Key to symbols :

} Start-up = operating position

▭ In plants without a bleed valve = test circuit put under atmospheric pressure by opening of valve on the furnace side of the burner.

TEST 1 "TEST 1" pipeline at atmospheric pressure (blow-by verification at closure of relief valve)

▬ Putting test circuit gas under pressure by opening of relief valve

TEST 2 "TEST 2" pipeline at gas pressure (blow-by verification of valve on furnace side of burner)

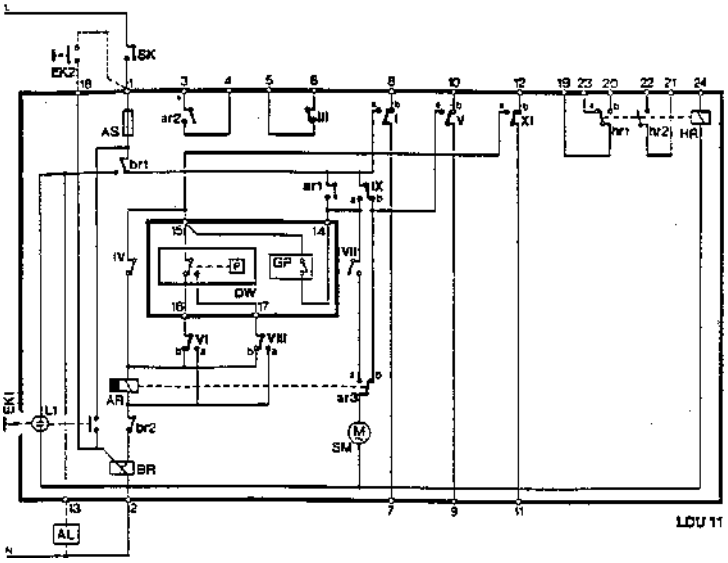
III Automatic zero (or inoperative mode) reset of programmer

} Operation = set for new blow-by verification

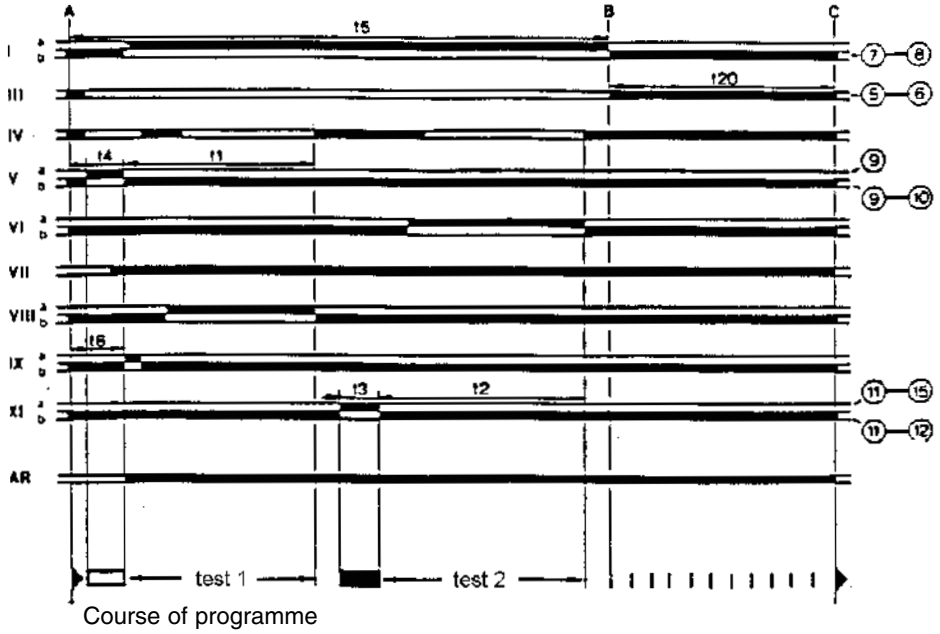
If trouble is signalled, there is no voltage in all control equipment terminals excepting terminals **13** which gives remote, visual indication of trouble.
When verification is over, the programmer automatically returns to rest position, and is ready to carry out a further programme for checking tightness of valves as they close.

Control programme

t_4	**5s**	Putting control circuit under atmospheric pressure
t_6	**7,5s**	Time between start-up and energizing of main "**AR**" relay
t_1	**22,5s**	1st verification stage at atmospheric pressure
t_3	**5s**	Putting control circuit gas under pressure
t_2	**27,5s**	2nd verification stage at gas pressure
t_5	**67,5s**	Total time of tightness control, up to burner operation consent
t_{20}	**22,5s**	Return of programmer to rest position = fresh verification is enabled



AL	remote alarm signalling
AR	main relay with "ar" contacts
AS	equipment fuse
BR	blocking relay with "ar" contacts
DW	outer pressure switch (tightness control)
EK...	unblocking button
GP	outer pressure switch (for mains gas pressure)
HR	auxiliary relay with "ar" contacts
L1	equipment trouble signalling lamp
SK	line switch
I...XI	programmer cam contacts



Course of programme

Terminals activated by equipment or by electric connections

Control box for burners of average and high power, with forced draught, intermittent service (*), 1 or 2 stages, or modulating types, with supervision of the air pressure for controlling the air damper.
This control box bears the EC mark, in accordance with the Gas and Electromagnetic Compatibility Directive.
* For reasons of safety, it is necessary to make at least one controlled stop every 24 hours!

As regards the standards

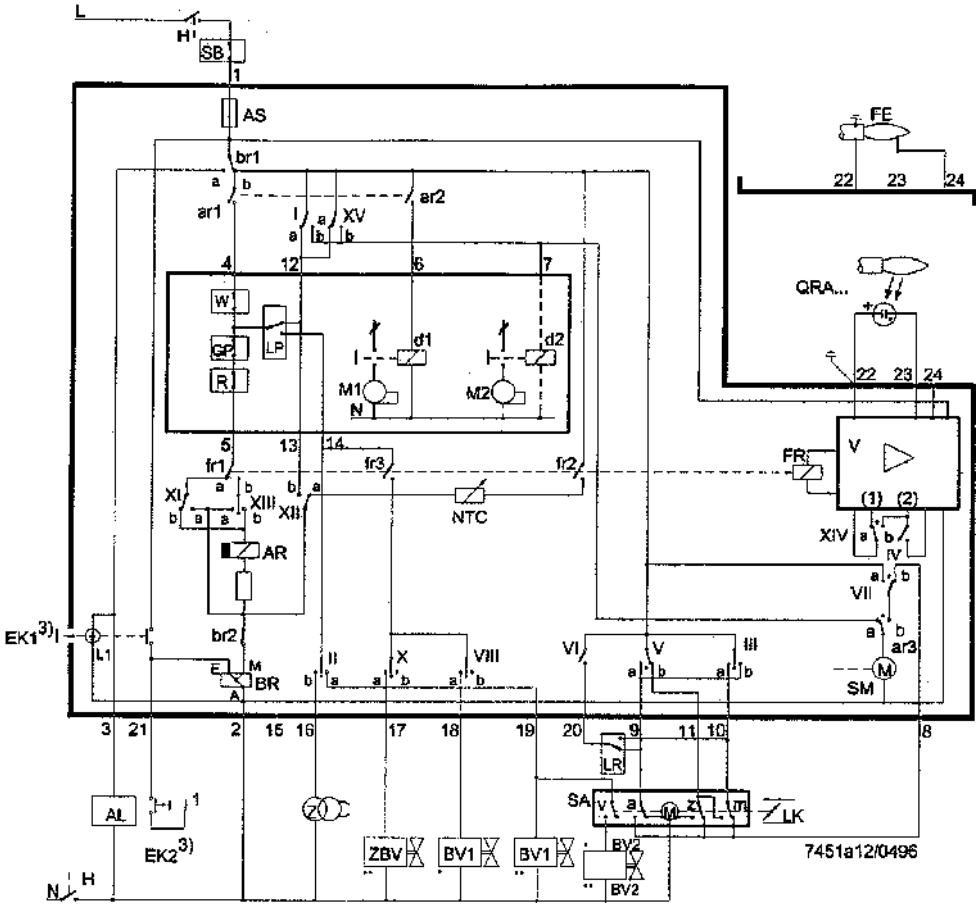
The following LFL1… features exceed the standards, offering a high level of additional safety:

- The flame detector test and false flame test start immediately after the tolerated post-combustion time. If the valves remain open, or do not close completely after adjustment stops, a lock-out stop is triggered at the end of the tolerated post-combustion period. The tests will end only at the end of the pre-ventilation time of the next start-up.
- The validity of working of the flame control circuit is checked each time the burner starts up.
- The fuel valve control contacts are checked for wear during the post-ventilation time.
- A built-in fuse in the appliance protects the control contacts from any overloads that may occur.

As regards the burner control

- The equipment allows operation with or without post-ventilation.
- Controlled activation of the air damper to ensure pre-ventilation with nominal airflows. Positions checked: CLOSED or MIN (position of ignition flame on start-up); OPEN at the beginning and MIN at the end of the pre-ventilation time. If the servomotor does not position the air damper at the points described, the burner does not start-up.
- Ionization current minimum value = 6mA
- UV cell current minimum value = 70mA
- Phase and neutral must not be inverted.
- Any place may be used for installation and assembly (IP40 protection).

Electrical connections



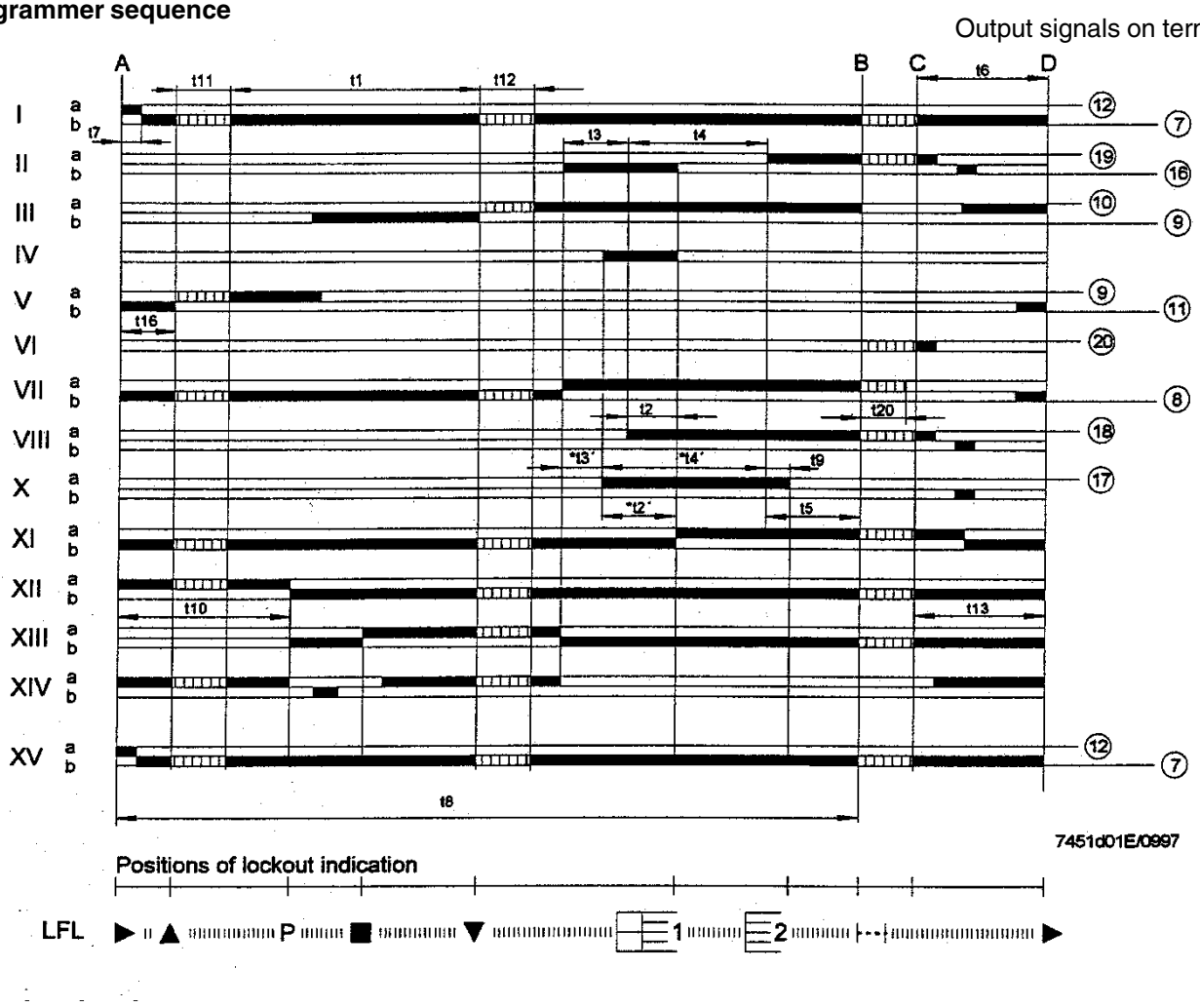
The burner manufacturer's diagram is valid for the relief valve connections.

LEGEND

For the entire catalogue sheet

a	Limit switch commutation contact for air damper OPEN position
AL	Remote signalling of lock-out stop (alarm)
AR	Main relay (operating relay) with "ar…" contacts
AS	Appliance fuse
BR	Lock-out relay with "br…" contacts
BV	Fuel valve
bv...	Control contact for gas valve CLOSED position
d…	Remote control switch or relay
EK…	Lock-out push-button
FE	Ionization current probe electrode
FR	Flame relay with "fr…" contacts
GP	Gas pressure switch
H	Main switch
L1	Fault indicator light
L3	Ready for operation indicator
LK	Air damper
LP	Air pressure switch
LR	Power regulator
m	Auxiliary commutation contact for air damper MIN position
M…	Motor fan or burner
NTC	NTC resistor
QRA..	UV probe
R	Thermostat or pressure probe
RV	Fuel valve with continuous regulation
S	Fuse
SA	Air damper servomotor
SB	Safety limiter (temperature, pressure, etc.)
SM	Programmer synchronous motor
v	In the case of servomotor: auxiliary contact for consensus for fuel valve depending on air damper position
V	Flame signal amplifier
W	Thermostat or safety pressure switch
z	In the case of servomotor: limit switch commutation contact for air damper CLOSED position
Z	Ignition transformer
ZBV	Pilot burner fuel valve
•	Valid for forced draught burners, with obe tube
••	Valid for pilot burners with intermittent operation
(1)	Input for increasing operating voltage for UV probe (probe test)
(2)	Input for forced energizing of flame relay during functional test of flame supervision circuit (contact XIV) and during safety time t2 (contact IV)
3)	**Do not press EK for more than 10 seconds**

Notes on the programmer
Programmer sequence



Times Legend

time (50 Hz) in seconds

31.5	t1	Pre-ventilation time with air damper open
3	t2	Safety time
-	t2'	Safety time or safety time with burners that use pilot burners
6	t3	Short pre-ignition time (ignition transformer on terminal 16)
-	t3'	Long pre-ignition time (ignition transformer on terminal 15)
12	t4	Time between beginning of t2' and valve consensus on terminal 19 with t2
-	t4'	Time between beginning of t2' and valve consensus on terminal 19
12	t5	Time between end of t4 and consensus at power regulator or at valve on terminal 20
18	t6	Post-ventilation time (with M2)
3	t7	Time between consensus for start-up and voltage at terminal 7 (start delay for fan motor M2)
72	t8	Start-up duration (without t11 and t12)
3	t9	Second safety time for burners that use pilot burners
12	t10	Time from start-up to beginning of air pressure control without air damper travel time
	t11	Air damper opening travel time
	t12	Air damper in flow flame position (MIN) travel time
18	t13	Permitted post-combustion time
6	t16	Initial delay of consensus for air damper OPENING
27	t20	Time up to automatic closure of programmer mechanism after burner start-up

NOTE: With voltages at 60 Hz, the times are reduced by about 20%.

t2', t3', t3':
These times are valid **only** for **series 01** or LFL1.335, LFL1.635, LFL1.638 burner control and command equipment.
They are not valid for types of Series 032, since they involve **simultaneous activation of cams X and VIII**.

Working

The above diagrams illustrate both the connection circuit and the sequencer mechanism control program.

A Consensus for start-up by means of installation thermostat or pressure switch “R”.

A-B Start-up program

B-C Normal burner operation (on the basis of “LR” power regulator control commands)

C Stop controlled by “R”

C-D Return of programmer to start-up position “A”, post-ventilation.
During periods of inactivity of the burner, only the command outputs 11 and 12 are powered, and the air damper is in the CLOSED position, determined by limit switch “z” of the air damper servo motor. During the probe test and false flame test, the flame supervision test is also powered (terminals 22/23 and 22/24).

Safety standards

- In association with the use of QRA…, earthing of terminal 22 is compulsory.
- The power cables must conform to existing national and local standards.
- LFL1… is a safety device, and it is therefore forbidden to open it, tamper with it or modify it!
- The LFL1… device must be completely insulated from the mains before carrying out any operations on it!
- Check all the safety functions before activating the unit or after replacing a fuse!
- Provide protection against electric shock on the unit and all electric connections. This is ensured by following the assembly instructions correctly!
- During operation and maintenance, prevent infiltration of condensate into the command and control equipment.
- Electromagnetic discharges must be checked on the application plan.

Control program in the event of stopping, indicating position of stop
As a rule, in the event of any kind of stop, the fuel flow is cut off immediately. At the same time, the programmer remains immobile, as does the switch position indicator. The symbol visible on the indicator reading disk indicates the type of fault.

◀ **No start-up,** because of failure in closing of a contact or lock-out stop during or at the end of the command sequence because of external lights (for example: flames not extinguished, loss at the level of the fuel valve, defects in the flame control circuit, etc.)

▲ **Start-up sequence stops**, because the OPEN signal was not sent to terminal 8 by limit switch contact “a”. Terminals 6, 7 and 15 remain powered until the defect is eliminated.

P **Lock-out stop**, because of lack of air pressure signal.
Any lack of pressure from this moment onwards will cause a lock-out stop!

■ **Lock-out stop** because of flame detection circuit malfunction.

▼ **Start-up sequence stops**, because the position signal for low flame was not sent to terminal 8 by auxiliary switch “m”. Terminals 6, 7 and 15 remain powered until the fault is eliminated.

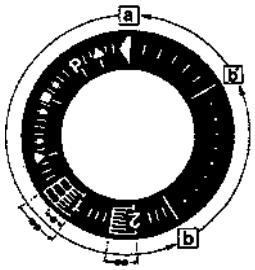
1 **Lock-out stop**, due to lack of flame signal at the end of the first safety time.

2 **Lock-out stop**, because no flame signal was received at the end of the second safety time (main flame signal with pilot burners at intermittent operation).

| **Lock-out stop**, due to lack of flame signal during burner operation.

If a lock-out stop occurs at any moment between the start and pre-ignition without a symbol, the cause is generally to be attributed to a premature or abnormal flame signal caused, for example, by self-ignition of a UV tube.

Stop indications



LFL …, Series 01

LFL …, Series 02

a-b Start-up program

b-b’ “Trips” (without contact confirmation)

b(b’)-a Post-ventilation program

TROUBLESHOOTING OPERATING FAULTS IN "TS-G" GAS BURNERS

DETAILS OF PROBLEM	POSSIBLE CAUSE	SOLUTION
Appliance locked out due to no flame (red light lit). The fault is limited to the flame control system or points 3 and 4.	1) Dirty flame sensor (UV photocell) 2) Appliance failure 3) Dirty disk or head 4) Insufficient draught	1) Clean or replace 2) Replace appliance 3) Clean 4) Check all flues
Appliance locked out with fuel flowing from combustion head, but no flame (red light lit). The fault is limited to the ignition system, upon the assumption that fuel is in good condition	1) Break in ignition circuit 2) Ignition transformer leads discharge to earth 3) Ignition transformer leads not properly connected 4) Ignition transformer failure 5) The tips of the electrodes are not spaced properly 6) The electrodes discharge to earth because dirty or due to cracked insulation; also check insulation clamps 7) If fitted, "gas pilot" flame fails to ignite since gas flow rate or air/gas ratio not set correctly 8) In the case of burner switched on for the first time, there may be air in the pipes	1) Check the entire circuit 2) Replace 3) Connect correctly 4) Replace 5) Return to the correct position 6) Clean or, if necessary, replace 7) Check and carry out the necessary adjustments 8) Bleed air from the pipes again
Appliance locked out with fuel flowing from combustion head, but no flame (red light lit).	1) Excess combustion air 2) Passage of air between disk and head is too narrow 3) In the case of gas burner, the cause may be incorrect air/gas ratio of "pilot burner" (if fitted) or main burner 4) There may be air in the pipes if switching on for the first time	1) Reduce combustion air 2) Correct position of combustion head air-flow regulator 3) Check and adjust air/gas ratio as necessary 4) Bleed air from the pipes again
Appliance locked out without fuel flowing from burner (red light lit)	1) Missing phase 2) Inefficient electric motor 3) Three-phase motor does not rotate in the correct direction (indicated by the arrow) 4) Air pressure switch not actuated due to insufficient pressure 5) Power or coil failure of main gas valves 6) No gas	1) Check power line 2) Repair or replace 3) Invert a phase in the power switch 4) Adjust pressure switch as necessary or increase air pressure (open intake damper wider or close head) 5) Check that power reaches the gas valve terminal block; check efficiency of coils and respective power circuits 6) Ensure that gas filter is clean. Check there is sufficient pressure by installing a pressure gauge at the gas train inlet
Burner fails to start	1) Thermostats (boiler or minimum) or pressure switches or level switches actuated 2) Flame sensor (UV photocell) short circuit 3) No power due to main circuit breaker tripped or meter overload cutout tripped or power cut or blown fuses 4) The thermostat line has not been executed as per layout or a thermostat or level switch has been tripped 5) Internal fault in appliance 6) No gas and therefore gas minimum pressure switch will not allow burner to start	1) Change settings to more suitable level or wait for them to reset 2) Replace 3) Reset circuit breakers or wait for power to come back on or replace blown fuses 4) Check thermostat and level switch connections 5) Replace 6) Check gas pressure value and if necessary the efficiency of gas filter and pressure regulator. Check the efficiency of gas minimum pressure switch and relative power line

DETAILS OF PROBLEM	POSSIBLE CAUSE	SOLUTION
Defective flame with presence of sparks	1) Excess combustion air or insufficient gas delivery flow	1) Adjust combustion air and/or gas setting
Flame not properly shaped with presence of smoke and soot	1) Insufficient combustion air 2) Unsuitable refractory coating (excessive reduction in gap for flame) 3) Boiler or chimney ducts blocked	1) Increase combustion air 2) Modify ensuring that the instructions of the boiler manufacturer are carefully followed 3) Arrange to be cleaned
Defective flame (flickering or protruding from combustion head)	1) Excessive draught (only if flue aspirator is fitted) 2) Disk dirty 3) Excess combustion air 4) Passage of air between disk and head is too narrow	1) Adjust speed of aspirator by altering diameter of the pulleys. Do not “throttle” the cross section of chimney with damper 2) Clean 3) Reduce combustion air 4) Correct the position of combustion head air flow regulator
Scale inside boiler and/or presence of condensate in tube nest	1) Boiler operating temperature too low (less than dew point) 2) Temperature of flue gas too low	1) Increase operating temperature 2) Request manufacturer’s approval to increase fuel flow rate
Soot at chimney outlet	1) Chronic lack of combustion air or notable excess of gas	1) Regulate flow of combustion air and/or gas
Water in chimney serving gas burner	1) Excessive cooling (below dew point) of flue gas due to insufficient chimney insulation or infiltration of cold air	1) Improve chimney insulation and close any opening that could allow cold air to enter the chimney

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