# Bowker Machinery Ltd

## Information Booklet for Gas Fired Powder Curing Oven

Revision 4 – May 2024

Bowker Machinery Ltd
Unit 29
Dinting Vale Business Park
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Derbyshire
SK13 6LG
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Table of Contents:

# EC Declaration of Conformity

We declare that unit serial no:

Conforms to:

BSEN746-2:2010

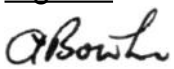
European standard EN746-2:2010

Low voltage directive 2006/95/EC

Gas appliance directive 90/396/EEC

EMC directive 2004/108/EC and Electromagnetic Compatibility Regulations SI2006 No.341

Signed:



Anthony Bowker
Director
Bowker Machinery Ltd
Unit 29
Dinting Vale Business Park
Glossop
Derbyshire
SK13 6LG

# Declaration of Conformity Counterpart Letter

Manufacturer: Bowker Machinery Ltd

Machine or Item of Equipment: Powder Cure Oven

Serial No:

Complies with current European legislation EN 746-2:2010

Complies with British Standard 'Industrial thermo processing equipment' BSEN746-2:2010

Low voltage directive 2006/95/EC

Gas appliance directive 90/396/EEC

EMC directive 2004/108/EC and Electromagnetic Compatibility Regulations SI2006 No.341

# Form MME

The following work has been carried out by Bowker Machinery Limited to ensure that products supplied comply with the ***The Supply of Machinery (Safety) (Amendment) Regulations 2008*** as amended by the ***The Supply of Machinery (Safety) (Amendment) Regulations 2011***, and are in compliance with current CE legislation.

The Powder Cure Oven designed and built by Bowker Machinery Limited adopts the following safety features:

The gas burner is bought as a “package” burner with CE markings to verify compliance. Within the package is a “Dungs” gas valve with a separate CE certificate of conformity. Manufacturer instructions are provided for both products.

A study of BSEN 746-2 (2010) has been carried out and all relevant safety precautions have been followed.

An explosion relief panel larger than minimum requirements is built into the roof of all ovens.

Internal safety lock release mechanism is built into every oven larger than one meter cubed and tested prior to dispatch.

Structural tests are carried out on the roof and the stability of the heat exchange during design and build.

Every effort is taken to obtain relevant CE markings for all products used in manufacture.

Burners Division Ariston Thermo Group

elco CUENOD Ecoflam

# DICHIARAZIONE DI CONFORMITÁ
# *DECLARATION OF CONFORMITY*

La scrivente ditta
The writing company

**ECOFLAM BRUCIATORI S.p.A.**

Con sede in via Roma, 64 – Resana (TV)
*Address: via Roma, 64 – Resana (TV)*

DICHIARA

DECLARES

*Sotto la propria responsabilità, che tutti i propri* ***bruciatori di gas della serie MAX GAS...*** *sono* ***conformi*** *alla :*
*Under his sole responsibility that all the* ***gas burners MAX GAS... series*** *comply with requirements included in the following European Directives and Standards:*

- **2006/95/CEE "Direttiva bassa tensione" (Low voltage directive)**
- **2004/108/CEE "Direttiva EMC" (EMC directive)**
- **2009/142/CEE "Direttiva gas" (Gas appliance directive)**
- **2006/42/EC "Direttiva macchine'' (Machine directive)**
- **EN 676: 2008**
- **EN 60335-2-102: 2012**
- **EN 50156-1 :2004**
- **EN 55014-1: 2008 + A1: 2009**
- **EN 55014-2: 1998 + A1: 2001 + A2: 2008**

***Date/Authorized Signature*** **March, 2014 / Mr. Camillo Rena**

Title of Signatory *R&D manager - Ecoflam Bruciatori Spa*

R&D BBU Manager

Ecoflam CUENOD elco

**ECOFLAM BRUCIATORI S.p.A.**
**Sede operativa:**
Via Roma, 64 - 31023 Resana (TV), Italy
Tel. +39 (0) 423 719 500
Fax. +39 (0) 423 719 580
www.ecoflam-burners.com

**Sede legale:**
Viale Aristide Merloni, 45 - 60044 Fabriano(AN)
P.IVA e CF 00879740264

*società soggetta alla direzione e al coordinamento della Ariston Thermo S.p.A., via A. Merloni, 45 - 60044 Fabriano (AN) CF*

**Contents** - Conformity declaration / **Contenuti generali** - Dichiarazione di conformità / **Contenus généraux** - Déclaration de conformite / **Contenidos generales** - Declaración de conformidad / **Содержание** - Сертификат соответствия

**Declaration of conformity for gas burners**

We,
**Ecoflam Bruciatori S.p.A.**

declare under our sole responsibility that the gas burners named

## MAX GAS

conform to the following standards:

| | |
|---|---|
| **EN 676** | **EN 50156-1** |
| **EN 55014-1** | **EN 55014-2** |
| **EN 60335-1** | **EN 60335-2-102** |
| **EN 61000-6-2** | **EN 61000-6-3** |

These products bear the CE mark in accordance with the stipulations of the following directives:
**2014/35/UE Low Voltage Directive**
**2014/30/UE EMC Directive**
**2006/42/EC Machine directive**
**2011/65/EU RoHS2 directive**
**2009/142/CEE Gas Appliance Directive**

February 2016 - Mr. Roberto Cavalieri
R&D manager

**Dichiarazione di conformità per bruciatori a gas**

Noi ,
**Ecoflam Bruciatori S.p.A.**

dichiariamo sotto la nostra responsabilità, che i bruciatori a gas

## MAX GAS

sono conformi alle norme elencate :

| | |
|---|---|
| **EN 676** | **EN 50156-1** |
| **EN 55014-1** | **EN 55014-2** |
| **EN 60335-1** | **EN 60335-2-102** |
| **EN 61000-6-2** | **EN 61000-6-3** |

Questi prodotti vengono contrassegnati con il marchio CE nel rispetto delle direttive:
**2014/35/UE Low Voltage Directive**
**2014/30/UE EMC Directive**
**2006/42/EC Machine directive**
**2011/65/EU RoHS2 directive**
**2009/142/CEE Gas Appliance Directive**

February 2016 - Mr. Roberto Cavalieri
R&D manager

**Déclaration de conformité pour brûleurs de gaz**

Nous ,
**Ecoflam Bruciatori S.p.A.**

déclarons sous notre responsabilite, que les brûleurs de gaz

## MAX GAS

sont en conformité avec les normes suivantes:

| | |
|---|---|
| **EN 676** | **EN 50156-1** |
| **EN 55014-1** | **EN 55014-2** |
| **EN 60335-1** | **EN 60335-2-102** |
| **EN 61000-6-2** | **EN 61000-6-3** |

Ces produits sont marqués avec la marque CE dans le respect des directives:
**2014/35/UE Low Voltage Directive**
**2014/30/UE EMC Directive**
**2006/42/EC Machine directive**
**2011/65/EU RoHS2 directive**
**2009/142/CEE Gas Appliance Directive**

February 2016 - Mr. Roberto Cavalieri
R&D manager

**Declaración de conformidad para quemadores de gas**

Nosotros ,
**Ecoflam Bruciatori S.p.A.**

declaramos bajo nuestra responsabilidad que los quemadores de gas

## MAX GAS

cumplen las normas siguientes :

| | |
|---|---|
| **EN 676** | **EN 50156-1** |
| **EN 55014-1** | **EN 55014-2** |
| **EN 60335-1** | **EN 60335-2-102** |
| **EN 61000-6-2** | **EN 61000-6-3** |

Estos productos están marcados con la marca CE de conformidad con la directivas:
**2014/35/UE Low Voltage Directive**
**2014/30/UE EMC Directive**
**2006/42/EC Machine directive**
**2011/65/EU RoHS2 directive**
**2009/142/CEE Gas Appliance Directive**

February 2016 - Mr. Roberto Cavalieri
R&D manager

**Декларация о соответствии для газовых горелок**

Мы,компания ,
**Ecoflam Bruciatori S.p.A.**

заявляем под свою ответственность, что газовые горелки

## MAX GAS

соответствуют требованиям следующих стандартов :

| | |
|---|---|
| **EN 676** | **EN 50156-1** |
| **EN 55014-1** | **EN 55014-2** |
| **EN 60335-1** | **EN 60335-2-102** |
| **EN 61000-6-2** | **EN 61000-6-3** |

Эти изделия маркируются знаком CE в соответствии с директивами:
**2014/35/UE Low Voltage Directive**
**2014/30/UE EMC Directive**
**2006/42/EC Machine directive**
**2011/65/EU RoHS2 directive**
**2009/142/CEE Gas Appliance Directive**

February 2016 - Mr. Roberto Cavalieri
R&D manager

**Ecoflam**

**Ecoflam Bruciatori S.p.A.**
Via Roma, 64 31023 Resana (TV) Italy
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www.ecoflam-burners.com - export@ecoflam.it
P.IVA e CF 00879740264 - Iscr. Trib. Treviso 28656
CCIAA TV 193884 - Mecc. estero TV005116 - Cap. Soc. € 3.690.000,00 i.v..

# Dichiarazione di Conformità CE
# *EC Declaration of Conformity*

**Ecoflam Bruciatori S.p.A. via Roma, 64 - 31023 Resana (TV) – Italia**

**Dichiara**
***Herewith declare***

Che tutti i propri **bruciatori di gas tipo: Azur…, Max Gas…, Blu…**, sono **conformi** ai requisiti stabiliti dalle seguenti direttive e norme:

*That all the **gas burners, models*** **Azur…, Max Gas…, Blu…**, *comply with requirements included in the following European Directives and Standards:*

| | |
|---|---|
| Direttive applicabili<br>Applicable EC Directives | **EC Gas Directive (90/396/EEC and 93/68/EEC)**<br>**EC Low Voltage Directive (2006/95/EEC)**<br>**EC Directive of Electromagnetic Compatibility (2004/108/EEC)** |
| Applicable Standard | **EN 676**<br>**EN 60335-1 and EN 60335-2-30**<br>**EN 50165**<br>**EN 50082-1**<br>**EN 55014** |

Date/Authorized Signature — October, 2008/ Mr. Mario Panizzon

Title of Signatory — R&D manager

UNIVERSAL
MOTORS

# DECLARATION OF CONFORMITY

We, the Company

E.M.S Ltd
Electric Motor
Suppliers Ltd

Electric Motor Suppliers Ltd
56 Eldon Street
Devonshire Business Park
Sheffield
S1 4GT

Hereby declare that the **PRODUCTS** -

Three Phase Induction Motors type **EM30, UMC,** BF31, **UMA, HE30, UMHC, HE31, UMHA** IEC frame sizes D56-355

Single Phase Induction Motors type **BF31C, BF31D, UCC, UPC** IEC frame sizes D56-112

Bearing 'Universal Motors' marking as supplied by: -

Universal Motors **SA,** Rue de Bras, 745 – 4480-782, Vila Do Conde, Portugal

are in conformity with provisions of the following Council Directives: **Directive 2006/95/EC (of 12 December 2006).**
The motors are in conformity with provisions of the harmonized standard **EN 60 034-1(2010)** which thus comply with Principal Elements of the safety objectives for Electrical Equipment stated in Annex I of said directive. When the motor is fitted into machinery the conformity of the end product with the Directive **2006/42/EC** has to be established by the commissioning party.

**Note:** When installing motors for Inverter supply applications, additional requirements must be respected regarding the motor as well as the installation, as described in the installation manual delivered with inverter.
**Directive 2009/125/EC (of 21st October 2009)**
The motors are in conformity with requirements set in the Regulation **(EC) N° 640/2009** dated of 22 July 2009.
Efficiency class is defined according to the standard **EN 60034-30**: March 2009.

**EMC Directive 2004/108/EC** (note -according to this directive induction motors are "Equipment which is inherently benign in terms of electromagnetic compatibility and are excluded from the scope of the EMC Directive").

On Behalf of Electric Motor Suppliers Ltd

P. Thompson
Director

On Behalf of Universal Motors

J Barbosa
Director

Pixsys
ELECTRONICS

# ATR 121-141

Controller / Regolatore

User manual / Manuale d'uso

Read carefully the safety guidelines and programming instructions contained in this manual before using/connecting the device.

Prima di utilizzare il dispositivo leggere con attenzione le informazioni di sicurezza e settaggio contenute in questo manuale.

CE RoHS Compliant

**PIXSYS** s.r.l.
www.pixsys.net
sales@pixsys.net - support@pixsys.net
online assistance: http://forum.pixsys.net

2300.10.056-RevE
Software Rev. 3.05
090913

# Terms and Conditions relating to the installation of Powder Coating Equipment

1. The site area must be clear and have a level concrete floor.

2. Access by fork lift truck must be possible.

3. A fork lift truck must be available during the building process.
   An Autowash will require either 1 large 4 tonne truck or 2 small 2 tonne trucks.

4. An electrical supply of 3 phase and neutral must be provided and terminate in an isolating switch that is within 3 meters of the installation.
   Capacity as follows:
   Ovens up to 6 Mrts = 1 x 3Kw motor
   Ovens over 6 Mrts = 2 x 3Kw motors
   Spray booths up to 2 Mrts wide = 1 x 5.5Kw motors
   Spray booths 3 Mrts wide = 2 x 5.5Kw motors
   Autowash machines will vary, please enquire

5. In the case of Natural Gas a gas supply with a dynamic pressure of 21m. Bar and a flow rate of 20$m^3$ must be available. If propane is supplied from an outside tank, a low pressure regulator must be fitted onto the termination of the pipe run and fitted to the outside wall. This must be suitably sized to supply a dynamic pressure of 32m. Bar. If 47kg bottles are to be used the high pressure and low pressure regulators will be supplied by ourselves but the secure housing of the bottles is the responsibility of the customer. 2 bottles in tandem are suitable for ovens up to 4 Mrts, 4 bottles for sizes greater than 4 Mrts.

   **The gas supply must terminate in an isolating valve that is in an accessible position and can be accessed quickly in the event of an emergency. The valve must be compliance with BB EN T46 and be switched off after every shift.**
   **It is the customers responsibility to have the gas supply installed and connected.**

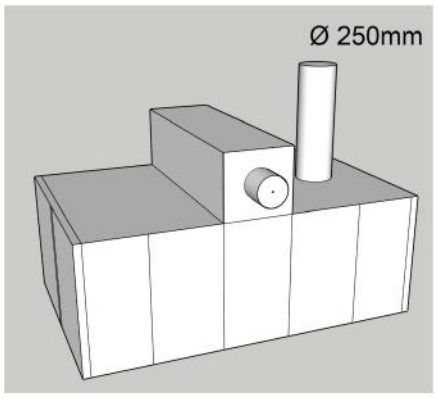
6. **Exhaust Flue**
   The exhaust flue is the responsibility of the customer. A 250mm diameter adjustable damper is supplied and attached to a roof panel. The exhaust chimney is required to be attached to this and to terminate outside. It is preferable if the chimney is straight but if a bend is required it should be no more than 45º with a further 45º bend outside to return the outlet to vertical. A cowl must be fitted to the end.

All powder coating ovens are direct fired, that results in all products of combustion being recirculated, unlike a boiler for example that has a closed or indirect system. These circumstances require an adequate ventilated system that necessitates a suitable extraction fan. Details of the size requirements can be found in the information booklet provided.

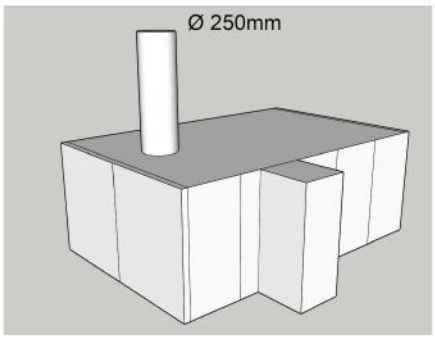
## 7. Ventilation

It is important to understand that all powder coating and general process ovens are direct fired, not indirect fired as in, for example, a boiler. The removal of fumes therefore relies on good ventilation rather than bleeding a portion of the hot ait to atmosphere. General fumes are vented via an exhaust spigot attached to the oven. It is important that a wall or roof fan is fitted of a suitable size. Advise can be given, but it is the customer's responsibility to ensure suitable ventilation is supplied and fitted in the area the oven will be installed. An air change fo 15/20 times per hour is required.

# Notes regarding fitting flue ducts




Burner on top




Burner on side

Powder coating ovens are direct fired, unlike a boiler that is indirect fired.The flue is connected to the roof of the oven and is 250mm in diameter, the flue relies on convection.

The flue needs to be connected to the open air, outside of the building. Bowker Machinery do not provide or install the flue ducting.

The flue ducts can only remove a proportion of the products of combustion so adequate ventilation is required. This can only be achieved by the use of suitably sized and positioned wall fans.

Page 33 of this booklet offers advice on the number if of air changes per hour that are required.

It is important that the oven is serviced at regular 12 month intervals and emissions monitored.

# Information on Gas Meters

Below is a list of some different sizes of meters.

If you have a meter installed check the number (column under size) and relay the letter and number.

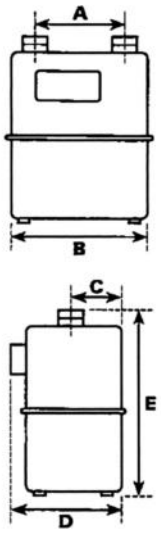
Also check with your supplier the inlet pressure and flow rate.

In this company's experience having a supply change can be extremely expensive. L.P.G. Gas, either bottled or in tank storage can be a very viable option.

## DIAPHRAGM GAS METERS



### SPECIFICATION




| P/N | Size | Test Point | Max. Capacity m³/hour | Max. Capacity m³/hour at 0.5 mbar Pressure Loss | Dimensions (mm) A | B | C | D | E | Max. Working Pressure mbar | Meter Connection Size |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18668* | G1.6 | N | 2.5 | 1.1 | 100 | 128 | 44 | 110 | 197 | 100 | ½" BSP TM |
| 20607* | G1.6 | N | 3.1 | 1.1 | 130 | 164 | 51 | 130 | 214 | 100 | ¾" BSP TM |
| 8293 | G4 | Y | 6 | 4 | 110 | 215 | 70 | 165 | 236 | 500 | 1" BS 746 |
| 12845 | G4 | Y | 6 | 4 | 152.4 | 235 | 68.5 | 165 | 250 | 500 | 1" BS 746 |
| 19957 | U6P | Y | 6 | 4 | 152.4 | 230 | 81 | 197 | 270 | 75 | 1" BS 746 |
| 21423 | U6P | Y | 6 | 5 | 152.4 | 230 | 65 | 197 | 270 | 500 | 1" BS 746 |
| 18410 | G6 | Y | 10 | 5.5 | 130 | 231 | 78 | 187 | 276 | 500 | 1" BS 746 |
| 18411 | G6P | Y | 10 | 5.5 | 130 | 231 | 78 | 187 | 276 | 500 | 1" BS 746 |
| 18412 | G10 | Y | 16 | 8.5 | 280 | 395 | 93 | 214 | 345 | 500 | 1¼" BS 746 |
| 18413 | G10P | Y | 16 | 8.5 | 280 | 395 | 93 | 214 | 345 | 500 | 1¼" BS 746 |
| 19958 | U16P | Y | 16 | 12 | 152.4 | 343 | 160 | 346 | 283 | 75 | 1¼" BS 746 |
| 18414 | G16P | Y | 25 | 12.5 | 280 | 395 | 93 | 214 | 345 | 500 | 2" BS 746 |
| 19959 | U25P | Y | 25 | 18.5 | 250 | 406 | 135 | 308 | 415 | 75 | 2" BS 746 |
| 22352 | G25P | N | 40 | 25 | 335 | 457 | 138 | 289 | 443 | 500 | 2" BSP TM |
| 19960 | U40P | Y | 40 | 32 | 280 | 553 | 178 | 381 | 496 | 75 | 2" BS 746 |
| 19961 | U65P | N | 65 | 34 | 335 | 614 | 178 | 385 | 545 | 75 | 65 mm (2½") PN10 flanged |
| 19979 | U100P | N | 100 | 70 | 430 | 775 | 271 | 552 | 630 | 75 | 80 mm (3") PN10 flanged |
| 19980 | U160P | N | 160 | 100 | 430 | 775 | 271 | 552 | 660 | 75 | 100 mm (4") PN10 flanged |

The larger capacity meters listed are very bulky. For some applications the compact meters on pages 30 and 31 are worth considering.

* P/Ns 18668 and 20607 are supplied with adaptors giving ½" BSP TM and ¾" BSP TM threads respectively, all other meters on this page are supplied without meter adaptors or washers, please see page 33 for these.

No claim in respect of damage, internal or external, to a gas meter of size U16 or G6 or larger will be accepted unless such damage is notified in writing by the end of the working day following our customer's receipt of the meter. We suggest that the internal mechanism is checked by passing air through the meter and noting that it registers.

# Safety Instructions For Gas Fired Powder Coating Ovens

1. Switch off the gas and electric isolator at the end of each shift.

2. Do not store any flammable or pressurised goods in close proximity to the oven.

3. Do not store any goods on top of the oven.

4. Keep the oven walls and floor clean and do not allow a build up of paint or powder to occur.

5. Wear protective clothing and insulated gloves when using the oven.

6. Never spray paint or powder spray inside the oven.

7. A suitable fire extinguisher must be kept in the work area.

8. Always maintain adequate ventilation and check flue pipes and extractor fans on a regular basis.

9. Ensure the oven is serviced at the following intervals:
   - Light work (approx. 20 hours per week): 1 year
   - Heavy work (approx. 40 hours per week): 6 months

The service must be carried out by a competent engineer, preferably by the manufacturer, and address the following:

- CO levels within the work room
- Gas pressure at the burner
- Integrity of gas pipework
- Condition of the burner box and recirculation fan
- New flame failure probes must be fitted
- The internal safety release mechanism must be tested

## IMPORTANT

No further maintenance is required.

Any fault must be reported to the manufacturer.

# Operating Instructions for Gas Fired Powder Coating Ovens

1. Select the desired temperature by ressing 'SET' on the PIXSYS controller then moving either the 'UP' or 'DOWN' button to select the required set point.

2. Set the cure time and run down time according to the parameters as follows:

    1. Press 'ESC' until the screen shows:

        STOP
        PROGRAM
        SET UP
        NETWORK
        DIAGNOSTIC

    2. Move cursor to 'PROGRAM'

    3. Press 'OK'

    4. Move cursor to 'SET PARAM'

    5. Press 'OK'

    6. Move cursor to B13 for cure time and B3 for run time

    7. Press 'OK'

    8. The number will now flash, alter to required time

    9. Press 'OK' and the number will now be set

        Recommended settings:
            B13 - Cure time: 15 minutes
            B3 - Run Time down time: 5 minutes

    (Ignore the other numbers, B2 – B12 and B17 – B18 never require adjustment and should all be set to 01-01 sec.

    Take care not to alter M-H-S (Minutes-Hours-Seconds)

    **If switched to 'Manual':**

1. The oven reaches the set point then modulates around it until the red button is pressed.

2. The burner will now switch off and the run down time will start (B3), after which the plant will shut down.

### If switched to 'Auto':

1. The oven will reach the set point and then the cure time will start (B13), the time light will illuminate and the elapsed time will be displayed on the logo screen.

2. After the time has expired the time light will go off and the finish light will illuminate.The fans will remain on for the duration of the run down period (B3), and then the plant will shut down.

### General

The air flow louvres may require adjustment at some time – move the louvres up or down to equalise the air flow within the oven.

Do not place components within 200mm of the discharge louvres (possibility of scorching).

At the end of the shift turn off the Gas and Electricity supplies at the isolator.

Check that the oven is empty.

## OPERATING FEATURES

| Models : Max Gas 170 -250 | | Gas family | | | |
|---|---|---|---|---|---|
| | | G20 | G25 | G31 | G30 |
| Max. gas pressure* | mbar | 360 | 360 | 362 | 360 |
| Min. gas pressure* | mbar | 16 | 16 | 30 | 30 |
| Fuel L.C.V. | kcal/Nm³ | 8.570 | 7.370 | 22.260 | 29.320 |
| **Model : Max Gas 170** | | | | | |
| Portata gas | max. | 17,60 Nm³/h | 20,47 Nm³/h | 6,78 Nm³/h | 5,14 Nm³/h |
| | min. | 5,53 Nm³/h | 6,43 Nm³/h | 2,13 Nm³/h | 1,62 Nm³/h |
| **Model : Max Gas 250** | | | | | |
| Gas flow rate | max. | 24,14 Nm³/h | 28,19 Nm³/h | 9,29 Nm³/h | 7,06 Nm³/h |
| | min. | 5,53 Nm³/h | 6,43 Nm³/h | 2,13 Nm³/h | 1,62 Nm³/h |

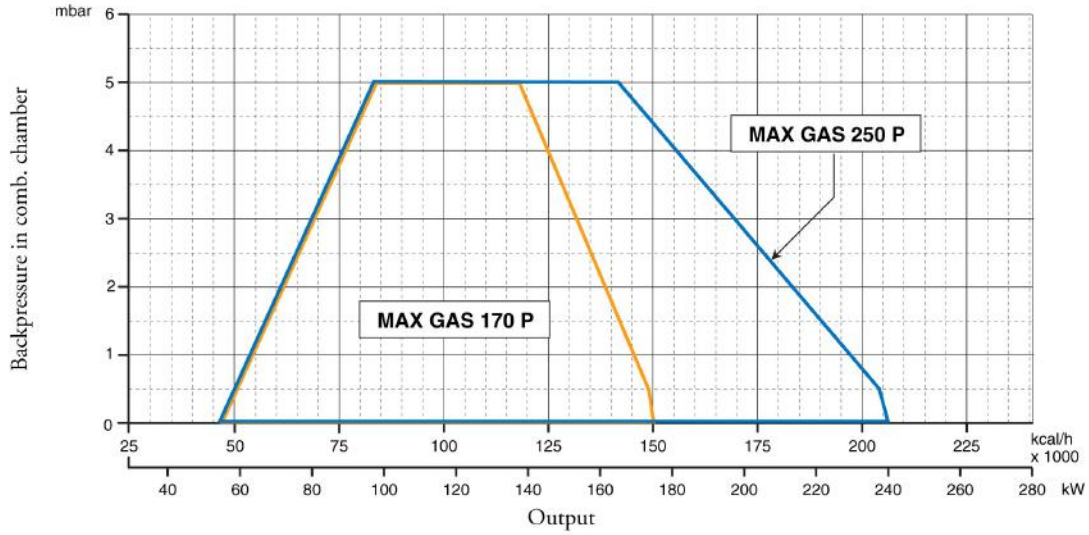
* : Minimum/maximum gas inlet pressures depend by the gas train matched to the burner. The values are written on the gas trains manual.

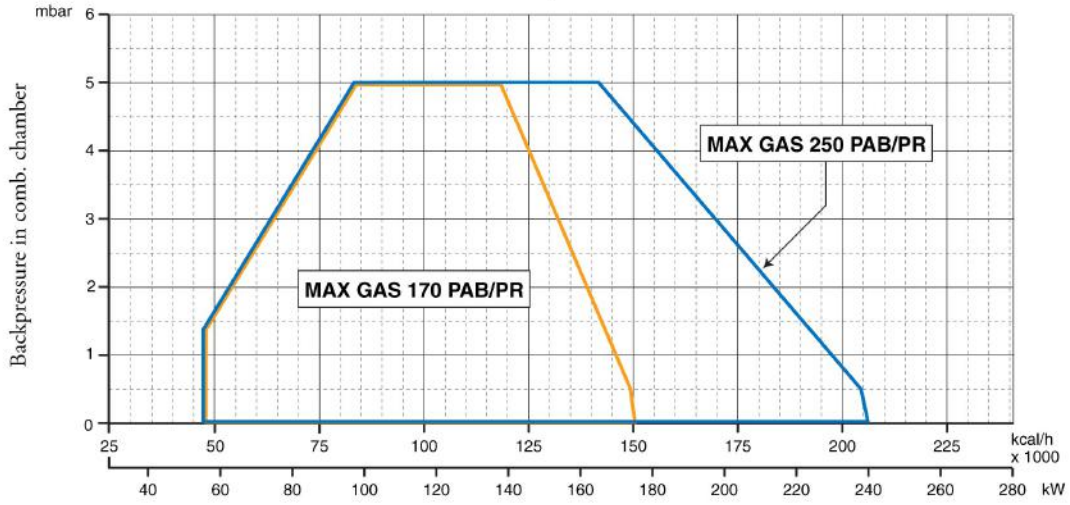
## TECHNICAL DATA

| | | Max Gas 170 P | Max Gas 170 P AB | Max Gas 250 P | Max Gas 250 P AB |
|---|---|---|---|---|---|
| Termal power max. | kW | 175 | 175 | 240 | 240 |
| | kcal/h | 150.860 | 150.860 | 206.900 | 206.900 |
| Termal power min. | kW | 55 | 55 | 55 | 55 |
| | kcal/h | 47.410 | 47.410 | 47.410 | 47.410 |

| Gas family : | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AT | $I_{2H}$, $I_{3B/P}$ | BE | $I_{2E(R)B}$, $I_{3P}$ | DE | $I_{2E}$, $I_{3B/P}$ | DK | $I_{2H}$, $I_{3B/P}$ | SE | $I_{2H}$, $I_{3B/P}$ |
| | ES | $I_{2H}$, $I_{3P}$ | FI | $I_{2H}$, $I_{3B/P}$ | FR | $I_{2Er}$, $I_{3B/P}$ | GB | $I_{2H}$, $I_{3B/P}$ | NL | $I_{2L}$, $I_{3B/P}$ |
| | GR | $I_{2H}$, $I_{3B/P}$ | IE | $I_{2H}$, $I_{3B/P}$ | IT | $I_{2H}$, $I_{3B/P}$ | PT | $I_{2H}$, $I_{3B/P}$ | | |

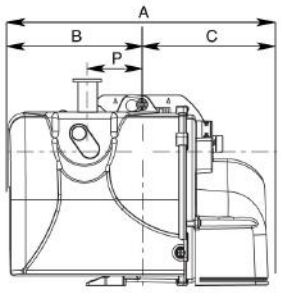
## WORKING FIELDS



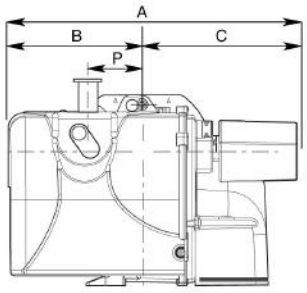



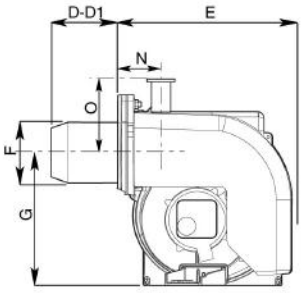
## OVERALL DIMENSIONS

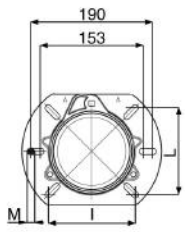
**MAX GAS 170-250 P**




**MAX GAS 170-250 PAB**



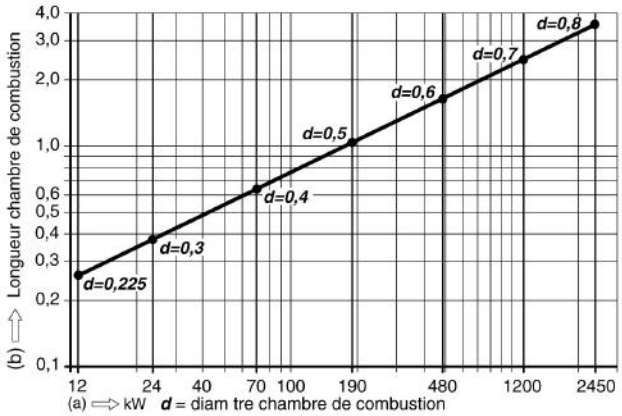




| MODEL | A | B | C | D | D1 | E | F | G | I | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX GAS 170 P | 392 | 202 | 190 | 180 | 280 | 280 | 125 | 201 | 106/130 | 106/130 | M8 | 74 | 52 | 104 |
| MAX GAS 170 PAB | 452 | 202 | 250 | 180 | 280 | 280 | 125 | 201 | 106/130 | 106/130 | M8 | 74 | 52 | 104 |
| MAX GAS 250 P | 392 | 202 | 190 | 180 | 280 | 280 | 125 | 201 | 106/130 | 106/130 | M8 | 74 | 52 | 104 |
| MAX GAS 250 PAB | 452 | 202 | 250 | 180 | 280 | 280 | 125 | 201 | 106/130 | 106/130 | M8 | 74 | 52 | 104 |

D = SHORT HEAD D1= LONG HEAD

**Installation must be carried out in compliance with the local provisions**




The burners have been certified in combustion chambers according to EN 676 standards. Consult the burner manufacturer if the combustion chamber of the boiler in which the burner is to be installed has smaller dimensions.

**L'installazione deve essere fatta in conformità alle disposizioni locali.**

## STARTING-UP THE BURNER

PRELIMINARY CHECKS

Before starting up the boiler check the following: - gas type and feed pressure; - gas valves closed; - the seals in the pipe fittings; - gas pipe breather and input pressure; - that the cable complies with the diagram and the phase and neutral wires correspond; - that the burner shuts down when the boiler thermostat opens; - the seal of the boiler furnace which prevents air from entering; - the seal on the flue-boiler pipe fitting; - the condition of the flue (sealed, free from blockage, etc ). If all these conditions are present, start the burner. The control device starts the motor to carry out prewashing of the combustion chamber. During this prewash period (about 30 seconds) the device checks that air pressure is correct via the air pressure switch. At the end, it supplies power to the transformer and opens the gas valves. The flame must be lit and stabilize within 3 seconds, which is the device's safety time limit. Check to ensure the flame is lit before placing any control instrument in the flue. Adjust and check the gas flow necessary for the boiler at the meter. Adjust the air flow according to the gas flow to obtain correct combustion.

IMPORTANT ADVICE

All adjustable parts must be fixed by the installer after making adjustments. Check flue combustion after each adjustiment. The $CO_2$ values must be approx. 9.7 (G20) 9.6 (G25) 11.7 (G30) 11.7 (G31) axld the CO must be less than 75 ppm.

## Adjusting the gas flow rate at the ignition for burners MAX GAS 170-250

The thermal power at the ignition, for such a burners, must be smaller than 120 kW or else than the ratio between the rated thermal power and control box's safety time (ignition time is assumed equal to safety time, i.e. 3 seconds). The adjustment of thermal power at the ignition is made by the manufacturer, anyhow, should it be necessary to intervene on such an adjustment, proceed as follows: - check that the thermal power of the burner at full running is the correct one. - With the burner switched off, disconnect the flame detection cable from relevant electrode, so as to make the valve to automatically shut off at the ignition, after the safety time. - Make a reading on the gas meter. - Start the burner and wait for the burner's lock out, after the repetition of the ignition sequence. - Make a second reading on the meter, and note the number of delivered litres. - The delivered thermal power, at the ignition, will then be equal to the ratio, between the delivered litres and the safety time, multiplied by the F factor (as function of the type of gas used) read on the table at the side. If the value thus obtained is higher than 120 kW it shall be necessary to reduce the gas valve's initial flow rate. At the end, reconnect the flame detection cable to its relevant electrode. **NOTE:** should it be difficult to measure the quantity of delivered litres of gas, due to the particular meter's dial, it is possible to repeat, sequentially, the above steps many times, so as to reach a significant amount of gas volume. In such a case, the thermal power at the ignition shall be obtained by multiplying the ratio, between the amount of delivered litres and the number of cumulated safety times (i.e. the value of the safety time multiplied by the number of ignitions) by the F factor. See the following examples: Example A: MAX GAS 170 burner, nat. gas; rated thermal power of 175 kW; safety time of 3 secs; a sequence of 4 ignitions is made, for a total amount of 41 delivered litres. The thermal power at the ignition, in kW, shall be: 41/(3x4)x34,02 = 116 kW and therefore correct, being smaller than 120 kW.

| GAS | F |
|---|---|
| G20 (nat.gas) | 34,02 |
| G25 | - |
| G30 (buthane) | - |
| G31 (propane) | 88 |

## CALCULATION OF WORKING OUTPUT OF THE BURNER

**To calculate the burner's working output, in kW, proceed as follows:**

- Check at the meter the quantity of supplied litres and the duration, in seconds, of the reading, then calculate the burner's output through the following formula:

$$\frac{e}{s} \times f = kW$$

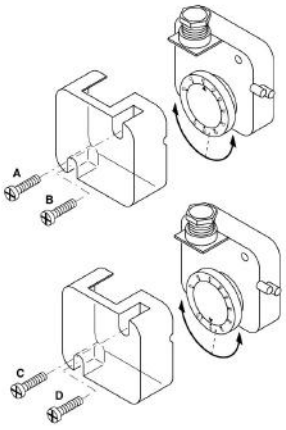
**e** = Litres of gas

**s** = Time in seconds

**f**
- G20 = 34,02
- G25 = 29,25
- G30 = 116
- G31 = 88

## ADJUSTING THE AIR PRESSURE SWITCH

The air pressure switch must be adjusted so that an insufficient air flow does not allow the CO value to exceed 1% in volume. After having adjusted the gas flow and obtained optimum combustion ($CO_2$ = 9.5 to 9.8% and a CO value of less than 75 ppm), the air pressure switch must be adjusted. Remove the cover with the burner operating, cover the air intake progressively with a piece of cardboard to obtain a value of $CO_2$ = 10.8 (G20-G25)> 13 (G30-G31) and a CO value of less than 5,000 ppm. Adjust the air pressure switch until the burner shuts down. Remove the cardboard from the air intake and start up the burner again. Replace the cover.

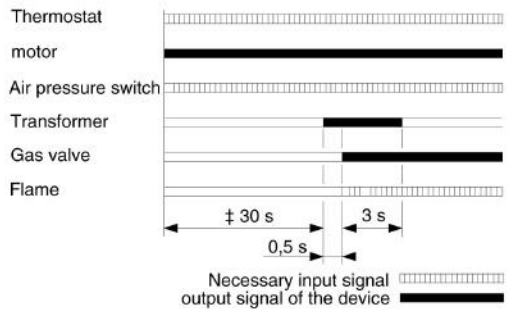



## ADJUSTING THE GAS PRESSURE SWITCH

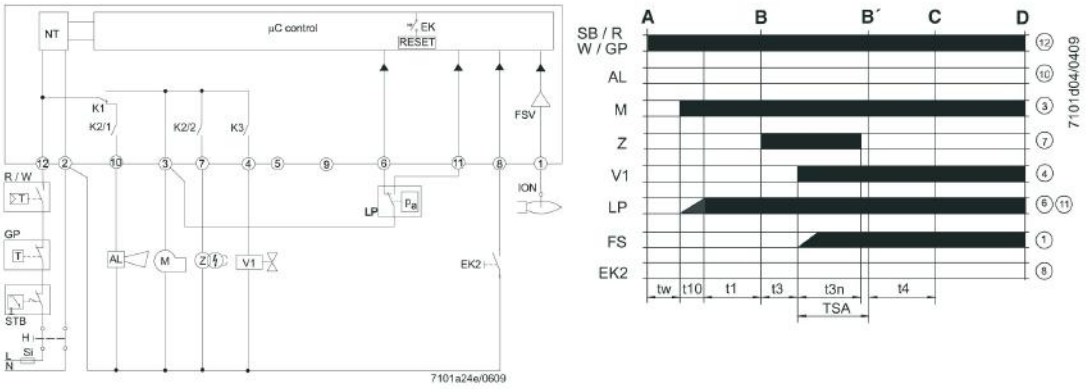
Adjust the pressure switch to 50% of the rated pressure of the gas used.

RARED PRESSURE: G 20 = 20 mbar G 25 = 25 mbar
G 30 = 29 mbar G 31 = 37 mbar

## (LANDIS & STAEFA LGB 21/LGB 22) UP CYCLE



**Connection diagram and control sequence of LME11...**




| | | | | | |
|---|---|---|---|---|---|
| AGK25... | PTC resistor | LKP | Air damper position | | flame |
| AL | Error message (alarm) | LP | Air pressure switch | C | Operating position of burner |
| V... | Fuel valve | LR | Load controller | | reached |
| CPI | Closed Position Indicator | M | Fan motor | C-D | Burner operation (generation |
| DBR... | Wire link | R | Control thermostat / | | of heat) |
| EK | Lockout reset button (internal) | | pressurestat | D | Controlled shutdown by «R» |
| EK2 | Remote lockout reset button | STB | Safety limit thermostat | t1 | Prepurge time |
| ION | Ionization probe | Si | External pre-fuse | t3 | Preignition time |
| FS | Flame signal | t | Time | t3n | Postignition time |
| FSV | Flame signal amplifier | W | Limit thermostat / pressure | t4 | Interval between ignition |
| GP | Pressure switch | | switch | | «Off» and release of «V2» |
| H | Main switch | Z | Ignition transformer | t10 | Specified time for air pressure |
| HS | Auxiliary contactor, relay | ZV | Pilot gas valve | | signal |
| K1...4 | Internal relays | A | Start command (switching on | TSA | Ignition safety time |
| KL | Low-fire | | by «R») | tw | Waiting time |
| LK | Air damper | B-B | Interval for establishment of | | |

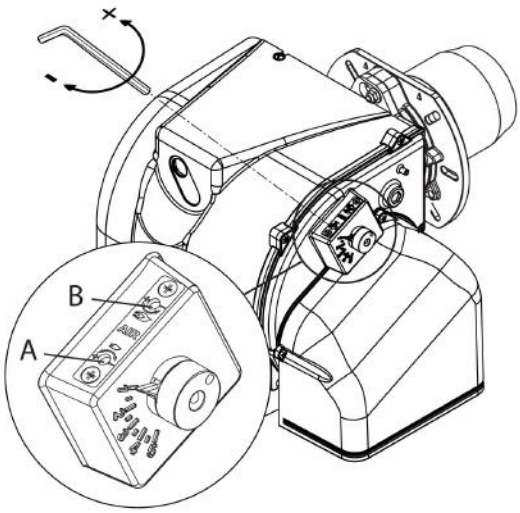
**Color code table for multicolor signal lamp (LED)**

| Status | Color code | Color |
|---|---|---|
| Waiting time «tw», other waiting states | ❍ ..... | Off |
| Ignition phase, ignition controlled | ●❍●❍●❍●❍●❍●❍●❍●❍●❍●❍●❍ | Flashing yellow |
| Operation, flame o.k. | ❑..... | Green |
| Operation, flame not o.k. | ❑❍❑❍❑❍❑❍❑❍❑❍❑❍❑❍❑❍❑❍ | Flashing green |
| Extraneous light on burner startup | ❑▲❑▲❑▲❑▲❑▲❑▲❑▲❑▲❑▲❑▲ | Green-red |
| Undervoltage | ●▲●▲●▲●▲●▲●▲●▲●▲●▲●▲ | Yellow-red |
| Fault, alarm | ▲..... | Red |
| Error code output (refer to «Error code table») | ▲❍ ▲❍ ▲❍ ▲❍ ▲❍ ▲❍ ▲❍ ▲❍ | Flashing red |
| Interface diagnostics | ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ | Red flicker light |
| Legend: ..... Steady on | ▲ Red ❑ Green ❍ Off ● Yellow | |

**Error code table**

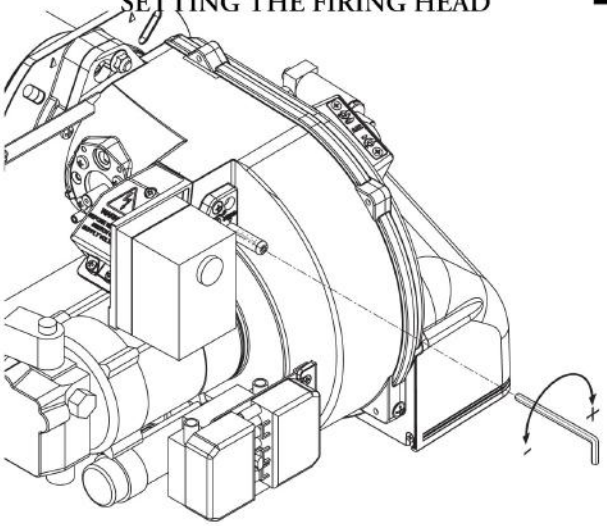
| Red blink code of signal lamp (LED)) | «AL» at term. 10 | Possible cause |
|---|---|---|
| 2 blinks | on | No establishment of flame at the end of «TSA»<br>- Faulty or soiled fuel valves - Faulty or soiled flame detector<br>- Poor adjustment of burner, no fuel - Faulty ignition equipment |
| 3 blinks | on | «LP» faulty<br>- Loss of air pressure signal after «t10», - «LP» welded in normal position |
| 4 blinks | on | Extraneous light when burner is started up |
| 5 blinks | on | Time out «LP»<br>- «LP» welded in working position |
| 6 blinks | on | Free |
| 7 blinks | on | Too many losses of flame during operation<br>(limitation of the number of repetitions)- Faulty or soiled fuel valves.<br>- Faulty or soiled flame detector - Poor adjustment of burner. |
| 8 blinks | on | Free |
| 9 blinks | on | Free |
| 10 blinks | off | Wiring error or internal error, output contacts, other faults. |
| 14 blinks | on | CPI contact not closed |

## AIR ADJUSTMENT Max Gas 170-250 P




To adjust air flow, turn the screw **A** as required. To reduce output, turn screw clockwise, to increase it turn screw counterclockwise. **Note:** screw **B** not used.

## SETTING THE FIRING HEAD

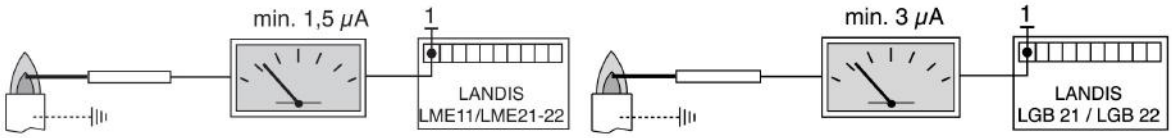


## AIR SERVOMOTOR ( SIEMENS SQN 75 ) MAX GAS 170-250 PAB

Remove cover to enter the adjusting cams. Adjust cams through the suitable key (on issue) and a screwdriver.

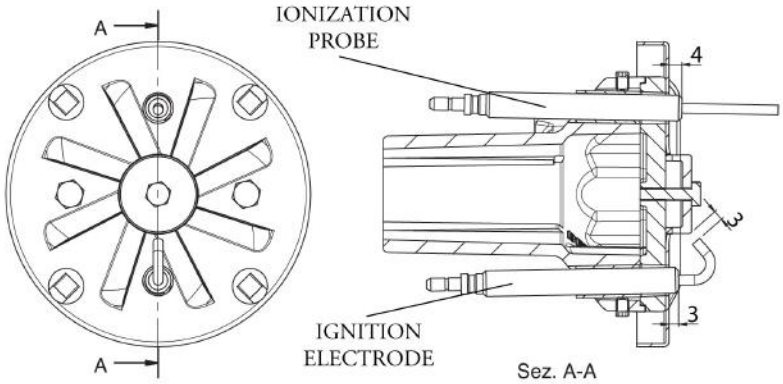
I - Adjusting cam (BLUE) for air damper position on burner's shutdown (total close 0°).
II - Adjusting cam (ORANGE) for opening position in ignition and Low Flame (by the screwdriver).
III - Adjusting cam (RED) for opening position in High Flame (max. output).
IV - Adjusting cam (BLACK) to allow the opening of High flame solenoid valve.

## FLAME DETECTION SYSTEM CHECK

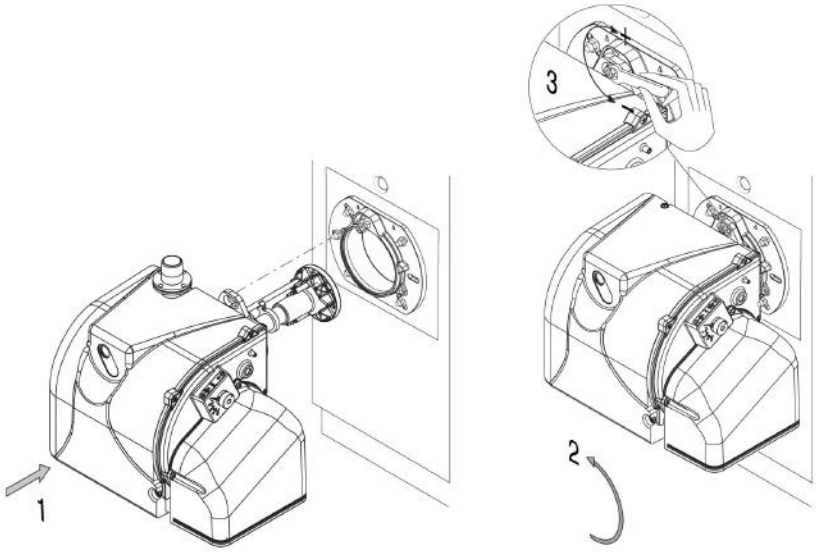



With the burner switched off, connect a DC microammeter with a 0÷50 or 0÷100 μA dial. When the burner is running, and is properly adjusted, the value read must be steady and never be smaller than 1,5 μA (LME 11/21) and 3 μA (LGB 21/22).

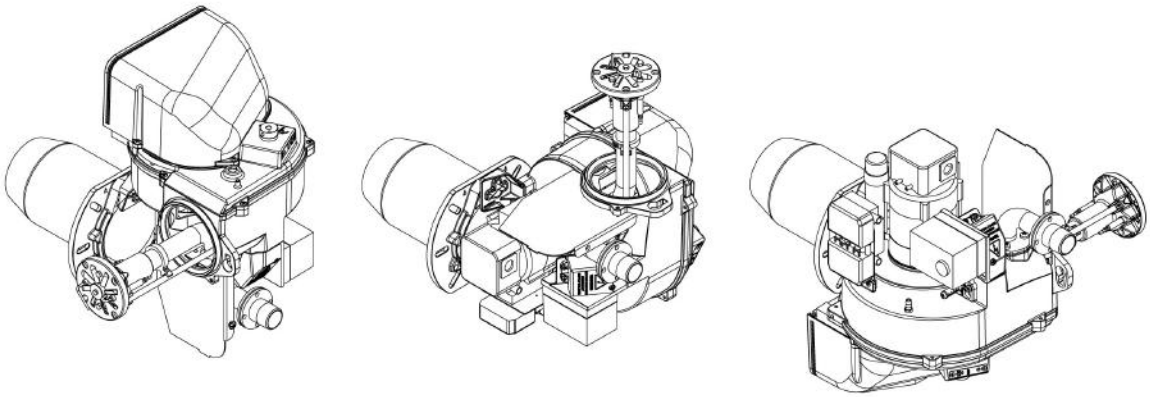
## POSITION OF ELECTRODES




## MOUNTING TO THE BOILER




## TUBE DISASSEMBLY



# MAINTENANCE

## YEARLY INSPECTION

Periodic inspection of the burner (combustion head, electrodes, etc.) must be carried out by authorised personnel once or twice a year, depending of use. Before carrying out maintenance inspection on the burner, it is advisable to check its general condition and carry out the following operations:

- Disconnect the burner from the power supply (remove the plug).
- Close the gas cock.
- Remove the burner cover, clean the fan and air intake.
- Clean the combustion head and check the position of the electrodes.
- Re-assemble the parts.
- Check the seal on the gas pipe fittings.
- Check the flue.
- Restart the burner.
- Check the combustion parameters ($CO_2$ = 9.5 to 9.8),(CO = less than 75 ppm)

## BEFORE EACH INTERVENTION CHECK;

- That the system is supplied with power and the burner connected.
- That the gas pressure is correct and the gas cock open.
- That the control systems are correctly connected.

If all these conditions are present, start the burner by pressing the release button. Check the burner cycle.

## THE BURNER WILL NOT START;

- Check the switch, thermostats, motor, gas pressure.

## THE BURNER PREVENTILATES AND LOCKS AT THE END OF THE CYCLE:

- Check the air pressure and fan.
- Check the air pressure switch.

## THE BURNER PREVENTILATES AND WILL NOT IGNITE:

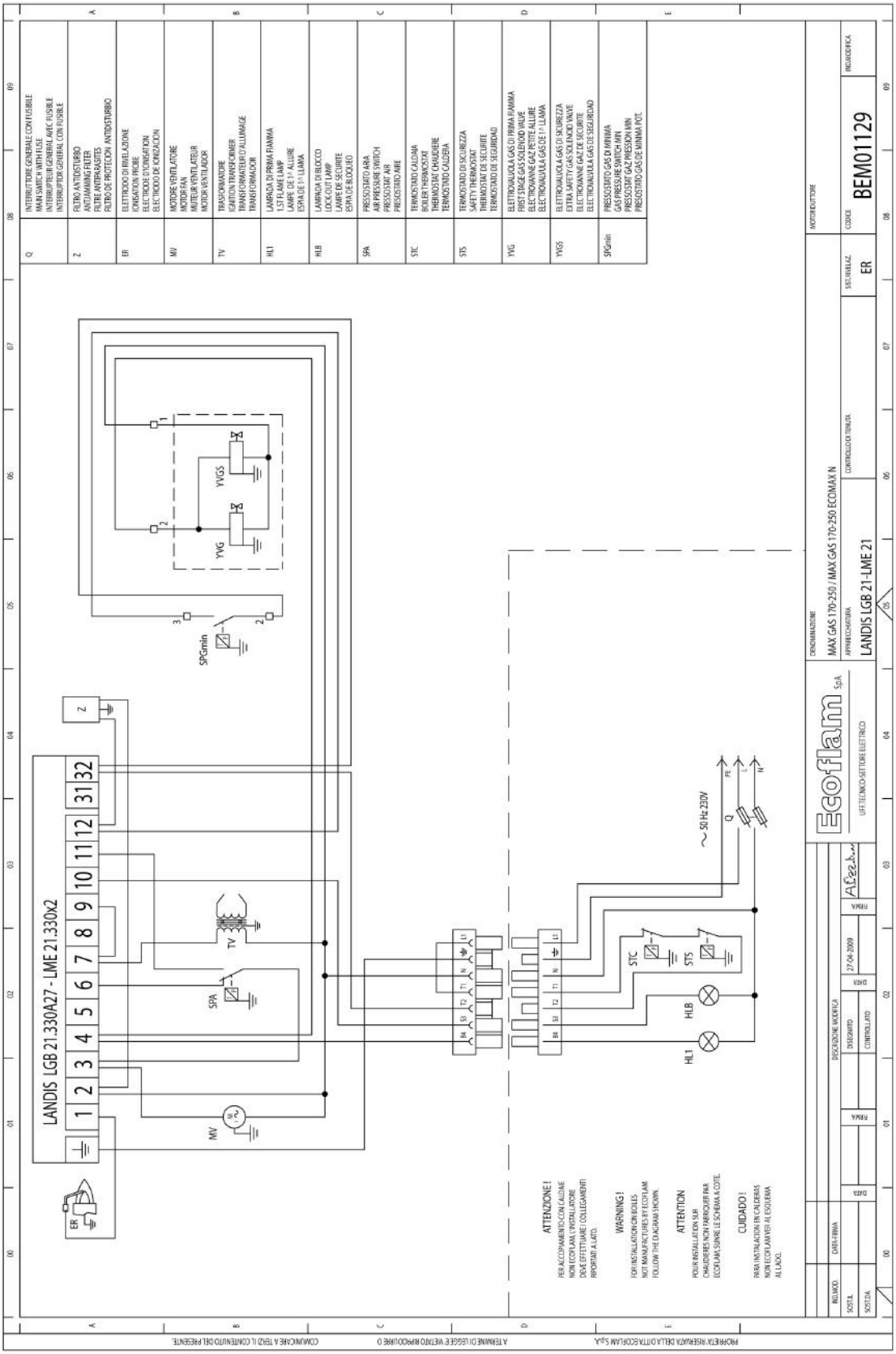
- Check the assembly and position of electrodes.
- Check the ignition cable.
- Check the ignition transformer.
- Check the safety devices.

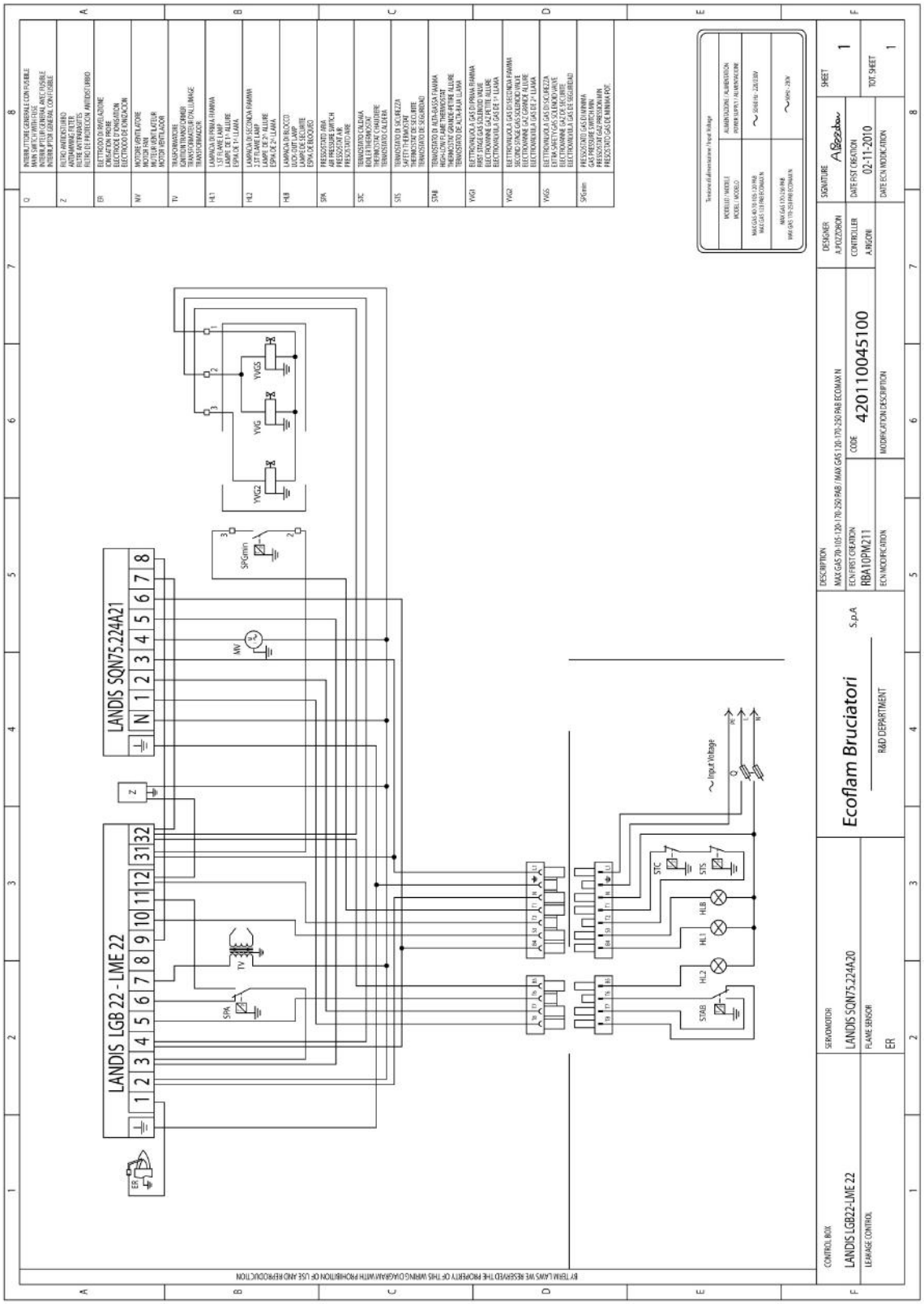
## THE BURNER STARTS UP AND LOCKS AFTER THE SAFETY TIME LIMIT:

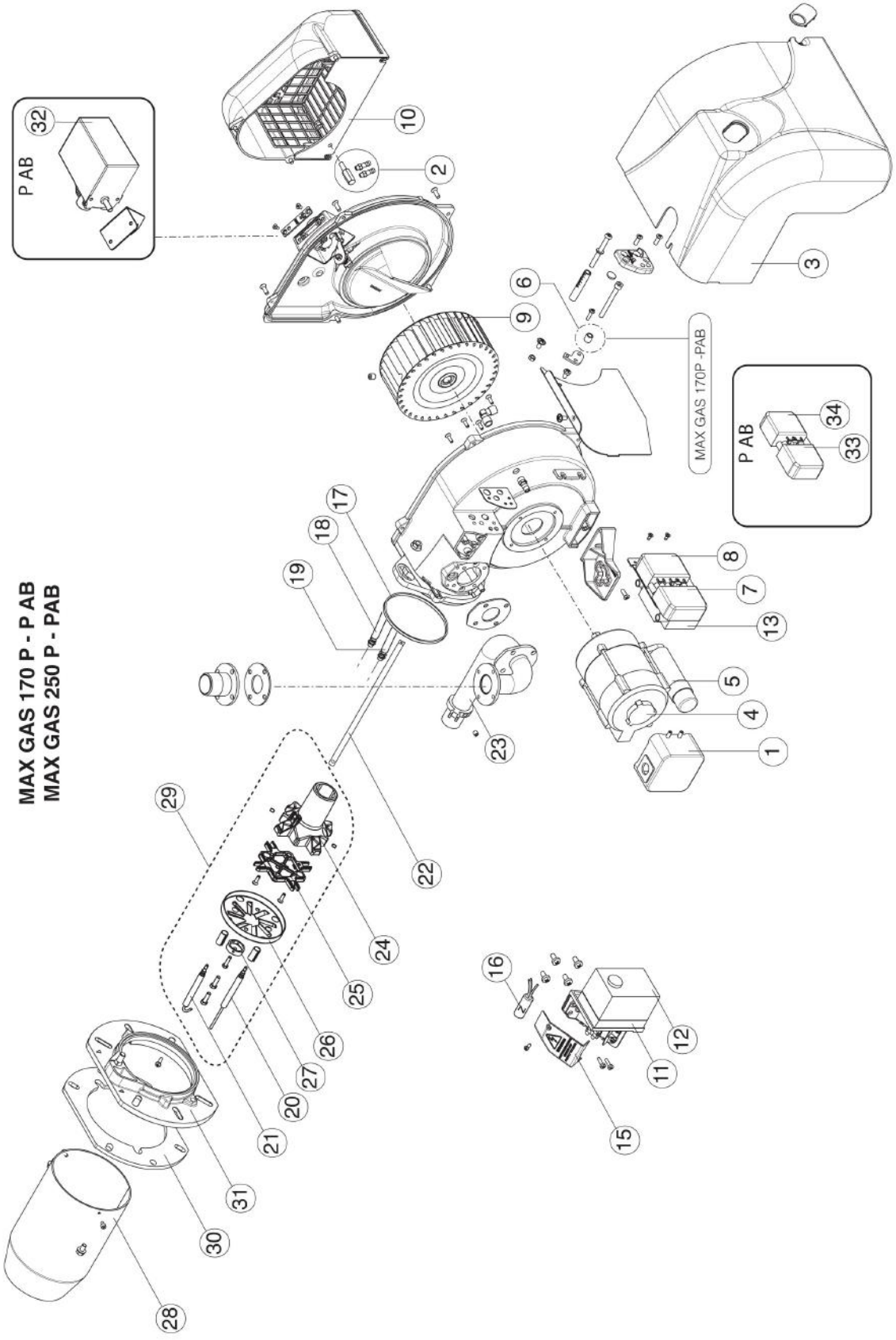
- Check that the phase and neutral wires are correctly connected.
- Check the gas electrovalves.
- Check the position of the detection electrode and its connection.
- Check the detection electrode.
- Check the safety devices.

## THE BURNER STARTS UP AND LOCKS AFTER RUNNING FOR A FEW MINUTES.

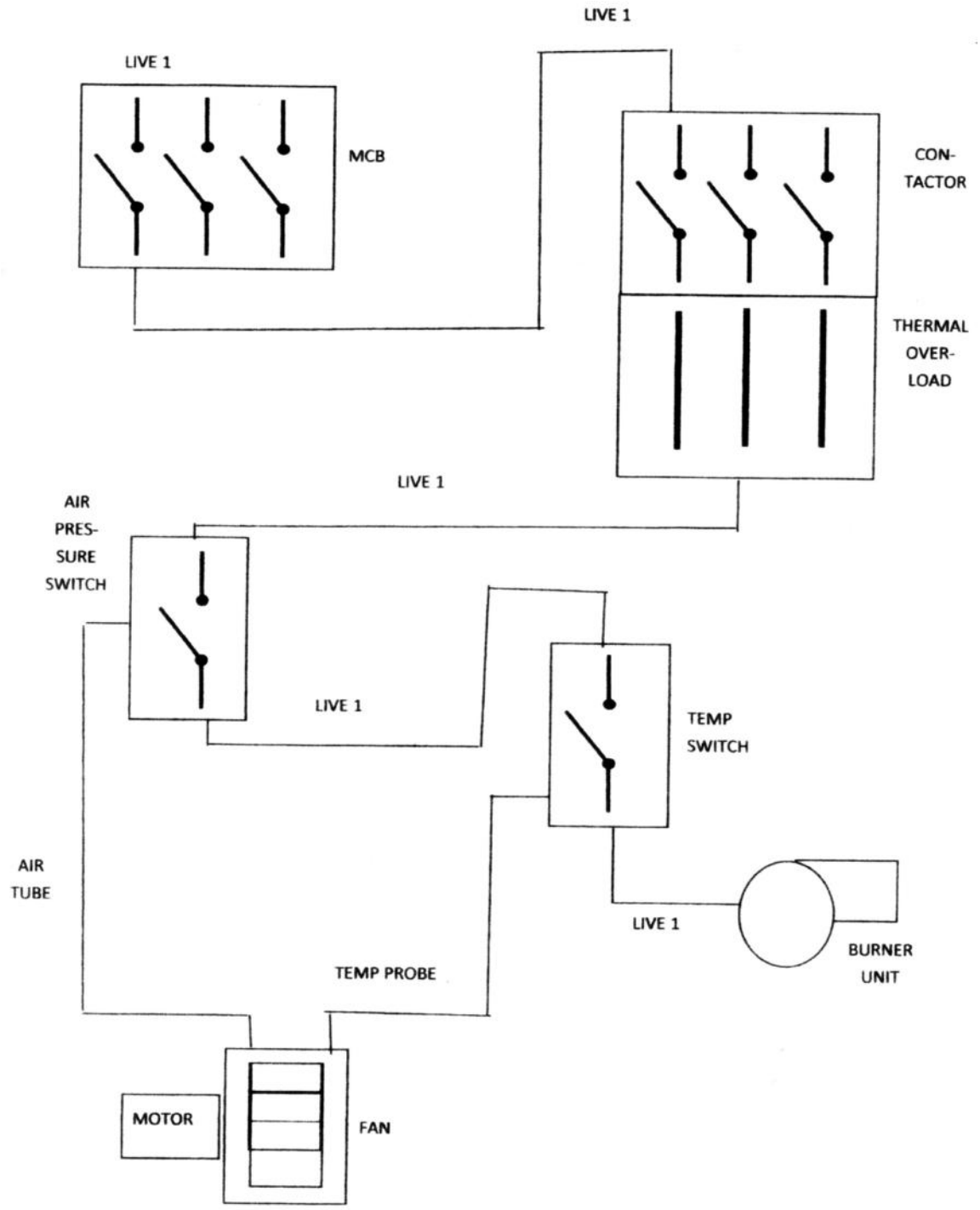
- Check the pressure regulator and the gas filter.
- Check the gas pressure with an ammeter.
- Check the detection value (min 1,5/3 µA Landis).


LANDIS LGB 21.330A27 - LME21.330x2
1 2 3 4 5 6 7 8 9 10 11 12 31 32
Q INTERRUTTORE GENERALE CON FUSIBILE
MAIN SWITCH WITH FUSE
INTERRUPTEUR GENERAL AVEC FUSIBLE
INTERRUPTOR GENERAL CON FUSIBLE
Z FILTRO ANTIDISTURBO
ANTIJAMMING FILTER
FILTRE ANTIPARASITES
FILTRO DE PROTECCION ANTIDISTURBIO
ER ELETTRODO DI RIVELAZIONE
IONISATION PROBE
ELECTRODE D'IONISATION
ELECTRODO DE IONIZACION
MV MOTORE VENTILATORE
MOTOR FAN
MOTEUR VENTILATEUR
MOTOR VENTILADOR
TV TRASFORMATORE
IGNITION TRANSFORMER
TRANSFORMATEUR D'ALLUMAGE
TRANSFORMADOR
HL1 LAMPADA DI PRIMA FIAMMA
1.ST FLAME LAMP
LAMPE DE 1re ALLURE
ESPIA DE 1a LLAMA
HLB LAMPADA DI BLOCCO
LOCK-OUT LAMP
LAMPE DE SECURITE
ESPIA DE BLOQUEO
SPA PRESSOSTATO ARIA
AIR PRESSURE SWITCH
PRESSOSTAT AIR
PRESOSTATO AIRE
STC TERMOSTATO CALDAIA
BOILER THERMOSTAT
THERMOSTAT CHAUDIERE
TERMOSTATO CALDERA
STS TERMOSTATO DI SICUREZZA
SAFETY THERMOSTAT
THERMOSTAT DE SECURITE
TERMOSTATO DE SEGURIDAD
YVG ELETTROVALVOLA GAS DI PRIMA FIAMMA
FIRST STAGE GAS SOLENOID VALVE
ELECTROVANNE GAZ PETITE ALLURE
ELECTROVALVULA GAS DE 1re LLAMA
YVGS ELETTROVALVOLA GAS DI SICUREZZA
EXTRA SAFETY GAS SOLENOID VALVE
ELECTROVANNE GAZ DE SECURITE
ELECTROVALVULA GAS DE SEGURIDAD
SPGmin PRESSOSTATO GAS DI MINIMA
GAS PRESSURE SWITCH MIN
PRESSOSTAT GAZ PRESSION MINI
PRESOSTATO GAS DE MINIMA POT.
ATTENZIONE !
PER ACCOPPIAMENTO CON CALDAIE NON ECOFLAM, L'INSTALLATORE DEVE EFFETTUARE I COLLEGAMENTI RIPORTATI A LATO.
WARNING !
FOR INSTALLATION ON BOILERS NOT MANUFACTURED BY ECOFLAM FOLLOW THE DIAGRAM SHOWN.
ATTENTION
POUR INSTALLATION SUR CHAUDIERES NON FABRIQUEES PAR ECOFLAM, SUIVRE LE SCHEMA A COTE.
CUIDADO !
PARA INSTALACION EN CALDERAS NON ECOFLAM VEDI AL ESQUEMA AL LADO.
~ 50 Hz 230V
PE
L
N
Ecoflam SpA
UFF. TECNICO-SETTORE ELETTRICO
DENOMINAZIONE
MAX GAS 170-250 / MAX GAS 170-250 ECOMAX N
APPARECCHIATURA
LANDIS LGB 21-LME 21
CONTROLLO DI TENUTA
SIGLA RIFERIM.
ER
MOTORE/UTTORE
CODICE
BEM01129
INGRANDIMENTO
DISEGNATO
CONTROLLATO
DATA 17-04-2009
FIRMA Alessio
DESCRIZIONE MODIFICA
DATA-FIRMA
INGLMODO.
SOSTIT.
SOSTITA
PROPRIETA' RISERVATA DELLA DITTA ECOFLAM S.p.A.
A TERMINE DI LEGGE E' VIETATO RIPRODURRE O COMUNICARE A TERZI IL CONTENUTO DEL PRESENTE.


LANDIS LGB 22 - LME 22
LANDIS SQN75.224A21
Ecoflam Bruciatori S.p.A.
R&D DEPARTMENT
CONTROL BOX
LANDIS LGB22-LME 22
SERVOMOTOR
LANDIS SQN75.224A20
FLAME SENSOR
ER
DESCRIPTION
MAX GAS 70-105-120-170-250 PAB / MAX GAS 120-170-250 PAB ECOMAX N
ECN FIRST CREATION
RBA10PM211
ECN MODIFICATION
CODE
42011004510 0
MODIFICATION DESCRIPTION
DESIGNER
A.POZZORON
CONTROLLER
A.RIGONI
SIGNATURE
DATE FIRST CREATION
02-11-2010
DATE ECN MODIFICATION
SHEET
1
TOT. SHEET
1
BY TERMI LAWS WE RESERVED THE PROPERTY OF THIS DRAWING WITH PROHIBITION OF USE AND REPRODUCTION


MAX GAS 170 P - P AB
MAX GAS 250 P - PAB
P AB
MAX GAS 170P -PAB
P AB

## Schematic 1.13 – Air Pressure Failure Devices




Routine examination of the circuit will be carried out as part of the service.

Our Powder Coating Ovens must be serviced within the recommended intervals.

# Notes on Powder Coating

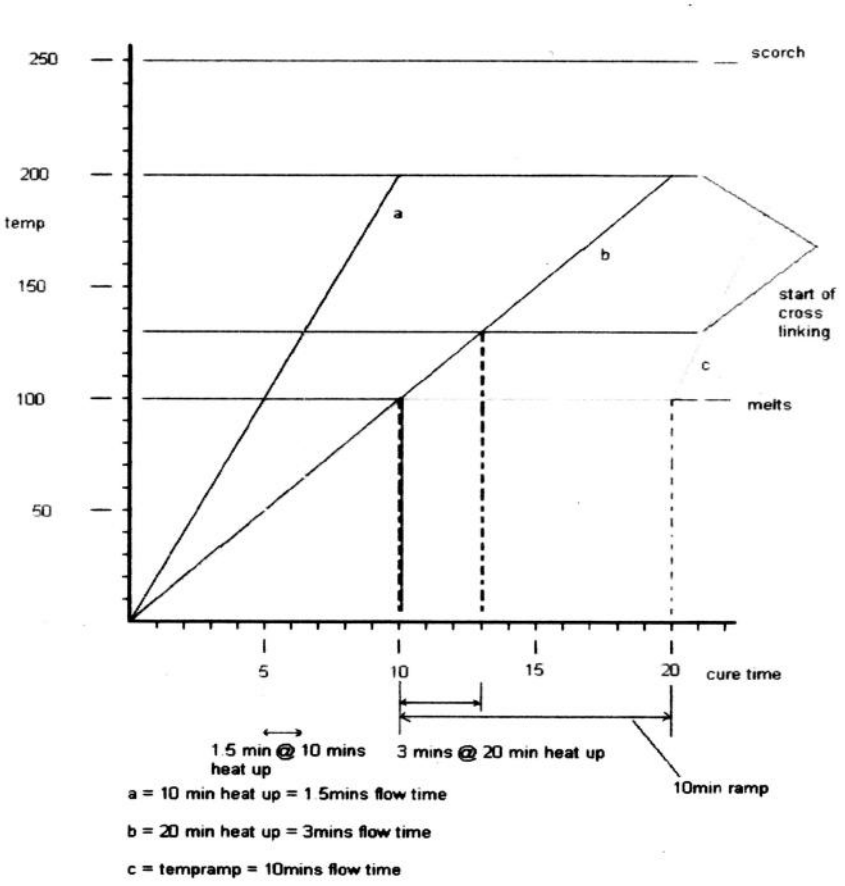
The following notes are designed to help overcome some of the problems that can be encountered in powder coating, especially the coating of alloy wheels.

Scorching

The most frequent question we are asked is: “How quickly can the oven reach full temperature?” - Although speed of operation is important, fast heat up time can easily lead to scorching and bad results.

Fig 1 describes the stages that the powder passes through on its way to being finally cured. It should be notde that the time between melting and cross-linking is critical and enough time allowed for the powder to de-gas and to flow into a smooth surface before cross-linking starts. Otherwise small pimples are made as the gas escapes, these can be mistaken for dirt. A rough orange peel effect can also occur.

**Fig 1**



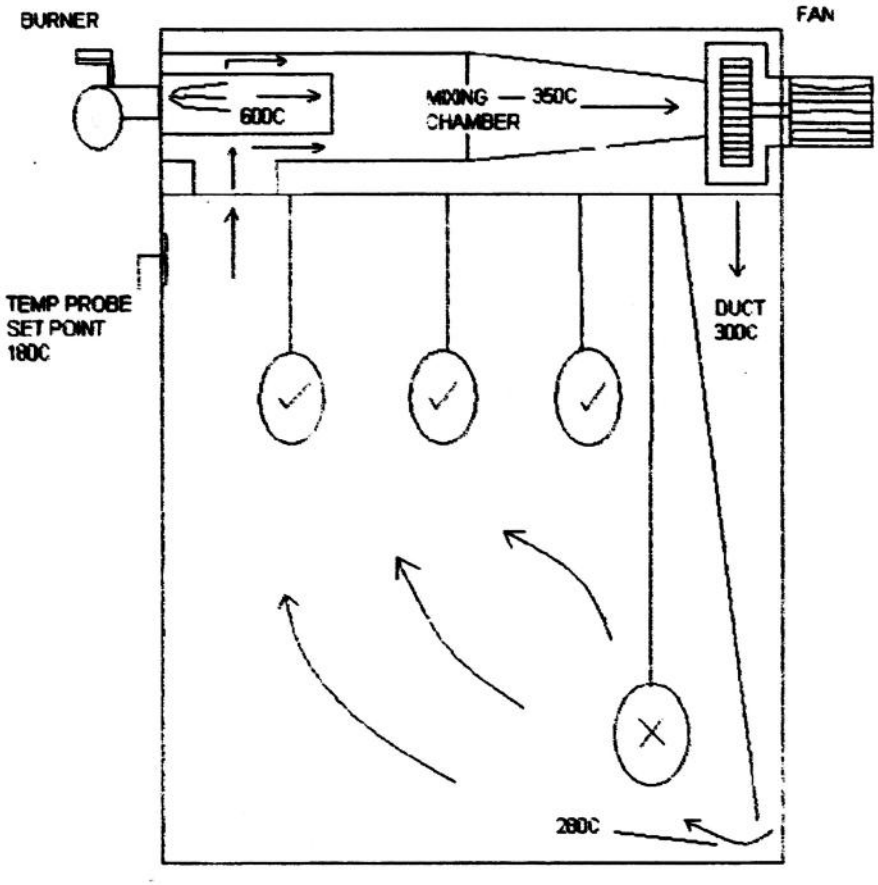
# Heat Distribution

Fig 2 shows how heat is generated in the burner box of a gas oven and circulated throughout the oven. The heat is pumped via a high volume centrifugal fan. The heat entering the oven must be considerably higher than the desired set point. When the sensor reaches the set point temperature, it will then maintain the oven at this temperature. Air at different temperatures do mix throughout the body of the oven helped by the flow from the powerful fan but it must be emphasised that isn't an immediate process. Care and experience are required to minimize the dangers outlined in Fig 1.

For example, if positioned incorrectly an alloy wheel will soak up heat much quicker than the sensor that controls the oven, this can lead to a situation where, by the time the set point is reached, the wheel will be scorched.

The use of trolleys to hold the wheels can lead to difficulties and overhead conveyors are preferable.

**Fig 2**



It can be seen from this drawing that if placed incorrectly the wheels can soak up heat quicker than the heat sensor. Depending on the severity of the heat up process the results may be scorching or pimples that can be mistaken for dirt and orange peel effect.

## Heat Control

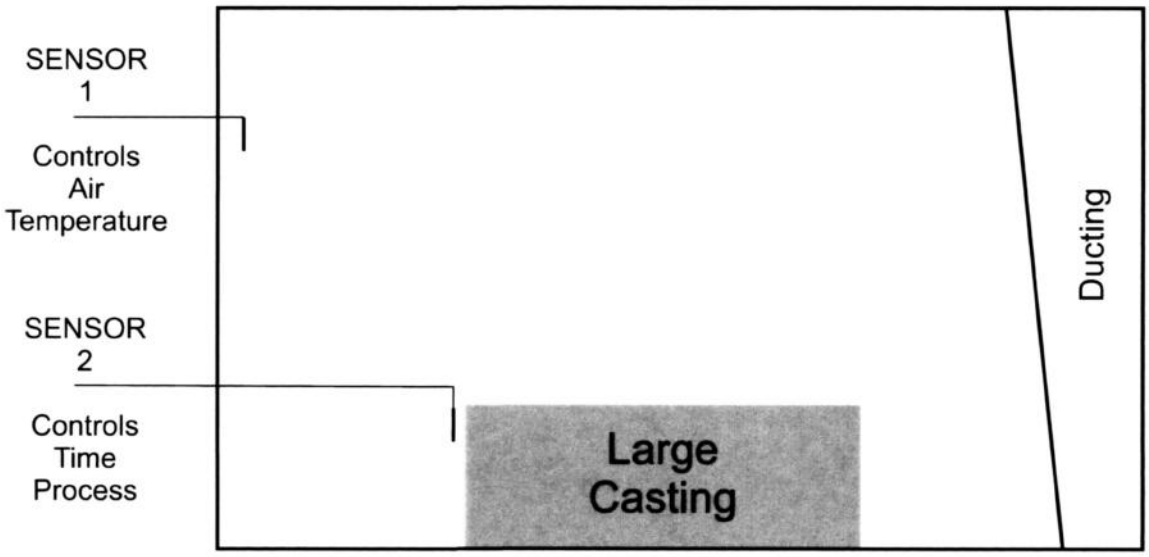
In some processes additional heat control is required.

Fig 3 shows one example; a large iron casting is required to be stoved at 200°C, to enable this to be done accurately a separate temperature sensor is attached to the casting, this controls the oven time control. The sensor attached to the oven wall controls the oven temperature, which is set to 200°C. The casting will lag considerably but when 200°C is reached, the time will then commence.

A process whereby an extremely smooth and high quality of finish is required may necessitate the use of a temperature ramp. The oven will reach 100°C and then hold at this temperature for sufficient time to allow the powder paint to run smoothly and de-gas fully before rising to 180°C for curing to take place.

The cycle time is obviously longer and fuel consumption higher but the results can be noticeably superior.

**Fig 3**



# General Tips

Powder melts at around 100°C

Powder de-gasses at around 100°C – 130°C

Cross-linking starts at around 130°C

The degassing period must be sufficiently long to allow full de-gassing to take place, otherwise small marks will appear. This has the appearance of dirt in the powder coating.

The powder must also have time to run smoothly before cross linking occurs, otherwise an 'orange peel' effect will take place. Some modern powders are 'low bake' types and this can exacerbate these problems.

In practise most curing problems can be solved by lowering the temperature and lengthening the cure time.

# Infra-red Temperature Sensors

Professional models made by companies such as Fluke or Raydot are supplied in a kit along with a special conductive masking tape and calibration chart.

When the masking tape, which is make black in colour, is applied to the surfaces to be tested it provides surfaces with an equal emissivity value. The device then has to be adjusted to the distance to be measured and calibrated to the light setting.

The emissivity valve comprises of various factors; including reflectivity, surface contamination, absorption properties, chemical composition, etc. and varies even in the same material. A copper pipe for example, will have a different emissivity value as it wends its way through a building.

The strength of the returning signal weakens over distance as the reflective spot becomes larger and the device has to be adjusted accordingly.

The result from inexpensive hand held models are not reliable and cannot be taken as accurate.

# Guide to Air Changes in the Working Area

The tables below show the number of air changes per hour (Number of Renewals per Hour – NR/h) that are required depending on the usage of the premises.

It is advisable however, to carry out a more detailed study in each individual case.

| Industrial Premises | NR/h |
|---|---|
| Toxic atmosphere | 30 – 60 |
| Goods warehouse | 3 – 6 |
| Foundry | 20 – 30 |
| Industrial laundry | 15 – 30 |
| Machine room | 20 – 30 |
| Workshop (general) | 8 – 10 |
| Workshop with furnace | 30 – 60 |
| Machine workshop | 5 – 10 |
| Paint workshop | 30 – 60 |
| Welding workshop | 15 – 30 |
| Dry Cleaner's | 20 – 30 |

| Service Sector and Premises | NR/h |
|---|---|
| Classroom | 2 – 4 |
| Bank | 3 – 4 |
| Bar – cafe | 10 – 12 |
| Library | 3 – 5 |
| Cinema – theatre | 10 – 15 |
| Industrial kitchen | 15 – 30 |
| Canteen dining hall | 5 – 10 |

# Important Notes on Measuring Carbon Monoxide Levels

It must be realised that this oven is direct fired, this means that the products of combustion cannot be directly vented to atmosphere as would be the case with an indirect fired boiler. The testing methods are therefore different than those used for a boiler or a sealed system.

Readings must be taken in the immediate working area.

It is important that a suitably sized wall or roof fan with a capacity of 20/25 room air changes per hour is installed.

If regular servicing is not undertaken it is advised that the user purchases a meter and carries out regular checks.

Below is a list of permitted levels, oil, grease and paint etc. are all capable of producing high levels of CO, for example if cigarette smoke is in the immediate vicinity it can produce a high level reading 300ppm.

Cleanliness and ventilation are essential.

## CO Levels and it's Effect

| ppm (parts per million) | Symptoms and Applicable Standards |
|---|---|
| 0 – 1 | Normal background levels |
| 9 | Maximum indoor air quality level: Maximum allowable concentration per ASHRAE Residential standards 62-1989 for living areas. |
| 25 | Maximum limit 8 hrs of continuous exposure per California OSHA workplace standards |
| 35 | Maximum 8hrs average exposure level per US OSHA workplace standards |
| 50 | Maximum concentration for continuous exposure in any 8 hrs average level per OSHA standards |
| 100 | Remove employees from enclosed space if the C) concentration exceeds 100 ppm per OSHA exposure limit |
| 200 | Mild headache, fatigue, nausea and dizziness within 2 – 3 hours |
| 400 | Frontal headache, life threatening after 3 hours. Maximum concentration in flue gas per the US EPA and AGA standards |

| ppm (parts per million) | Symptoms and Applicable Standards |
|---|---|
| 800 | Dizziness, nausea, convulsions, death within 2 – 3 hours |
| 1600 | Nausea with 20 minutes, death within 2 – 3 hours |