GENERAL BRUCIATORI
We tailor your heat

INDUSTRIAL MONOBLOCK BURNERS

GB-ML

GAS DIESEL OIL LOWGAS ALCOHOL

FUEL

INDEX

General Bruciatori was established in Parma in 1975 as a manufacturer of large capacity industrial burners for a variety of applications.
Our burners are used effectively on hot water boilers, steam boilers, diathermic boilers, incinerators, all types of dryers, industrial processes in energy-intensive industries.

For over **40 years** we have been making industrial burners with a single aim: to meet your specific needs.
Like a tailor who makes a suit to fit an individual's proportions, General Bruciatori listens to a customer's requirements, and on that basis rapidly and efficiently engineers solutions that are tailored in terms of technology as well as in terms of investment, offering highly customized products.
Thanks to the company's vast expertise, General Bruciatori can offer a complete service, from development of complex, articulated projects to supply of turnkey combustion systems, with the advantage of having a single partner throughout the entire project.

The General Bruciatori range covers a large number of industrial burner types and complementary products:

- Monoblock burners
- Burners with separate elements
- Burners with separate elements and flame register
- Dust burners
- Combustors

This brochure presents a detailed overview of our **GB-ML** range of monoblock burners.

General Bruciatori
Custom products built to your exact needs.


DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificato No./Certificate No.: 74392-2010-AQ-ITA-SINCERT
Data prima emissione/Initial date: 31 gennaio 2010
Validità/Valid: 25 giugno 2015 - 25 giugno 2018

Si certifica che il sistema di gestione di/This is to certify that the management system of

GENERAL BRUCIATORI S.r.l.

Via Azzali, 10 - 43100 Parma (PR) - Italy

È conforme ai requisiti della norma per il Sistema di Gestione Qualità/
has been found to conform to the Quality Management System standard:

UNI EN ISO 9001:2008 (ISO 9001:2008)

Questa certificazione è valida per il seguente campo applicativo:
Progettazione, produzione, installazione e assistenza post vendita di bruciatori industriali
(Settore EA : 18)

This certificate is valid for the following scope:
Design, manufacture, installation and after-sales servicing of industrial burners
(EA Sector : 18)

Luogo e Data/Place and date:
Vimercate, 18 settembre 2015

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
SGQ N° 003 A / EMAS N° 009 P
SGA N° 003 D / PRD N° 003 B
SGE N° 007 M / PRS N° 094 C
SCR N° 004 F / SSI N° 002 G
Membro di MLA EA per gli schemi di accreditamento SGQ, SGA, PRD, PRS, ISP, GHG, LAB e LAT, di MLA IAF per gli schemi di accreditamento SGQ, SGA, SSI, FSM e PRD e di MRA ILAC per gli schemi di accreditamento LAB, MED, LAT e ISP

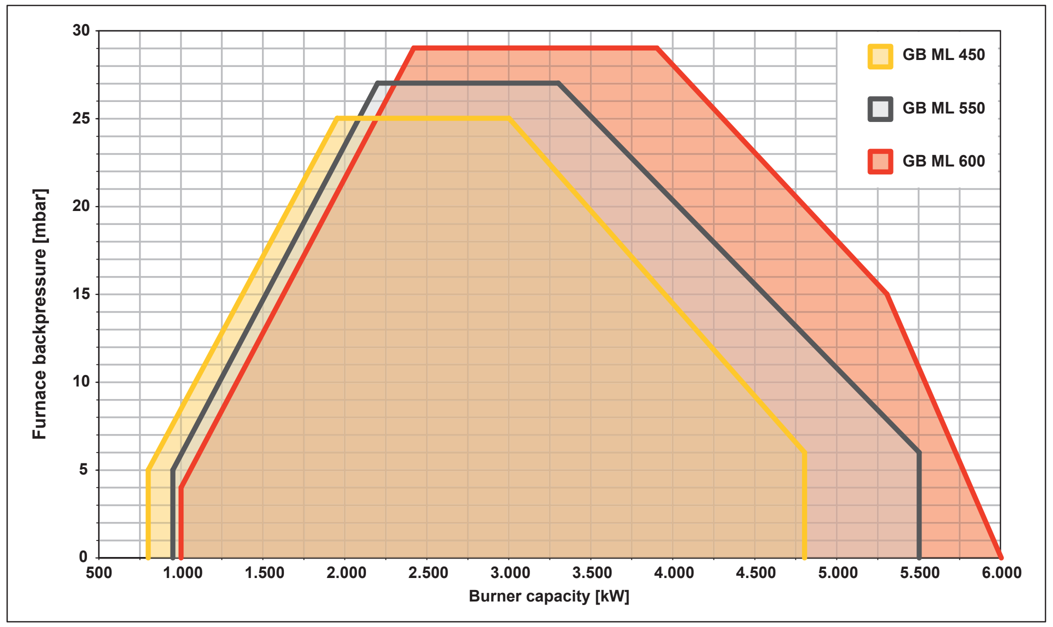
Per l'Organismo di Certificazione/
For the Certification Body

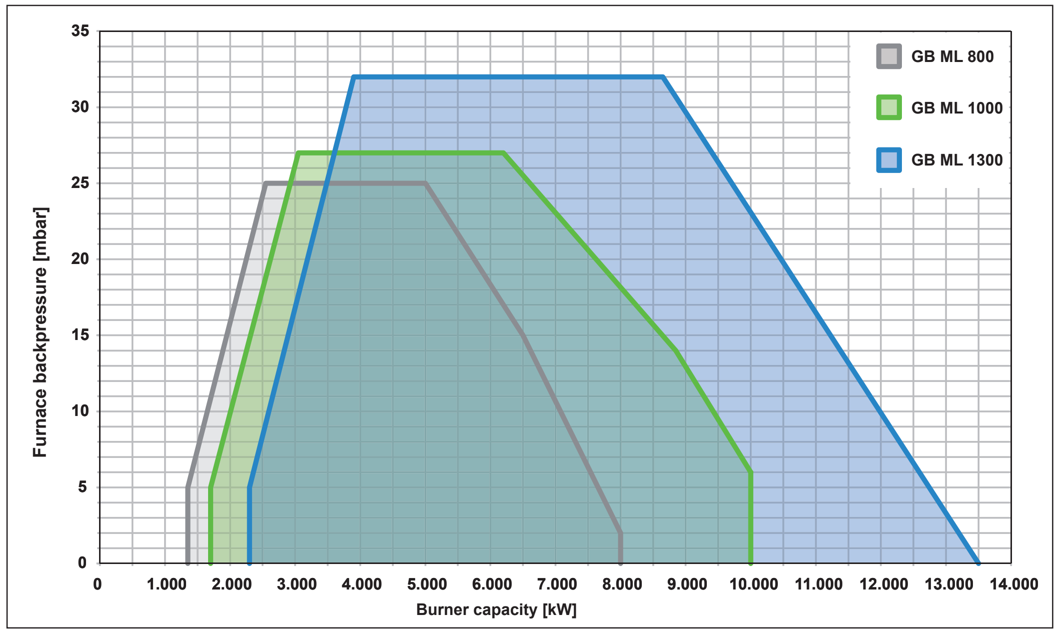
Vittore Marangon
Management Representative

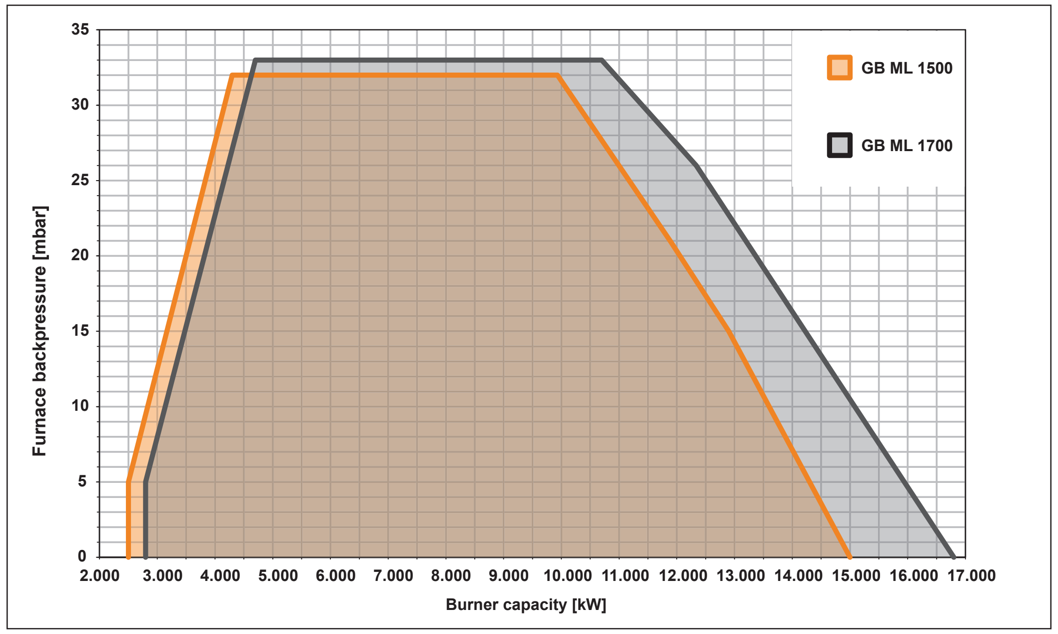
La validità del presente Certificato è subordinata al rispetto delle condizioni contenute nel Contratto di Certificazione/
Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
DNV GL Business Assurance Italia S.r.l. Via Energy Park, 14, 20871 Vimercate (MB), Italy. Tel: 039 68 99 905. www.dnvgl.it/businessassurance

Test conditions in accordance with
EN 676 and EN 267:
Air temperature 20°C
Pressure 1013.5 mbar
Altitude 0 m a.s.l

Min*: ref natural gas







GB-ML 1700 GN EM I A LP FGR

	LOW NOx OPTION	
FGR	Low NOx flue gas external recirculation	
LX	Low NOx internal recirculation	
LP	Low pressure fuel	**SPECIAL VERSION**
DF	Double air flow	
SF	Short flame	
V	Steam	**ATOMIZING OPTION**
A	Compressed air	
I	Inverter	
	BURNER OPERATION	
/2	Two stages	
MC	Mechanical cam	
EM	Electronic cam	
	FUEL TYPE	
D	Diesel oil	
G	Natural Gas	
N	Heavy oil	
GN	Dual fuel gas / heavy oil	
GD	Dual fuel gas / diesel oil	
	MODEL IDENTIFICATION	
	Size	
	FAMILY TYPE	
GB-ML	Monoblock burner	

The above listed LX option and special version, if required, might be installed simultaneously: LP + DF

Note: in case of capacity over 16.800 kW models available on demand.
Please contact our Sales Department

			GB-ML 450	GB-ML 550	GB-ML 600	GB-ML 800	GB-ML 1000	GB-ML 1300	GB-ML 1500	GB-ML 1700	
HEATING OUTPUT	MODEL										
	OUTPUT	min*-max [kW]	800 - 4800	950 - 5500	1000 - 6000	1350 - 8000	1700 - 10000	2300 - 13500	2500 - 15000	2800 - 16800	min-max [kW]
FUEL DATA	CAPACITY HEAVY OIL	min-max [kg]	110 - 430	120 - 490	135 - 540	180 - 715	225 - 900	300- 1210	340 - 1340	385 - 1500	min-max [kg]
	VISCOSITY FUEL (diesel oil)	°E - cSt	1.5 °E at 20°C - 6 cSt at 20°C				1.5 °E at 20 °C - 6 cSt at 20 °C				°E - cSt
	VISCOSITY FUEL (heavy oil)	°E - cSt	60°E at 50°C - 450 cSt at 50 °C				60°E at 50°C - 450 cSt at 50 °C				°E - cSt
	CAPACITY NATURAL GAS (G20)	min-max [m³n/h]	80 - 485	95 - 555	100 - 605	135 - 810	170 - 1010	235 - 1365	255 - 1520	285 - 1700	min-max [m³n/h]
	MAX GAS PRESSURE	mbar	490	490	490	490	490	490	490	490	mbar
GAS CONNECTION	GAS OPERATION		Intermittent operation (min. 1 stop each 24hrs of operation)				Intermittent operation (min. 1 stop each 24hrs of operation)				
BURNER OPERA-TION	OPERATING CONDITION		PROGRESSIVE 2 STAGE				PROGRESSIVE 2 STAGE				
	MODULATING RATIO (at max output)		1 - 6 Gas 1 - 4 Diesel oil 1- 4 Heavy oil				1 - 6 Gas 1 - 4 Diesel oil 1- 4 Heavy oil				
	WORKING TEMPERATURE	min-max [°C]	-15°C +50°C				-15°C +50°C				min-max [°C]
ELECTRICAL DATA	ELECTRIC SUPPLY	V - Hz	3N ~ 230 - 400V ±10% / 50Hz				3N ~ 230 - 400V ±10% / 50Hz				V - Hz
	IGNITION TRANSFORMER OIL	V2 - I2mA	13000 V- 35 mA				13000 V - 35 mA				V2 - I2mA
	IGNITION TRANSFORMER GAS	V2 - I2mA	8000 V - 20 mA				8000 V - 20 mA				V2 - I2mA
	FUN MOTOR rotation	RPM'	2900				2900				RPM'
	electric power	kW	7,5	9,2	11	11	15	22	30	37	kW
	PUMP MOTOR rotation	RPM'	1450				1450				RPM'
	electric power	kW	2,2	2,2	2,2	2,2	3	3	4	5,5	kW
	PROTECION LEVEL	IP	IP 54				IP 54				IP
APPROVALS	DIRECTIVE		2006/42/CE - 2006/95CE- 2011/65/CE - 2004/108/CE				2006/42/CE - 2006/95CE- 2011/65/CE - 2004/108/CE				
	CONFORMING TO		EN 60204-1 / EN 62233 / EN 61000-6-2 EN 61000-6-4 / EN 60529				EN 60204-1 / EN 62233 / EN 61000-6-2 EN 61000-6-4 / EN 60529				

The whole range is available with Low NOx configuration:

- *Gas fired in Class III in accordance with EN 676 and related specification about combustion chamber dimensions and thermal load. The NOx level refer to the average NOx among the burner's working curve.*
- *Diesel fired Low NOx in accordance to EN 267*

Please note that fuel composition might also affect the NOx levels.

Min: ref natural gas*
Reference conditions:
Air temperature 20°C
Pressure 1013.5 mbar
Altitude 0 m a.s.l

Conversion of calorific values

1 kcal/kg = 4.186 kJ/kg
1 kWh/kg = 3600 kJ/kg
1 kcal/kg = 0.001163 kWh/kg

Heating values of gaseous fuels

LOWER HEATING VALUE

Fuel	densità kg/m³	MJ/kg	MJ/m³n	kcal/m³n	kWh/m³n
G20 nat gas	-	-	35.58	8500	9.88
Propano	2.02	45.98	92.88	22188	25.80
Butano	2.71	45.70	123.84	29585	34.40

Heating values of liquid fuels

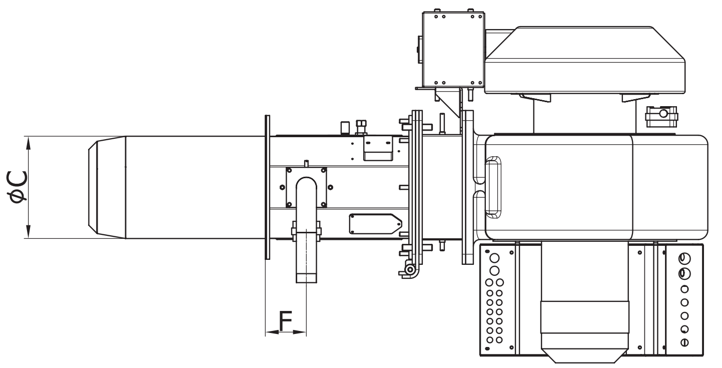
LOWER HEATING VALUE

Fuel	densità kg/l	MJ/l	MJ/kg	kcal/kg	kWh/kg
Diesel oil	0.84	35.86	42.70	10200	11.86
HFO	0.96	38.58	40.18	9600	11.16
Kerosene	0.81	34.68	42.81	10227	11.89

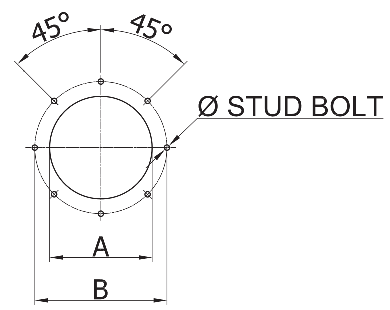
MODEL	A	B	C	ØD	E	F	G	L	P	Q	R	V	X *	Z	Ø STUD BOLT
GB-ML 450 MC LX	330	396	356	14	232	193	460	529	230	600	534	1325	525	1850	M12 X 50
GB-ML 550 MC LX	380	466	426	14	242	233	500	525	250	600	536	1348	529	1877	M12 X 50
GB-ML 600 MC LX	380	466	426	14	242	233	500	525	250	600	536	1348	529	1877	M12 X 50
GB-ML 800 MC LX	450	536	486	16	292	253	570	612	285	723	607	1619	535	2154	M12 X 50
GB-ML 1000 MC LX	450	536	486	16	292	253	570	612	285	723	607	1619	535	2154	M12 X 50
GB-ML 1300 MC LX	510	602	546	16	337	308	650	692	325	723	607	1729	540	2269	M12 X 50
GB-ML 1500 MC LX	570	662	606	16	396	318	710	822	355	778	662	1720	545	2265	M14 X 50
GB-ML 1700 MC LX	570	662	606	16	396	318	710	822	355	778	662	1720	545	2265	M14 X 50
MC = Mechanical cam															

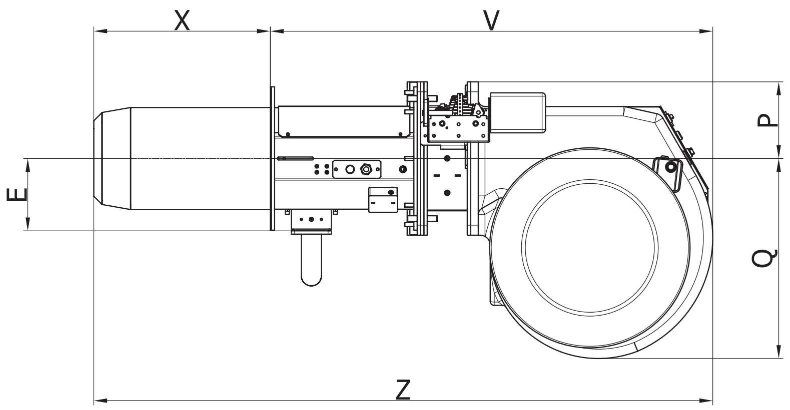
(**X***) The shown values refer to Low NOx burner execution. In case of standard model X=500mm on whole range. In case other dimensions are required please contact our sales offices for evaluation.
(**F**) Refers to Gas and dual fuel burner operation.

Bottom view

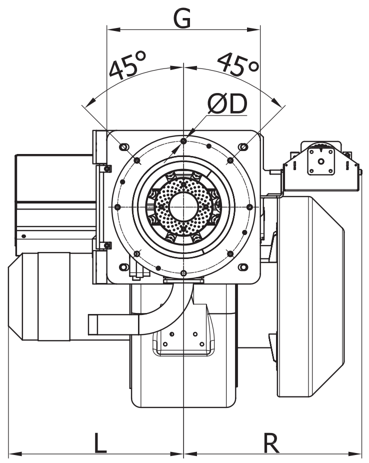


Flange connection





Side view



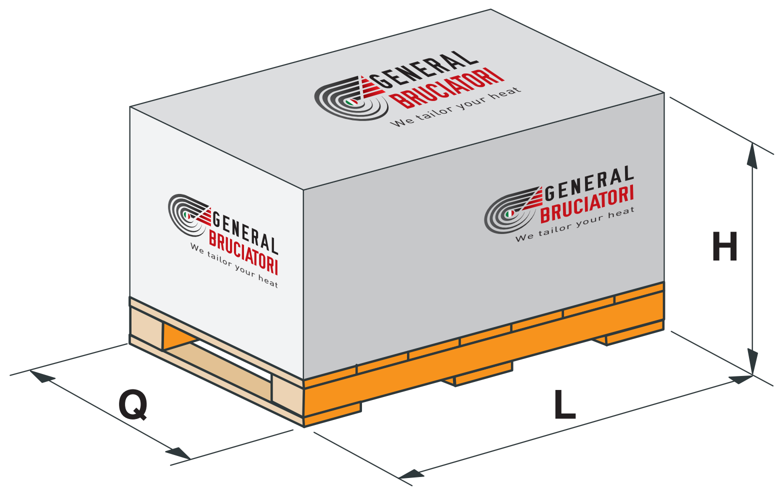
Front view

Note: above shown overall dimensions refers to gas range and are indicative of the whole GB-ML range.

MODEL	A	B	C	ØD	E	F	G	L	P	Q	R	V	X *	Z	Ø STUD BOLT
GB-ML 450 EM LX	330	396	356	14	232	123	460	529	230	600	481	1325	525	1850	M12 X 50
GB-ML 550 EM LX	380	466	426	14	242	143	500	525	250	600	481	1348	529	1877	M12 X 50
GB-ML 600 EM LX	380	466	426	14	242	143	500	525	250	600	481	1348	529	1877	M12 X 50
GB-ML 800 EM LX	450	536	486	16	292	163	570	612	285	723	607	1619	535	2154	M12 X 50
GB-ML 1000 EM LX	450	536	486	16	292	163	570	612	285	723	607	1619	535	2154	M12 X 50
GB-ML 1300 EM LX	510	602	546	16	337	173	650	692	325	723	607	1729	540	2269	M12 X 50
GB-ML 1500 EM LX	570	662	606	16	396	173	710	822	355	778	662	1720	545	2265	M14 X 50
GB-ML 1700 EM LX	570	662	606	16	396	173	710	822	355	778	662	1720	545	2265	M14 X 50
EM = Electronic cam															

(**X***) The shown values refer to Low NOx burner execution. In case of standard model X=500mm on whole range. In case other dimensions are required please contact our sales offices for evaluation.
(**F**) Refers to Gas and dual fuel burner operation.

Packaging dimensions			
Model	L mm	Q mm	H mm
GB-ML 450	2.042	1.292	1.069
GB-ML 550	2.092	1.192	1.119
GB-ML 600	2.092	1.192	1.119
GB-ML 800	2.292	1.392	1.319
GB-ML 1000	2.292	1.392	1.319
GB-ML 1300	2.422	1.541	1.349
GB-ML 1500	2.465	1.715	1.443
GB-ML 1700	2.465	1.715	1.443



Above burner's dimensions refer to the gas range and are indicative only. Please contact our sales office for any further.

GB-ML Burner specification - MC execution

DESCRIPTION	GB-ML ...G	GB-ML ...D	GB-ML ...N	GB-ML ...GD	GB-ML ...GN
powder coated finish cast alluminium body	●	●	●	●	●
air intake sound proof cover	●	●	●	●	●
combustion head and flame stability disk made from stainless stell withstand of apporox. 1150°C	●	●	●	●	●
air dampers	●	●	●	●	●
minimum air pressure switch	●	●	●	●	●
rear flame viewing port	●	●	●	●	●
progressive and continuous regulation group of the air/fuel	●	●	●	●	●
synoptic control panel	●	●	●	●	●
gas ignition tranformer	●			●	●
diesel/ heavy oil ignition tranformer		●	●	●	●
IP 54 electric protection level	●	●	●	●	●
gas pilot burner with ignition electrode and cable	●			●	●
gas pilot burner solenoid valves (igniter)	●			●	●
gas flexible hose for ignition pilot burner	opt			opt	opt
gas feed gun with multiple pipes	●			●	●
adjustable gas nozzles	●			●	●
UV flame sensor	●			●	●
gas butterfly valve controlled by air/ fuel (servomotor linkage)	●			●	●
burner/gas train adapter	●			●	●
main shut-off valve gas train	●			●	●
gas filter	●			●	●
max gas pressure switch (on the burner)	●			●	●
min gas pressure switch	●			●	●
tightness control kit	opt			opt	opt
oil feed gun made by steel		●	●	●	●
inox hardened spill back nozzle		●	●	●	●
opening oil electro-magnet		●	●	●	●
diesel/heavy oil flexible hoses for oil feed gun		●	●	●	●
Y oil filter		●	●	●	●
oil capacity regulator controlled by air/fuel CAM		●	●	●	●
photoresistive detectors		●	●		
oil pressure gauge		●	●	●	●
non return valve		●	●	●	●
pressure switch for return oil		●	●	●	●
oil pump installed on separate motor		●	●	●	●
solenoid valve for oil (NC)		●	●	●	●

STANDARD EQUIPMENT

burner flange gasket	●	●	●	●	●
self cleaning filter			●		●
diesel oil filter		●		●	
diesel/heavy oil flexible hoses		●	●	●	●
instruction manual	●	●	●	●	●
spare part list	●	●	●	●	●

● standard
opt optional

Main features

Suitable applications
The GB-ML range fit any application on hot water boilers steam boilers, hot air generators, ovens, dryers, diathermic oil generators, incinerators, ovens for industrial thermoprocessing and any other equipment where heat imput is required.

Fuels
Gas (G)
Diesel oil (D) with viscosity of 6mm2/s at 20°C (1.5°E at 20°C)
Heavy oil (N) with mechanic atomization for viscosity up to 60°E (450 cSt) at 50°C, steam or compressed air atomization up to 350°E (2650 cSt) at 50°C
Dual fuel gas-diesel oil
Dual fuel gas-heavy oil
Other fuels, such as biofuel, fuel from waste, industrial process fuel, animal fat, these fuels can be supported in gasseous, liquid or solid state request.
For versions with solid fuel (dust) please see specific documentation.

Operating principle
The GB-ML range as standard operates as two stage progressive. It's possible to upgrade into modulating execution with the installation of a PID control "GB 3M" and relative probes (option). Please see dedicated section (Pag. 23)
Burner output is adjusted according to heat demand.
The modulation signal is supplied from PID control (option) installed on the burner control panel or it can be supplied directly by the customer (3 point or 4-20mA).

Modulation ratio
Gas (G) 1/6
Diesel oil (D) 1/4
Heavy oil (N) 1/4

Flame monitoring
Flame monitoring for gas fuel is by UV while for diesel fuels and heavy oil is by photo resistance or UV sensor. Continuous operation executions are available.
For “multiple burner” applications or incinerators special variable-frequency flame monitoring systems are installed.

Ignition
Direct ignition for Diesel oil (D) and heavy oil (N).
For gas fuel and all the others executions with compressed air/steam atomization, ignition is always with gas pilot burner.
Our pilot burners can run on both natural gas or LPG. Maximum pressure on pilot valves: 500 mbar
Diesel oil pilot ignition is available on request.

Burner operation
GB-ML range is equipped with on board control panel with pre-wired burner connection and auxiliary devices. As standard GB-ML operates as two stage progressive by mechanical cam (MC). The system is designed with possibility to be upgraded to continuous modulation by means of installation of PID controller and modulation probe (i.e. temperature / pressure). This can be done at order confirmation or in a second time during the burner lifetime.
The standard electric protection is IP54 while higher IP protection are available on demand.
GB-ML range is also available with electronic cam (EM). Thanks to modular design of both burner and electronic cam is possible to choose among different configuration and related options like O_2 trim, frequency converter (VSD) and CO trim. All these option are available at order confirmation or can be installed in a second step during the burner lifetime on modular base.

Emissions
With environmental care approach the whole GB-ML range is available with Low NOx (EN676 and EN267). In order to fulfil the stricter NOx emission on the GB-ML range it’s also available the external Flue Gas Recirculation (FGR) system.

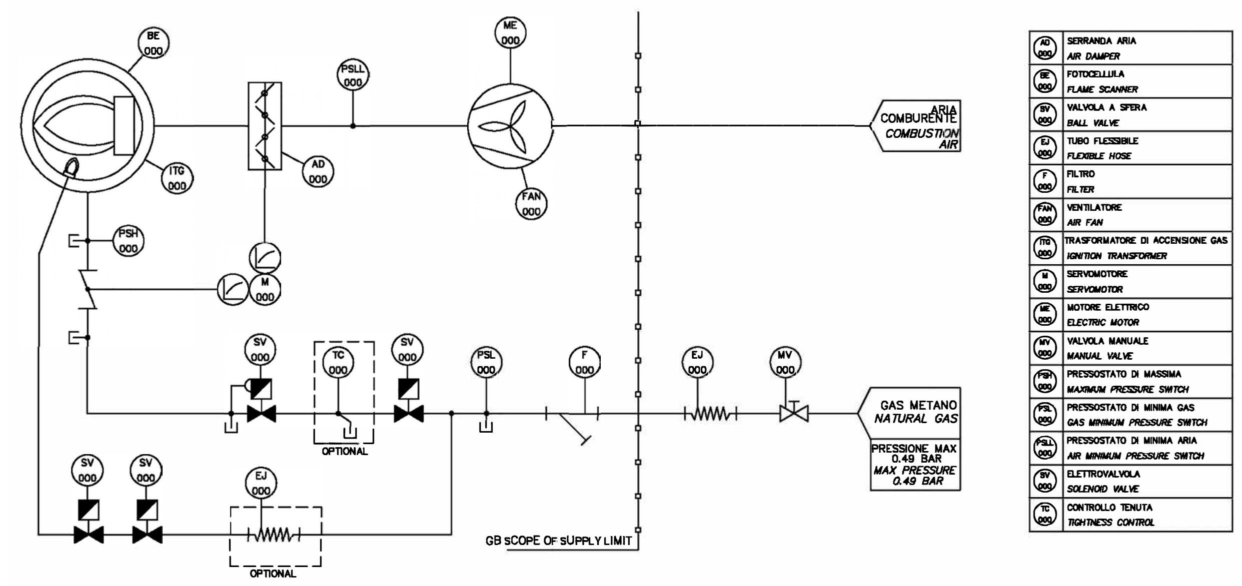
Gas trains
Gas trains and related components are made in compliance with EN 676.
Upon request Atex, Ex, IP 65 execution are available.

On board fuel pushing unit
For Diesel and Heavy oil burner the standard scope of supply includes related oil pushing unit. GB-ML Diesel and Gas/Diesel range are equipped with on board extra motor dedicated to oil pump. The Heavy Oil and Heavy Oil / Gas range, in addition to extra motor dedicated to oil pump, include related electric pre-heater for H.F.O.
On demand the pre-heater can be upgraded to steam/electric operation.
All GB-ML pumps both for Diesel and Heavy Oil run at lower rpm to extendet the lifetime.

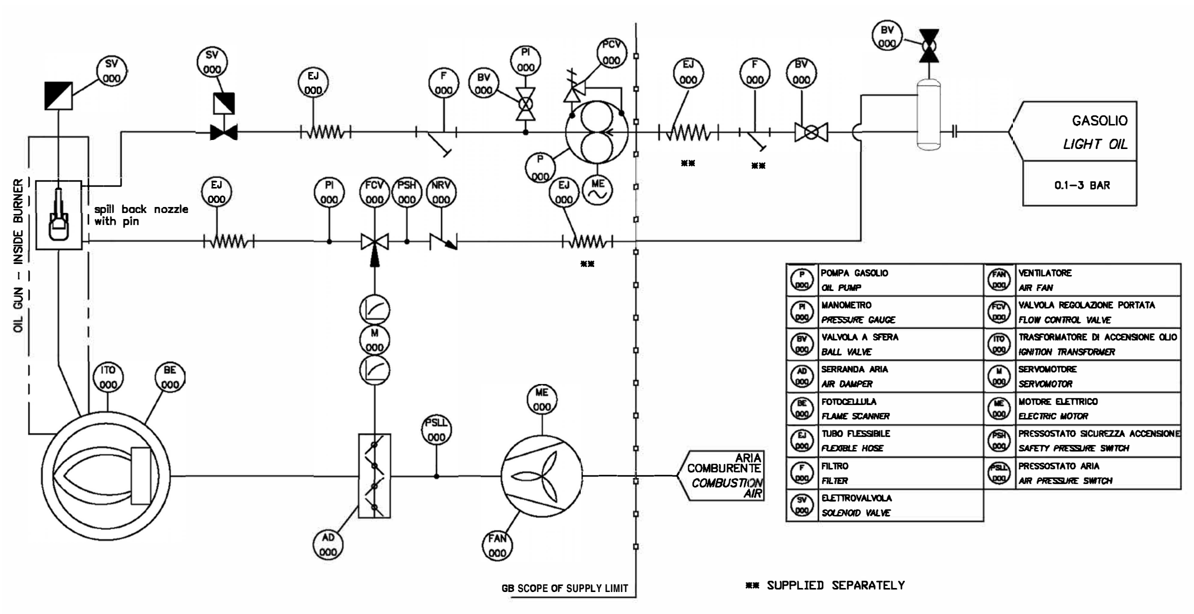
Maintenance
General Bruciatori design of GB-ML range keep maintenance quick and easy thanks to wide opening over the GCO™ (Octagonal Combustion Group).
On demand are even available Hinged models.

Low noise operation
Thanks to combined action of new soundproof air intake cover and reverse blade fan design, the overall noise while in operation is reduced.
In case of extreme low noise demand and specification overall soundproof case is available on demand.

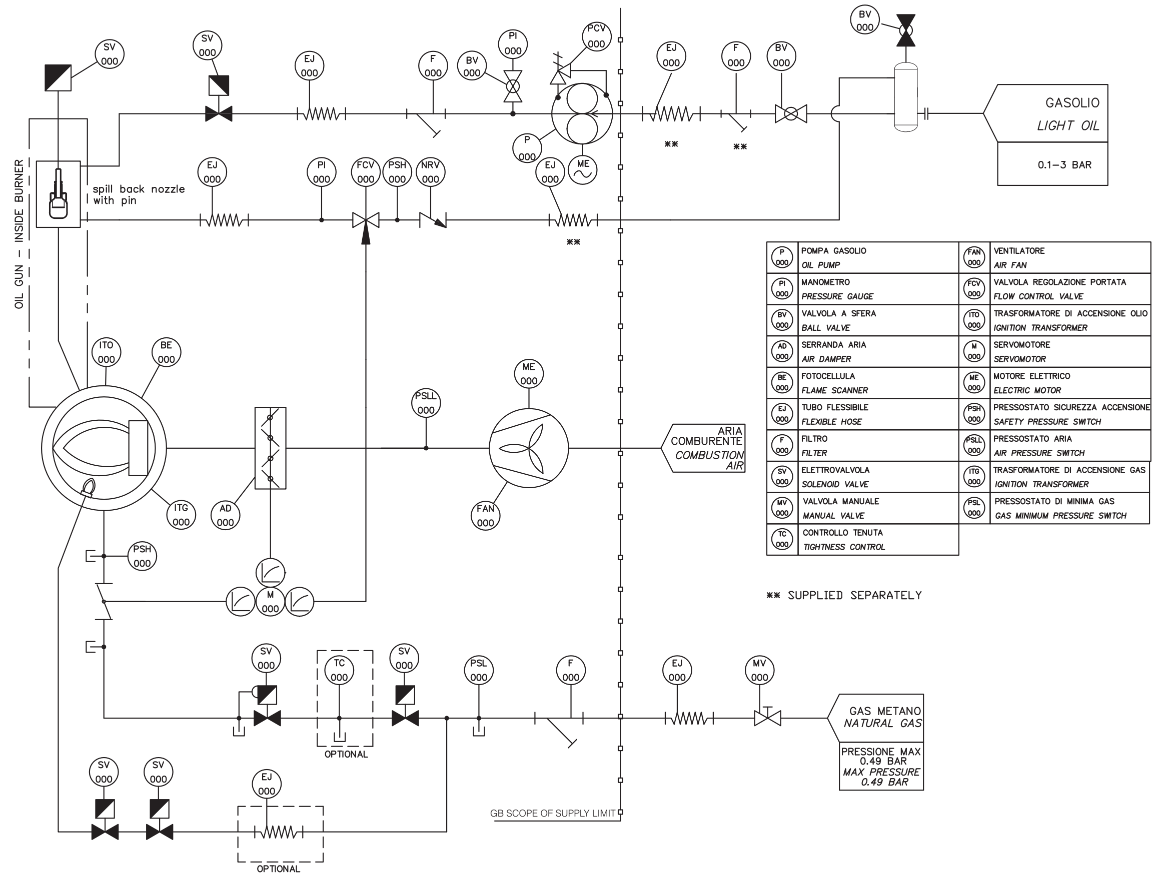
Burner Wiring
Special care has been given to Control Panel (Electric Power Board) design. Thanks to great job the new electrical layout is more user friendly and rationalized. On the new control panel the terminal board of field signal (i.e. pressure feedback) has dedicated electrical connection separate from the BMS.



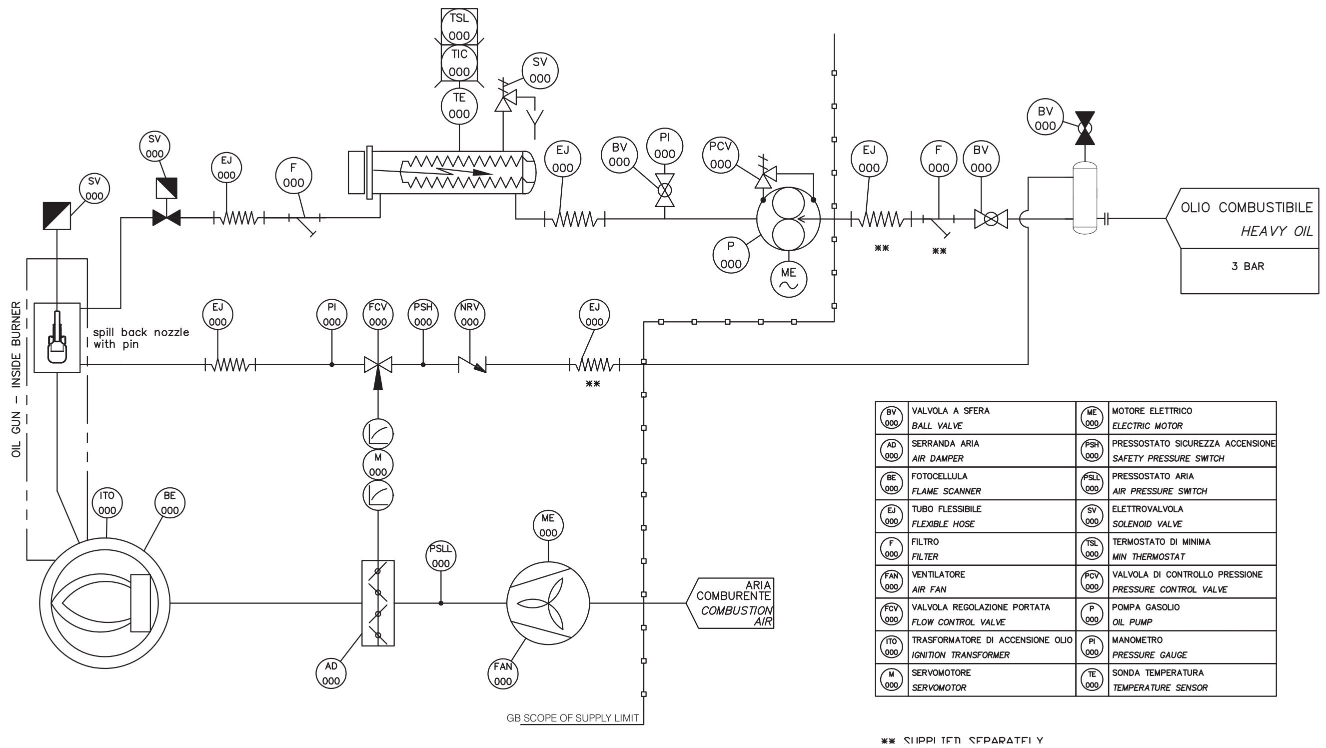
NATURAL GAS



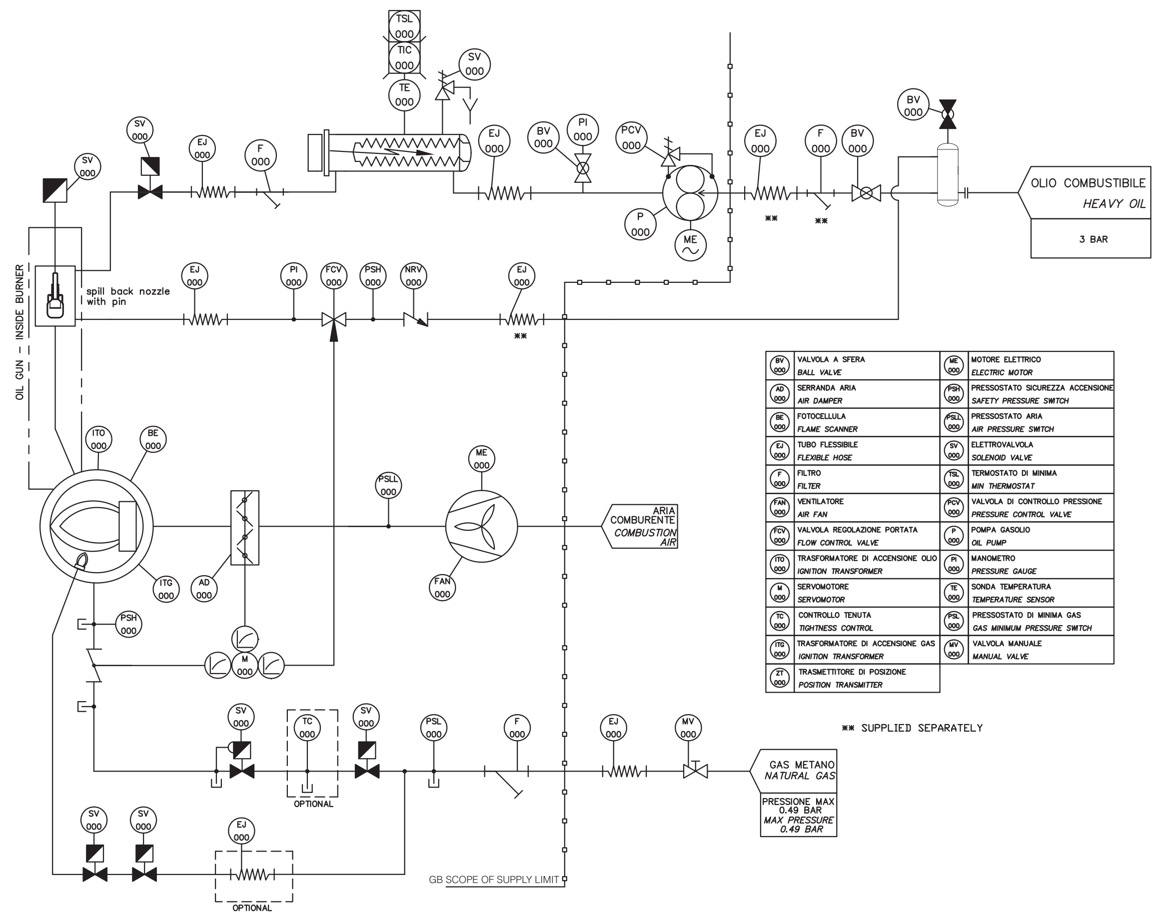
LIGHT OIL



NATURAL GAS/LIGHT OIL



HEAVY OIL



NATURAL GAS/HEAVY OIL

Techniques for reduction of NOx emissions

NOx is the generic terms to indicate nitrogen oxides (NO + NO_2), produced by the reaction of nitrogen and oxygen during combustion, especially at high temperatures.
In conventional systems NOx consist of 95 - 98% nitrogen monoxide (NO), and 2 - 5% nitrogen dioxide (NO_2). However, when in the atmosphere, NO reacts with the oxygen in the air and forms NO_2.

The three main sources of NOx production are:

NOx thermic, coming from the nitrogen present in combustion air which, at temperatures >1300°C reacts with oxygen and oxidizes. It is (certainly) the largest fraction of NOx originated from combustion of gaseous fuels. Therefore the flame must be prevented from reaching excessively high temperatures and burnt gases from remaining in the hot area of the flame too long.

NOx fuel is produced starting from the nitrogen compounds chemically linked in the fuel that react into oxygen and oxidize, significant in liquid fuels.

NOx prompt, due to the rapid reaction of atmospheric nitrogen with hydrocarbon radicals. NOx prompts are a minor source as they are generally a small part of the overall quantity of the NOx produced by combustion.

NOx production is influenced not only by flame temperature and oxygen content (air excess) but also by other factors not strictly related to the burner.

Such as for example the geometry and volume of the combustion chamber. The achieved experience shows that the construction characteristics of combustion chambers and their operating principles directly affect the production of NOx.
In terms of NOx emission, there is a big difference in performance between a three-pass boiler and a reverse flame boiler! With equal volume, producing greater output means increasing the temperature in the chamber; in other words, high thermal loads result in higher flame temperature and consequently greater NOx emissions.

Conversion factor for Nox emissions (as NO_2) for natural gas

G 20

O_2 rif (%)		mg/kWh	mg/MJ
0%	1 ppm=	1.764	0.490
3%	1 ppm=	2.059	0.572

Conversion factor for Nox emissions (as NO_2) for natural gas

G 20

O_2 rif (%)		mg/kWh	mg/MJ
0%	1 mg/m3n=	0.859	0.239
3%	1 mg/m3n=	1.002	0.278

Conversion from ppm to %

ppm	rate
1.000.000 ppm	100%
100.000 ppm	10%
10.000 ppm	1%
1.000 ppm	0.1%
100 ppm	0.01%
10 ppm	0.001%
1 ppm	0.0001%

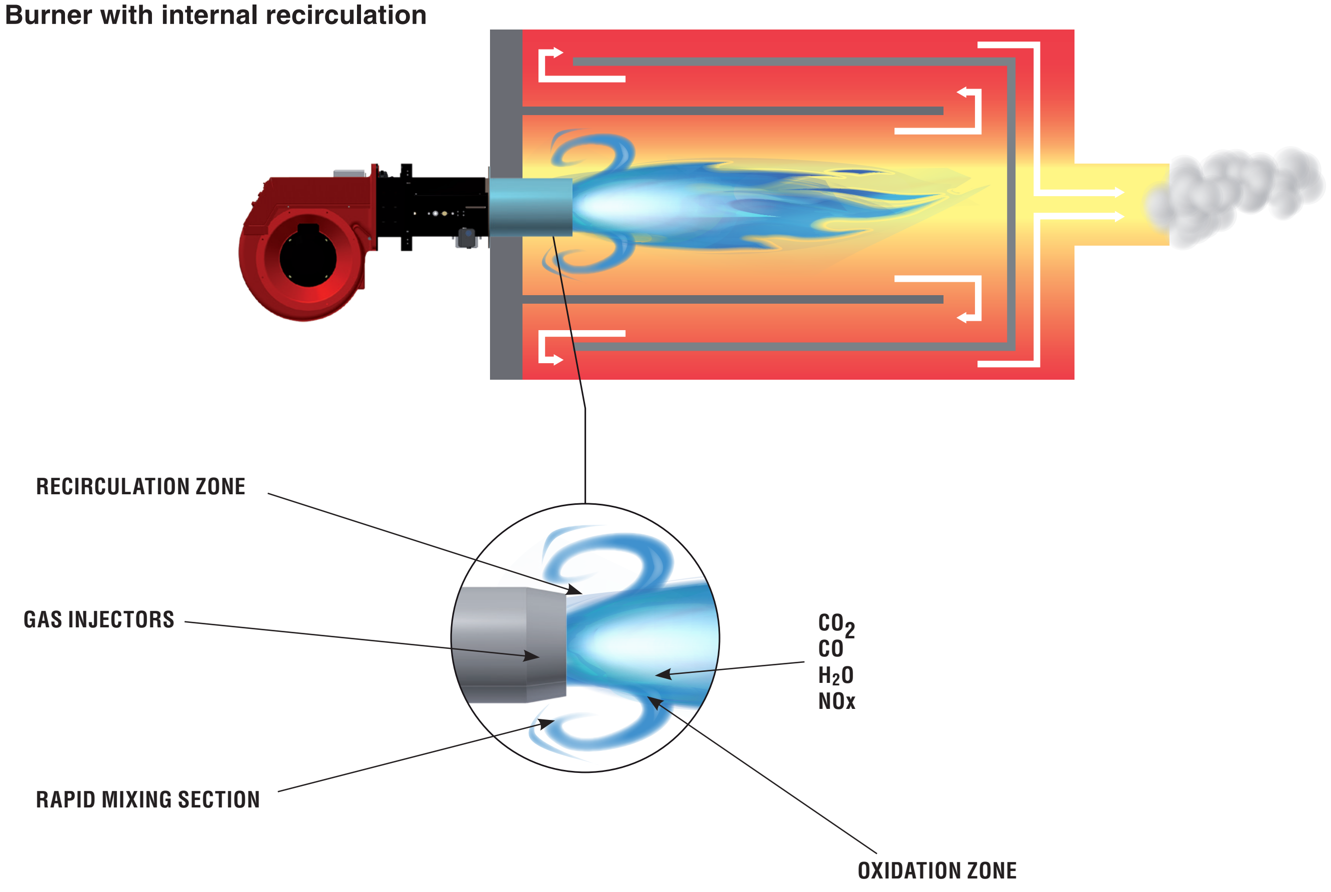
Flame temperature also depends on the temperature of combustion air.
The higher the temperature of combustion air the higher will the flame temperature be.

The temperature of boiler fluid, i.e. the superficial temperature of chamber walls, also affects NOx emission: the colder the walls, the greater the thermal exchange and the lower the average flame temperature the smaller the production of NOx.
For this reason, it is important, in order to correctly evaluate NOx emission, to know what kind of boiler is used, whether hot water, steam and steam pressure, diathermic oil, adiabatic furnace, etc.

The use of appropriate combustion technology makes it possible to limit the production of thermal NOx.

General Bruciatori uses mostly the combustion gas recirculation system.

Burner with internal recirculation

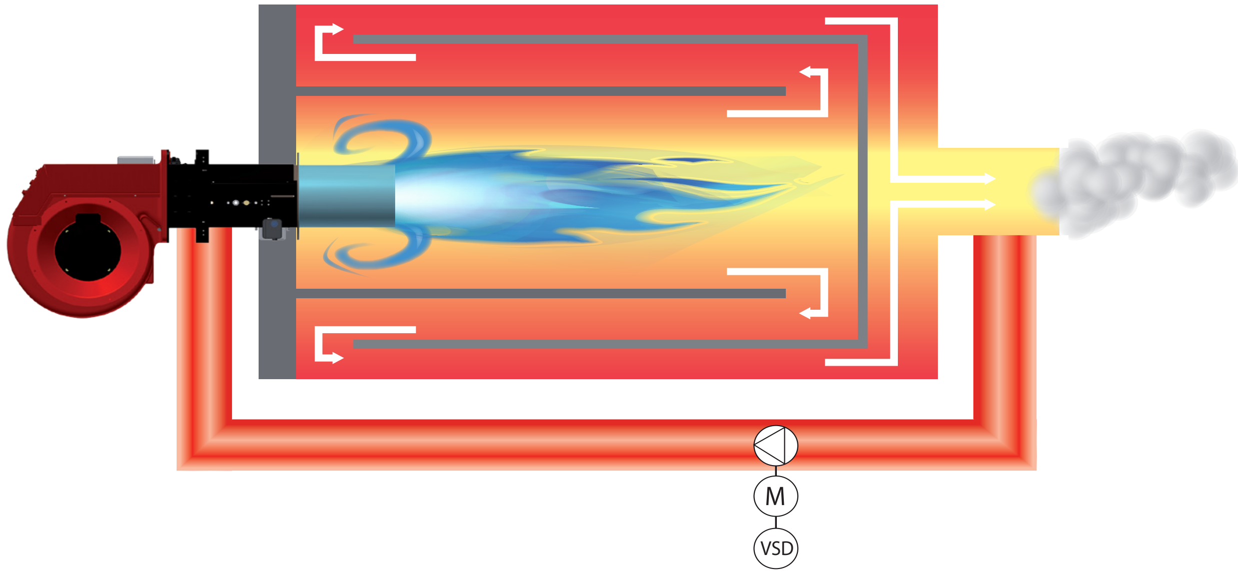


In the internal recirculation system, a fraction of the combustion gas is reintroduced in the flame, where it will absorb flame heat, thus lowering the average temperature; this causes a "dilution" of flame volume, which further lowers the temperature.
The fraction of gas reintroduced is between 10 and 25%.

For higher outputs, flue gas recirculation is generally enhanced by adding to the above described recirculation, the system of external flue gas recirculation.

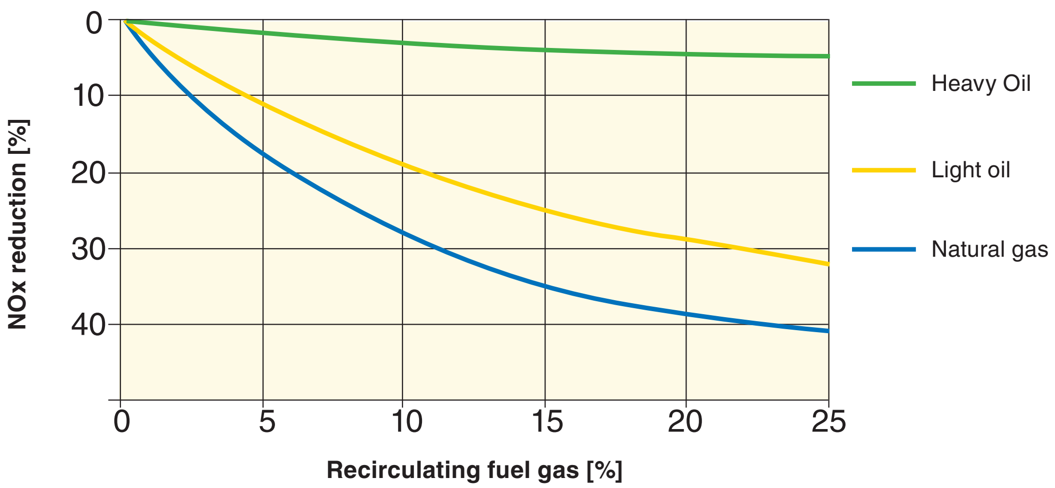
This system uses a fan to introduce a large quantity of combustion gas into the burner head. The flue gas is sucked up at the base of the flue and introduced into the burner by means of a flue gas distributor. The external flue gas recirculation fan, controlled by a variable speed drive, will enable flue gas to be introduced into a normally pressurized combustion chamber.

Burner with external flue gas recirculation

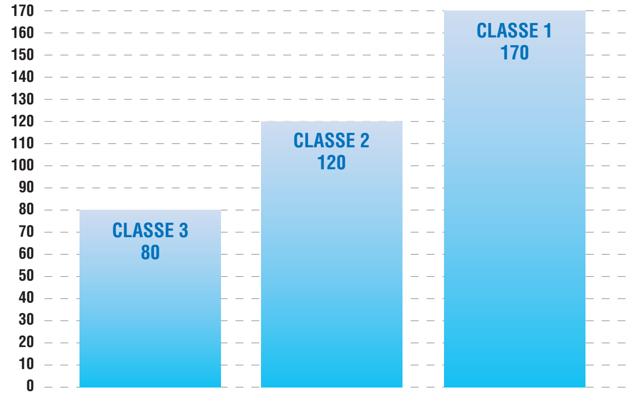


The average quantity of gas to be recirculated can be estimated at 10-25%. The graph below gives an indication of the value that can be obtained.

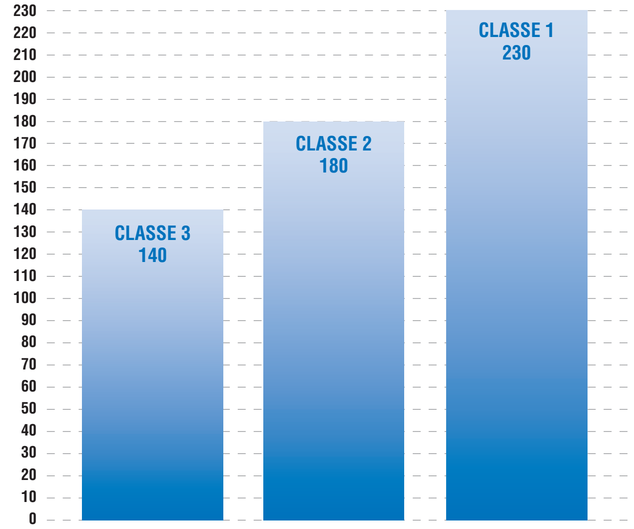
Incidence of recirculating fuel gas in the combustion head



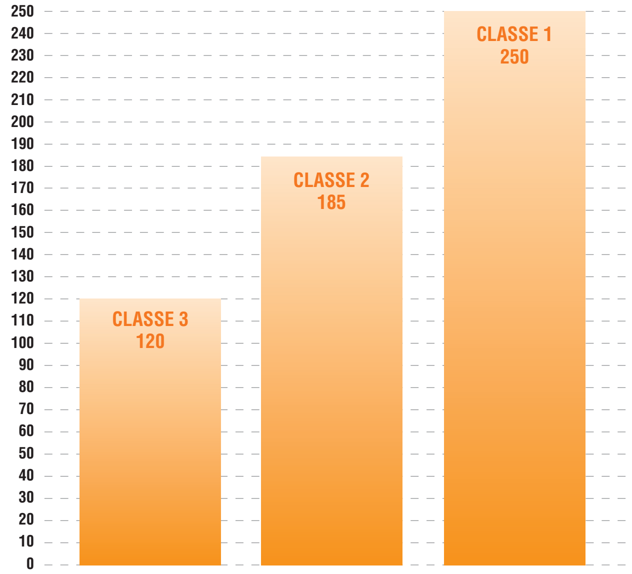
Classes defined by Regulation EN 676 for NOx emissions with natural gas



Classes defined by Regulation EN 676 for NOx emissions with propane



Classes defined by Regulation EN 267 for NOx emissions with Light oil



Conversion of emissions with O_2 reference

$$E_{rif} = E_{mis} \times \left(\frac{21\%\ vol. - O_{2\ rif}}{21\%\ vol. - O_{2\ mis}} \right)$$

Conversion from ppm to mg/m³n

1 ppm CO = 1.25 mg/m³ $_n$ CO
1 ppm CO_2 = 1.96 mg/m³ $_n$ CO_2
1 ppm NO = 1.34 mg/m³ $_n$ NO
1 ppm NO_2 = 2.05 mg/m³ $_n$ NO_2
1 ppm SO_2 = 2.93 mg/m³ $_n$ SO_2

Standard scope of supply: MC execution control panel

description	GB-ML ...G	GB-ML ...D	GB-ML ...N	GB-ML ...GD	GB-ML ...GN
control box	●	●	●	●	●
fan control	●	●	●	●	●
oil pump control		●	●	●	●
preheater oil control			●		●
oil preheated temperature controller			●		●
overcurrent protection devices	●	●	●	●	●
terminal strips	●	●	●	●	●
signal lamps	●	●	●	●	●
failure reset button	●	●	●	●	●
burner control switch	●	●	●	●	●
PID capacity controller	opt	opt	opt	opt	opt
Flame on signal (230V)	●	●	●	●	●
remote start/stop	●	●	●	●	●
emergency stop pushbutton	opt	opt	opt	opt	opt
Burner fault signal (230V)	●	●	●	●	●

● standard
opt optional

Burner control and regulation equipment are assembled on a IP54 on board control panel.

The flame control unit automatically performs all the burner functions and, in case of burner failure, the system automatically stops the burner.

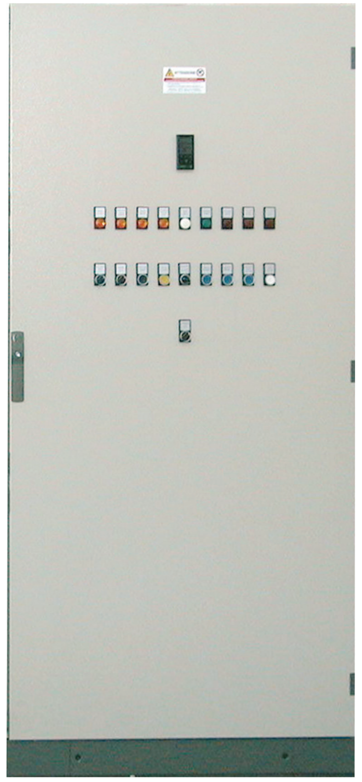
The standard burner configuration features are two progressive stage operation with mechanical cam (MC version).

In modulating execution, the control panel also contains a wired PID load controller (option). If necessary, the modulating probe will be selected according to the process variable.

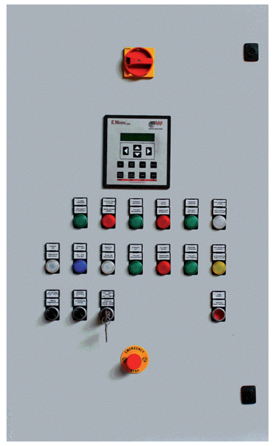
Upon request, the burner can also be supplied with electronic cam (EM version), with variable speed drive (VSD version), with O_2 control and CO control .

Standard control panel protection is IP54.

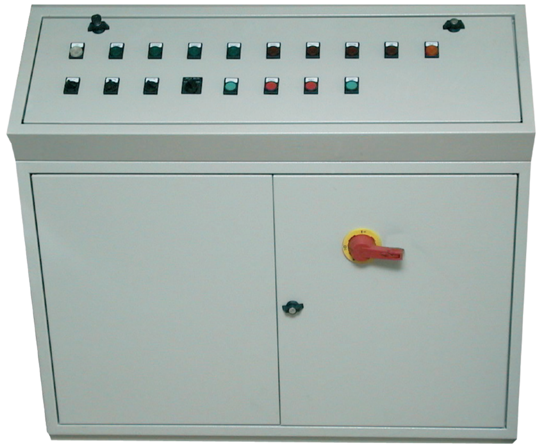
On demand separate control panel
In case of separate control panel the GB-ML range will be equipped with on board electric terminal box.



Cabinets



Wall mounted



Desk type

FULL MODULATION ACCESSORIES (MC operation)
In order to upgrade GB-ML range from two stage progressive up to continuous/full modulation it's necessary to install PID regulator and probe feedback.
If PID is ordered together with burner the GB3M is pre-wired and already with probe configuration (Temperature or Pressure). In case PID is ordered once burner is already on site the Control Panel is already pre-set to host the GBM3 for easy installation.

GB3M PID load regulator

PT100 temperature probe

Pressure transmitter

Benefits at a glance

Simple to use
Sturdy system,
long service life

Features execution MC

The basic combustion control principle is to satisfy the boiler load requirements by controlling the quantity of fuel and air to obtain optima combustion and ensure safety conditions for operators and equipment.
The control system for combustion with mechanical cam consists in a servomotor which by means of mechanical gear moves regulation parts, such as gas butterfly valve and combustion air dampers.
The main disadvantage of mechanical control is the "slack" that inevitably develops over time. Depending on mechanical characteristics, these hystereses can cause control inaccuracy which, especially with minimal loads, will result in substantial fuel waste.
This mechanical control solution has the advantage of being simple to use and sturdy of construction but the disadvantage is that it cannot guarantee operation with low air excess.
It should also be considered that with multifuel burners there is only one combustion air setting for all of the fuels, which means that it will not be possible to diversity output curves. The turndown ratio will be the same.
Overall, mechanical cams are not suitable for the energy saving requirements of modern combustion systems, especially if we consider that, with its "open ring" control, O_2 and CO corrections are not possible.

Did you know?

A 20 mbar variation in atmospheric pressure changes the 0_2 content by 0.4%.

Mechanical cam

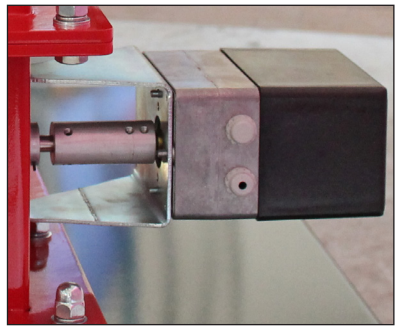
All the disadvantages of mechanical cam can be overcome by using combustion control with electronic cam.

Features execution EM

In electronic cam combustion control all the control and safety functions of the burner are managed by a microprocessor based electronic device (fail safe). It features a display that shows all the data about to servomotor positions, operation sequence, shutdown codes in case of malfunction, boiler pressure or temperature, O_2 and CO values (if installed).
In addition, all control parts, butterfly, dampers, etc. have a dedicated servomotor, these movements can be individually set for each load points.
Unlike what happens with the mechanical cam, in case of multi-fuel burners with electronic cam (EM execution), we have dedicated servomotors, one for each fuel type and one for combustion air, which can be programmed individually for the different positions according to load. This way combustion air regulation can be different, with different ratios (and not the same as with mechanical modulation) depending on the fuel used and accurately adjusted to suit combustion needs.
A further advantage of the electronic cam is that servomotors are directly connected to regulation parts without the use of other gear or mechanical joints. This means the system has no mechanical hysteresis.
Electronic servomotors are very accurate (+/- 0.1°) and ensure high positioning repeatability. High positioning repeatability over time means guarantee that the combustion settings will be maintained which in turn means a guarantee of energy efficiency.

Benefits at a glance

- No mechanical hysteresis
- Performance is constant over time
- Individual setting of servomotor position
- Possibility of setting ignition point other than minimum load
- Built-in valve seal control
- Indication and description of shutdowns
- Open and easy-to-update system
- Optional VSD, 0_2, CO, remote monitoring



Detail air servomotor.

The electronic cam offers advantages that are definitely superior to those of the mechanical cam, more in line with the energy requirements of modern combustion systems.
Last but not least, the electronic cam is an open system, easy to implement with energy saving functions such as variable speed drive (VSD), O_2 control, CO control, or "utility" functions such as remote monitoring.
Let us see them in detail.

Energy tips

Energy tips: Increase the energy performance of an EM burner by installing:

- VSD
- O_2 trim (please see on page 38)
- CO trim (please see on page 40)

Bonus tip

Use a second setpoint in case the system does not function continuously, e.g. in period of reduced activity or night standby.
It can be used to set the boiler to a lower steam pressure value.
Our customers obtain savings up to 10%.

Benefits of a O_2 trim at a glance

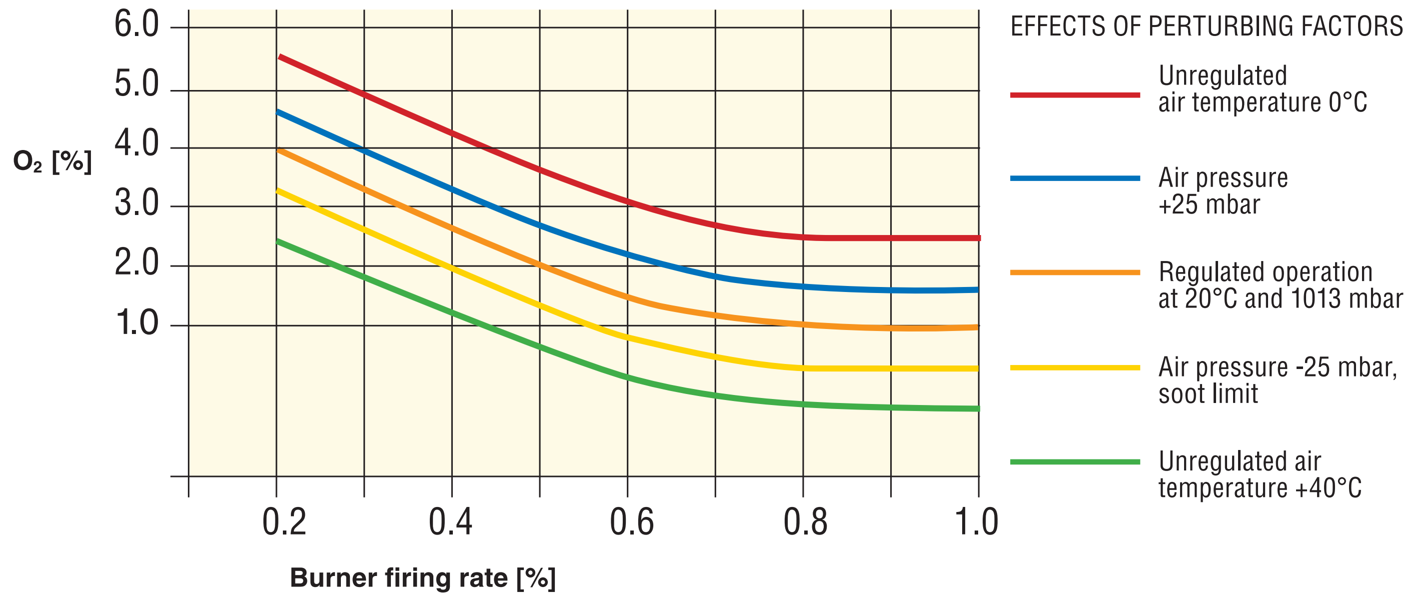
- it can be used on all burners
- improvement of efficiency up to 3%
- lower losses to the chimney
- lower emissions
- low maintenance
- simple upgrade with CO trim

O_2 trim

Electronic cam combustion control (EM execution) in combination with modern flue gas sensor technology (O_2 sensors and CO sensors) offers to industrial burner users important energy saving applications.
The equally important aspect of safety is a further advantage with the possibility of having continuous combustion monitoring.

In terms of combustion efficiency, air excess management is the key point.
Air and fuel control is fundamental to maintain high level of energy efficiency.
Burners are often checked just once a year and the rest of the time are left as they are, even with great temperature variations (summer/winter) and changes in atmospheric barometric conditions.
It is important to remember that the quantity of oxygen in the air is directly correlated to air density and temperature. If the temperature goes down (thicker air), the content of oxygen increases; changes in barometric pressure also cause variations in oxygen content: the greater the atmospheric pressure the greater the content of oxygen in a given volume of air.
The influence of air temperature and pressure on residual oxygen in exhaust gas is shown in the graph below.

Influence of air temperature and the atmospheric pressure to the combustion



There are other perturbing factors that affect the achievement and maintenance of energy efficiency: there are changes in fuel temperature, viscosity and density, changes in heating capacity, firebox counter pressure, etc.
With mechanical cam control, as we saw above, these important perturbing factors cannot be compensated.
That is why air excess setting in mechanical cam burners needs to be high: we have to be absolutely sure that we can neutralize all unfavourable circumstances which can, at the same time, concur to have no residual oxygen in flue gas.
This air excess, which must be allowed for safety, is something that has a high cost, in both economic and environmental terms, as we are heating a considerable mass of air coming out of the flue and not providing any heating contribution. The higher the temperature of flue gas, the greater will be the efficiency loss.
This is the main source of energy waste and these losses can be up to 2-3%.
If the burner is fitted with an electronic cam (EM execution) the solution to the problem is very simple: it is called O_2 trim.

O_2 trim: fuel saving rate up to
3%

Safety tip
Set the minimum O_2 values: once these values are reached the burner will shut down.

Did you know?
Every 1% reduction in O_2 you have an efficiency increase of:
0.6% for natural gas
0.7% for Diesel oil
0.75% for fuel oil

With the addition of a zirconium oxide oxygen sensor and a "bit of electronics" we can keep the air/fuel mixture set at optimal values even with the above perturbing factors as they will be immediately compensated to preserve combustion efficiency.
The sensor continuously monitors residual oxygen content in flue gas, sends a signal to the electronic system which, based on the control curves set during the commissioning stage (O_2 setpoint), will adjust the quantity of combustion air to the minimum necessary, over the entire operating range.

To have an idea of the efficiency improvement, consider that with flue temperatures above 200°C, a 1% oxygen reduction in combustion will produce an increase in efficiency between 0.6 and 0.75%, depending on the type of fuel used.

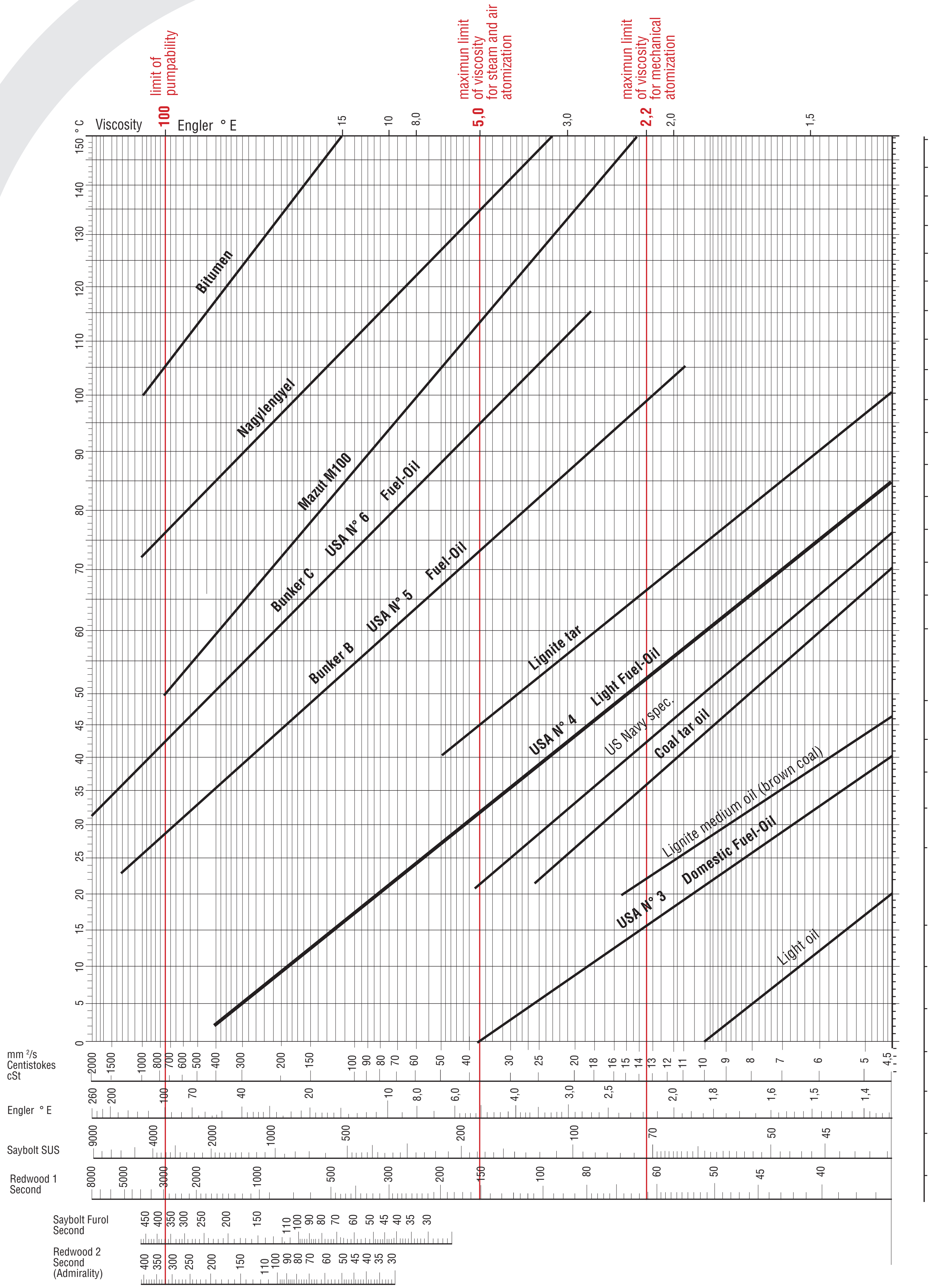
Good news from CO trim
Average return on investment (ROI) is less than 2 years.

TECHNICAL TIP:
Install the sensor as close as possible to the combustion chamber outlet.
This gives you fast feedback on what is happing inside the firebox.

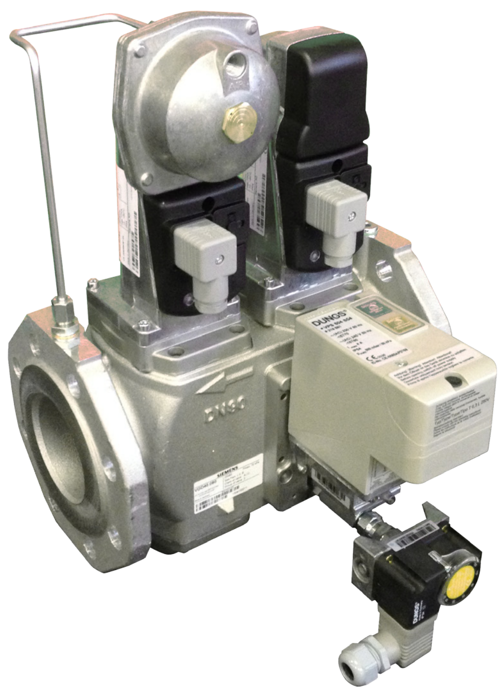
Benefits of a CO trim at a glance
- Minimum air excess in every point of the work curve
- Up to 0.5% combustion efficiency improvement compared to O_2 control
- Maximum accuracy in combustion control
- minimal air infiltrations in the flue will not affect the reliability of the readings and consequent control logic
- Totally safe combustion: any unburnt fuel is measured directly (not presumed)
- Low maintenance and servicing costs
- Average Return on investment (ROI) < 2 years

CO control: Utmost efficiency and safety on gas fuel systems

If you combine the O_2 control system with a CO monitoring sensor, you can further reduce air excess, and consequently flue losses as well.
At the core of this technology is direct (not presumed) measurement of unburnt fuel.
With a fully automatic mode, the system reduces combustion air in every point of the load curve until the volumetric content of carbon monoxide measured in flue gas is stabilized to a few tens per million.
This reduction in combustion agent is due not so much to a capacity damper, which does not have the necessary angular resolution, but rather to the use of a variable speed drive with much higher sensitivity.
At this point, the system will fix the final combustion setpoint to a slightly higher λ, thus obtaining an optimal operating point.
The energy saving achievable exceeds the potential supplied by the use of O_2 control alone; with a self-learning system, the CO system allows the burner to operate with very low air excess, as already mentioned, at the limit of CO emissions.
Compared to O_2 only control, an additional 0.5% energy efficiency improvement can be achieved and, in terms of safety, we can be certain that dangerous operating conditions will be avoided.

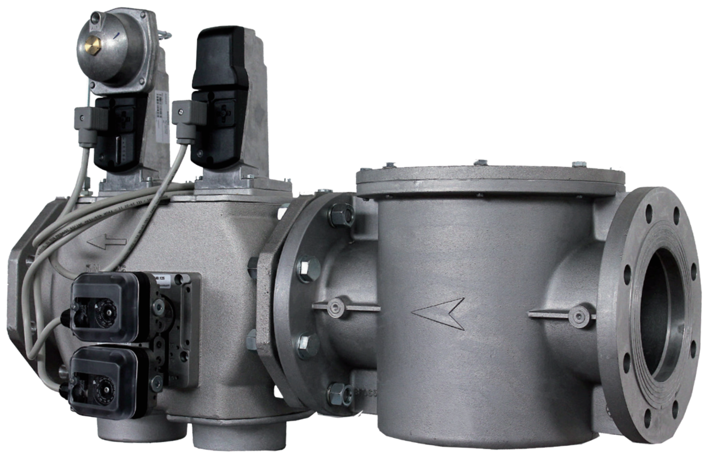


Mechanical cam (MC) gas train



The valve tightness control it is perfomred by means of VPS system. The VPS is IP54 electrical protection and can be installed as indipendent kit.

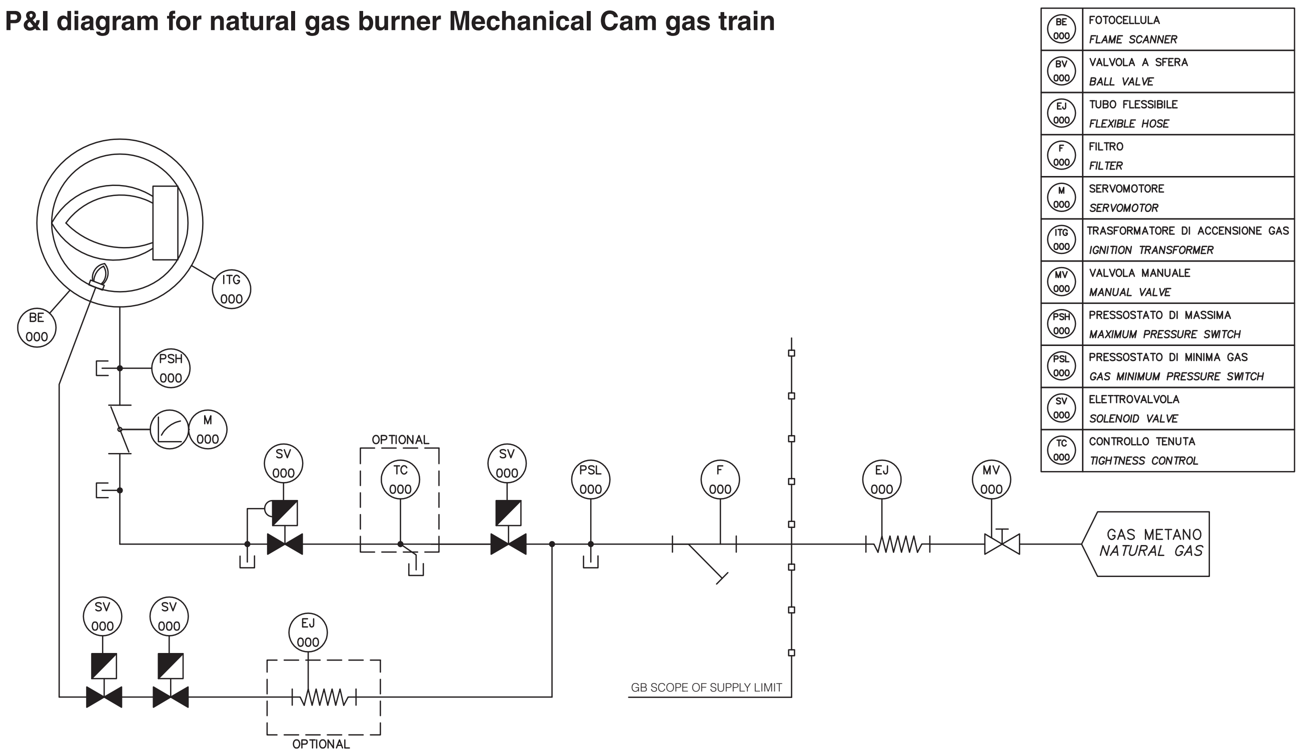
Electronic modulation (EM) gas train



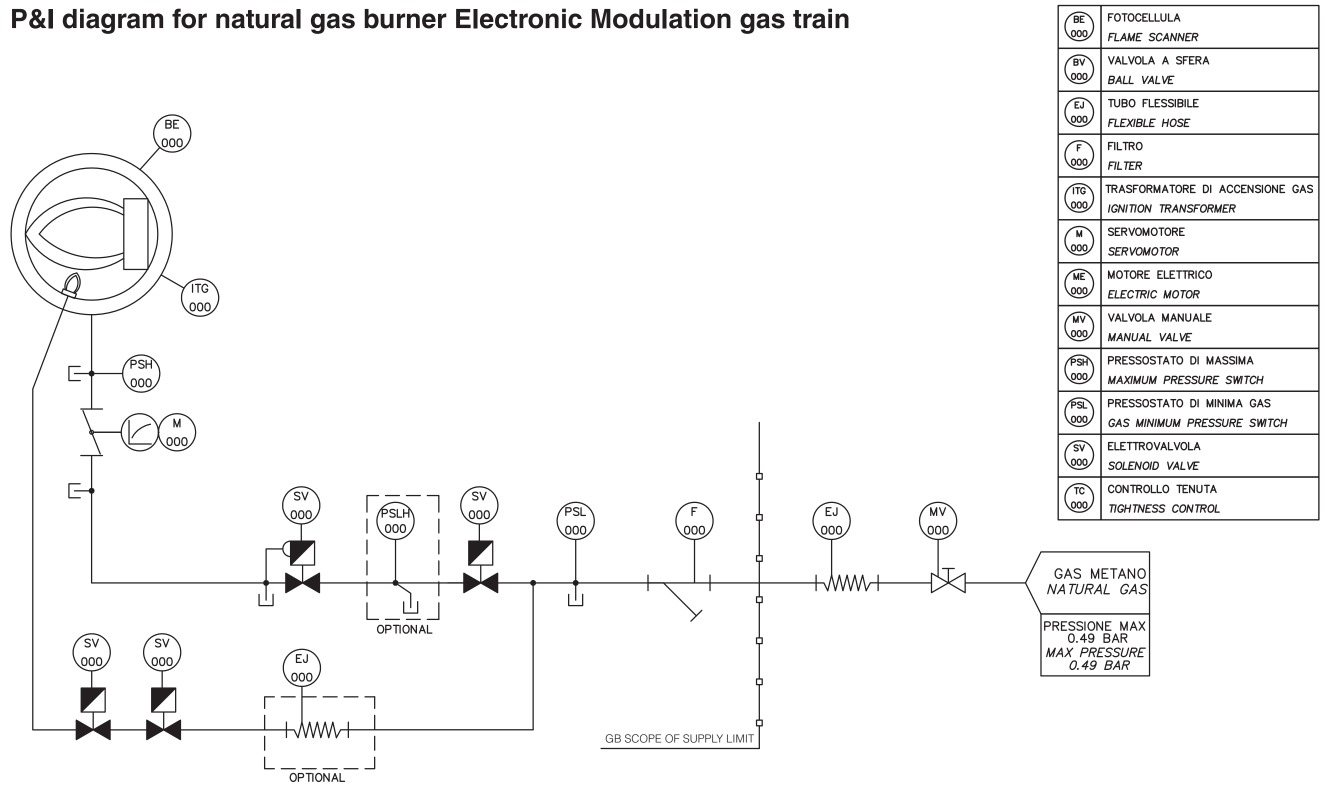
The valve tightness control is perfomed by the BMS by means of pressure switches installed on board of the gas train.
IP54 electrical protection.

Note: conforming to the European standard EN 676, the tightness control device is compulsory on gas trains of burners with a maximum output over 1200 kW

P&I diagram for natural gas burner Mechanical Cam gas train



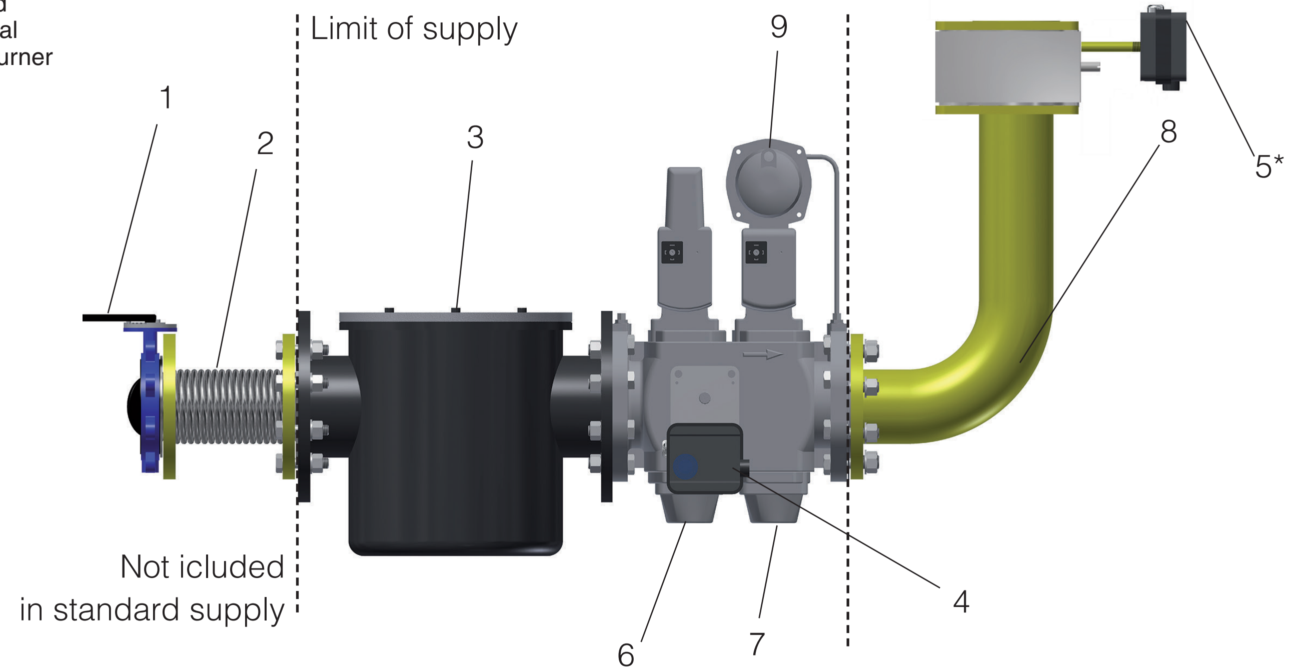
P&I diagram for natural gas burner Electronic Modulation gas train



Standard scope of supply

n°ref	description	
1	ball valve	opt
2	anti vibration joint	opt
3	gas fliter	●
4	minimum gas pressure switch	●
5	maximum gas pressure switch*	●
6-7	main gas valve	●
8	burner gas train adapter	●
9	gas pressure regulator	●

● standard
opt optional
* on the burner



Note: conforming to the European standard EN 676, the tightness control device is compulsory on gas trains of burners with a maximum output over 1200 kW

Corrective factor combustion air rate based on temperature and altitude

	Metres above sea level												
Air temperature in °C	0	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
0	1,071	1,040	1,009	0,978	0,950	0,920	0,895	0,867	0,841	0,813	0,791	0,765	0,741
5	1,052	1,021	0,991	0,960	0,933	0,904	0,879	0,851	0,826	0,798	0,776	0,751	0,728
10	1.033	1,003	0,973	0,943	0,916	0,888	0,863	0,836	0,812	0,784	0,763	0,738	0,715
15	1,015	0,986	0,956	0,927	0,900	0,872	0,848	0,822	0,797	0,771	0,749	0,725	0,723
20	0,998	0,969	0,940	0,911	0,885	0,857	0,834	0,807	0,784	0,758	0,737	0,713	0,691
25	0,981	0,953	0,924	0,896	0,870	0,843	0,820	0,794	0,771	0,745	0,724	0,701	0,679
30	0,965	0,937	0,909	0,881	0,856	0,829	0,806	0,781	0,758	0,733	0,712	0,689	0,668
40	0,934	0,907	0,880	0,853	0,828	0,803	0,781	0,756	0,734	0,709	0,690	0,667	0,647
50	0,905	0,879	0,853	0,827	0,803	0,778	0,756	0,733	0,711	0,687	0,668	0,647	0,627
60	0,878	0,853	0,827	0,802	0,779	0,754	0,734	0,711	0,690	0,667	0,648	0,627	0,608
80	0,828	0,804	0,780	0,756	0,735	0,712	0,692	0,670	0,651	0,629	0,611	0,592	0,573
100	0,784	0,761	0,739	0,716	0,695	0,674	0,655	0,634	0,616	0,595	0,579	0,560	0,543
150	0,691	0,671	0,651	0,631	0,613	0,594	0,578	0,559	0,543	0,525	0,510	0,494	0,478
200	0,618	0,600	0,582	0,565	0,548	0,531	0,517	0,500	0,486	0,469	0,456	0,442	0,428
250	0,559	0,543	0,527	0,511	0,496	0,480	0,467	0,452	0,439	0,425	0,413	0,400	0,387
300	0,510	0,496	0,481	0,466	0,453	0,439	0,426	0,413	0,401	0,387	0,377	0,365	0,353

Factor

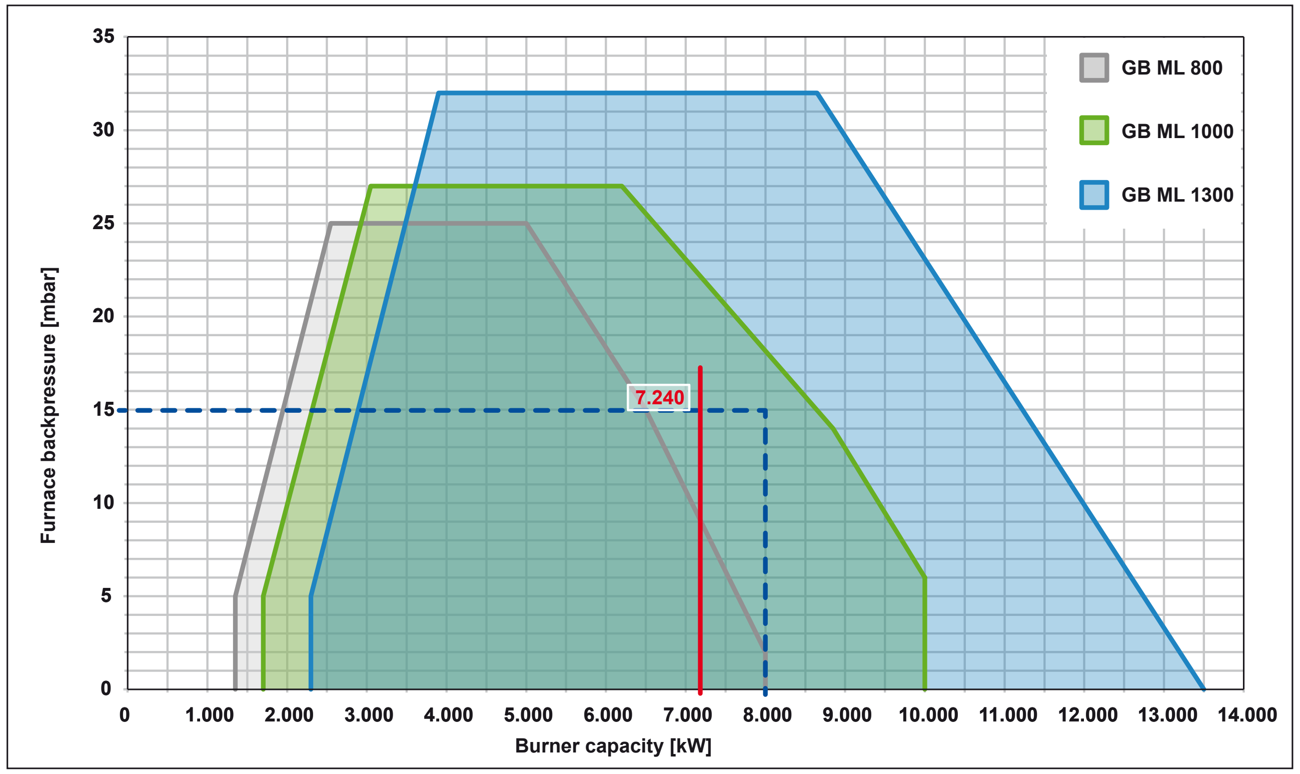
Combustion air flow correction factor in accordance with temperature and altitude
The working range of GB-ML refers to air temperature of 20°C and at sea level (0 mts above sea level). In those cases, where the burner will operate at different condition compared to the one of the test, it's necessary to correct the shown working range.
Warmer air or altitude are affecting the O_2% on each cubic meter of air. Higher is the temperature or the altitude lower is the O_2% content on each air cubic meter. Therefore to achieve the same thermal output (burning same quantity of fuel) bigger volume of air is required.
On all the monoblock range the fan is already set and installed on burner and for this reason is not possible to modify or size accordingly to each installation. In order to keep the correct ratio between air / fuel it's necessary to reduce the fuel quantity as is not possible to increase the air volume.
The above table shows the corrective factor in accordance with altitude and air temperature.

Example:
Sea level installation
Air temperature: 25°C
Required burner output: 8.000kW
Boiler Back pressure: 15 mbar
Burner model: GB-ML 1000 G MC

2.500mts above sea level installation
Air temperature: 25°C
Required burner output: 8.000kW
Boiler Back pressure: 15 mbar
Burner Model: GB-ML 1300 G MC

The corrective factor at 2.500mts a.s.l. and 25°C is 0,724.
10.000kW * 0,724 = 7.240kW
Under these working condition GB-ML 1000 G MC will not achieve the required thermal output. It is then necessary to choose a bigger burner like GB-ML 1300 G MC

13.000kW * 0,724= 9.412kW



Pressure conversion table

Unit	bar	mbar	Pa	kPa	MPa	mm Hg	mm WC	psi
1 bar	1	1000	100000	100	0.1	750.062	10197.16	14.5038
1 mbar	0.001	1	100	0.1	0.0001	0.7501	10.1972	0.0145
1 Pa	0.0001	0,01	1	0.001	0.000001	0.0075	0.10197	0.000145
1 kPa	0.01	10	1000	1	0.001	7.5006	101.9716	0.145
1 MPa	10	10000	1000000	1000	1	7500.62	101972	145.0377
1 mm Hg	0.00133	1.333	133.63	0.13332	0.00013332	1	13.5951	0.01934
1 mm WC	0.000098	0.098	9.807	0.009807	9.807106	0.07356	1	0.0012
1 psi	0.068947	68.95	6894.76	6.8947	0.00689475	51.7149	703.0695	1

Did you know?
Standard air density:
1.293 kg/m3 refers to 0°C and 1013 mbar

Note

Note

We tailor your heat

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