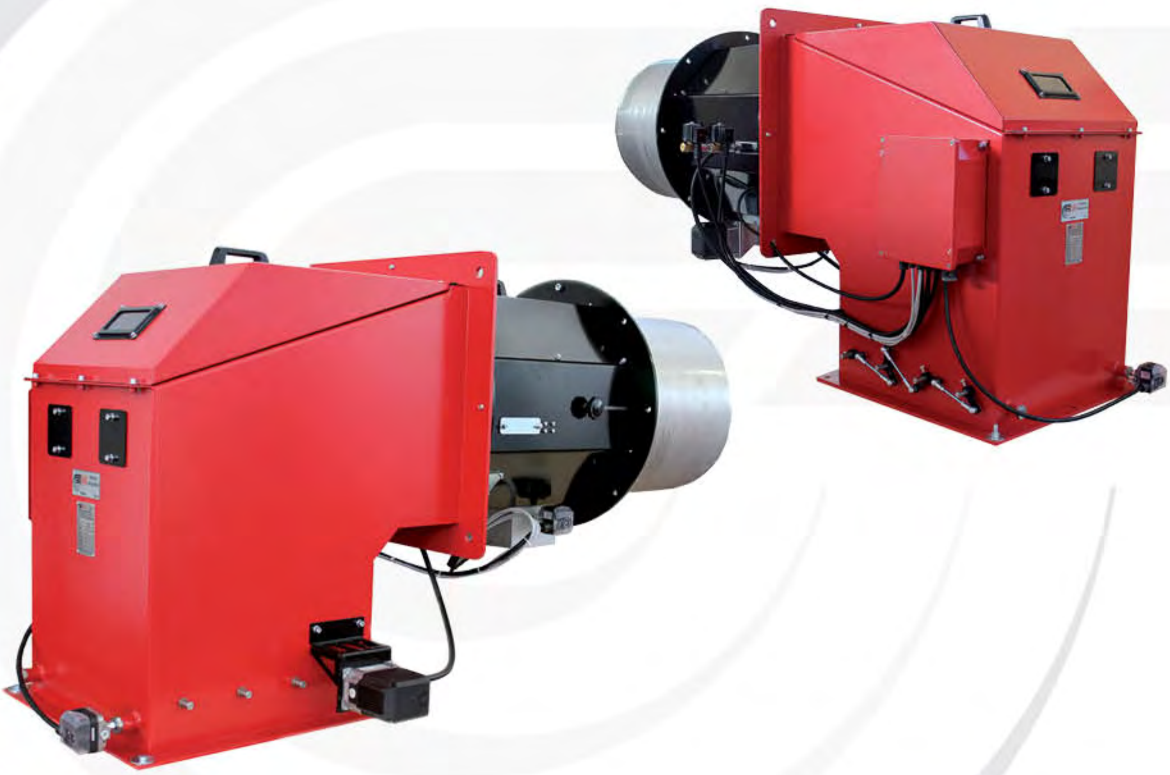
We tailor your heat

INDUSTRIAL DUOBLOCK BURNERS

GB-S



FUEL

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-S** range of duoblock burners.

General Bruciatori
Custom products built to your exact needs.


DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificato No./Certificate No.: 74332-2010-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)

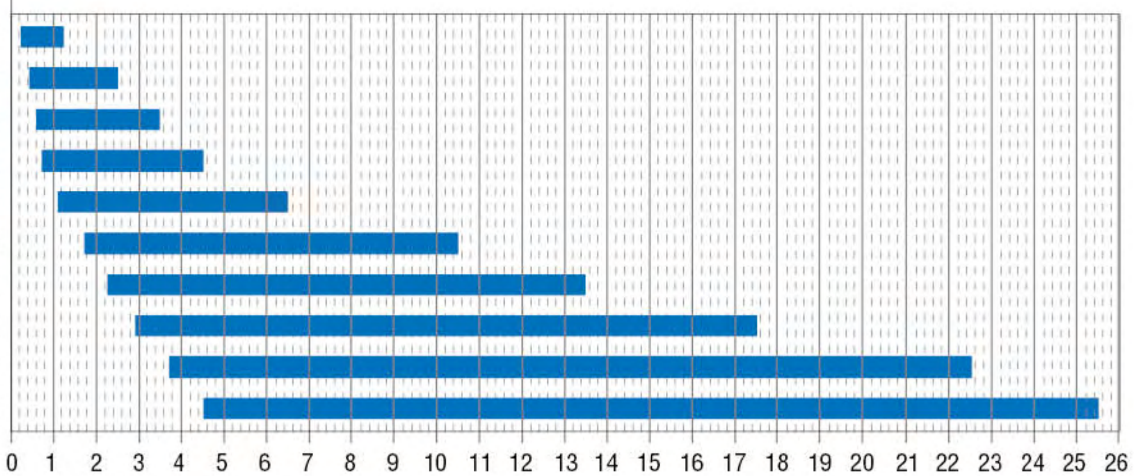
This certificate is valid for the following scope:
Design, manufacture, installation and after-sales servicing of industrial burners
(EA Sector : 18)

ACCREDIA

Duoblock burner range overview

Rating GB-S series - Air temperature 20°C

Model	Capacity (MW) Min*	Max
GB-S - 1	0,22	1,3
GB-S - 2	0,42	2,5
GB-S - 3	0,6	3,5
GB-S - 4	0,75	4,5
GB-S - 6	1,1	6,5
GB-S - 10	1,75	10,5
GB-S - 13	2,25	13,5
GB-S - 17	2,95	17,5
GB-S - 22	3,75	22,5
GB-S - 25	4,25	25,5



Min*: ref natural gas

GB-S 25 GN EM AC 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	
AC	Combustion hot air	
	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-S	Duoblock burner	
GB-SP	PLATE Duoblock burner	

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

			GB-S 1	GB-S 2	GB-S 3	GB-S 4	GB-S 6
HEATING OUTPUT	MODEL						
	OUTPUT	min*-max [kW]	220 - 1300	420 - 2500	600 - 3500	750 - 4500	1100 - 6500
FUEL DATA	CAPACITY HEAVY OIL	min-max [kg]	30 - 115	60 - 225	80 - 315	105 - 400	150 - 580
	VISCOSITY FUEL (diesel oil)	°E - cSt	1.5 °E at 20°C - 6 cSt at 20°C				
	VISCOSITY FUEL (heavy oil)	°E - cSt	60°E at 50°C - 450 cSt at 50 °C				
	CAPACITY NATURAL GAS (G20)	min-max [m³n/h]	22 - 130	42 - 250	60 - 350	75 - 450	110 - 650
	MAX GAS PRESSURE	mbar	490	490	490	490	490
GAS CONNECTION	GAS OPERATION		Intermittent operation (min. 1 stop each 24hrs of operation)				
BURNER OPERATION	OPERATING CONDITION		PROGRESSIVE 2 STAGE				
	MODULATING RATIO (at max output)		1 - 6 Gas 1 - 4 Diesel oil 1- 4 Heavy oil				
	WORKING TEMPERATURE	min-max [°C]	-15°C +50°C				
ELECTRICAL DATA	ELECTRIC SUPPLY	V - Hz	230 V - 50 Hz				
	IGNITION TRANSFORMER OIL	V2 - I2mA	13000 V- 35 mA				
	IGNITION TRANSFORMER GAS	V2 - I2mA	8000 V - 20 mA				
	AUXILIARY ELECTRICAL POWER INSTALLED	kW	0.65				
	PROTECION LEVEL	IP	IP 54				
APPROVALS	DIRECTIVE		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				

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.

GB-S 10	GB-S 13	GB-S 17	GB-S 22	GB-S 25	
1750 - 10500	2250 - 13500	2950 - 17500	3350 - 22500	4250 - 25500	min-max [kW]
240 - 940	305 - 1210	395 - 1570	505 - 2015	575 - 2285	min-max [kg]
1.5 °E at 20 °C - 6 cSt at 20 °C					°E - cSt
60°E at 50°C - 450 cSt at 50 °C					°E - cSt
175 - 1050	225 - 1350	295 - 1750	335 - 2250	425 - 2550	min-max [m³n/h]
490	490	490	490	490	mbar
Intermittent operation (min. 1 stop each 24hrs of operation)					
PROGRESSIVE 2 STAGE					
1 - 6 Gas 1 - 4 Diesel oil 1- 4 Heavy oil					
-15°C +50°C					min-max [°C]
230 V - 50 Hz					V - Hz
13000 V- 35 mA					V2 - I2mA
8000 V - 20 mA					V2 - I2mA
0.65					kW
IP 54					IP
2006/42/CE - 2006/95CE- 2011/65/CE - 2004/108/CE					
EN 60204-1 / EN 62233 / EN 61000-6-2 EN 61000-6-4 / EN 60529					

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

Fuel	densità kg/m³	LOWER HEATING VALUE 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

Fuel	densità kg/l	LOWER HEATING VALUE 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	Ø H	L	M	N	P
GB-S 1 MC	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.
GB-S 2 MC	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.
GB-S 3 MC	280	356	256	14	216	123	390	14	269	271	360	200
GB-S 4 MC	330	396	306	14	232	123	430	14	293	320	422	222
GB-S 6 MC	380	466	356	14	242	143	500	14	313	359	492	250
GB-S 10 MC	450	536	426	16	292	163	570	14	348	429	530	285
GB-S 13 MC	510	602	486	16	337	173	650	14	381	489	596	325
GB-S 17 MC	570	662	546	16	396	173	710	14	404	542	650	355
GB-S 22 MC	630	722	606	18	426	204	770	14	434	602	708	385
GB-S 25 MC	680	772	658	18	451	204	820	14	459	653	758	410

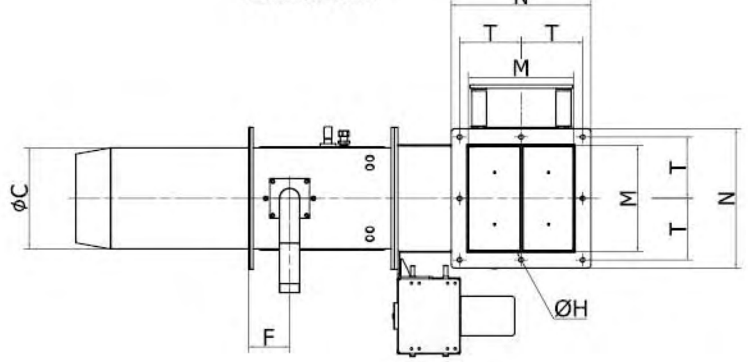
MC = Mechanical cam

MODEL	A	B	C	ØD	E	F	G	Ø H	L	M	N	P
GB-S 1 EM	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.
GB-S 2 EM	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.
GB-S 3 EM	280	356	256	14	216	123	390	14	269	271	360	200
GB-S 4 EM	330	396	306	14	232	123	430	14	293	320	422	222
GB-S 6 EM	380	466	356	14	242	143	500	14	313	359	492	250
GB-S 10 EM	450	536	426	16	292	163	570	14	348	429	530	285
GB-S 13 EM	510	602	486	16	337	173	650	14	381	489	596	325
GB-S 17 EM	570	662	546	16	396	173	710	14	404	542	650	355
GB-S 22 EM	630	722	606	18	426	204	770	14	434	602	708	385
GB-S 25 EM	680	772	658	18	451	204	820	14	459	653	758	410

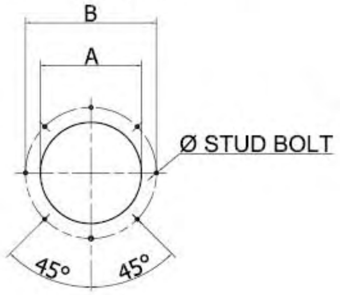
EM = Electronic cam

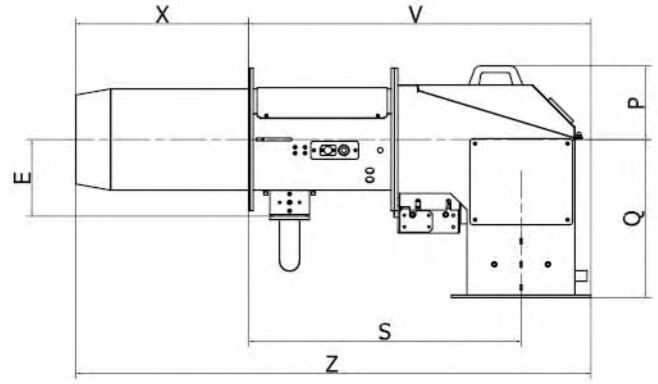
(**F**) quota refers to Gas and dual fuel models.

Bottom view

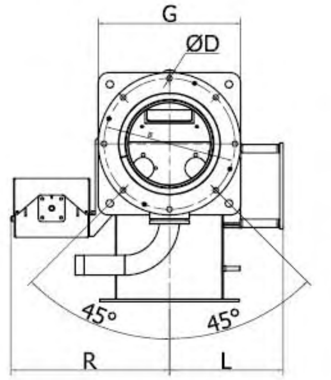


Flange connection





Side view



Front view

Quota are indicative and applicable to enteire GB-S range.

Q	R	S	T	V	X *	Z	Ø STUD BOLT	MODEL
W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	GB-S 1 MC
W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	GB-S 2 MC
415	460	780	160	960	521	1481	M12 x 50 MM	GB-S 3 MC
477	488	823	186	1034	525	1560	M12 x 50 MM	GB-S 4 MC
490	520	846	221	1092	530	1622	M12 x 50 MM	GB-S 6 MC
585	545	960	245	1226	535	1761	M12 x 50 MM	GB-S 10 MC
670	585	1136	273	1434	540	1974	M12 x 50 MM	GB-S 13 MC
684	595	1180	300	1505	545	2050	M14 x 50 MM	GB-S 17 MC
724	640	1260	328	1614	550	2164	M14 x 50 MM	GB-S 22 MC
785	664	1320	353	1698	555	2253	M16 x 50 MM	GB-S 25 MC

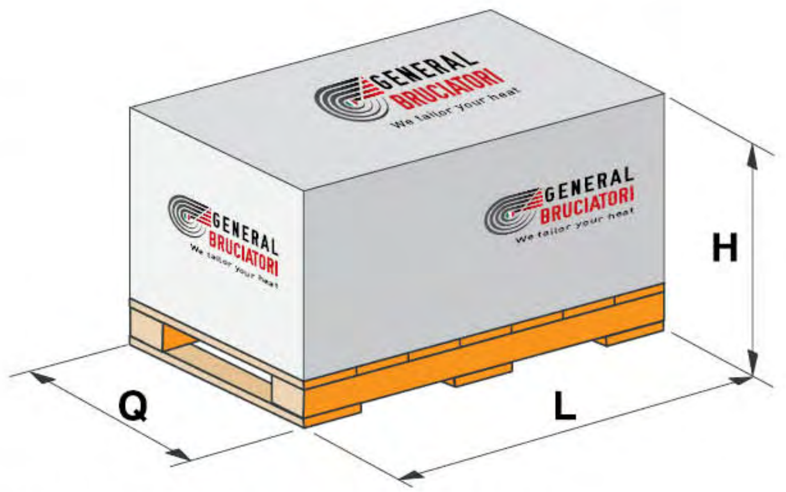
MC = Mechanical cam

Q	R	S	T	V	X *	Z	Ø STUD BOLT	MODEL
W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	GB-S 1 EM
W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	W.I.P.	GB-S 2 EM
415	394	780	160	960	521	1481	M12 x 50 MM	GB-S 3 EM
477	422	823	186	1034	525	1560	M12 x 50 MM	GB-S 4 EM
490	454	846	221	1092	530	1622	M12 x 50 MM	GB-S 6 EM
585	479	960	245	1226	535	1761	M12 x 50 MM	GB-S 10 EM
670	519	1136	273	1434	540	1974	M12 x 50 MM	GB-S 13 EM
684	529	1180	300	1505	545	2050	M14 x 50 MM	GB-S 17 EM
724	574	1260	328	1614	550	2164	M14 x 50 MM	GB-S 22 EM
785	598	1320	353	1698	555	2253	M16 x 50 MM	GB-S 25 EM

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.

Packaging dimensions			
Model	L mm	Q mm	H mm
GB-S 1 G MC	W.I.P	W.I.P	W.I.P
GB-S 2 G MC	W.I.P	W.I.P	W.I.P
GB-S 3 G MC	1.765	940	880
GB-S 4 G MC	1.842	992	964
GB-S 6 G MC	1.842	1.042	1.064
GB-S 10 G MC	2.008	1.028	1.244
GB-S 13 G MC	2.212	1.282	1.244
GB-S 17 G MC	2.212	1.282	1.244
GB-S 22 G MC	2.442	1.192	1.314
GB-S 25 G MC	2.542	1.292	1.469



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

GB-S Burner specification - MC execution

DESCRIPTION	GB-S ...G	GB-S ...D	GB-S ...N	GB-S ...GD	GB-S ...GN
powder coated finish carbon steel body	●	●	●	●	●
casing suitable for high temperature	●	●	●	●	●
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/flame inspection window	●	●	●	●	●
progressive and continuous regulation group of the air/fuel	●	●	●	●	●
electrical interface box	●	●	●	●	●
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	opt			opt	opt
steel oil feed gun		●	●	●	●
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		●	●	●	●

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-S industrial burners range fit especially applications like steam boilers, boilers with multiple heads operation, ovens, dryers, diathermic oil generators, incinerators, oven for Industrial thermoprocessing equipment in general.
They can be installed horizontally, vertically with flame down and vertically with flame up.

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.

Modular concept design
GB-S burners are made up of separate units that are selected according to the specific application requirements.
The units available are:
- combustion head (burner body)
- fan
- control panel
- gas train fuel
- preheater and push unit

Operating principle
The GB-S 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. 33)
Burner output is adjusted according to head 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, option up to 1/10
Diesel oil (D) 1/4, option up to 1/10
Heavy oil (N) 1/4, option up to 1/10

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 used. (Ref pag. 28)

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.

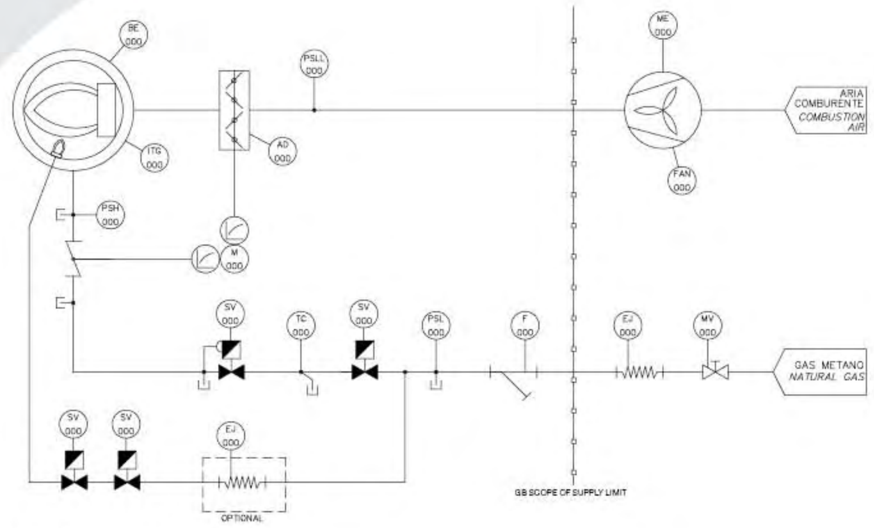
Burner operation
In the standard execution, burners feature are two progressive stages with mechanic cam (MC). For the full modulating execution a modulation kit consisting of PID control and modulation probe needs to be installed; the probe will be chosen according to the process variable controlled.
Standard protection is IP 54.
Available on request is a execution with electronic cam (EM) with the various associated options, such as O_2 trim, CO trim, variable speed drive (VSD).

Emissions
With environmental care approach the whole GB-S range is available with Low NOx (EN676 and EN267). In order to fulfil the stricter NOx emission on the GB-S 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.

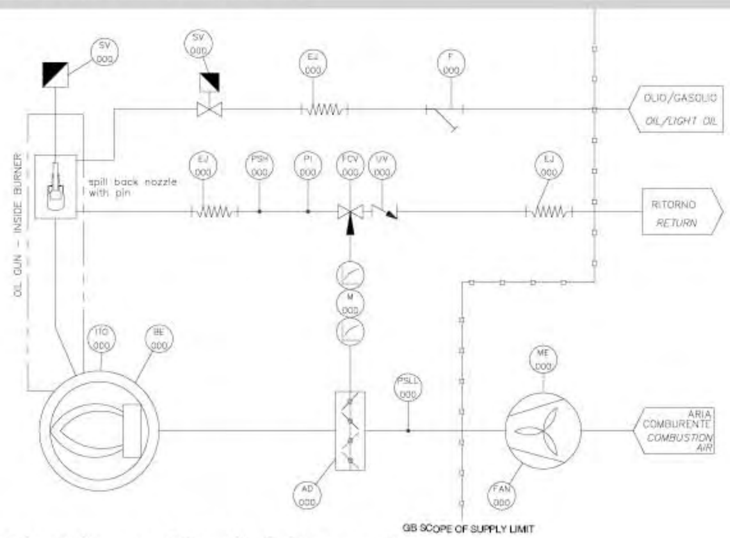
Pushing Unit / preheating device
According to customer needs the push and preheating units can be supplied already assembled on a metallic frame or CKD (Completely Knock Down).
The preheating unit is available on different configuration also in accordance with the application. The unit can be with electrical resistance, combined electric / steam or electric / diathermic oil.

Burner Wiring
As standard the GB-S range is equipped with on board terminal box to facilitate thet wiring between burner and main control panel. On demand it’s also available a GB-S range with complete on board control panel to include all wiring, BMS and electrical supply.



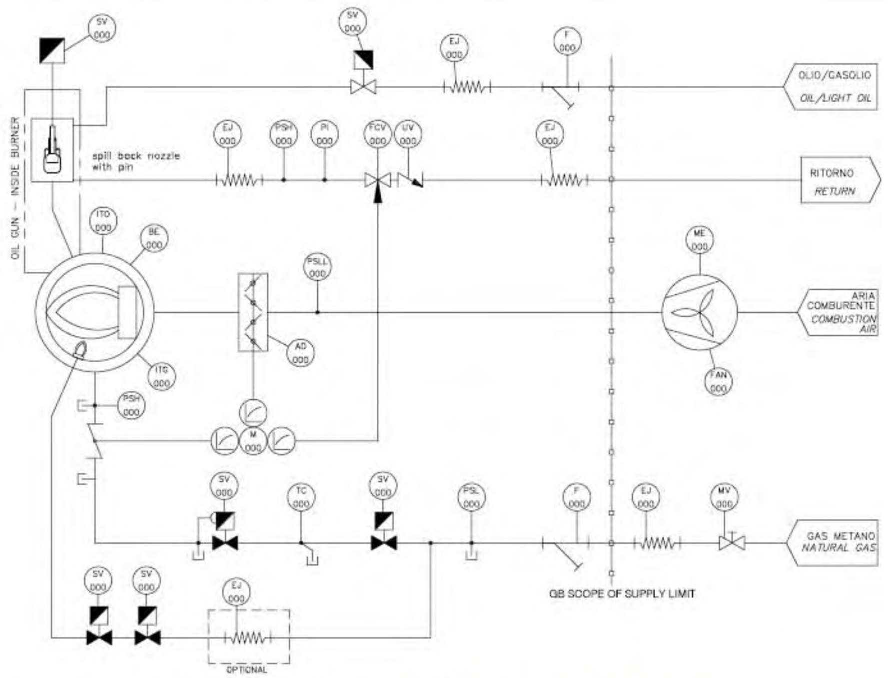
AD 000	SERRANDA ARIA / AIR DAMPER
BE 000	FOTOCELLULA / FLAME SCANNER
BV 000	VALVOLA A SFERA / BALL VALVE
EJ 000	TUBO FLESSIBILE / FLEXIBLE HOSE
F 000	FILTRO / FILTER
FAN 000	VENTILATORE / AIR FAN
ITG 000	TRASFORMATORE DI ACCENSIONE GAS / IGNITION TRANSFORMER
M 000	SERVOMOTORE / SERVOMOTOR
ME 000	MOTORE ELETTRICO / ELECTRIC MOTOR
MV 000	VALVOLA MANUALE / MANUAL VALVE
PSH 000	PRESSOSTATO DI MASSIMA / MAXIMUM PRESSURE SWITCH
PSL 000	PRESSOSTATO DI MINIMA GAS / GAS MINIMUM PRESSURE SWITCH
PSLL 000	PRESSOSTATO DI MINIMA ARIA / AIR MINIMUM PRESSURE SWITCH
PSLH 000	PRESSOSTATO PROVA VALVOLE / TEST PRESSURE VALVES
SV 000	ELETTROVALVOLA / SOLENOID VALVE
TC 000	CONTROLLO TENUTA / TIGHTNESS CONTROL

Duoblock burner Natural Gas.



AD 000	SERRANDA ARIA / AIR DAMPER
BE 000	FOTOCELLULA / FLAME SCANNER
EJ 000	TUBO FLESSIBILE / FLEXIBLE HOSE
F 000	FILTRO / FILTER
FAN 000	VENTILATORE / AIR FAN
FCV 000	VALVOLA REGOLAZIONE PORTATA / FLOW CONTROL VALVE
ITO 000	TRASFORMATORE DI ACCENSIONE OLIO / IGNITION TRANSFORMER
M 000	SERVOMOTORE / SERVOMOTOR
ME 000	MOTORE ELETTRICO / ELECTRIC MOTOR
PSH 000	PRESSOSTATO SICUREZZA ACCENSIONE / SAFETY PRESSURE SWITCH
PSLL 000	PRESSOSTATO ARIA / AIR PRESSURE SWITCH
SV 000	ELETTROVALVOLA / SOLENOID VALVE

Duoblock burner Diesel oil, Heavy oil



AD 000	SERRANDA ARIA / AIR DAMPER
BE 000	FOTOCELLULA / FLAME SCANNER
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F 000	FILTRO / FILTER
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ITO 000	TRASFORMATORE DI ACCENSIONE OLIO / OIL IGNITION TRANSFORMER
M 000	SERVOMOTORE / SERVOMOTOR
ME 000	MOTORE ELETTRICO / ELECTRIC MOTOR
MV 000	VALVOLA MANUALE / MANUAL VALVE
PSH 000	PRESSOSTATO SICUREZZA ACCENSIONE / SAFETY PRESSURE SWITCH
PSL 000	PRESSOSTATO DI MINIMA GAS / GAS MINIMUM PRESSURE SWITCH
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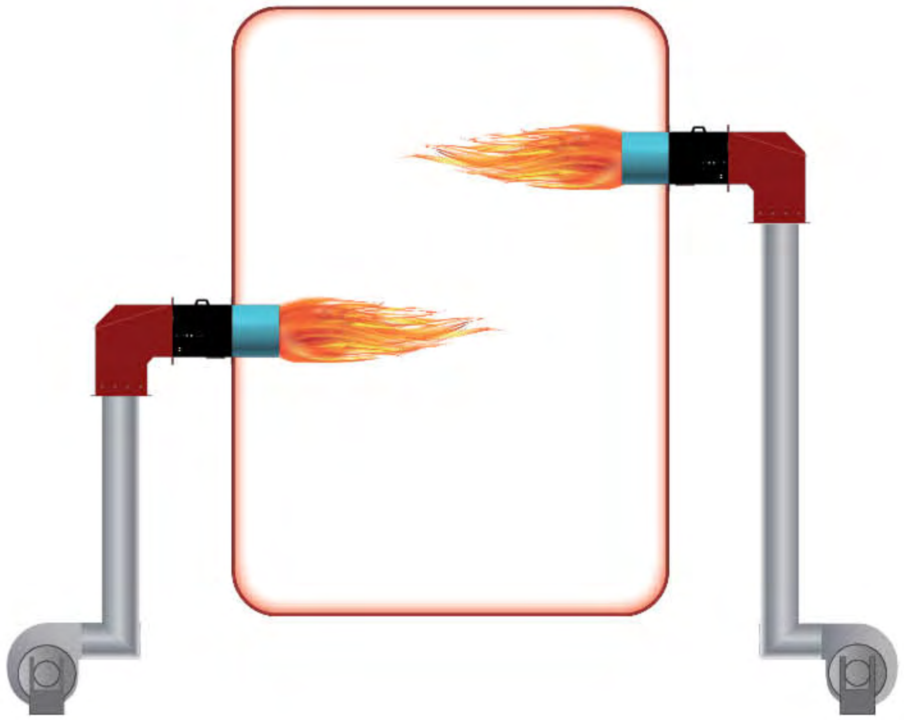
TC 000	CONTROLLO TENUTA / TIGHTNESS CONTROL

Duoblock burner Natural Gas/Diesel oil, Natural Gas/Heavy oil

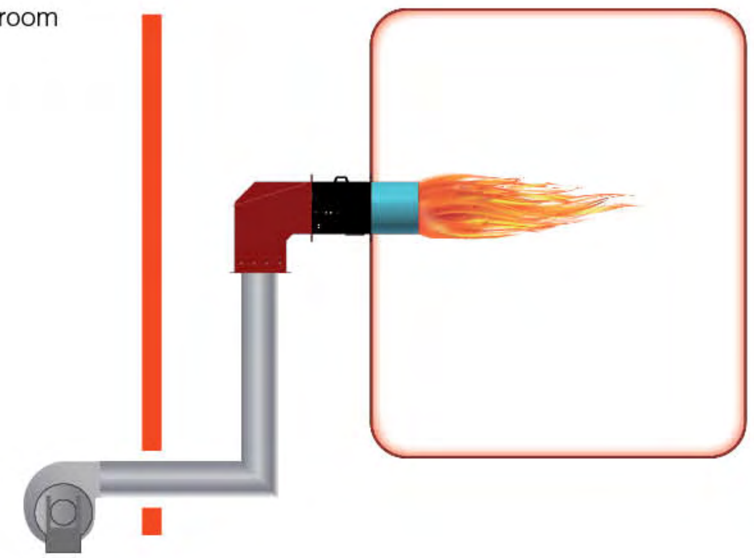
Designing with modular concept for customized solutions

As mentioned above, the burners of the GB-S ranges are composed of various functional units.
This technical solution, combined with the several versions and the available options, enables to dimension and equip the burners down to the smallest details with the maximum flexibility.
Here are some examples of possible achievements.

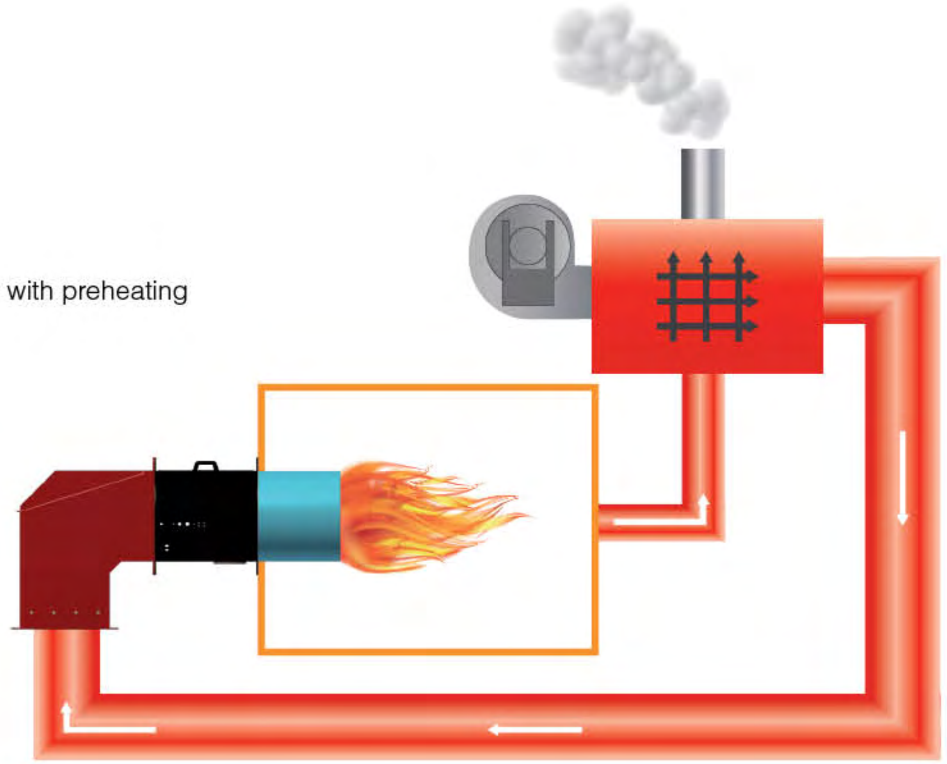
Multi-burner boiler



Burner with fan outside boiler room



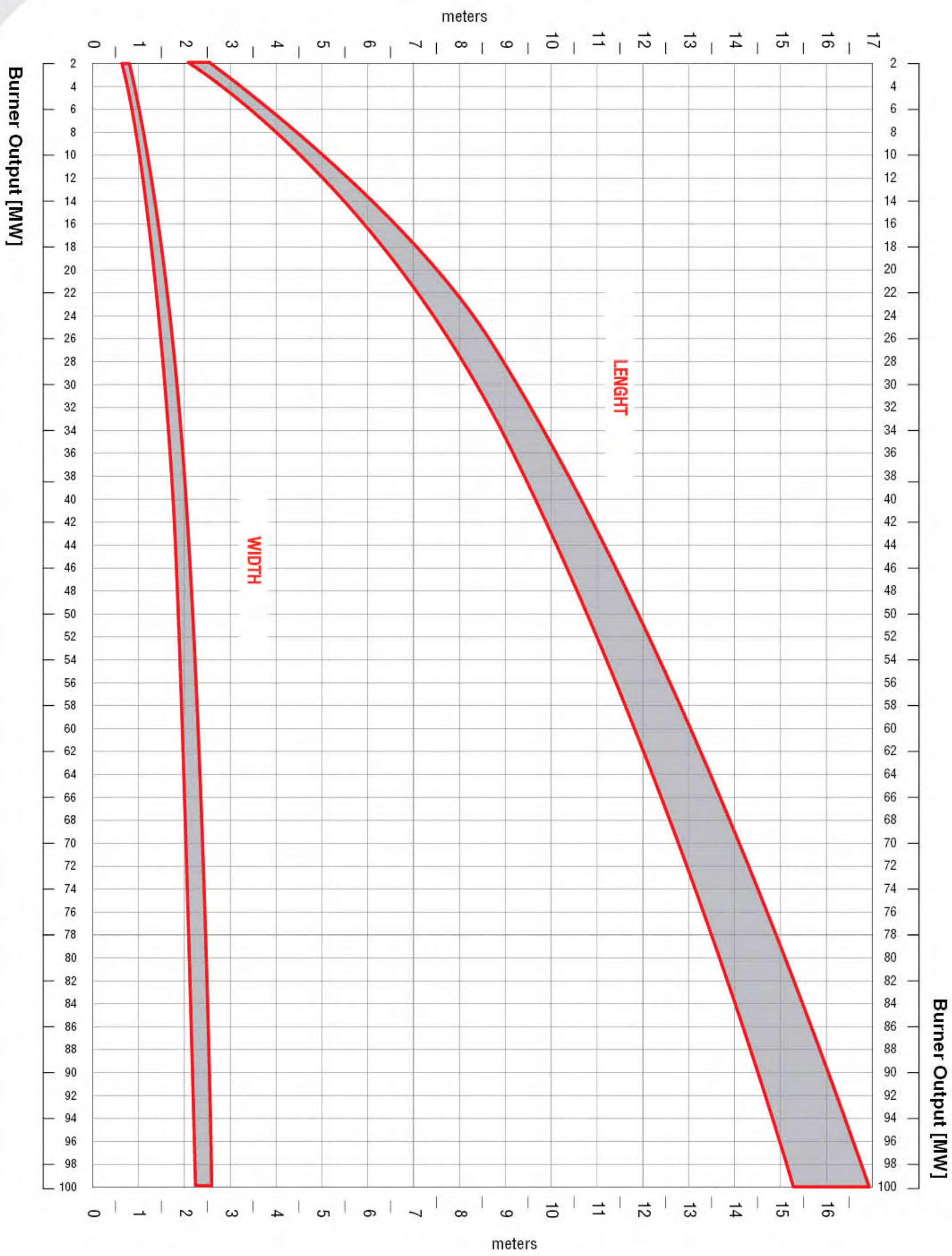
Hot air burner with preheating



As you can see, having a separate fan gives a number of advantages:

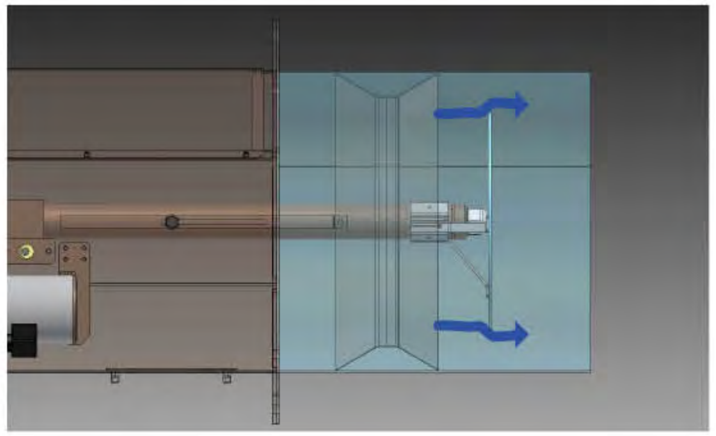
- it can be installed outside the thermal plant, in a separate room, thus reducing burner noise significantly.
- it can be sized to the exact needs of the system even on boilers with high back pressure values.
- less weight on the boiler front.
- a combustion air preheater can be used to increase efficiency.

FLAME DIMENSIONS

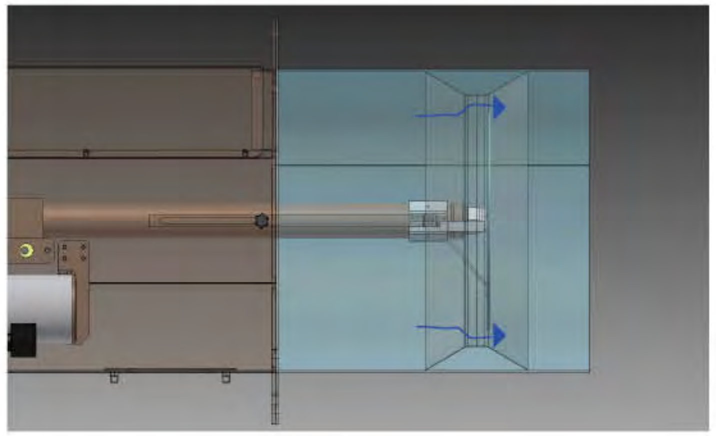


BI-CONE OPERATION PRINCIPLE

SYSTEM TOTALLY OPEN: MAXIMUM BURNER CAPACITY



SYSTEM TOTALLY CLOSED: MINIMUM BURNER CAPACITY



In addition to the traditional combustion head group and flame disk, both on normal and Low NOx version, the new system is including a BI-CONE device as shown above.
The design allow the possibility to slide backward and forward the cone modifying the gap between the flame disk and the blast pipe.
In this way it is possible to adjust the speed of the combustion air to optimize the combustion values depending on the burner capacity

1. **System totally open:**
When the system is totally open the gap between the flame disk and the blast pipe is at the maximum level. This enable the max flow of combustion air. This position is required when the burner is sized and is operating at the maximum nominal capacity.

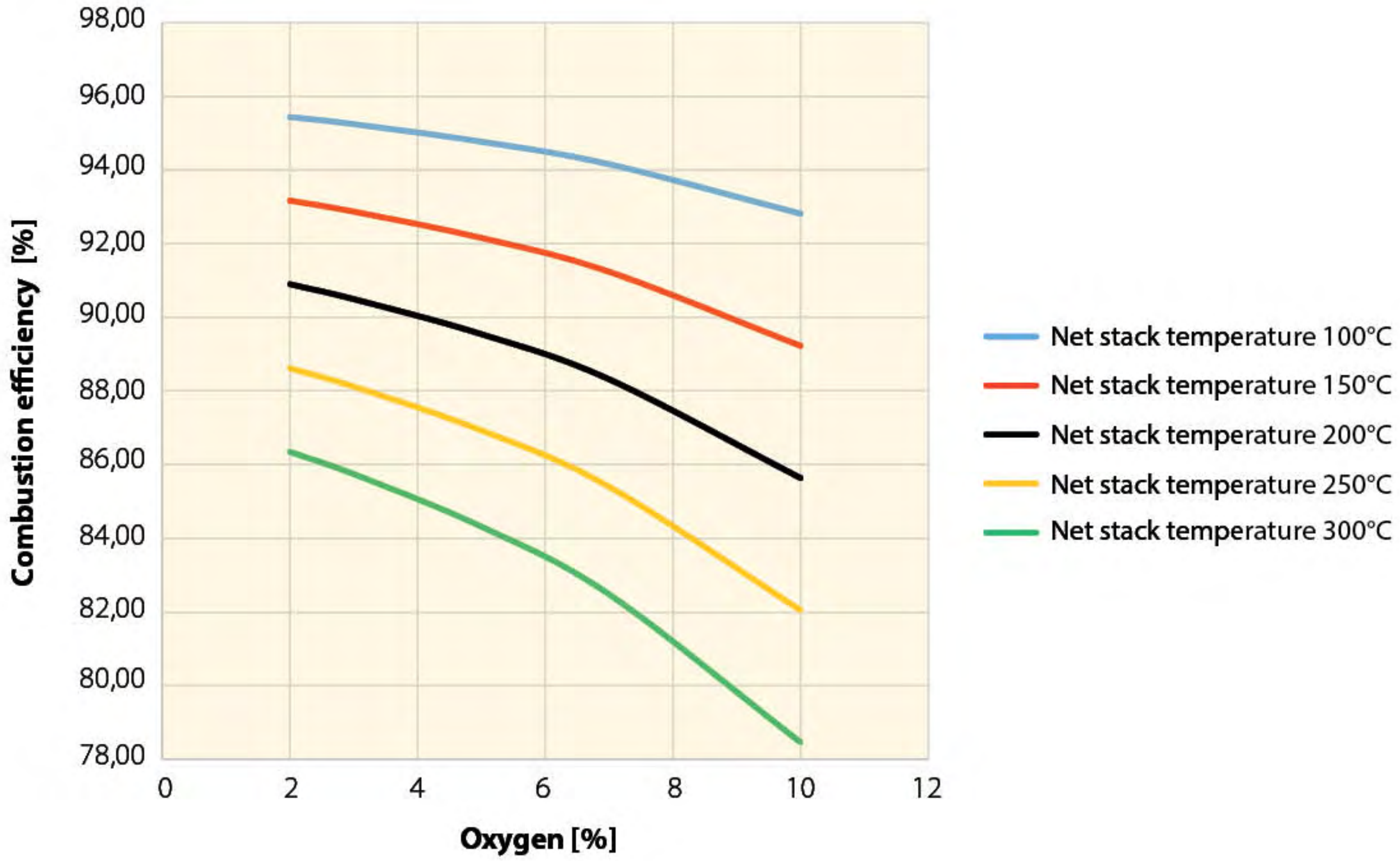
2. **System totally closed:**
When the system is totally closed the gap between the flame disk and the blast pipe is at the minimum level. This position is reducing the available section for the secondary air by reducing the flow of the same but keeping the needed speed for a correct fuel / air mixing. This position is required when the burner is installed on an application that not requires the 100% of the capacity.

The exhaust fumes to the chimney of industrial heat processes, owing to their high temperature, are the main source of energy loss. An estimate of the loss of sensible heat can be avaluated on the following graphic according to the air excess.

Benefits at a glance

- Increase in efficiency
- Reduction in fuel consumption
- Short payback period

Diagram of the combustion efficiency with natural gas.



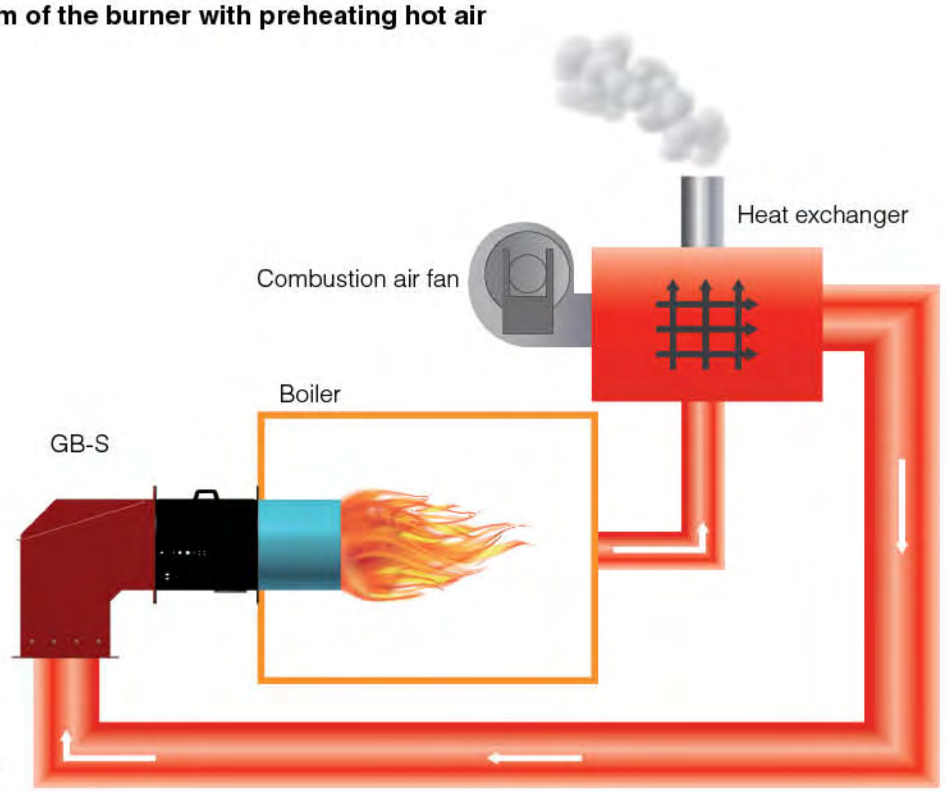
Therefore the exhaust fumes contain a large amount of heat that can, or better, must be recovered.
One of the most effective ways to reduce the consumption of fuel in industrial heat processes is to recover heat from the flue gases by preheating the combustion air inlet to the burners.
The heat recovery can be obtained by installing an heat exchanger just upstream the axhaust chimney. This heat exchanger, also named preheater, extract large protion of the thermal energy still in the exhaust and transfer it to the burner combustion air.
The inclusion of a preheating unit is very easy even in existing systems (retrofit) and it is an investment that pays back quite rapidly.

Energy tips

Air preheating is the ideal solution for increasing efficiency. It is an investment that pays for itself.

The temperature of the flame increases, there is more heat available for heating and, with equal power, fuel consumption is reduced.
This is what a system with air preheater will normally look like.

Basic diagram of the burner with preheating hot air



To have a rough idea of the benefits of such a solution, consider that by reducing the temperature difference between the flue gas temperature and the combustion air temperature fed into the burner by about 25°C, the efficiency of the boiler will increase by 1%.

Energy tips

Energy tips: Flue gas temperature is an indication of how combustion heat is actually transferred for use. If over time you notice a gradual increase of flue gas temperature, this is a sign of progressive deterioration of heat transfer. This could be cause by rust buildup on the heat exchange surfaces.
A 100°C increase of flue gas temperature results in a 4% boiler efficiency decrease.

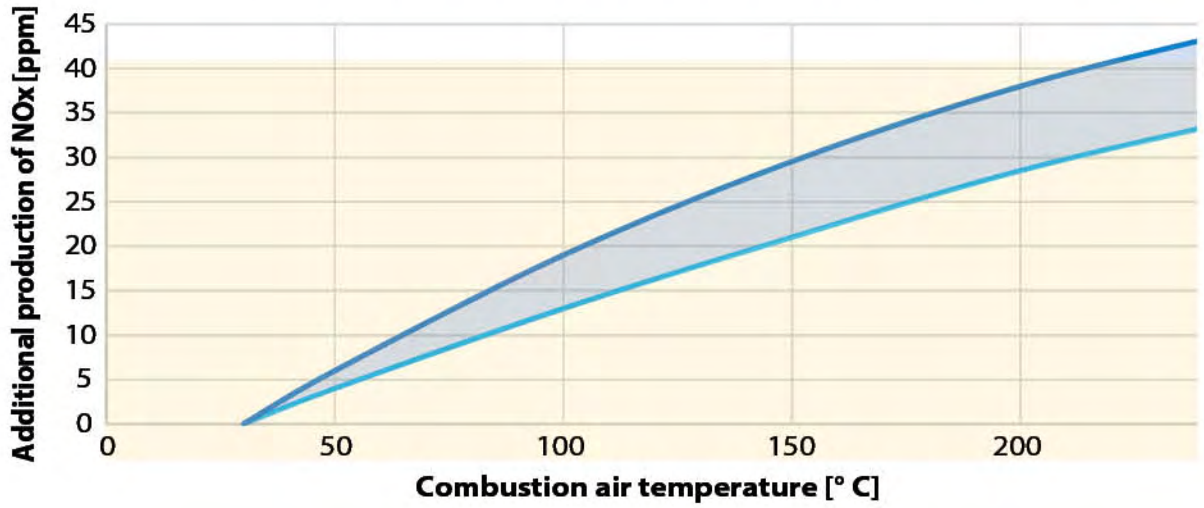
Technical tip

Technical tip: For correct fan sizing bear in mind that it must be able to deal not only with the firebox counter pressure but also to the additional one due to the addition of air preheating in the flue gas duct.

GB-S burners are designed in standard configuration to function with air temperature up to 50°C.
Hot air executions are available, designed to take temperatures up to 400°C (option).

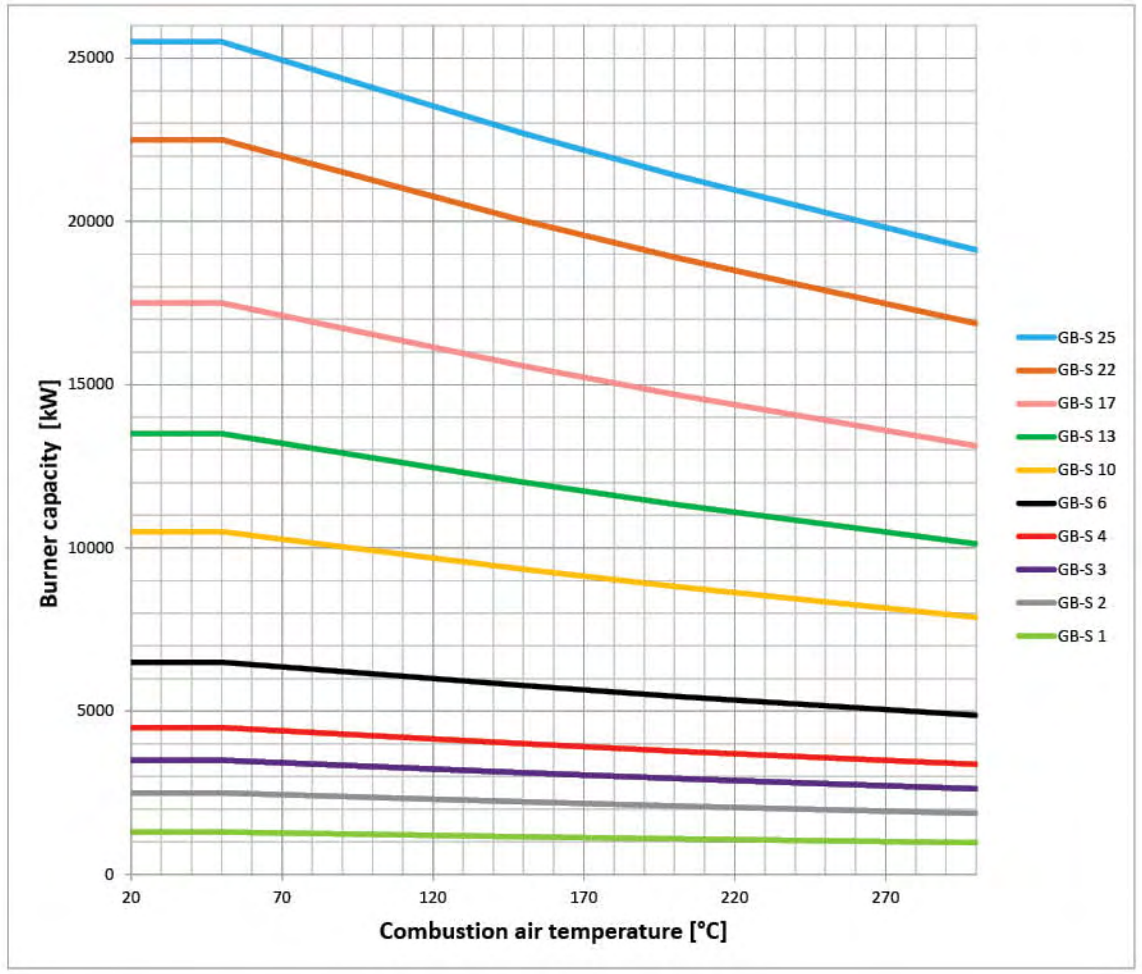
Any increase in combustion air temperature leads to an increase in the adiabatic flame temperature, which in turn increases the formation of NOx. The increase in NOx emissions as a function of combustion air preheating is shown in the graph below

NOx production as a function of the temperature of the combustion air



Hot combustion air reduced the maximum capacity point, as shown in the graph.

Hot air operating range for GB-S from 1 to 25



Techniques for reduction of NOx emissions

NOx is the generic terms used 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, derived 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 derived 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, formed from 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 experience developed so far has clearly shown that the construction characteristics of combustion chambers and their operating principles 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%

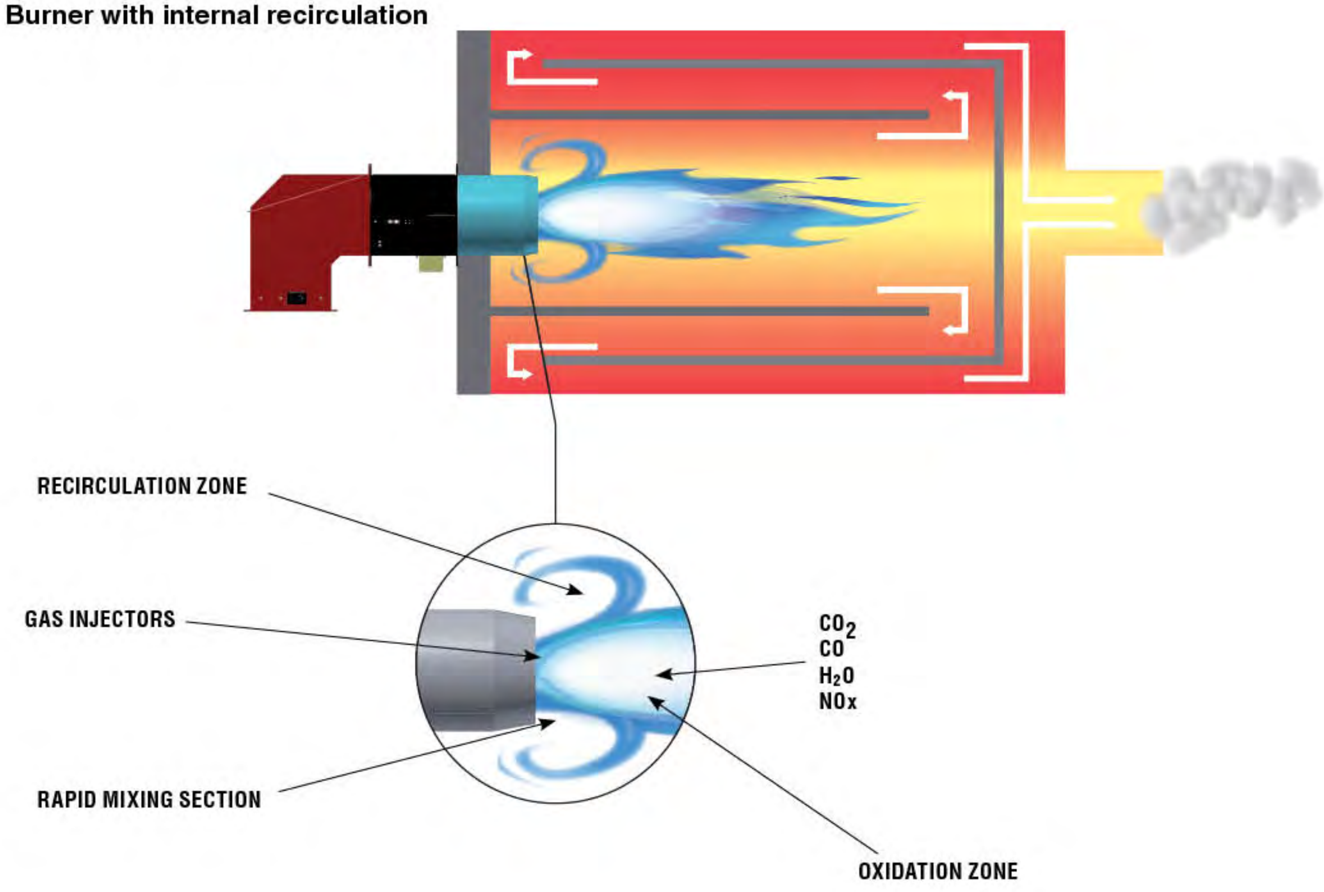
Flame temperature also depends on the temperature of combustion air (see paragraph on preheated air). The higher the temperature of combustion air the higher will the flame temperature be.

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

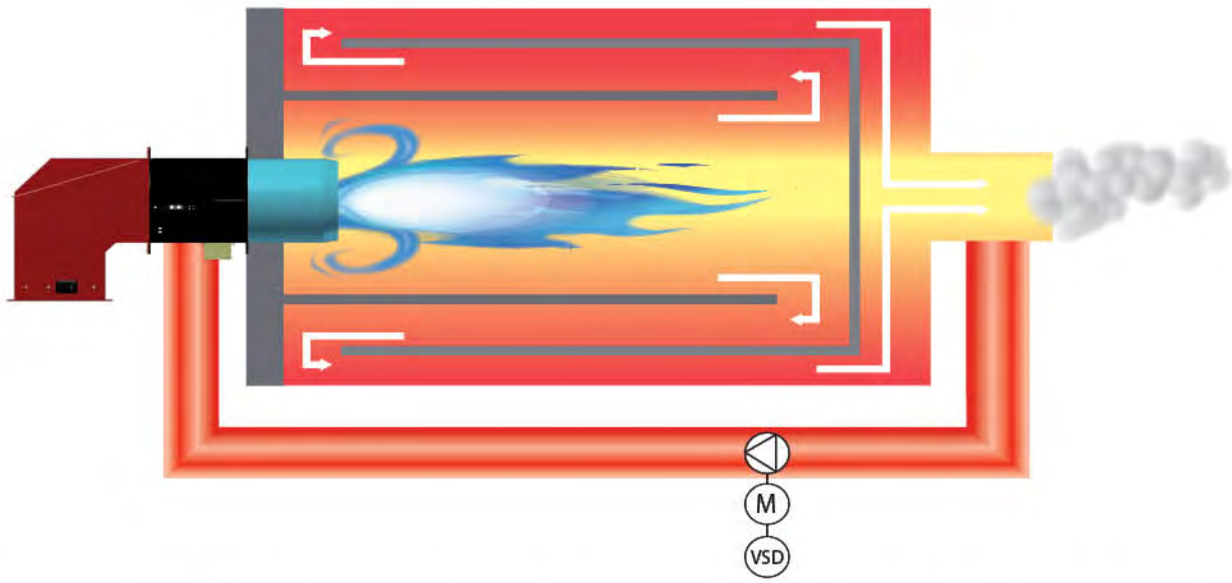


In the internal recirculation system, a fraction of the combustion gas is reintroduced in the flame, and it will absorb flame heat. This lower the average temperature and causes a “dilution” of flame volume, which further lowers the temperature.

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

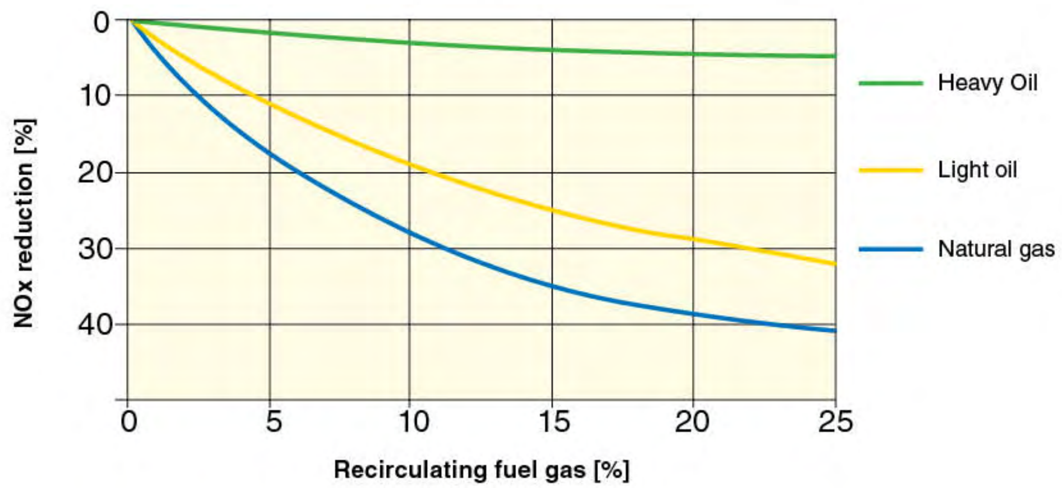
This system uses a fan to introduce a large quantity of combustion gas into the burner head. The flue gas is sucked up at the base of the flue and introduced into the burner by means of a flue gas distributor. The external flue gas recirculation fan, controlled by a variable speed drive, will enable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

Burner with external flue gas recirculation



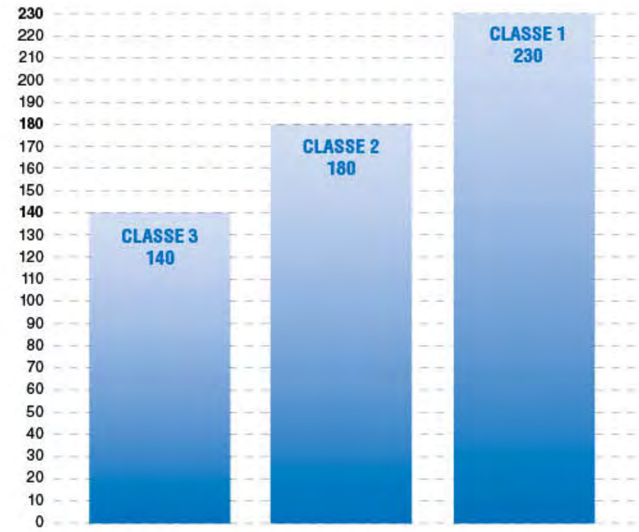
The average quantity of gas to be recirculated can be estimated at 10-25%. The graph below gives an indication of the value that can be obtained.

Incidence of recirculating fuel gas in the combustion head

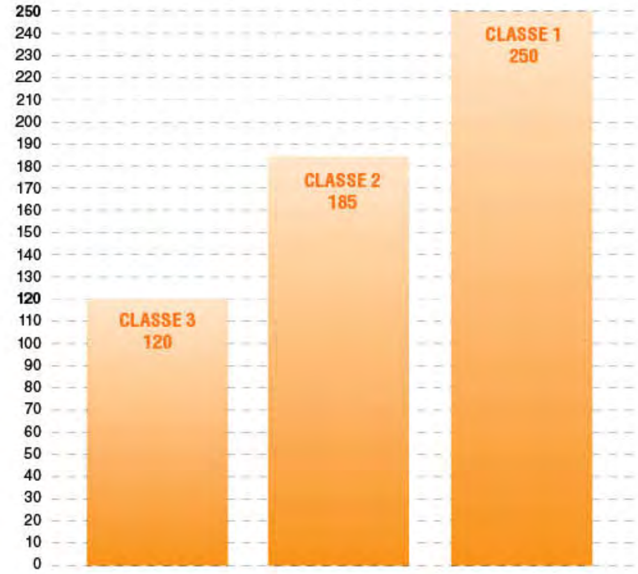


Classes defined by Regulation EN 676 for NOx emissions with natural gas

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/$m^3{}_n$ CO
1 ppm CO_2 = 1.96 mg/$m^3{}_n$ CO_2
1 ppm NO = 1.34 mg/$m^3{}_n$ NO
1 ppm NO_2 = 2.05 mg/$m^3{}_n$ NO_2
1 ppm SO_2 = 2.93 mg/$m^3{}_n$ SO_2

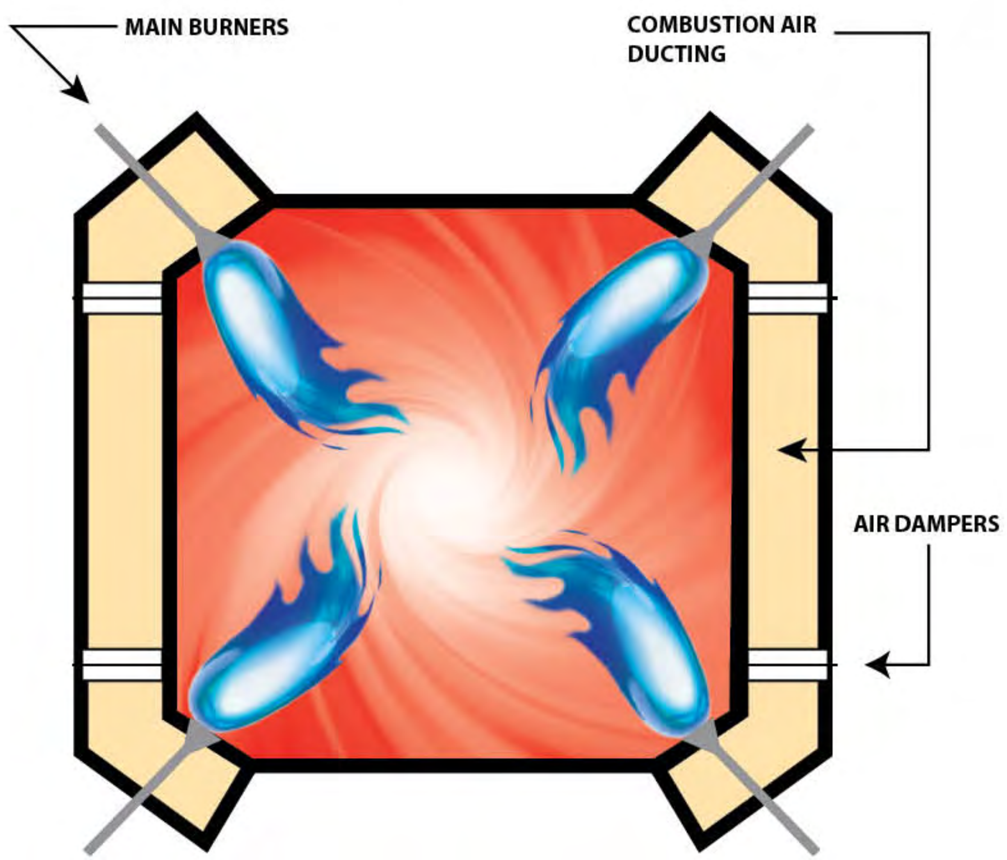
Flame monitoring

One of the key safety elements in combustion processes is the flame monitoring.
When a single burner is used the operation of flame monitoring is relatively simple and safe.

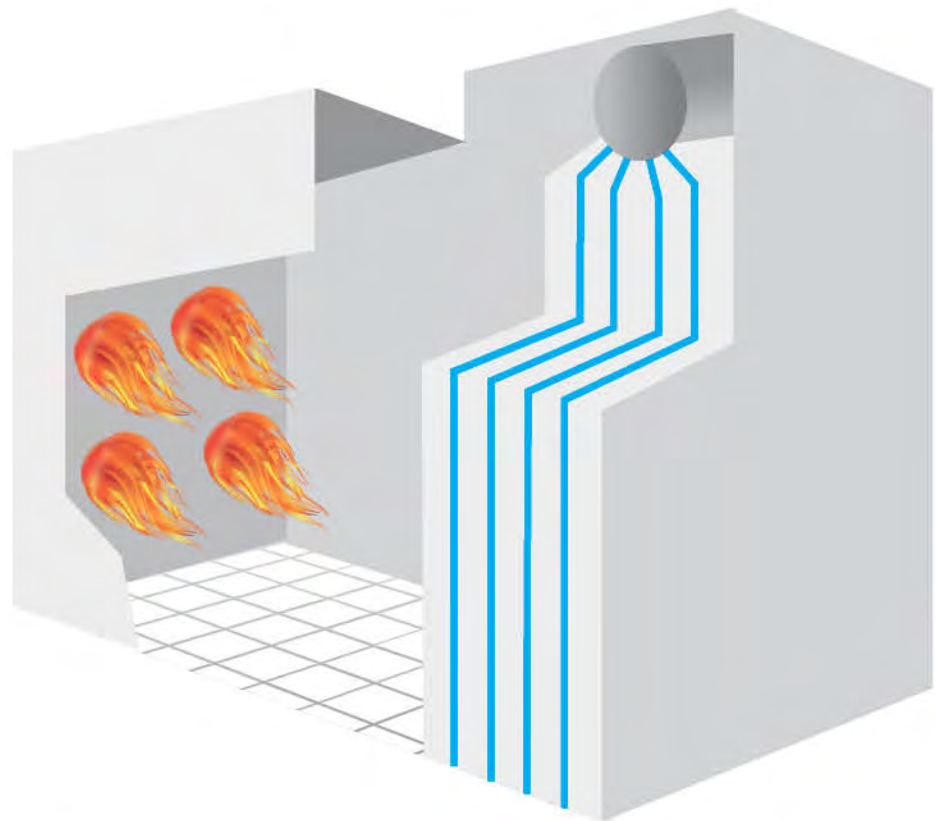
In the industrial field the systems used are often very complex in terms of flame monitoring. Let us consider for example an incinerator where, in addition to the burner flame there are other flames produced by waste combustion and all of these need to be monitored or multiburner applications where a number of burners operate simultaneously in a shared firebox sometimes with different fuels used simultaneously.

Let us look at some applications.

Boiler with tangential flames



Water tube boiler with 4 burners

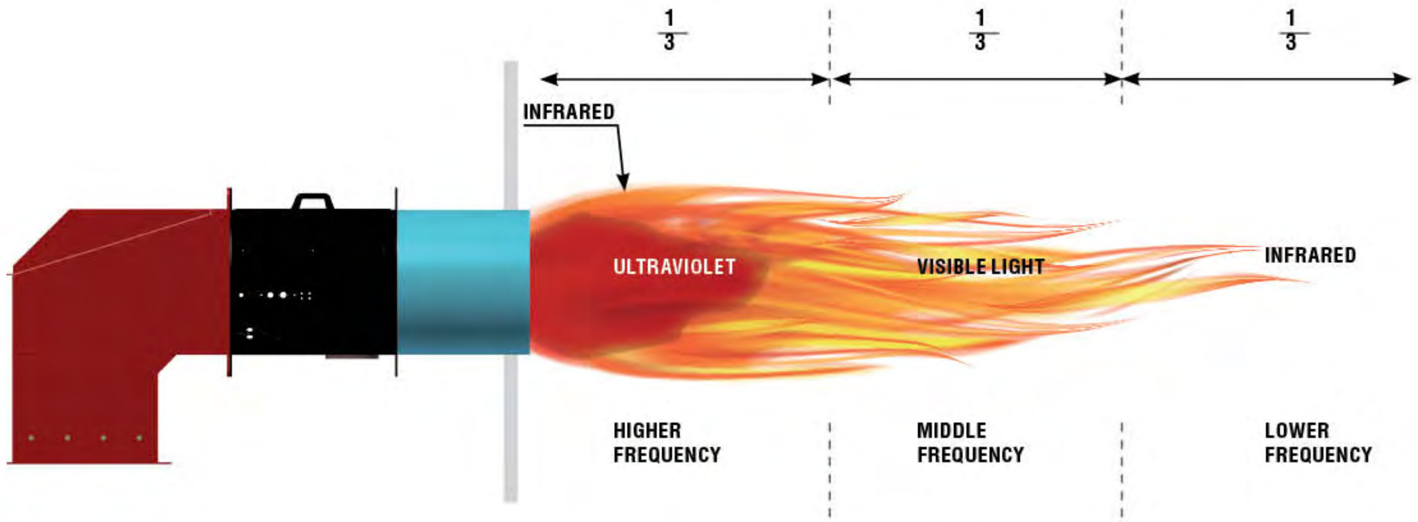


In these applications it is essential, in terms of safety, to discriminate with absolute certainty between burner flame and flames from waste or from an adjacent burner.
Various type of flame scanners depending on the sensor: photo resistance, IR, UV.
Flame radiation in the visible region is easy to identify because it is visible to the naked eye. Every time we can see a flame, it means it is irradiated visible light.
Infrared radiation from a heavy oil flame is very similar to that from visible radiation except for the fact that it will also be present slightly beyond the flame.

The flame area irradiating UV rays is much smaller than the visible or infrared areas.
The following table shows the quantities for the different radiations regions for the most common fuels used in the industrial field.

RADIANT ENERGY			
Fuel	**Visible**	**Dynamic infrared**	**Ultraviolet**
Gas	Medium	Medium	Medium
Premix Gas	Low	Low	High
Oil	High	High	Medium
Powder Coal	High	High	Medium

In order to separately monitor each of the flames present in the fire box and also ensuring a distinction of external sources, General Bruciatori uses special variable frequency flame monitoring sensors.
The flame monitoring system converts the burner's flame radiation into an electrical signal. As shown in the picture below, the flame has a variable frequency depending on the distance from the "root" of the flame which is the area with the highest frequency.



All the versions of variable frequency flame scanner are type-approved for continuous service.
NOTE: in hot air applications (see page 21) ensure that flame scanner temperature does not exceed 60°C. Overheating will cause a loss of sensitivity and, in the worst case, will result in damage to sensor parts.
In these cases air should be provided for cooling the flame scanner.
This will not only cool down the flame scanner, but also prevent dirt from building up on the lens damaging the sensor.

The complexity of the flame monitoring task together with the large variety of application types requires a lot care in the selection of the type of sensor to be used.
The consolidated experience that General Bruciatori have acquired in 40 years of industrial burner production, plays an essential role.

Thorough knowledge of the different flame characteristics means ability to select the right flame scanner that will recognize the burner flame regardless of adjacent burner flames or furnace conditions, ensuring totally safe operation.

Detail of the UV flame scanner variable frequency

GB-S 4 G EM for incinerator

Standard scope of supply: MC execution control panel

description	GB-S ...G	GB-S ...D	GB-S ...N	GB-S ...GD	GB-S ...GN
main switch with door coupling	●	●	●	●	●
control box	●	●	●	●	●
fan control	●	●	●	●	●
oil pump control		●	●		●
preheater oil control			●	●	●
oil preheater temperature controller			●		●
overcurrent protection devices	●	●	●	●	●
terminal strips	●	●	●	●	●
signal lamps	●	●	●	●	●
failure reset button	●	●	●	●	●
burner control switch	●	●	●	●	●
auxiliary relays	●	●	●	●	●
PID capacity controller	opt	opt	opt	opt	opt
run hour counter for gas	opt			opt	opt
run hour counter for oil		opt	opt	opt	opt
potential-free alarms	opt	opt	opt	opt	opt
remote start/stop	opt	opt	opt	opt	opt
soft starter	opt	opt	opt	opt	opt
elevated IP class	opt	opt	opt	opt	opt
alarm bell	opt	opt	opt	opt	opt
emergency stop pushbutton	opt	opt	opt	opt	opt

● standard
opt optional

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.

Cabinets

Wall mounted

Desk type

FULL MODULATION ACCESSORIES (MC operation)
In order to upgrade GB-S 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 GB3M 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 O_2 content by 0.4%.

Mechanical cam

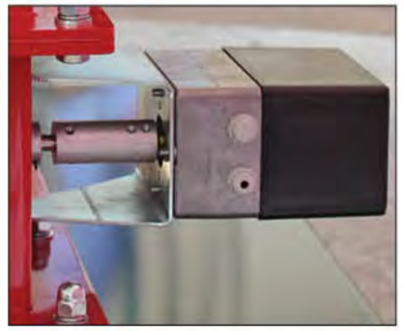
All the disadvantages of mechanical cam can be overcome by using combustion control with electronic cam.

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, O_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

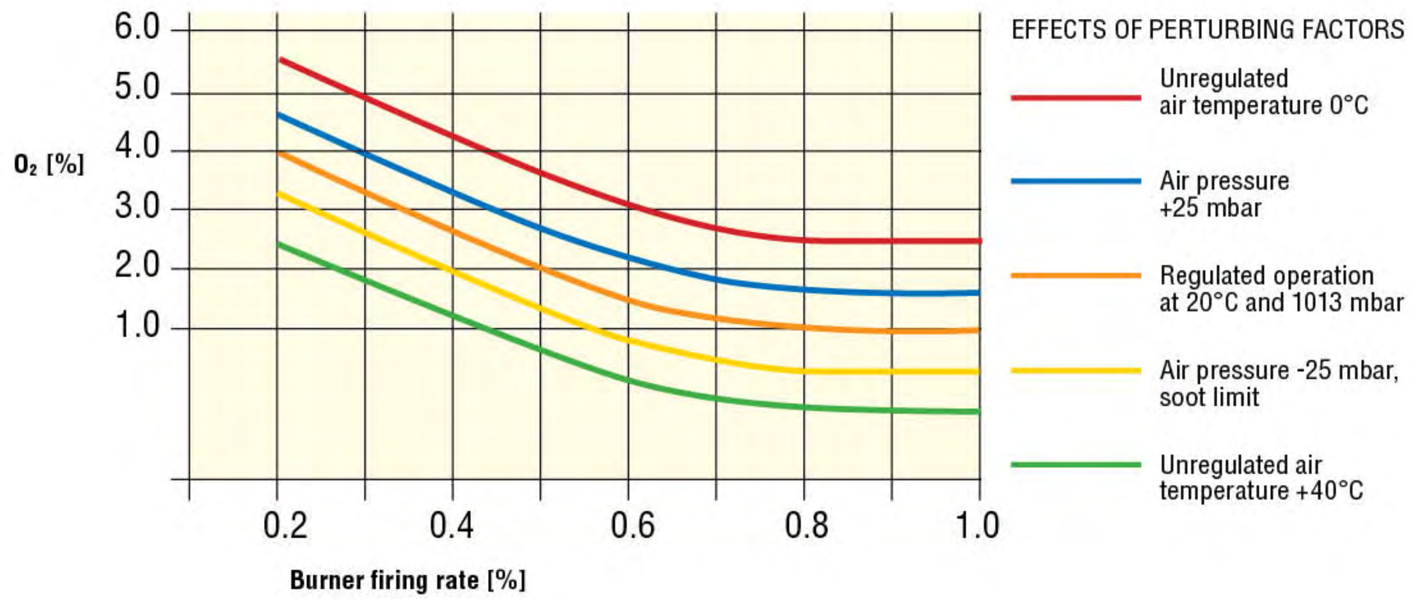
- it can be used on all burners
- improvement of efficiency up to 3%
- lower losses to the chimney
- lower emissions
- low maintenance
- simple upgrade with CO trim

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 ⊠, 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.

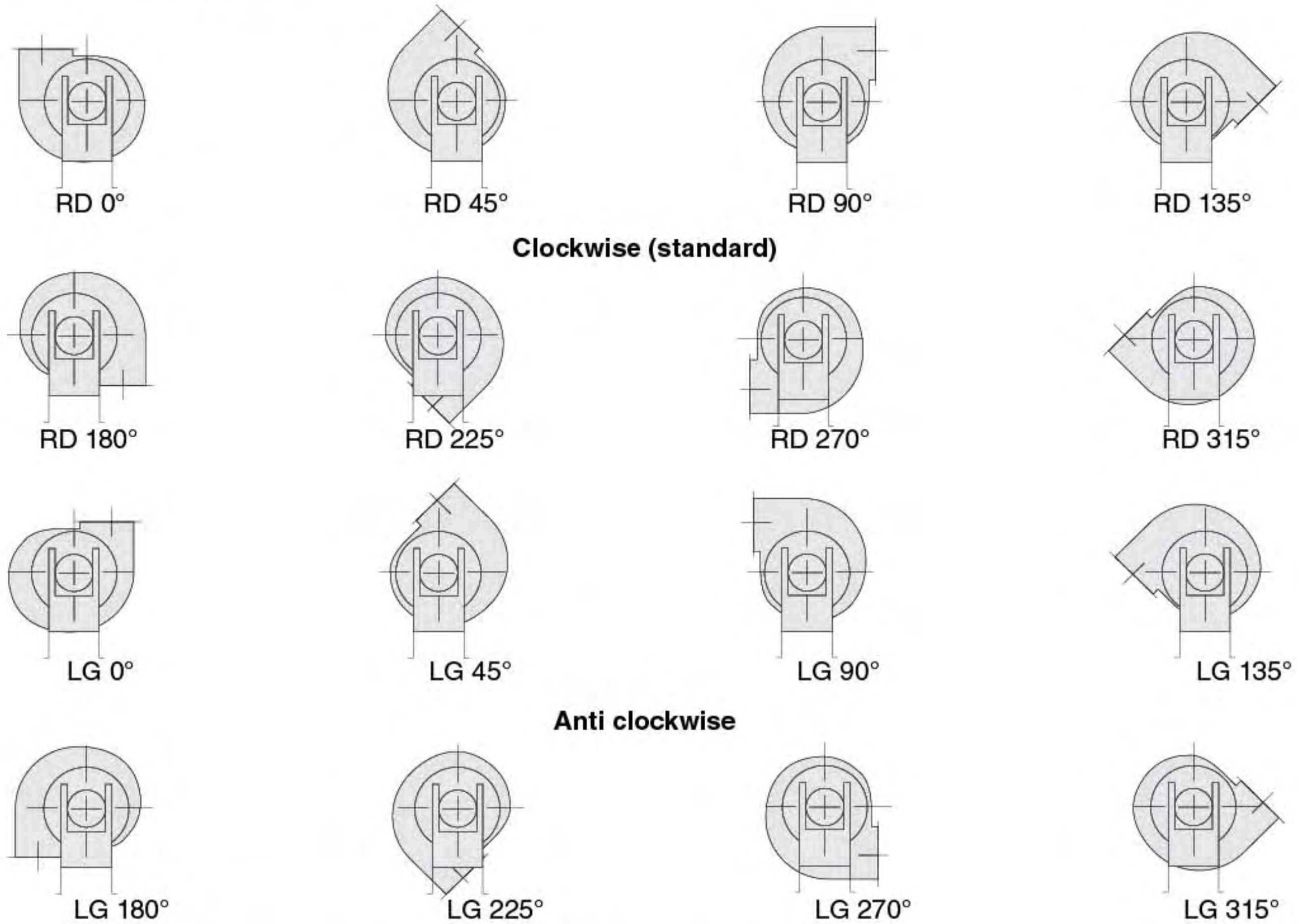
As previously mentioned, GB-S burners are made up of separate units that are selected according to the specific application requirements.

Scope of supply:

description	
Electric motor	●
Fan	●
Protection grille on inlet side	●
Delivery counter flange	●
Flexible delivery coupling	opt
Soundproof casing on inlet side	opt
Complete fan casing	opt

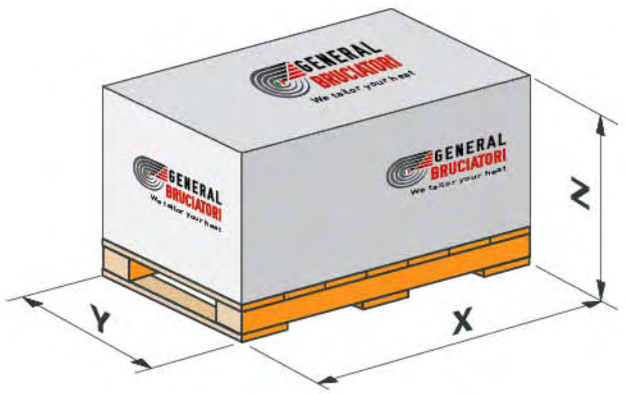
● standard
opt optional

Fan orientation (view from motor side)*



* At order confirmation use the special form to indicate orientation of burner and fan.

Technical characteristics			
Model	capacity m3n/h	electrical power kW	noise db(A)
GBM 501	1000	5,5	85
GBM 562	2000	7,5	85
GBM 561	3000	11	86
GBM 561	4000	11	86
GBM 632	5000	15	87
GBM 632	6000	15	87
GBM 631	7000	18,5	88
GBM 631	8000	18,5	88
GBT 632	9000	22	88
GBT 631	10.000	30	91
GBT 631	12.000	30	91
GBT 712	14.000	37	92
GBT 712	16.000	37	92
GBT 711	18.000	45	93
GBT 711	20.000	45	93
GBT 711	22.000	45	94
GBT 802	24.000	75	94
GBT 802	26.000	75	95
GBT 801	28.000	90	95
GBT 801	30.000	90	95
GBT 801	35.000	90	95
GBT 902	40.000	132	97
GBT 1121/4	40.000	55	91
GBT 1252/4	45.000	75	93
GBT 1251/4	50.000	110	94
GBT 1402/4	55.000	132	96
GBT 1401/4	60.000	200	97
GBT 1401/4	100.000	200	97



Packaging dimensions				
Model	X mm	Y mm	Z mm	Weight Kg (max)
GBM 501	800	600	940	111
GBM 562	890	650	1030	140
GBM 561	890	700	1030	230
GBM 632	990	810	1150	270
GBM 631	990	850	1150	285
GBT 502	1010	650	1100	150
GBT 501	1010	750	1110	270
GBT 562	1120	830	1220	310
GBT 561	1120	830	1220	325
GBT 632	1250	1000	1350	365
GBT 631	1250	1100	1350	440
GBT 712	1430	1200	1340	500
GBT 711	1430	1300	1340	560
GBT 802	1600	1500	1460	900
GBT 801	1600	1600	1460	990
GBT 902	1785	1500	1630	1420
GBT 1121	2235	1450	2010	1050
GBT 1251	2510	1650	2230	1700
GBT 1402	2790	1720	2470	2160

* Orientation of the fan "RD0"

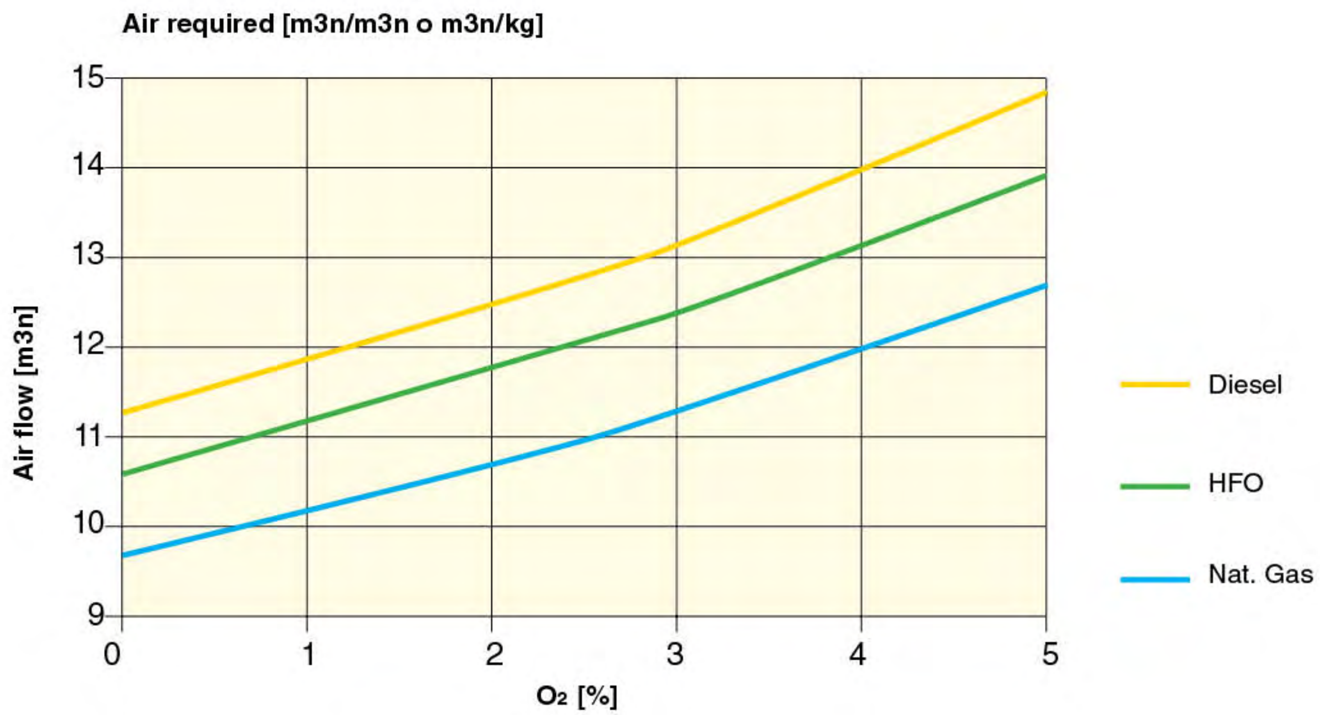
Correct sizing of the fan is extremely important for correct operation.
Depending on the required output, the fan will be selected taking into account the fuel type, the load loss associated with the air fuel pathway, the temperature of combustion air and altitude. Let see an example of calculations for fan sizing.

Calculating input capacity:

Boiler output: 20000 kW
Efficiency: 90%
Burner capacity: 20000/0.9 = 22220 kW
Fuel: Natural gas
Gas capacity: 22220 / 9.88* (gas PCI) = 2249 m3n/h
*See table page 8-9 for the PCI values of other fuels

Calculation for fan air capacity:

Based on the fuel used and the oxygen content considered, you can calculate the required air capacity.
The graph below can be used for these calculations.



Let us assume we want to size the fan for an oxygen value of 3%, the required quantity of air will be:
Q air: 2249 * 11.3 = 25414 m3n/h
This value must be corrected according to the temperature and altitude, due to the change in density.
See the tables below for the correction values to be applied.

Corrective factor combustion air rate based on temperature and altitude

Air temperature in °C	Metres above sea level: 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

A 5% safety factor is considered
Q air: 25414 * 1.05 = 26685 m3n/h

Calculation of fan static pressure

To calculate the static pressure of a fan, you need to consider all the load loss associated with the air fuel pathway:
Load loss in burner
Pressure in combustion chamber and flue
Loss in any air preheaters / economizer / filters etc.
Air channel loss

Example of static pressure calculation

Load loss in burner: 30 mbar
Pressure in combustion chamber and flue: 20 mbar
Loss in any air preheaters / economizer / filters etc. 15 mbar
Air channel loss: 5mbar
Total load loss: 30+20+15+5 = 70 mbar

A 5% safety factor is considered
Fan static pressure: 70 * 1.05 = 73.5 mbar

To summarize, the data needed for fan selection are:

Q air: 26685 m3n/h
Fan static pressure: 73.5 mbar

Did you know?

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

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

TECHNICAL TIP:

We recommend use of round ducting for combustion air supply to minimize transmission of noise and vibrations. If that is not possible, the duct should be properly stiffened to prevent the "drum effect".

Mechanical cam (MC) gas train

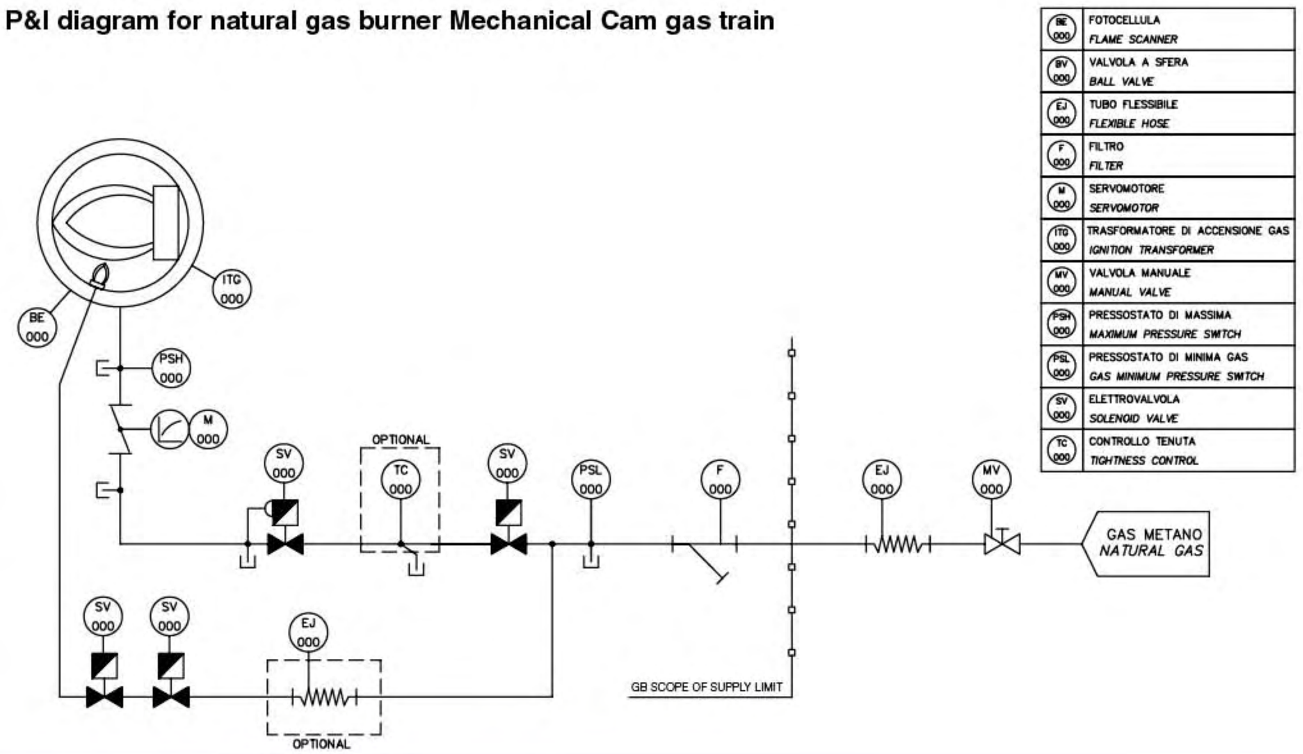
The valve tightness control it is perfomred by means of VPS system. The VPS is IP54 electrical protection and can be installed as indipendent kit.

Electronic modulation (EM) gas train

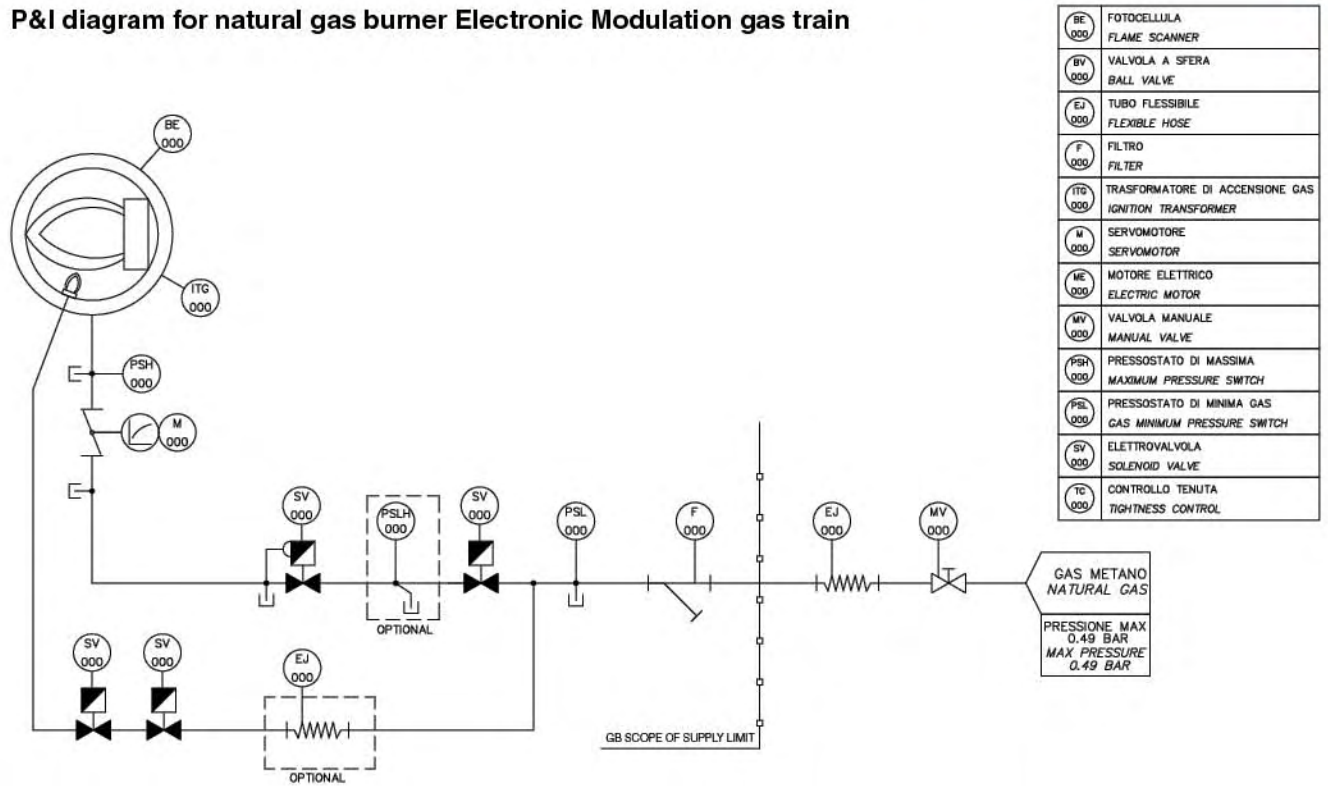
The valve tightness control is perfomed by the BMS by means of pressure switches installed on board of the gas train.
IP54 electrical protection.

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



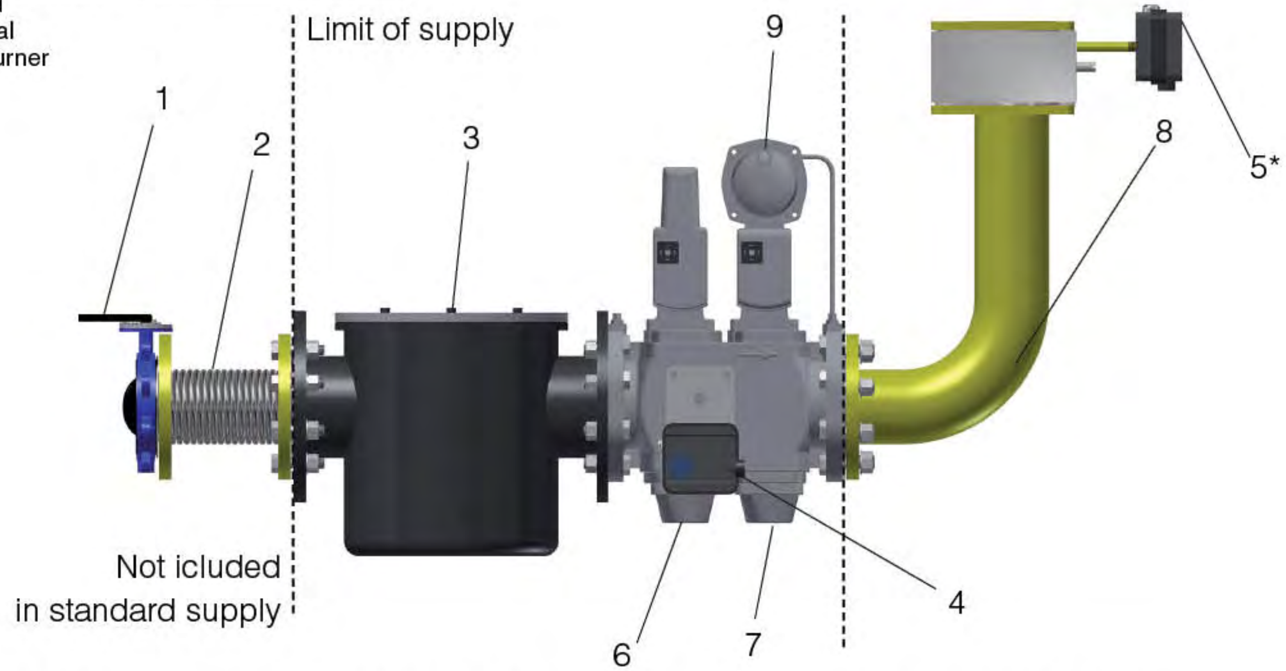
P&I diagram for natural gas burner Electronic Modulation gas train



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	●

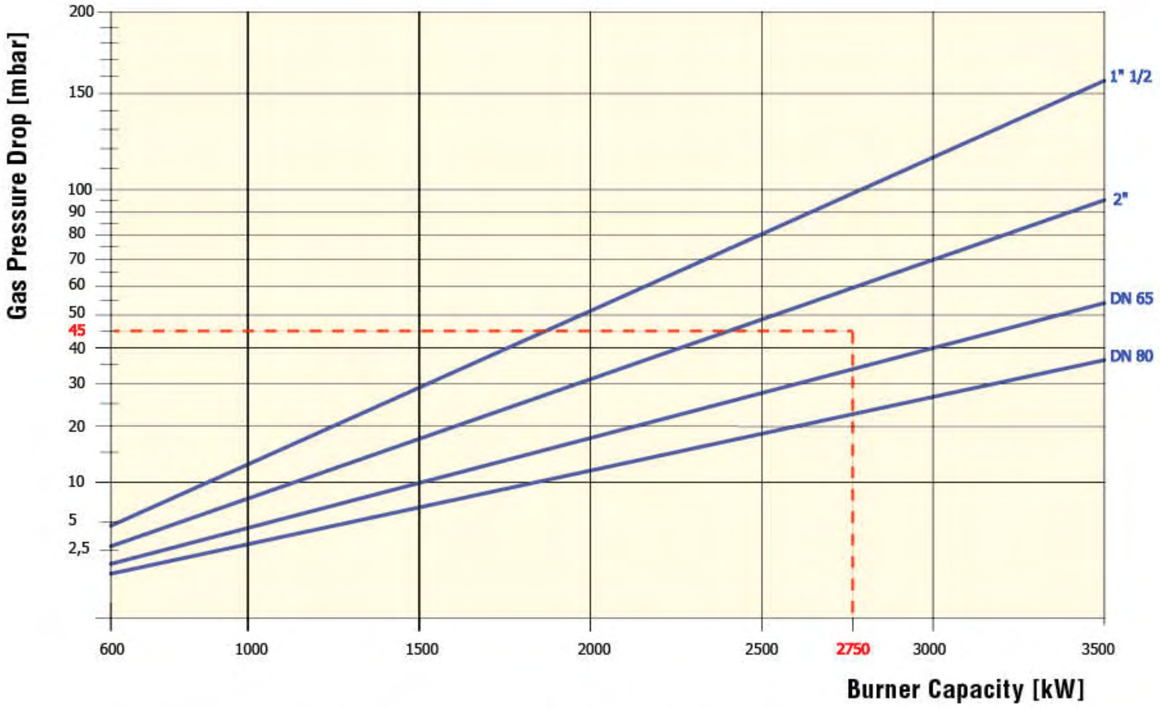
● standard
opt optional
* on the burner



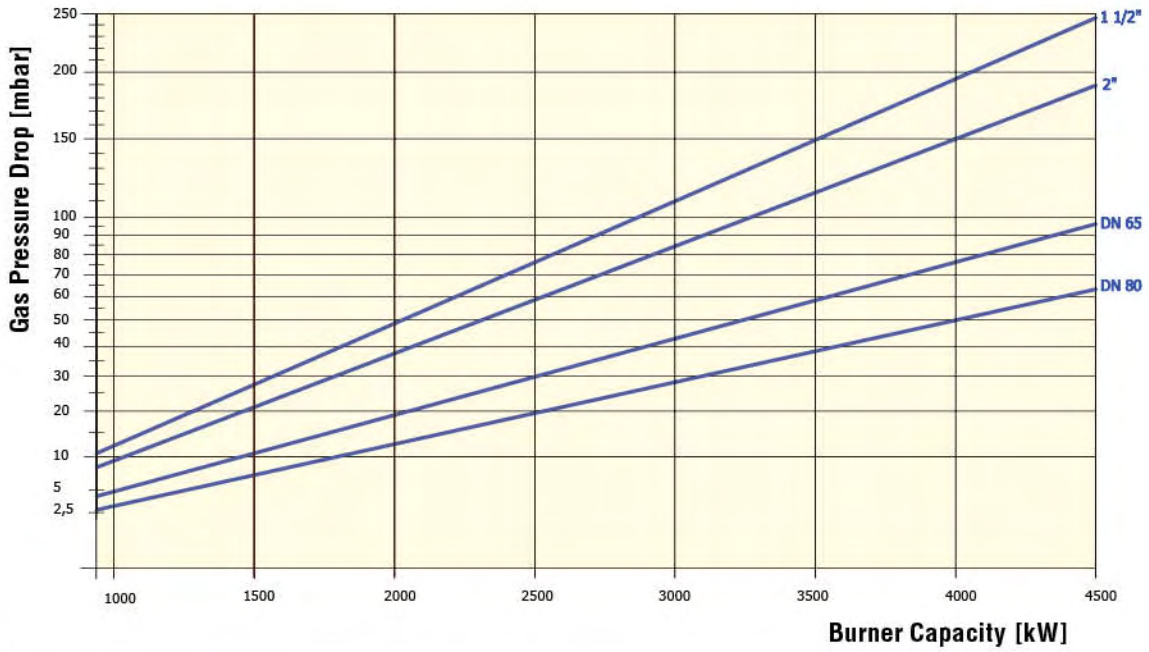
Note: conforming to the European standard EN 676, the tightness control device is compulsory on gas trains of burners with a maximum output over 1200 kW

The chart indicates the available gas trains with each burner model
The chart, for each gas train, shows the inlet minimum required gas pressure at gas trains when boiler back pressure is zero.
The boiler back pressure must be added to that value

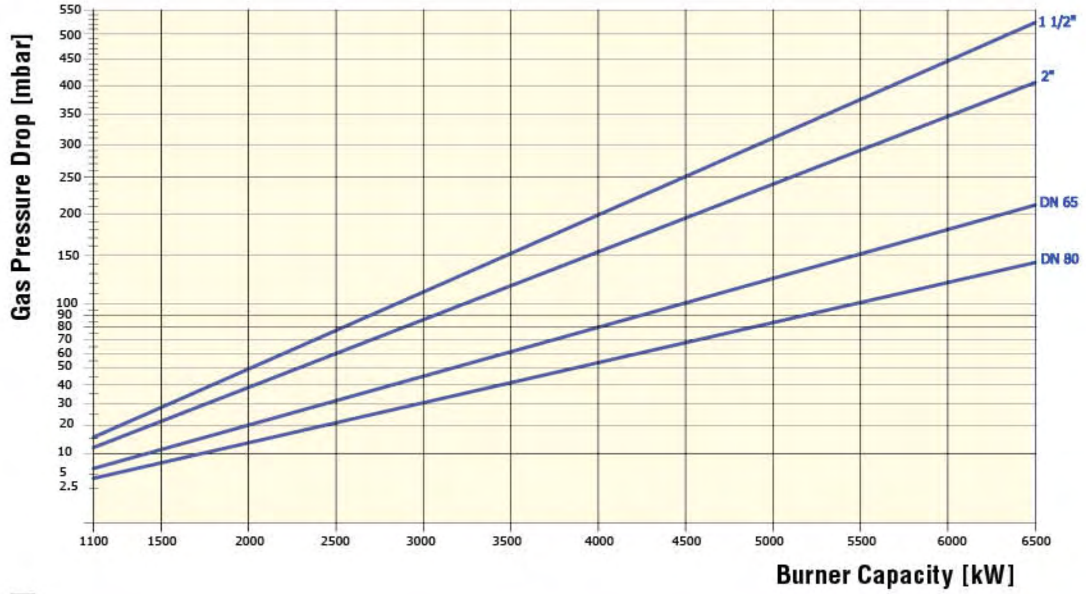
Example:
Boiler input: 2750 kW
Boiler back pressure: 11mbar
Burner: GB-S 3
Gas train: DN 65
Value determined from chart: 34mbar
Minimun inlet gas pressure should not be less than: 34 +11 = 45mbar



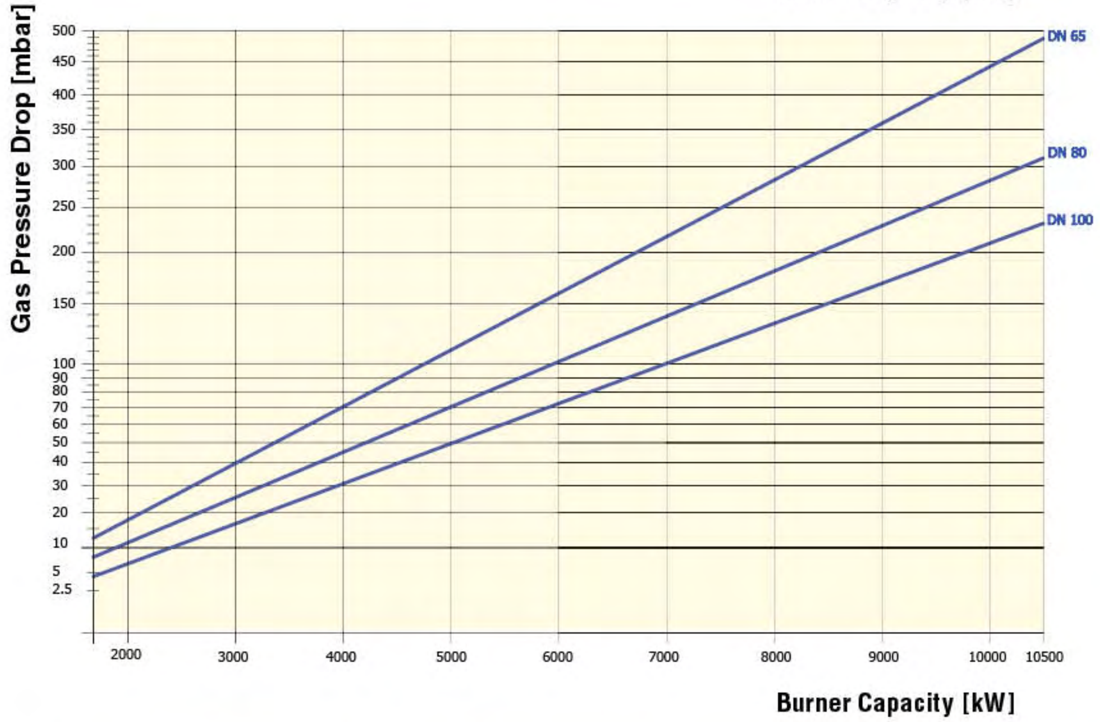
GB-S 3



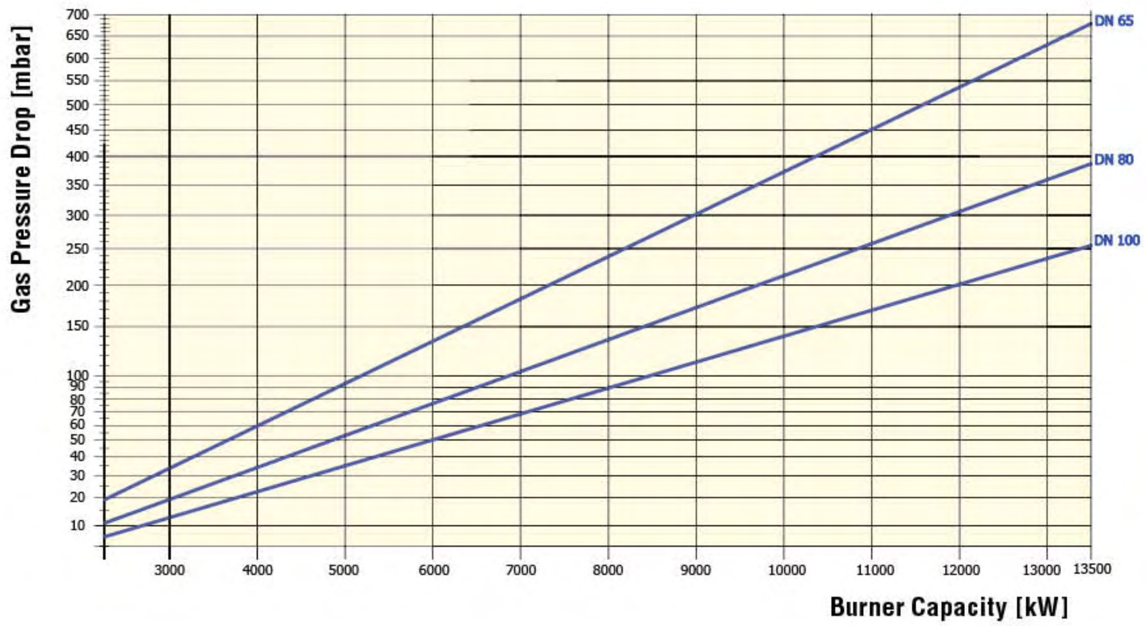
GB-S 4



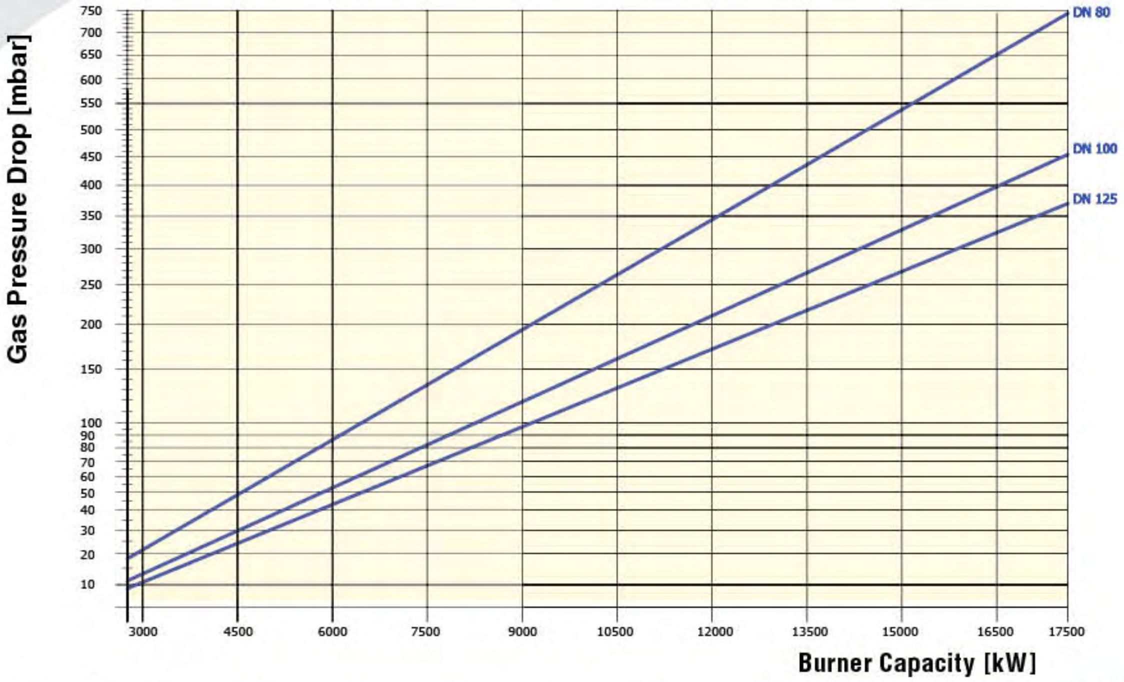
GB-S 6



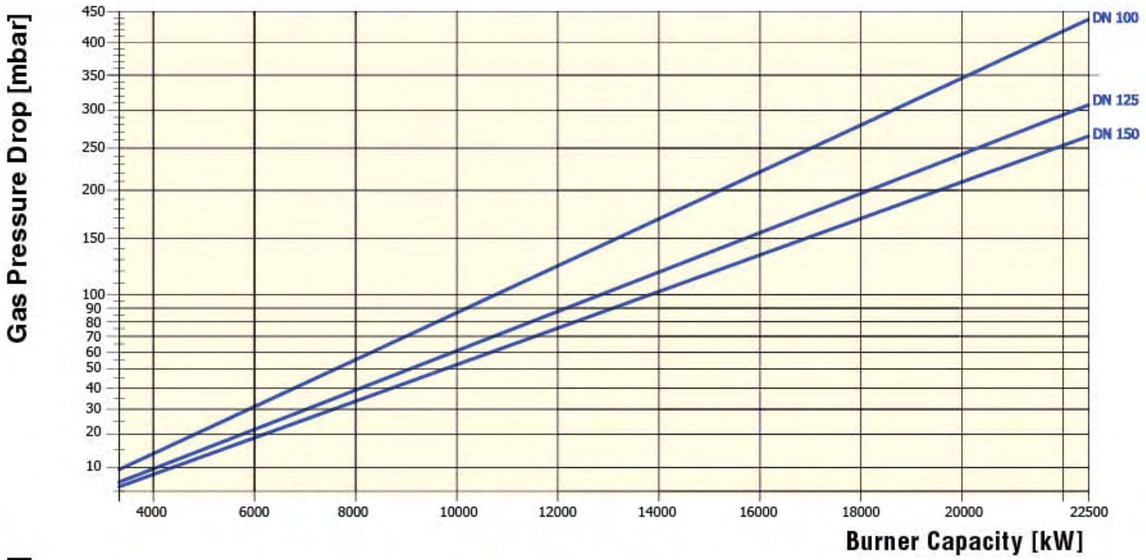
GB-S 10



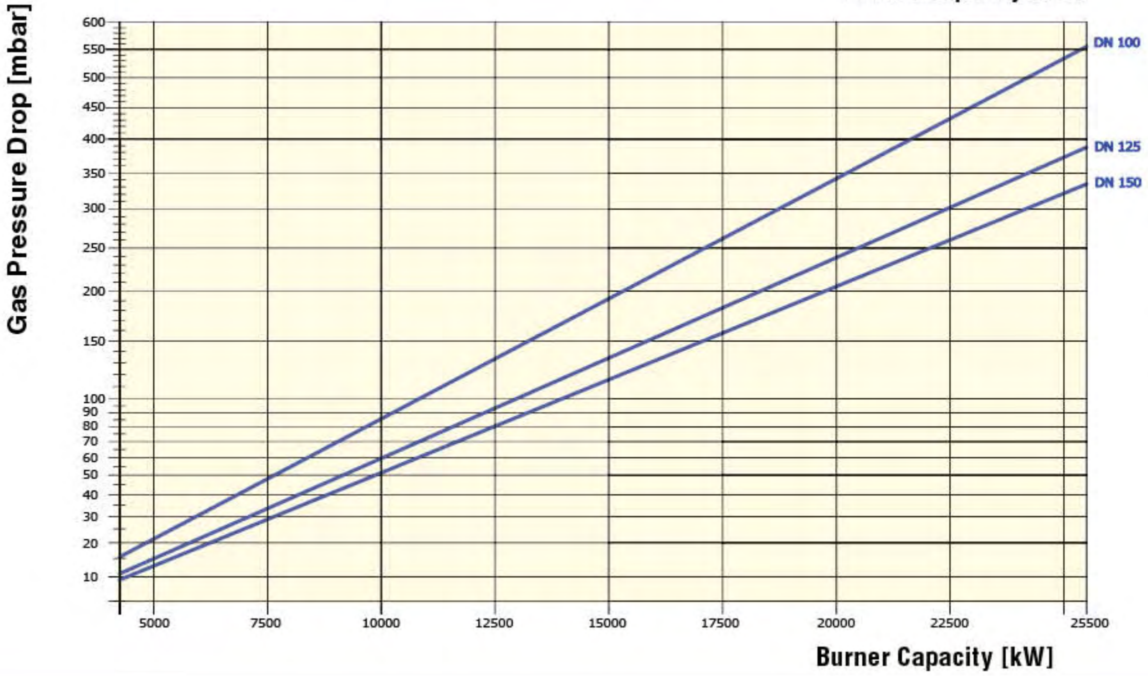
GB-S 13



GB-S 17



GB-S 22



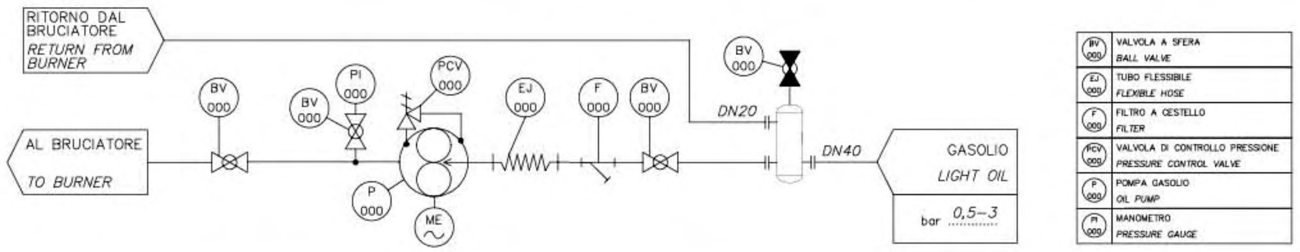
GB-S 25

scope of standard supply DIESEL OIL push unit

description		
containment tank in painted steel sheet		●
degasing tank		●
ball valve		●
oil filter		●
oil pressure gauge on the supply circuit		●
oil pump with pressure control valve		●
electric motor		●
flexible hose		●
selfcleaning filter		opt
Kit low temperature *	thermostat bulbs Electric heat tracing cable heating basket filter	opt
oil inlet pressure gauge		opt
min outlet oil pressure switch		opt
min inlet oil pressure switch		opt
shutoff electrovalve		opt
electrical shunt box		opt
control panel		opt
double pumping group with filter		opt

accessories to be ordered separately	
pumping unit for main ring	opt
control panel for pumping unit	opt
flow control valve	opt

● standard
opt optional
*to use when the viscosity of diesel input is > 6mm2/s at 20°C.
Note: The pipe between the burner and push unit must be built on site by the installation.

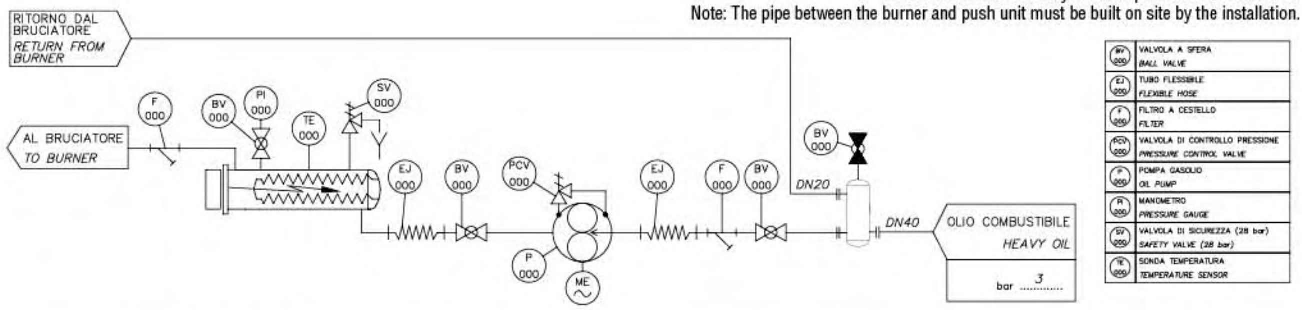


Technical characteristics			
Model	max capacity nozzle [kg/h]	pump capacity [l/h]	motor [kW]
CGS 150	150	450	1.1
CGS 250	250	600	1.1
CGS 350	350	1000	2.2
CGS 550	550	1500	2.2
CGS 850	850	2000	3
CGS 1000	1000	3000	4
CGS 1500	1500	4500	5.5
CGS 2600	2600	6000	7.5
CGS 3500	3500	8000	9.2
CGS 5000	5000	12000	15
CGS 7000	7000	17000	22
CGS 10000	10000	22000	30

Scope of standard supply of heavy oil push unit

description		
containment tank in painted steel sheet		●
degasing tank		●
ball valve		●
selfcleaning filter		●
oil pressure gauge on the delivery circuit		●
oil pump with pressure control valve		●
electric motor		●
flexible hose		●
electrical oil preheater		●
temperature sensor		●
safety valve		●
electrical and steam oil preheater		opt
steam oil preheater	condensate drain steam control valve maximum thermostat oil temperature	opt
diathermic - oil preheater		opt
electronic temperature control		opt
Kit low temperature *	thermostat bulbs Electric heat tracing cable selfcleaning heating filter	opt
shutoff electrovalve		opt
oil inlet pressure gauge		opt
min oil supply pressure switch		opt
min oil ring pressure switch		opt
shunt box		opt
control panel		opt
double pumping group with filter		opt
Steam control kit *	condensate drain steam control valve	opt
accessories to be ordered separately		
pumping unit for main ring		opt
control panel for pumping unit		opt
flow control valve		opt

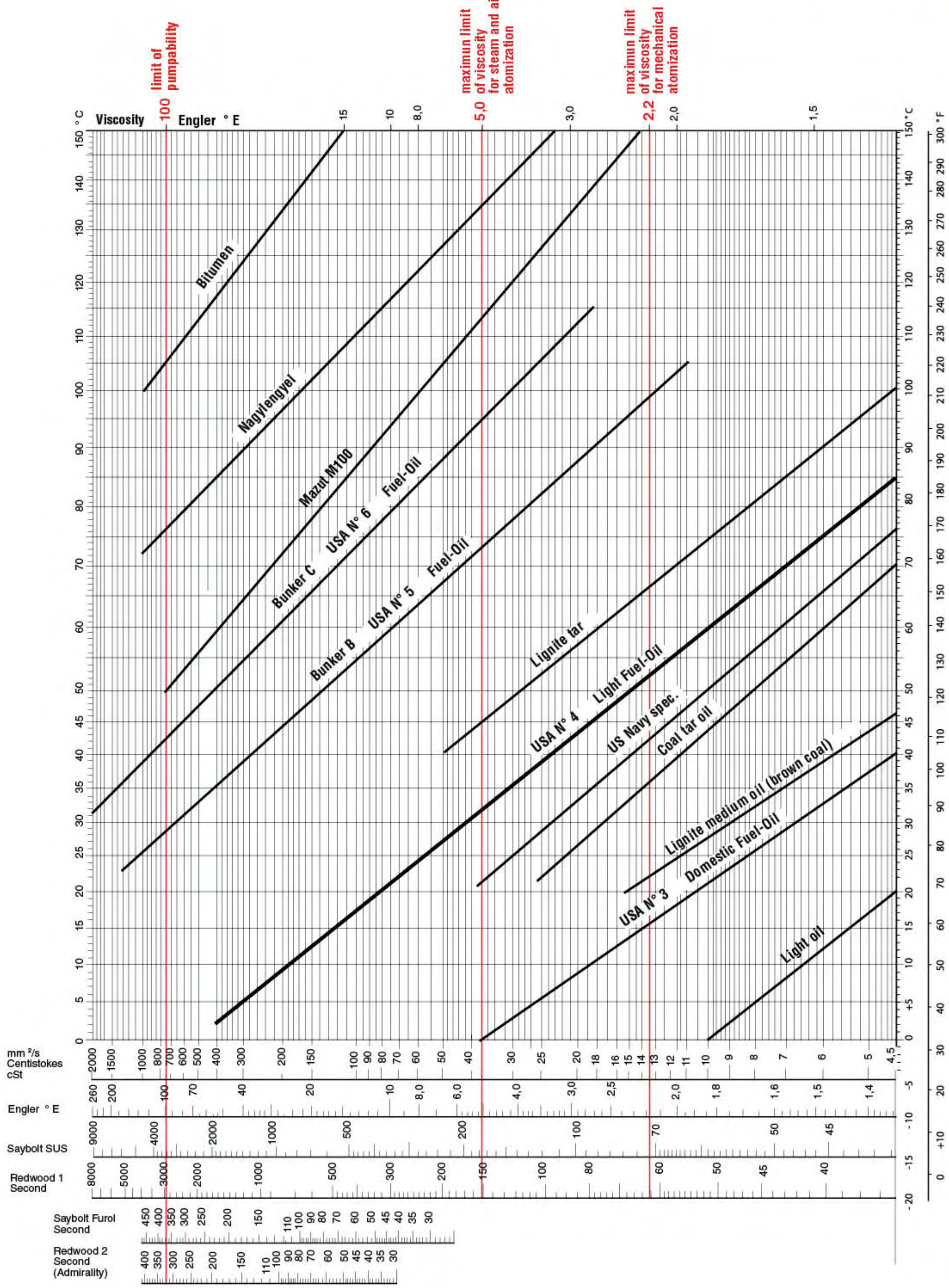
● standard
opt optional
*to use when the viscosity of fuel input is > of 15°E at 50°C.
Note: The pipe between the burner and push unit must be built on site by the installation.



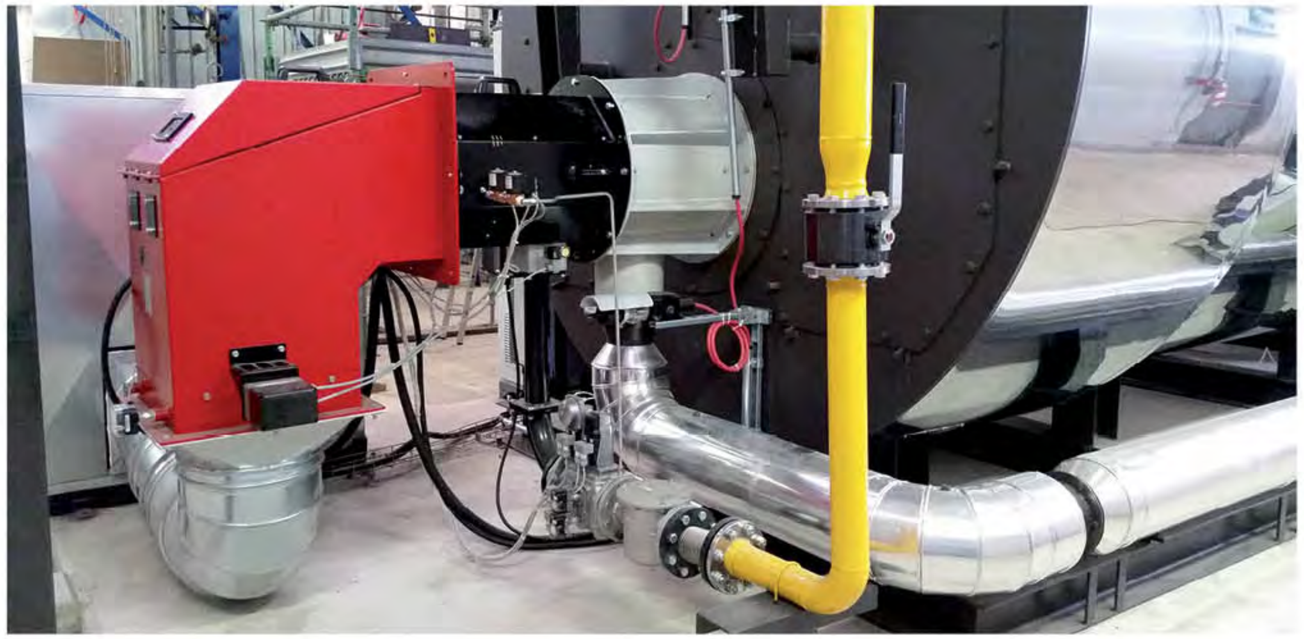
Technical characteristics

Model	max capacity nozzle [kg/h]	pump capacity [l/h]	motor [kW]	pre-heater [kW]
CNS 150	150	450	1.1	8
CNS 250	250	600	1.1	10
CNS 350	350	1000	2.2	15
CNS 550	550	1500	2.2	30
CNS 850	850	2000	3	40
CNS 1000	1000	3000	4	40
CNS 1500	1500	4500	5.5	60
CNS 2200	2200	6000	7.5	90
CNS 2600	2600	6000	7.5	100
CNS 3500	3500	8000	11	160
CNS 5000	5000	12000	15	200
CNS 7000	7000	17000	22	290
CNS 10000	10000	22000	30	410

Viscosity diagram

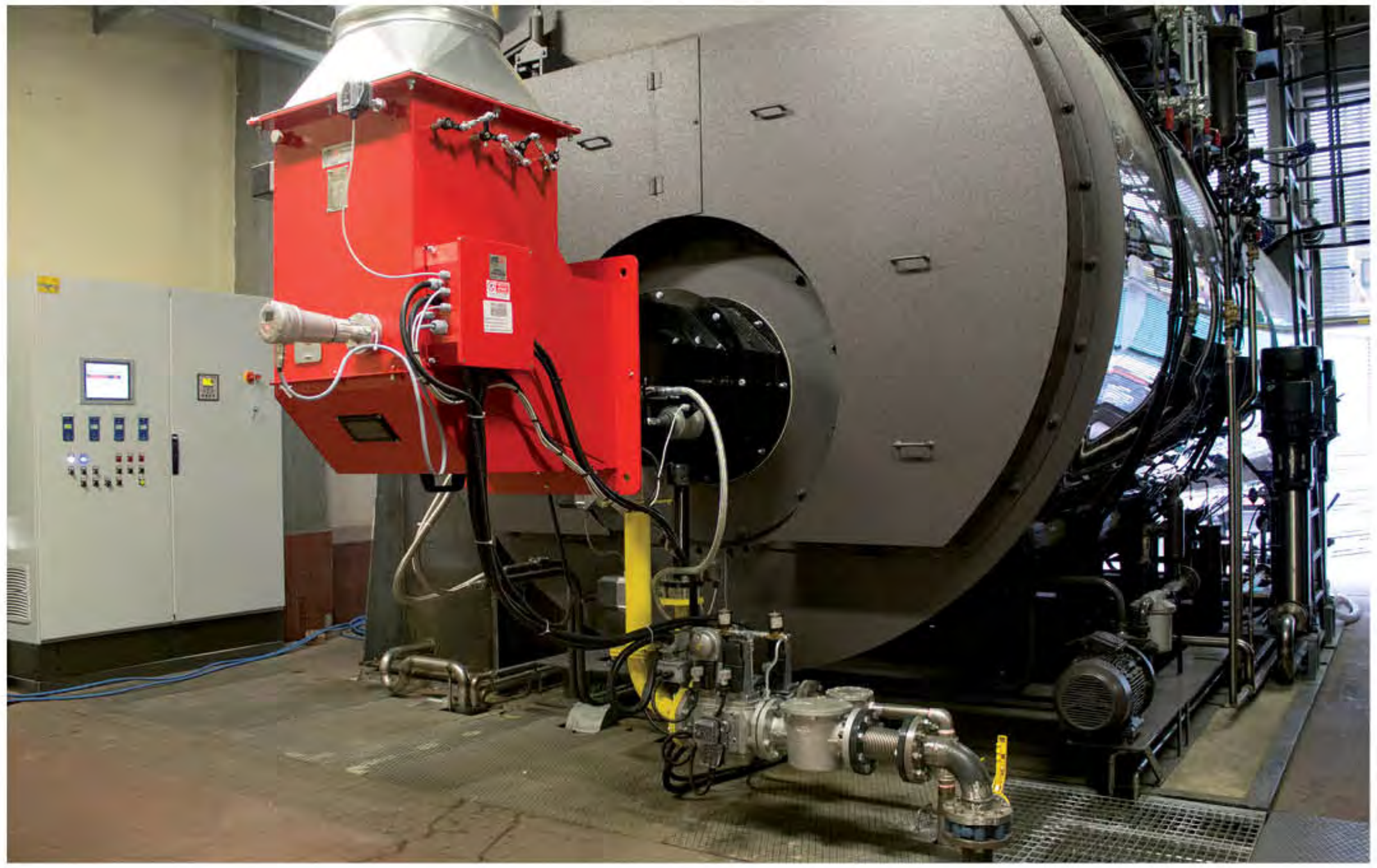


Burners model: **GB-S 13 G EM LX FGR**
Capacity plant: **10,5MW**
Fuel: **Nat.gas**
Application: **Power plant steam production**



Burners model: **GB-S 13 G EM LX**
Capacity plant: **7.7MW x 2**
Fuel: **Nat.gas**
Application: **Chemical industry**
3 pass steam boiler

Burners model: **GB-S 17 D-G-BG EM LX**
Capacity plant: **12MW**
Fuel: **Nat.gas / Diesel / Biogas combined with Nat.gas**
Application: **Brewery industry**
3 pass steam boiler



Note

Note

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