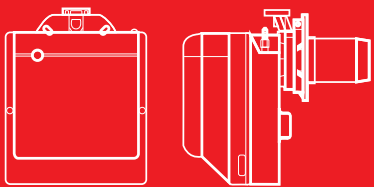




Gulliver BS/M Series

Low NOx Two Stage Progressive and Modulating Gas Burners

BS1/M	16/19 ÷ 52	kW
BS2/M	26/49 ÷ 91	kW
BS3/M	48/79 ÷ 195	kW
BS4/M	68/140 ÷ 250	kW



The Riello Gulliver BS/M series of two stage, progressive or modulating gas burners, is a complete range of Low NOx emission products, developed to respond to any request for home heating, conforming to the most severe standards regarding the reduction of polluting emissions.

This series of burners is available in four different models with an output ranging from 16 to 250 kW, divided in four different structures.

All the models use the same components designed by Riello for the Gulliver series.

The high quality level guarantees safe working.

In developing these burners, special attention was paid to reducing noise, the ease of installation and adjustment, to obtaining the smallest size possible to fit into any sort of boiler available on the market.

Two stage operation guarantees high level performance from the thermal unit.

All the models are approved by the EN 676 European Standard and conform to European Directives, Gas Appliance, EMC, Low Voltage, Boiler Efficiency. All the Gulliver BS/M burners are tested before leaving the factory.

Technical Data

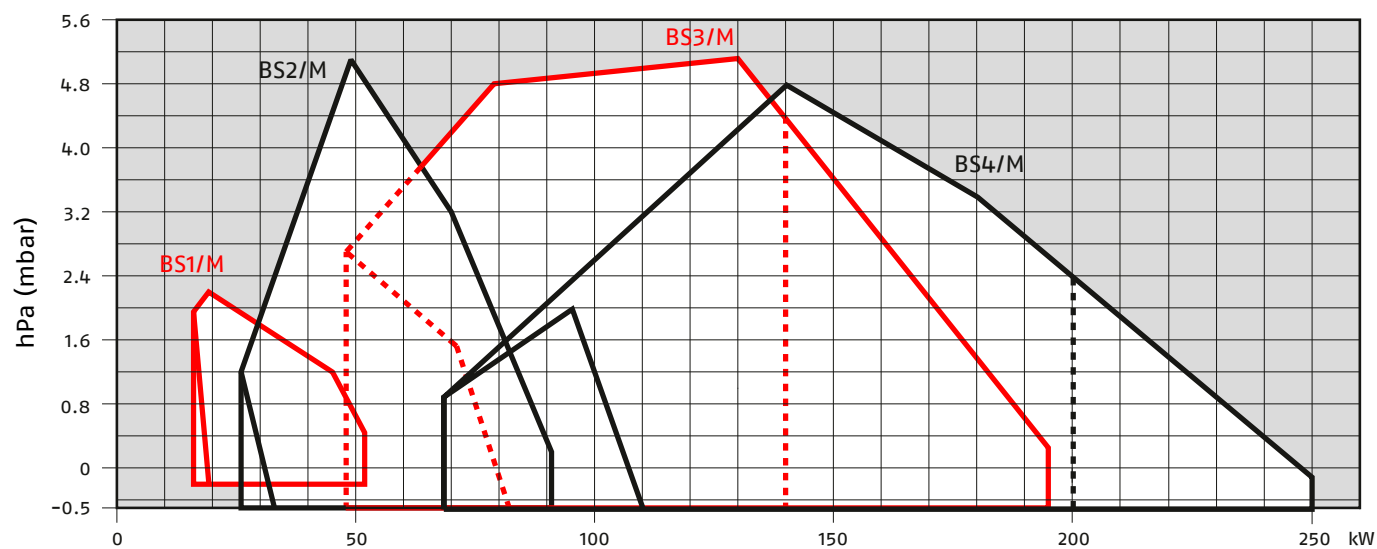
MODEL			BS1/M	BS2/M	BS3/M	BS4/M	
Burner operation mode			Modulating Proportional				
Modulation ratio at max. output			1 ÷ 3				
Servomotor			type	LANDIS SQN91			
			run time s	24			
Heat output			kW	16/19 ÷ 52	26/49 ÷ 91	48/79 ÷ 195	68/140 ÷ 250
			Mcal/h	13.8/16.4 ÷ 44.7	22.4/42.1 ÷ 78.2	41.3/67.9 ÷ 167.7	58.5/120.4 ÷ 215
Working temperature			°C min./max.	0/40			
FUEL/AIR DATA							
G20 gas	net calorific value	kWh/Nm³	10				
	gas density	kg/Nm³	0.71				
	gas delivery	Nm³/h	1.6/1.9 ÷ 5.2	2.6/4.9 ÷ 9.1	4.8/7.9 ÷ 19,5	6.8/14 ÷ 25	
G25 gas	net calorific value	kWh/Nm³	8.6				
	gas density	kg/Nm³	0.78				
	gas delivery	Nm³/h	1.9/2.3 ÷ 6.2	3/5.5 ÷ 10.6	5.6/9.2 ÷ 22.7	7.9/16.3 ÷ 29.1	
LPG gas	net calorific value	kWh/Nm³	25.8				
	gas density	kg/Nm³	2.02				
	gas delivery	Nm³/h	0.8/0.9 ÷ 2.2	1/1.9 ÷ 3.5	1.9/3.1 ÷ 7.6	2.6/5.4 ÷ 9.7	
Fan			type	Centrifugal with forward curve blades			
Air temperature			max °C	40			
ELECTRICAL DATA							
Electrical supply			Ph/Hz/V	1/50/230 (±10%)			
Auxiliary electrical supply			Ph/Hz/V	--			
Control box			type	LANDIS LMG 22			
Total electrical power			kW	0.14	0.18	0.35	0.53
Auxiliary electrical power			kW	--			
Protection level			IP	X0D			
Fan motor	electrical power	kW	0.09	0.09	0.15	0.25	
	rated current	A	0.8	0.8	1.8	1.9	
	start up current	A	--	2.68	5.6	8	
	protection level	IP	20				
Ignition transformer			type	Separated from the control box			
			V1 - V2	230V - 1x15 kV			
			I1 - I2	0.2 A - 25 mA			
Operation			Intermittent (at least one stop every 24 h)				
EMISSIONS							
Noise levels	sound pressure	dB (A)	58	60	65	67	
	sound power	W	69	71	76	78	
Gas G20	CO emission	mg/kWh	15	9	8	5	
	NOx emission	mg/kWh	60	58	48	53	
APPROVAL							
Directive			2006/42 - 2009/142 - 2014/30 - 2014/35				
Conforming to			EN 676 - EN 12100				
Certification			in progress		CE-0085BN0609		

Reference conditions:

Temperature: 20°C - Pressure: 1013,5 mbar - Altitude: 0 m a.s.l. - Noise measured at a distance of 1 meter.

Since the Company is constantly engaged in the production improvement, the aesthetic and dimensional features, the technical data, the equipment and the accessories can be changed. This document contains confidential and proprietary information of RIELLO S.p.A. Unless authorised, this information shall not be divulged, nor duplicated in whole or in part.

Firing Rates



□ Useful working field for choosing the burner

□ Modulation range

Test conditions conforming to EN 676:

Temperature: 20°C

Pressure: 1013,5 mbar

Altitude: 0 m a.s.l.

Gas train

GAS TRAIN DESIGNATION

Series: CG

Size: 120 220

Operation: /P stage mode opening

Leak detection control: - 0

Joint type: R threaded joint

F1 square flange BS1

F2 square flange BS2

F3 square flange BS3 – BS4

Electrical connection: SD Domestic plug

Standard output pressure range:

- without pressure governor

0 with governor and air/gas proportional pressure

2 with governor and output pressure up to 20 mbar

3 with governor and output pressure up to 30 mbar

4 with governor and output pressure up to 40 mbar

5 with governor and output pressure up to 50 mbar

Valve control: 0 shared

CG	120	/P	-	F2	SD	0	0
BASIC DESIGNATION				EXTENDED DESIGNATION			

GAS TRAINS

The burners are set for fuel supply from either the right or left hand sides.

Depending on the fuel output and the available pressure in the supply line, you should check the correct gas train to be adapted to the system requirements.

The gas train is CG 120 - CG 220 type, containing the main components in a single unit.

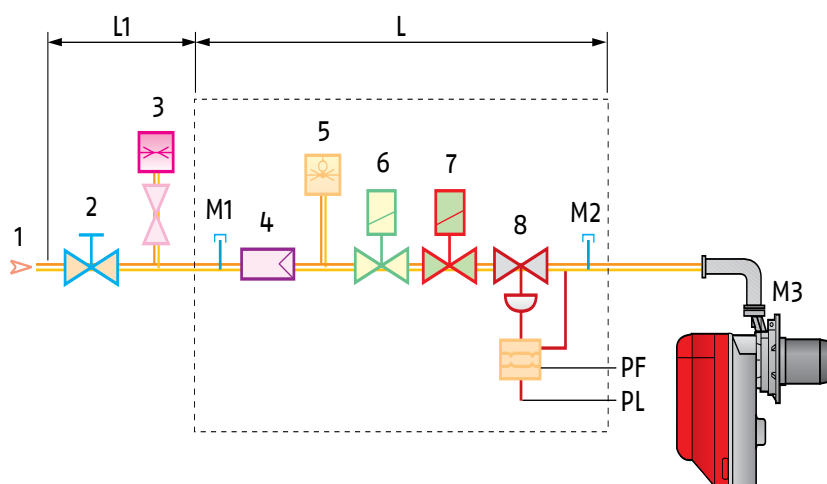


Gas train installed on the burner

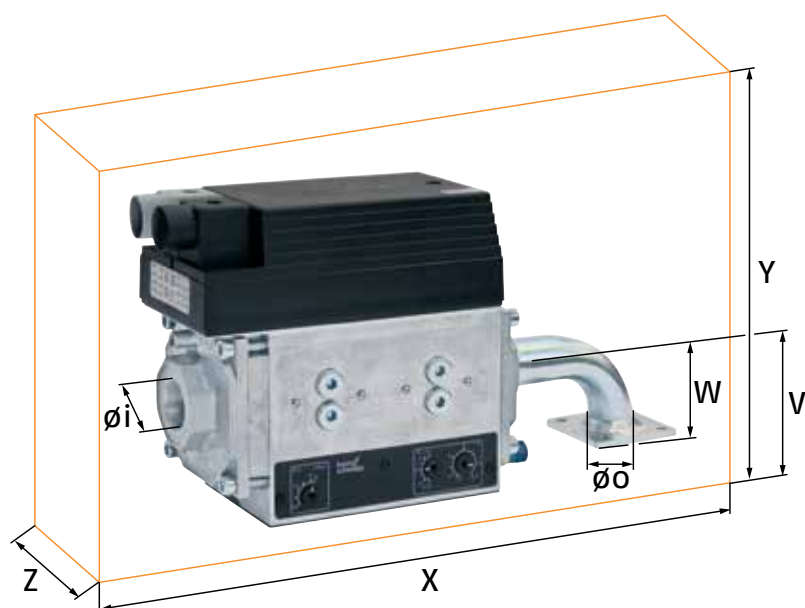


Gas train and RWF installed on the burner

CG 120 - 220



1	Gas input pipework
2	Manual valve (charged to the installer)
3	Gas pressure gauge (charged to the installer)
4	Filter
5	Gas pressure switch
6	Safety valve
7	Adjustment valve
8	Pressure adjuster
PF	Pressure in combustion chamber
PL	Air pressure at combustion head
M1	Gas-supply pressure test point
M2	Pressure point for gas measurement at gas train outlet
M3	Pressure point for gas pressure measurement at combustion head
L	Gas train supplied separately
L1	Installer's responsibility



The dimensions of the gas trains vary depending on their construction features.
The following table shows the dimensions of the gas trains that can be fitted to Gulliver BS/M burners, intake diameter and the coupling flange to the burner.

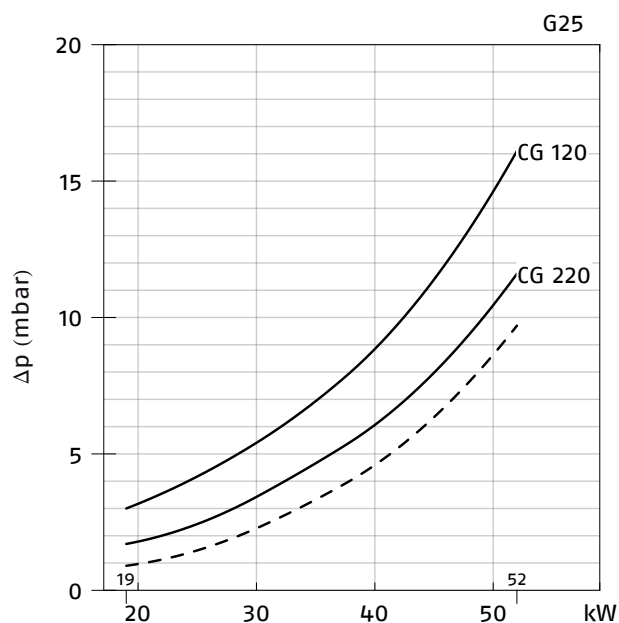
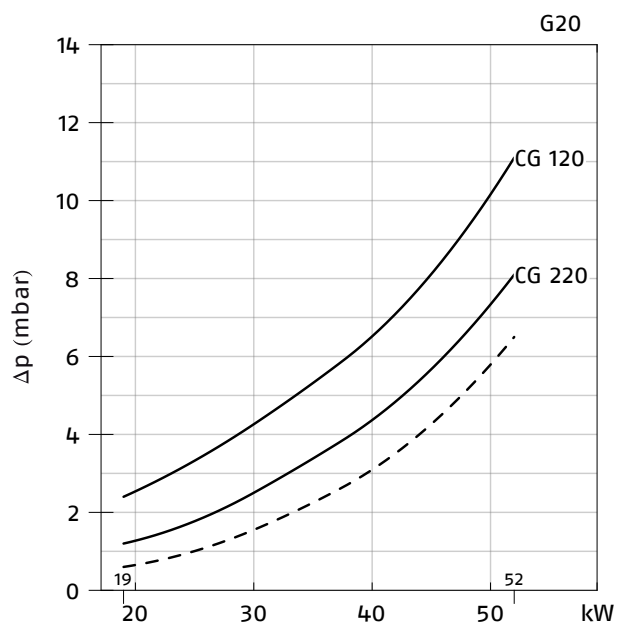
GAS TRAIN									
MODEL	CODE	Ø in	Ø out	X mm	Y mm	W mm	Z mm	V mm	mbar max*
CG 120/P - F2SD 00	3970587	3/4"	FLANGE 2	260	143	51	70	54	100
CG 220/P - F2SD 00	3970588	3/4"	FLANGE 3	290	159	51	87	54	100

* max inlet gas pressure (mbar)

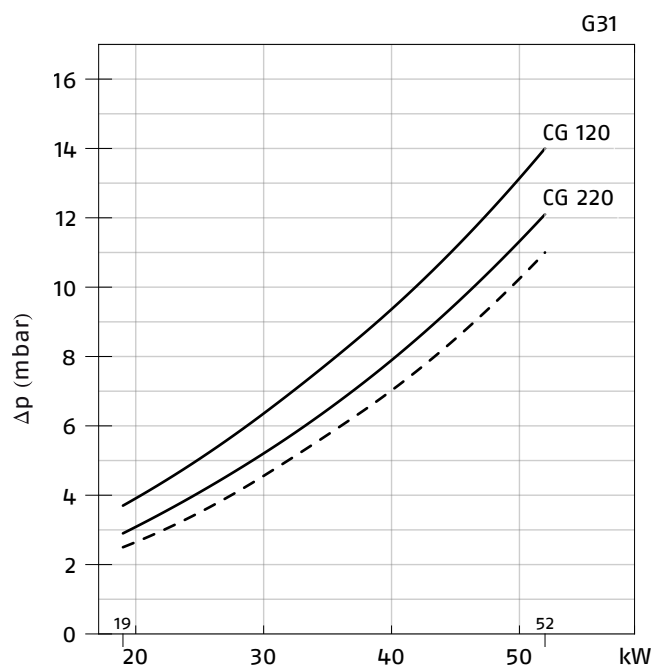
Pressure Drop Diagram

The diagrams indicate the minimum pressure drop of the burners with the various gas trains that can be matched with them; at the value of these pressure drop add the combustion chamber pressure. The value thus calculated represents the minimum required input pressure to the gas train.

BS1/M (NATURAL GAS)



BS1/M (LPG)

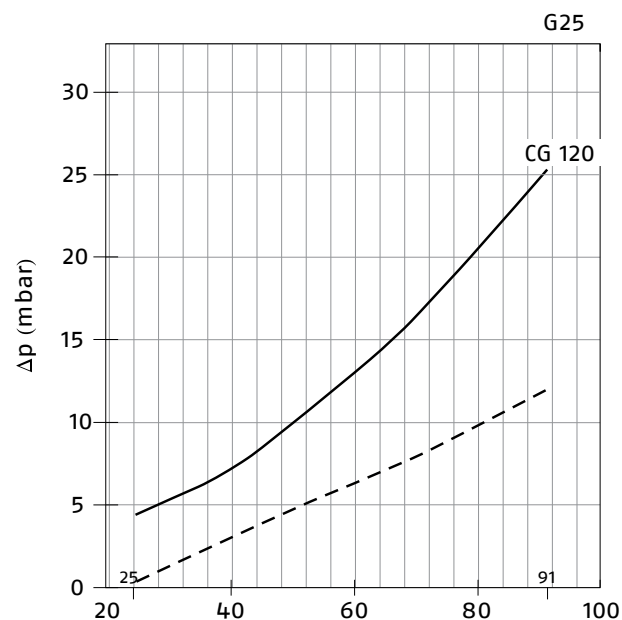
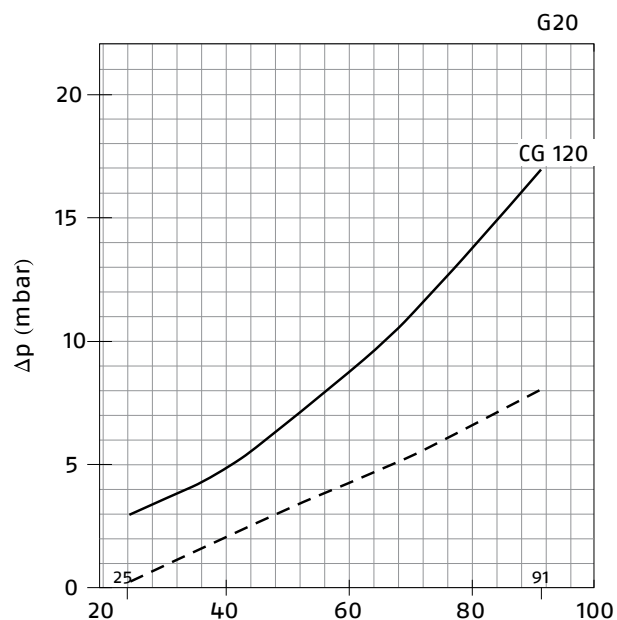
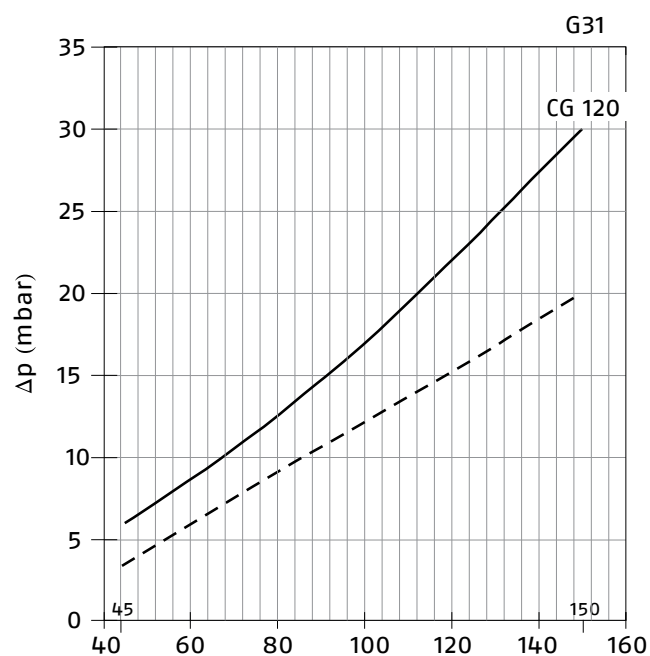


For pressure levels different from those indicated above, please contact Riello Burners Technical Office.

In LPG plants, Multibloc gas trains do not operate below 0°C.

They are only suitable for gaseous LPG (liquid hydrocarbons destroy the seal materials).

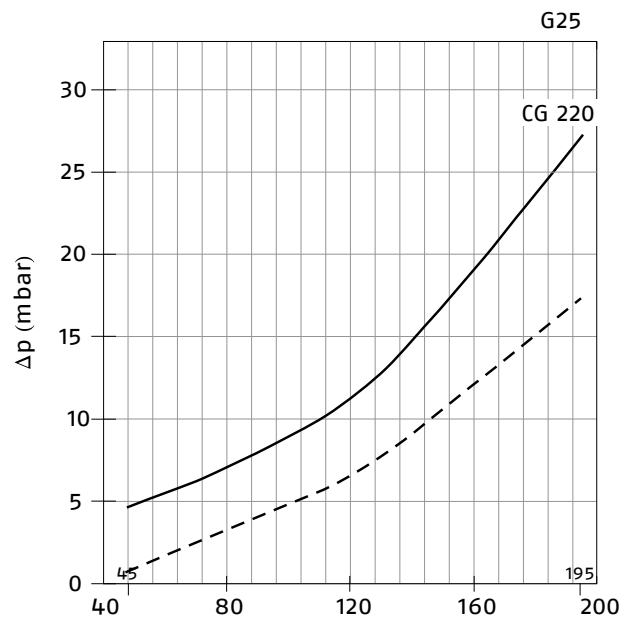
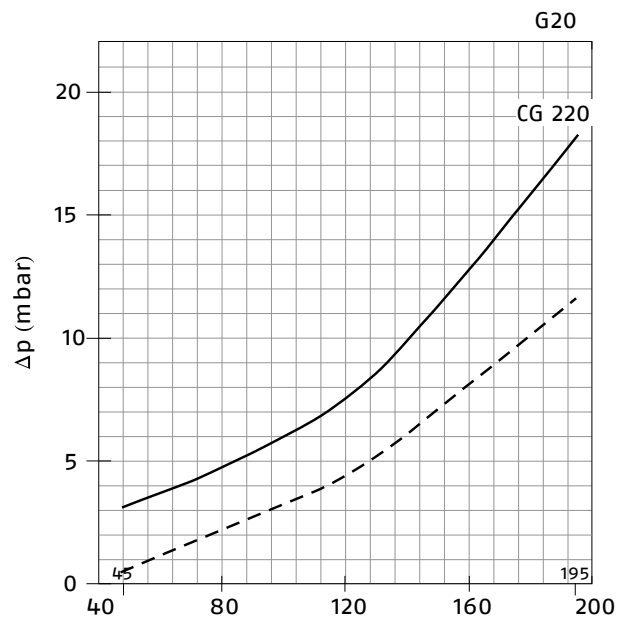
— Combustion head + gas train
 - - - Combustion head

BS2/M (NATURAL GAS)

BS2/M (LPG)


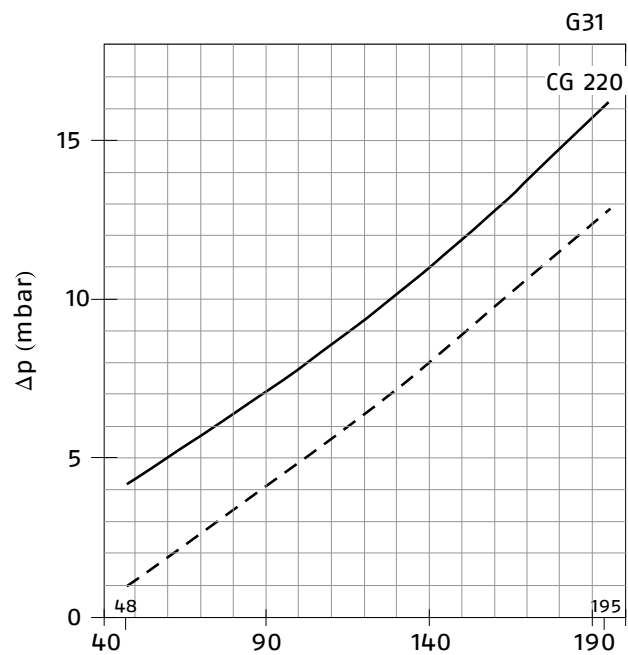
For pressure levels different from those indicated above, please contact Riello Burners Technical Office.
 In LPG plants, Multibloc gas trains do not operate below 0°C.
 They are only suitable for gaseous LPG (liquid hydrocarbons destroy the seal materials).

— Combustion head + gas train
 - - - Combustion head

BS3/M (NATURAL GAS)

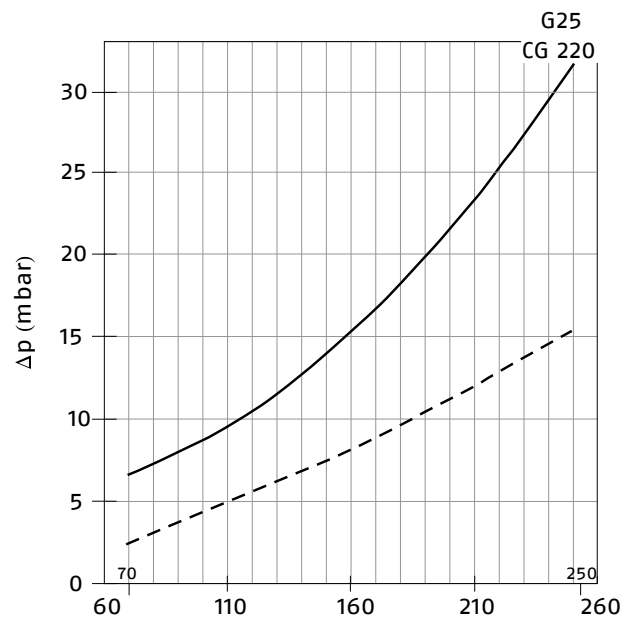
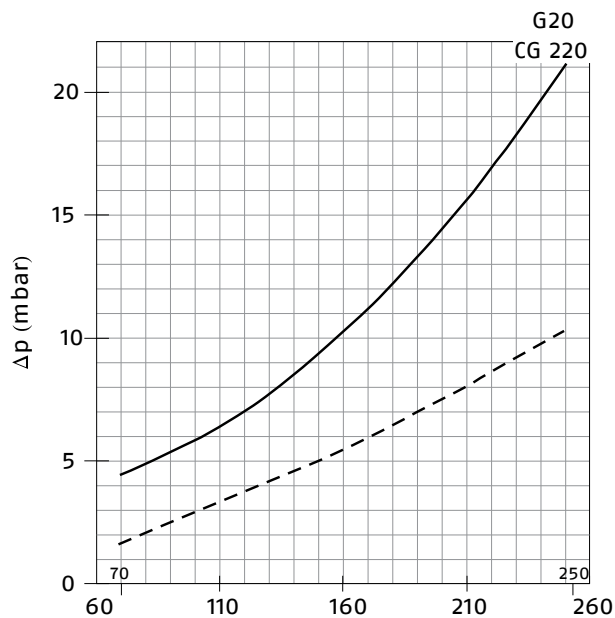
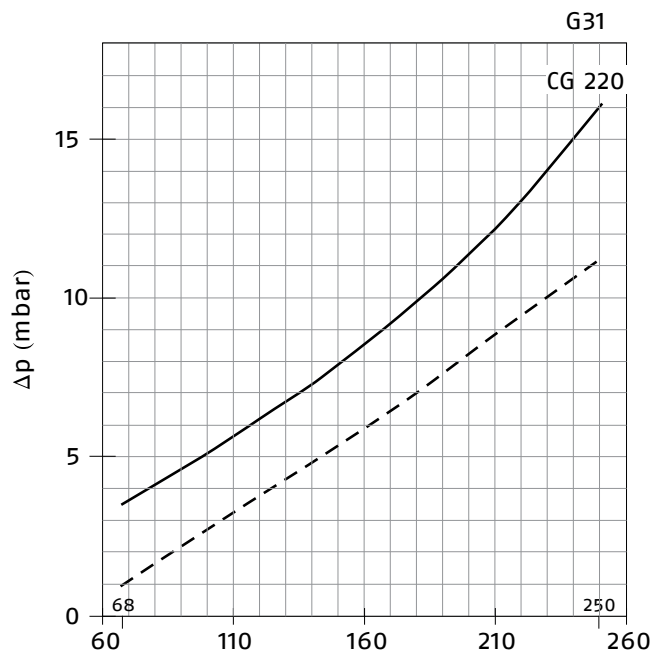


BS3/M (LPG)



For pressure levels different from those indicated above, please contact Riello Burners Technical Office.
 In LPG plants, Multibloc gas trains do not operate below 0°C.
 They are only suitable for gaseous LPG (liquid hydrocarbons destroy the seal materials).

— Combustion head + gas train
 - - - Combustion head

BS4/M (NATURAL GAS)

BS4/M (LPG)


For pressure levels different from those indicated above, please contact Riello Burners Technical Office.
In LPG plants, Multibloc gas trains do not operate below 0°C. They are only suitable for gaseous LPG (liquid hydrocarbons destroy the seal materials).

— Combustion head + gas train
- - - Combustion head

GAS TRAIN

CODE	MODEL	BURNER MODEL	OUTPUT	PLUG AND SOCKET
CG 120/P - F2SD 00	3970587	BS1/M - BS2/M	-	●
CG 220/P - F2SD 00	3970588	BS3/M - BS4/M	-	●

Selecting the Fuel Supply lines

The following diagram enables pressure drop in a pre-existing gas line to be calculated and to select the correct gas train.

The diagram can also be used to select a new gas line when fuel output and pipe length are known. The pipe diameter is selected on the basis of the desired pressure drop. The diagram uses methane gas as reference; if another gas is used, conversion coefficient and a simple formula (on the diagram) transform the gas output to a methane equivalent (refer to figure A). Please note that the gas train dimensions must take into account the back pressure of the combustion chamber during operations.

Control of the pressure drop in an existing gas line or selecting a new gas supply line.

The methane output equivalent is determined by the formula fig. A on the diagram and the conversion coefficient.

Once the equivalent output has been determined on the delivery scale ($\dot{V}$), shown at the top of the diagram, move vertically downwards until you cross the line that represents the pipe diameter; at this point, move horizontally to the left until you meet the line that represents the pipe length.

Once this point is established you can verify, by moving vertically downwards, the pipe pressure drop of on the bottom scale (mbar).

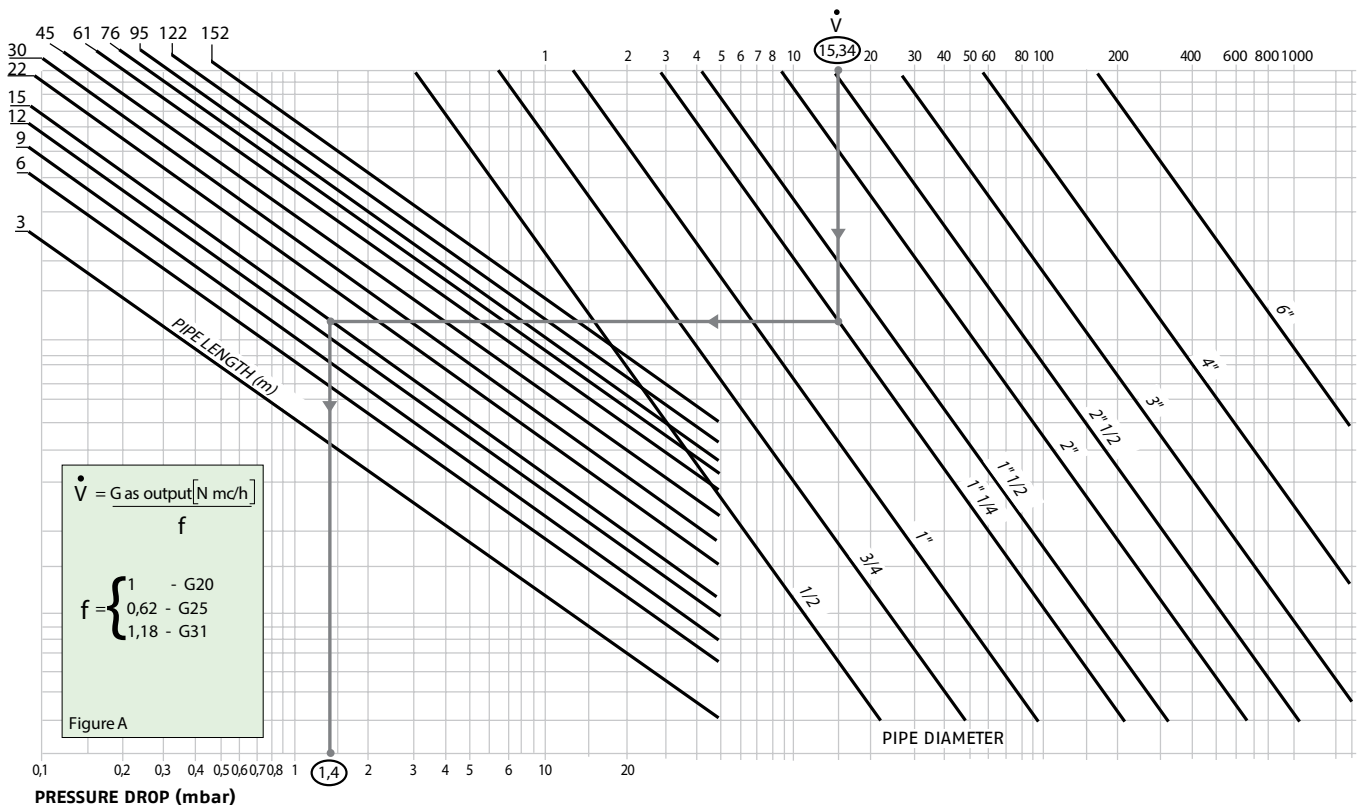
By subtracting this value from the pressure measured on the gas meter, the correct pressure value will be found for the choice of gas train.

Example: - gas used G25
- gas output 9.51 mc/h
- pressure at the gas meter 20 mbar
- gas line length 15 m
- conversion coefficient 0.62
(see figure A)

- equivalent methane output $\dot{V} = \left[\frac{9.51}{0.62} \right] = 15.34 \text{ mc/h}$

- once the value of 15.34 has been identified on the output scale ($\dot{V}$), moving vertically downwards you cross the line that represents 1" 1/4 (the chosen diameter for the piping);
- from this point, move horizontally to the left until you meet the line that represents the length of 15 m of the piping;
- move vertically downwards to determine a value of 1.4 mbar in the pressure drop bottom scale;
- subtract the determined pressure drop from the meter pressure, the correct pressure level will be found for the choice of gas train;

- correct pressure = (20 - 1.4) = 18.6 mbar



Ventilation

The different ventilation circuits always ensure low noise levels with high performance of pressure and air delivery, inspite of their compact size.

The burners are fitted with an adjustable air pressure switch, conforming to EN 676 standards.



Air suction

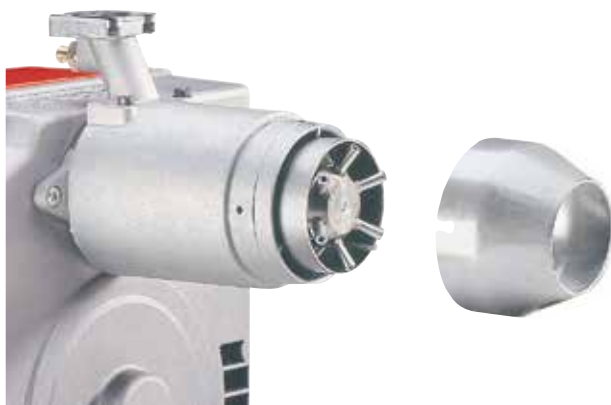


Air pressure switch

Combustion Head

The combustion head in Gulliver BS/M burners is the result of an innovative design, which allows combustion with low polluting emissions, while being easy to adapt to all the various types of boilers and combustion chambers.

Thanks to the use of a mobile coupling flange, the penetration of the head into the combustion chamber can be adjusted. Simple adjustment allows the internal geometry of the combustion head to be adapted to the burner output.

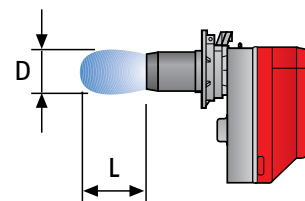
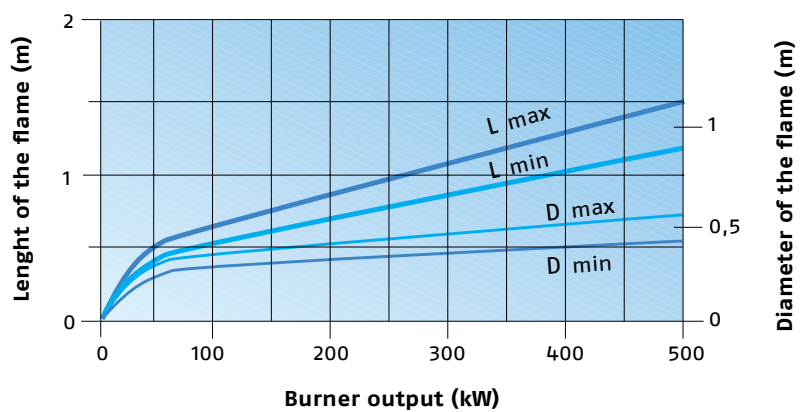


Combustion head



Mobile flange

DIMENSIONS OF THE FLAME



Example:
Burner thermal output = 350 kW;
L flame (m) = 1.2 m (medium value);
D flame (m) = 0.6 m (medium value)

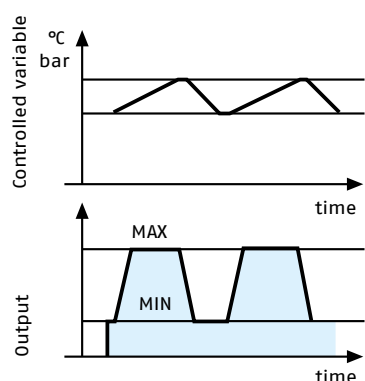
Operation

BURNER OPERATION MODE

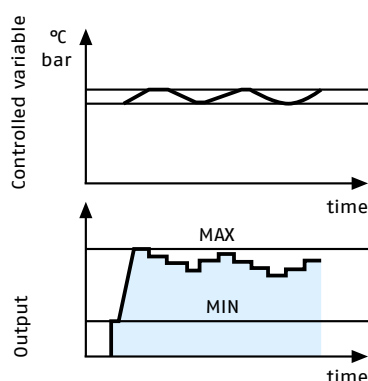
All these models are two stage operations.

The Gulliver BS/M series of two stage burners allows operating at both full and reduced output, with consequent reduction in turning the burner on and off, their giving better performance to the boiler.

During stand-by, the air damper is completely closed (controlled by an electric servomotor) and prevents heat loss due to the flue draught.



Two stage progressive" operation

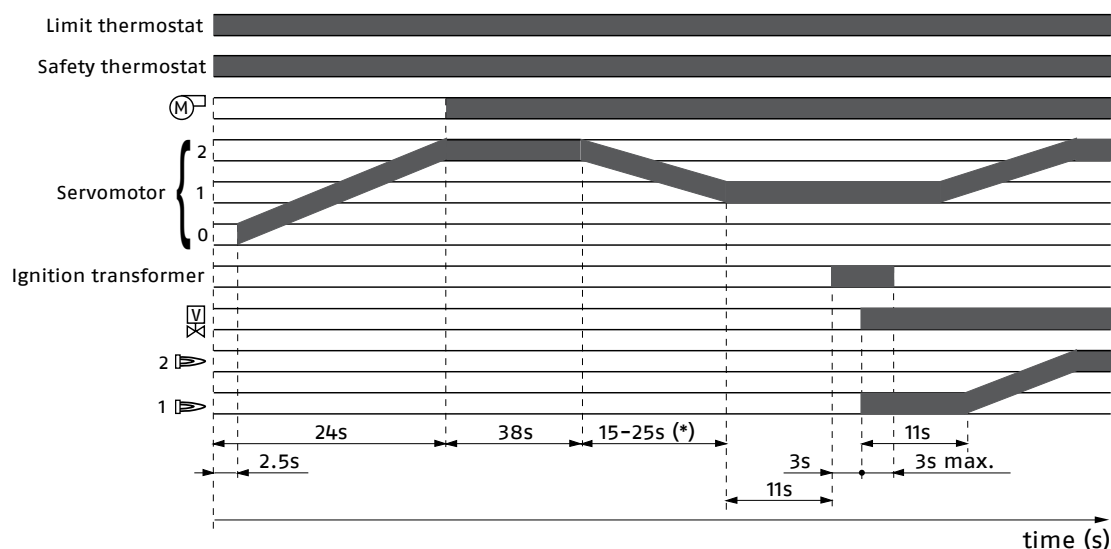


"Modulating" operation



Air regulation unit

START UP CYCLE



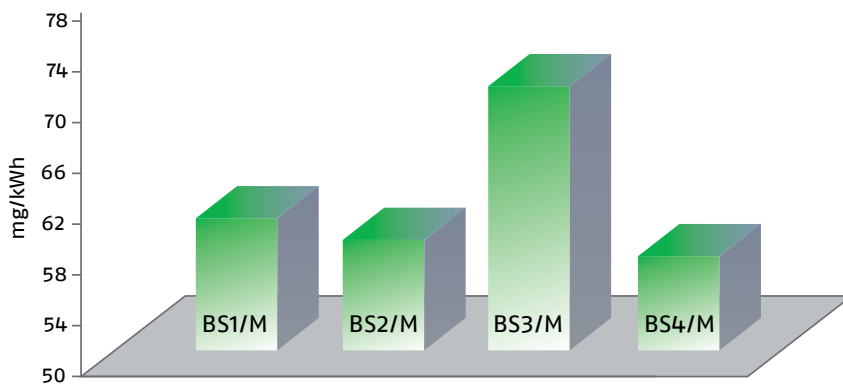
- 0s The burner begins the ignition cycle
- 0s ÷ 2.5s Safety time
- 2.5s ÷ 26.5s Progressive open of the air damper until the 2nd stage position
- 26.5s ÷ 64.5s Pre-purge at the 2nd stage
- 64.5s ÷ 89.5s The air damper closes until 1st stage position
- 89.5s ÷ 100.5s Pre-purge at the 1st stage
- 100.5s ÷ 106.5s The ignition transformer starts
- 103.5s The solenoid opens
- 103.5s ÷ 106.5s Ignition 1st stage
- 106.5s ÷ 114.5s Working on 1st stage
- 114.5s Progressive 2nd stage startup

(*) Change from 2nd stage to 1st stage happens in 25s

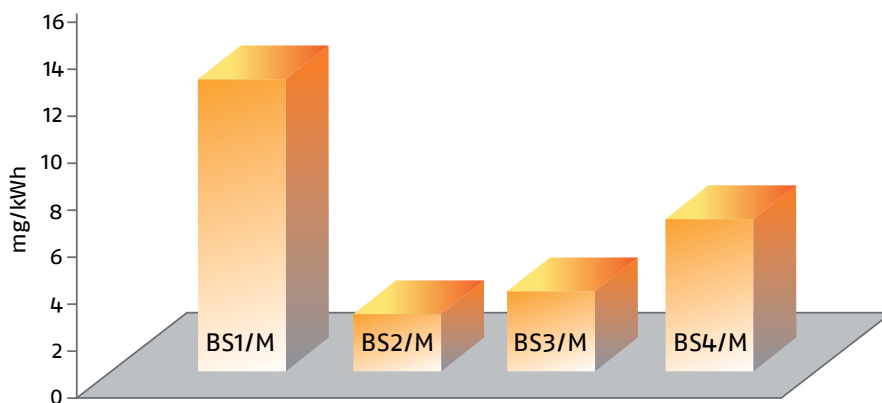
Emissions

The burners in the Gulliver BS/M series guarantee controlled combustion, reducing emissions of both CO and NOx. This combustion control is due to the recirculation of the combustion products in the chamber (thanks to different combustible air flow speeds) and to the fuel staging technique (thanks to the special geometry of the gas nozzles).

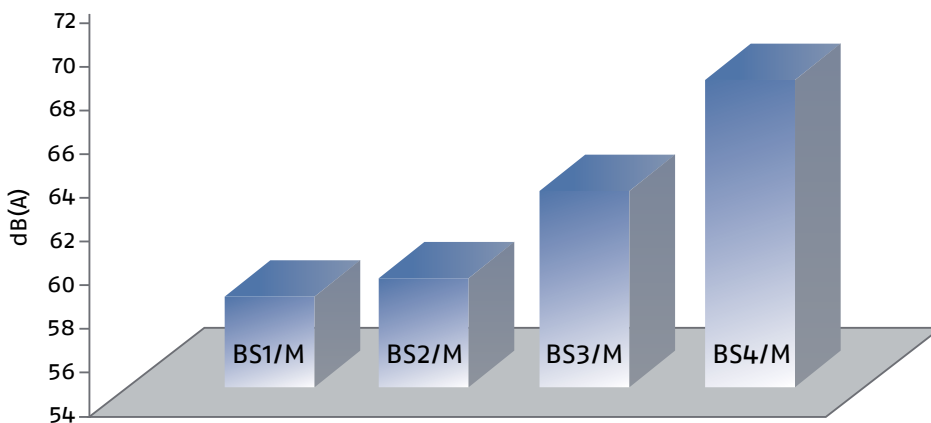
NO2 EMISSIONS



CO EMISSIONS (gas G20)



NOISE EMISSIONS



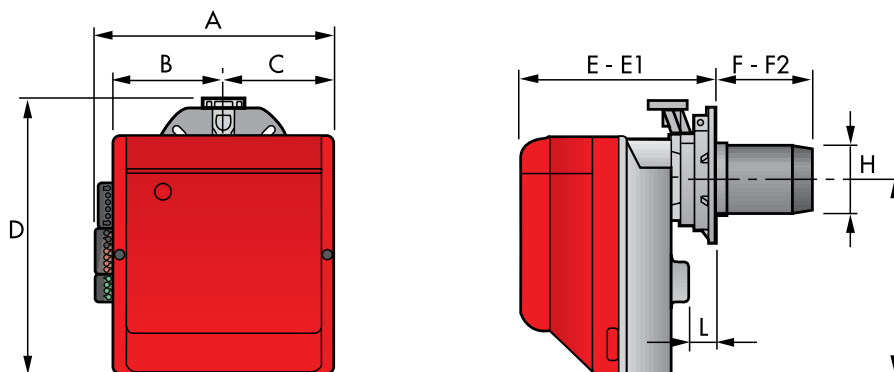
The emission data have been measured in the various models at maximum output, in conformity with EN 676 standard.

Special attention has been paid to noise reduction. All models are fitted with sound-proofing material inside the cover.



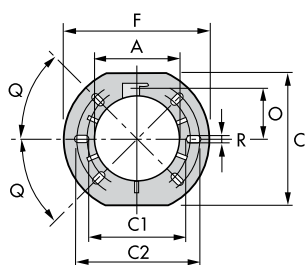
Overall Dimensions (mm)

These models are distinguished by their reduced size, in relation to the outputs achieved, which means they can be fitted to any boiler on the market.



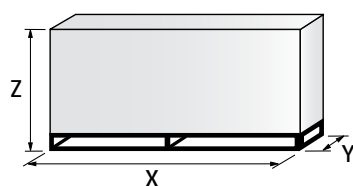
MODEL	A	B	C	D	E	E1	F	F2	H	I	L
BS1/M	285	125.5	12.5	316	234.5	-	116.5	-	89.5	230	manca
BS2/M	285	125.5	125.5	325	238	252	114	100	106	230	46
BS2/M TL	255	125.5	125.5	325	238	252	184	170	106	230	46
BS3/M	330	150	150	391	262	280	128	110	129	285	46
BS3/M TL	330	150	150	391	262	280	285	267	129	285	46
BS4/M	330	150	150	392	278	301	168	145	137	286	46
BS4/M TL	330	150	150	392	278	301	325	302	137	286	46

BURNER - BOILER MOUNTING FLANGE



MODEL	A	C	C1	C2	F	O	Q	R
BS1/M	89.5	167	140	170	192	66	45°	11
BS2/M	106	167	140	170	192	66	45°	11
BS2/M TL	106	167	140	170	192	66	45°	11
BS3/M	129	201	160	190	216	76.5	45°	11
BS3/M TL	129	201	160	190	216	76.5	45°	11
BS4/M	137	203	160	200	218	80.5	45°	11
BS4/M TL	137	203	170	200	218	80.5	45°	11

PACKAGING

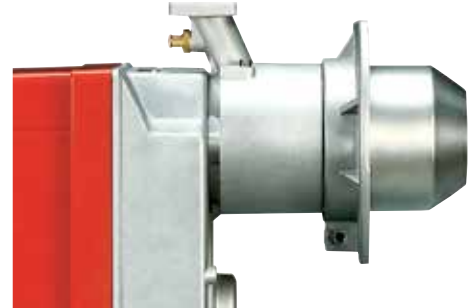


MODEL	X	Y	Z	kg
BS1/M	405	328	375	12
BS2/M	405	328	375	12
BS2/M TL	583	318	365	14
BS3/M	450	375	440	16
BS3/M TL	510	375	440	18
BS4/M	510	375	440	18
BS4/M TL	610	383	367	20

Installation Description

Installation, start up and maintenance must be carried out by qualified and skilled personnel. The burner is set in the factory on standard calibration (minimum output). If necessary adjustments can be made on the basis of the maximum output of the boiler. All operations must be performed as described in the technical handbook supplied with the burner.

The mobile flange allows adapting the length of the combustion head to the combustion chamber (flame inversion or 3 smoke cycles) and to the thickness of the boiler panel.



BURNER SETTING

The 1st stage and the 2nd stage air damper position can be easily carried out by setting the cam of the servomotor and following the manual instruction.



Head setting is easy and aided by a graduated scale, a test point allows reading the air pressure in the combustion head.



Gulliver BS/M burners are fitted with an air pressure switch which, in accordance with EN 676 standards, can be adjusted by the installer using a graduated selector, on the basis of the effective working conditions.



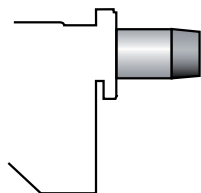
MAINTENANCE

Maintenance is easily solved because the combustion head can be disassembled without having to remove the burner and gas train from the boiler.



Burner accessories

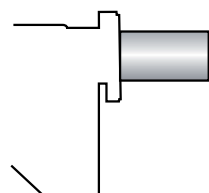
EXTENDED HEAD KIT



Burners standard head can be transformed into "extended head" versions by using the special kit. Here the KITS available for the various burners are listed, showing the original and the extended lengths.

BURNER	STANDARD HEAD LENGTH (mm)	EXTENDED HEAD LENGTH (mm)	CODE
BS1/M	70 ÷ 116	114 ÷ 160	20097850
BS2/M (long)	100 ÷ 114	170 ÷ 180	3002722
BS2/M (extra long)	100 ÷ 114	270 ÷ 280	3002723
BS3/M	110 ÷ 128	267 ÷ 282	3002724
BS4/M	145 ÷ 168	302 ÷ 317	3002725

ALTERNATIVE COMBUSTION HEAD KIT



This kit can be used to prevent combustion instability which could arise with particular heat generators.

To extend the adaptability of Gulliver BS burners to any sort of application, alternative combustion heads have been developed.

These heads cause a very limited increase in NO_x emissions, due to the slower air flow.

BURNER	CODE
BS1/M	3001064
BS2/M	3001064
BS3/M	3001060
BS4/M	3001070

PC INTERFACE KIT



To connect the control box to a personal computer for the transmission of operation, fault signals and detailed service information, an interface adapter with PC software are available.

BURNER	CODE
BS1/M ÷ BS4/M	3002719

LPG KIT



For burning LPG gas, a special kit is available to be fitted to the combustion head on the burner, as shown in the following table.

BURNER	STANDARD HEAD CODE	EXTENDED HEAD CODE
BS1/M	3001003	3001003
BS2/M	3002711	3002711
BS3/M	3002712	3002712
BS4/M	3001011	3001011

ACCESSORIES FOR MODULATING OPERATION



To obtain modulating operation, the BS/M series of burners requires a regulator with three point outlet controls. The following table lists the accessories for modulating operation with their application range.

BURNER	REGULATOR TYPE	CODE
BS1/M ÷ BS4/M	RWF50.2	20102002
	RWF55.5	20101966



The relative temperature or pressure probes fitted to the regulator, must be chosen on the basis of the application.

BURNER	PROBE TYPE	RANGE (°C) (bar)	CODE
BS1/M ÷ BS4/M	Temperature PT 100	-100 ÷ 500°C	3010110
	Pressure 4 ÷ 20 mA	0 ÷ 2,5 bar	3010213
	Pressure 4 ÷ 20 mA	0 ÷ 16 bar	3010214



Depending on the servomotor fitted to the burner, a three-pole potentiometer (1000 Ω) can be installed to check the position of the servomotor.

BURNER	CODE
BS1/M ÷ BS4/M	3010109



Modulating operation can also be obtained with an analog control signal converter and a feedback three-pole potentiometer. Alternatively, the potentiometer can be used to check the servomotor position.

BURNER	TYPE (INPUT SIGNAL)	CODE
BS1/M ÷ BS4/M	0/2 - 10 V (impedance 200 KΩ)	3091380
	0/4 - 20 mA (impedance 250 Ω)	

GROUND FAULT INTERRUPTER KIT



A "Ground fault interrupter kit" is available as a safety device in case of electrical system fault. It is supplied with burners with pin plug.

BURNER	CODE
BS1/M ÷ BS4/M	3001180

7-PIN PLUG KIT

If necessary a 7-pin plug kit is available (in packaging of n. 5 pieces).

BURNER	CODE
BS1/M ÷ BS4/M	3000945

Gas train accessories

SEAL CONTROL KIT



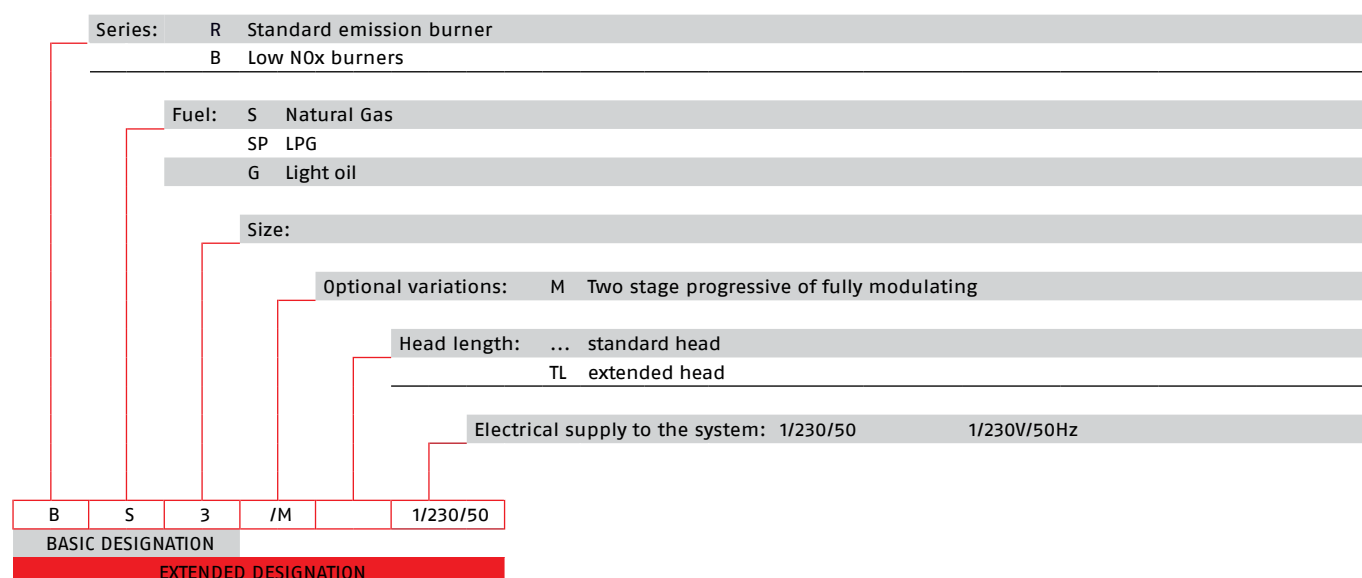
To test the valve seals on the gas train, a special "seal control kit" is available.

GAS TRAIN	CODE
CG/P type	20021563

Specification

DESIGNATION OF SERIES

A specific index guides your choice of burner from the various models available in the BS/M series. Below is a clear and detailed specification description of the product.



AVAILABLE BURNER MODELS

BURNER MODELS	ELECTRICAL SUPPLY	HEAT OUTPUT		TOTAL ELECTRICAL POWER (kW)	CERTIFICATION	NOTE
		(kW)	NATURAL GAS (Nm ³ /h)			
BS1/M	1/230/50	16/19 ÷ 52	1,6/1,9 ÷ 5,2	0.14	in progress	(1)
BS2/M	1/230/50	26/49 ÷ 91	2,6/4,9 ÷ 9,1	0.18	CE-0085BN0609	(1)
BS2/M TL	1/230/50	26/49 ÷ 91	2,6/4,9 ÷ 9,1	0.18	CE-0085BN0609	(1)(2)
BS3/M	1/230/50	48/79 ÷ 195	4,8/7,9 ÷ 19,5	0.35	CE-0085BN0609	(1)
BS3/M TL	1/230/50	48/79 ÷ 195	4,8/7,9 ÷ 19,5	0.35	CE-0085BN0609	(1)(2)
BS4/M	1/230/50	68/140 ÷ 250	6,8/14 ÷ 25	0.53	CE-0085BN0609	(1)
BS4/M TL	1/230/50	68/140 ÷ 250	6,8/14 ÷ 25	0.53	CE-0085BN0609	(1)(2)

Net calorific value G20: 10 kWh/Nm³ – Density: 0,71 kg/Nm³.

The burners of BS/M series are in according to EN 676.

(1) With plug and socket.

(2) Head Length: see quote F-F2 in the Overall Dimensions Table.

SPECIFICATION

STATE OF SUPPLY

Burner

Monobloc, gas burners, completely automatic, high/low progressive operation mode or fully modulating by using a regulator:

- Fan with forward curve blades
- Cover lined with sound proofing material
- Microprocessor-based burner safety control box, with diagnostic and remote reset functions
- Servomotor to drive the air damper to fully closed position at stand by, low and high fire position
- Single phase electric motor 230V, 50Hz
- Combustion head fitted with:
 - stainless steel head cone, resistant to high temperatures
 - ignition electrodes
 - ionisation probe
 - gas distributor
 - flame stability disk
- Flame inspection window
- Adjustable air pressure switch, with graduated selector, to guarantee burner lock out in the case of insufficient combustible air
- Protection filter against radio interference
- IP X0D (IP 40) electric protection level.

Standard equipment:

- Flange with insulating gasket
- Screws and nuts for flange to be fixed to boiler
- Screw and nut for flange
- Blue plastic tube
- G 1/8 union elbow
- 4-pin plug
- 7-pin plug
- Instruction handbook for installation, use and maintenance
- Spare parts catalogue.

Conforming to:

- 2004/108 EC Directive (electromagnetic compatibility)
- 2006/95 EC Directive (low voltage)
- 2009/142 EC Directive (gas)
- 2006/42 EC Directive (machine)
- EN 676 (gas burners)

Available accessories to be ordered separately:

- Extended head kit
- Alternative extended head kit
- LPG kit
- Ground fault interrupter kit
- 7-pin plug kit
- PC interface kit
- Accessories for modulating operation
- Seal control kit

Riello Burners a world of experience in every burner we sell.

04/2016

TS0057UK03



[1]



[2]

[1] BURNERS PRODUCTION PLANT
S. PIETRO, LEGNAGO (VERONA) - ITALIA

[2] HEADQUARTER BURNERS DIVISION
S. PIETRO, LEGNAGO (VERONA) - ITALIA

Across the world, Riello sets the standard in reliable and high efficiency burner technology.

With burner capacity from 5 kW to 48 MW, Riello gas, oil, dual fuel and Low Nox burners deliver unbeatable performance across the full range of residential and commercial heating applications, as well as in industrial processes.

With headquarter in Legnago, Italy, Riello has been manufacturing premium quality burners for over 90 year. The manufacturing plant is equipped with the most innovative systems of assembling lines and modern manufacturing cells for a quick and flexible response to the market.

Besides, the Riello Combustion Research Centre, located in Angiari, Italy, represents one of the most modern facility in Europe and one of the most advanced in the world for the development of the combustion technology.

Today, the company's presence on worldwide markets is distinguished by a well-constructed and efficient sales network, alongside many important Training Centres located in various countries to meet its customers' needs. Riello has 13 operational branches abroad (in Europe, America and Asia), with customers in over 60 countries.

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