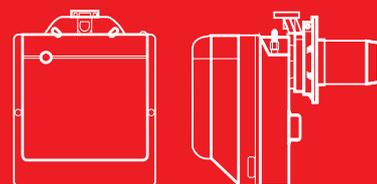




## Gulliver BSDF Series

Low NO<sub>x</sub> Two Stage Gas Burners

BS3DF	65/75	÷	189	kW
BS4DF	110/140	÷	246	kW



The Riello Gulliver BSDF series of two stage 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. The burners are fitted with a microprocessor-based burner safety control box which supplies indication of operation and diagnosis of fault cause.

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 working 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 BSD burners are tested before leaving the factory.

## Technical Data

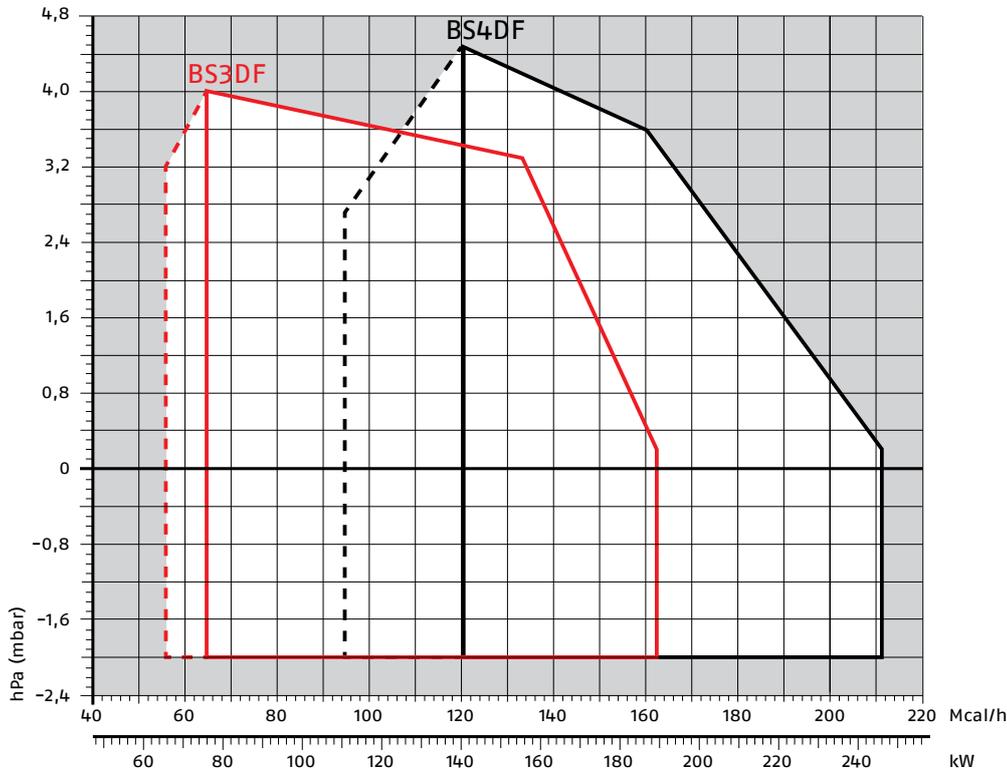
MODEL		BS3DF	BS4DF	
Burner operation mode		Two stage		
Modulation ratio at max. output		--		
Servomotor	type	--		
	run time s	--		
Heat output	kW	65/75 ÷ 189	110/140 ÷ 246	
	Mcal/h	55.9/64.5 ÷ 162.5	94.6/120.4 ÷ 211.6	
Working temperature	°C min./max.	0/40		
<b>FUEL/AIR DATA</b>				
G20 gas	net calorific value	kWh/Nm <sup>3</sup>	10	
	gas density	kg/Nm <sup>3</sup>	0.71	
	gas delivery	Nm <sup>3</sup> /h	6.5/7.5 ÷ 19	11/14 ÷ 24.6
G25 gas	net calorific value	kWh/Nm <sup>3</sup>	8.6	
	gas density	kg/Nm <sup>3</sup>	0.78	
	gas delivery	Nm <sup>3</sup> /h	7.6 ÷ 22	12.8 ÷ 28.6
LPG gas	net calorific value	kWh/Nm <sup>3</sup>	25.8	
	gas density	kg/Nm <sup>3</sup>	2.02	
	gas delivery	Nm <sup>3</sup> /h	2.5 ÷ 7.3	4.3 ÷ 9.5
Fan	type	Centrifugal with forward curve blades		
Air temperature	max °C	40		
<b>ELECTRICAL DATA</b>				
Electrical supply	Ph/Hz/V	1/50-60/220-230 (±10%)		
Auxiliary electrical supply	Ph/Hz/V	--		
Control box	type	MG569		
Total electrical power	kW	0.355 (50 Hz) 0.485 (60 Hz)	0.420 (50 Hz) 0.600 (60 Hz)	
Auxiliary electrical power	kW	--		
Protection level	IP	X0D		
Fan motor	electrical power	kW	0.15	0.25
	rated current	A	1.6 (50 Hz)	1.9 (50 Hz)
			2.2 (60 Hz)	2.7 (60 Hz)
	start up current	A	6.4 (50 Hz)	7.6 (50 Hz)
			8.8 (60 Hz)	10.8 (60 Hz)
protection level	IP	20		
Ignition transformer	type	Incorporated in the control box		
	V1 - V2	230V - 8 kV		
	I1 - I2	0.2 A - 12 mA		
Operation		Intermittent (at least one stop every 24 h)		
<b>EMISSIONS</b>				
Noise levels	sound pressure	dB (A)	66	71
	sound power	W	-	-
Gas G20	CO emission	mg/kWh	< 40	
	NOx emission	mg/kWh	< 80	
<b>APPROVAL</b>				
Directive		2006/42 - 2009/142 - 2004/108 - 2006/95 EC		
Conforming to		EN 676 - EN 12100		
Certification		--		

### 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  
 1<sup>st</sup> stage operation range  
 Test conditions conforming to EN676  
 Temperature: 20°C  
 Pressure: 1013,5 mbar  
 Altitude: 0 m a.s.l.

# Gas train

## GAS TRAIN DESIGNATION

Series: MB

Size: 407 410 412

Operation: /2 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

MB	407	/2		F2	SD	2	0
----	-----	----	--	----	----	---	---

**BASIC DESIGNATION**

**EXTENDED DESIGNATION**

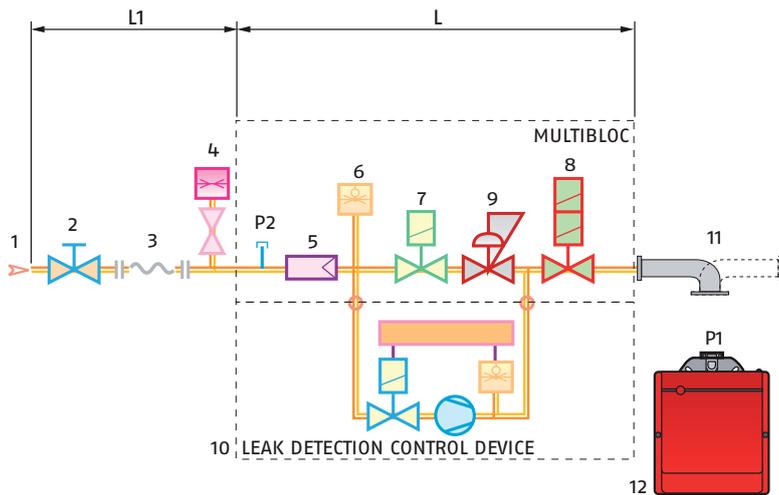
### GAS TRAINS

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.

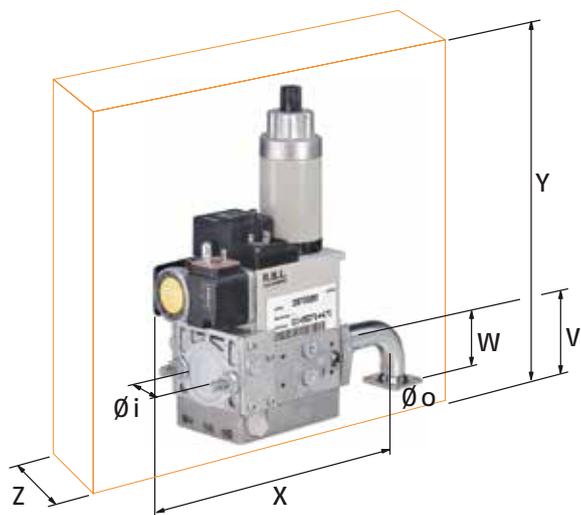
The gas train is Multibloc type, containing the main components in a single unit and it can be fitted with the valve seal control (as an accessory).

#### MB 407/2 – 410/2 – 412/2



Gas train installed on the burner

1	Gas input pipework
2	Manual valve
3	Anti-vibration joint
4	Gas pressure gauge
5	Filter
6	Gas pressure switch
7	Safety valve
8	Adjustment solenoid 1st and 2nd stage: firing delivery adjustment (rapid opening) maximum delivery adjustment (slow opening)
9	Pressure adjuster
10	Leak detection device for valves 7 and 8 (accessory)
11	Gas train-burner adapter
12	Burner
P1	Combustion head pressure
P2	Upstream pressure from the filter
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 BSD burners, intake diameter and the coupling flange to the burner.

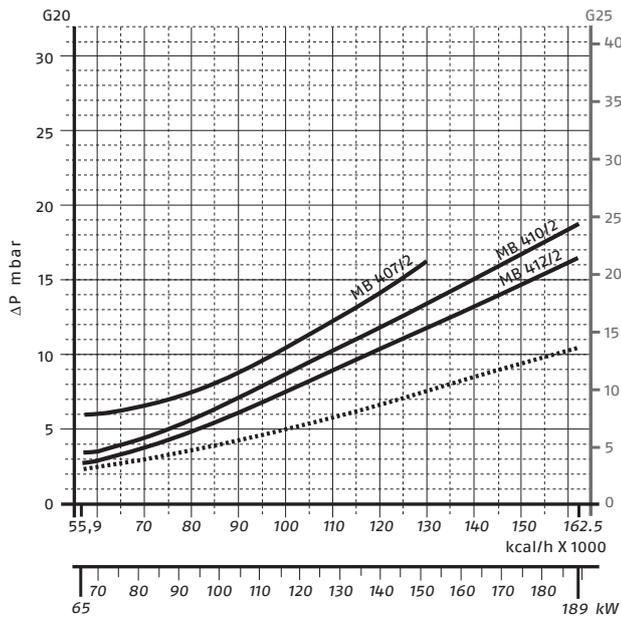
GAS TRAIN									
MODEL	CODE	Ø in	Ø out	X mm	Y mm	W mm	Z mm	V mm	mbar max*
MB 407/2	3970541	3/4"	FLANGE 3	236	257	47	120	46	300
MB 410/2	3970542	1" 1/4	FLANGE 3	259	315	47	145	55	300
MB 412/2	3970543	1" 1/4	FLANGE 3	259	315	47	145	55	300

\* max inlet gas pressure (mbar)

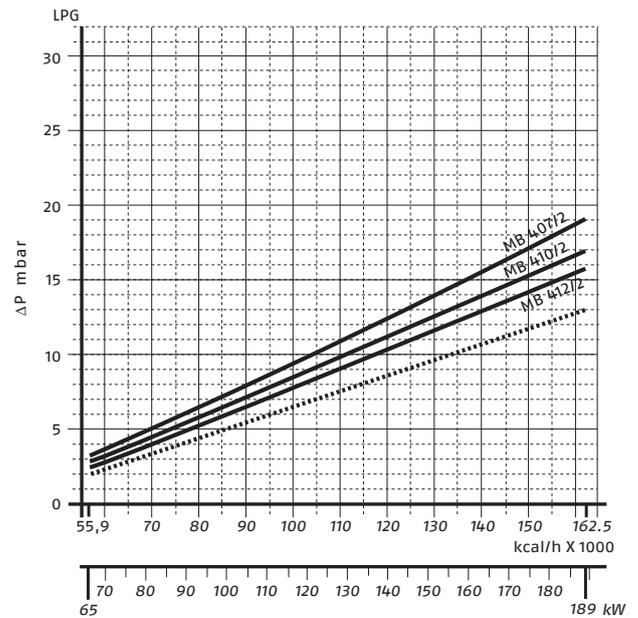
# Pressure Drop Diagram

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.

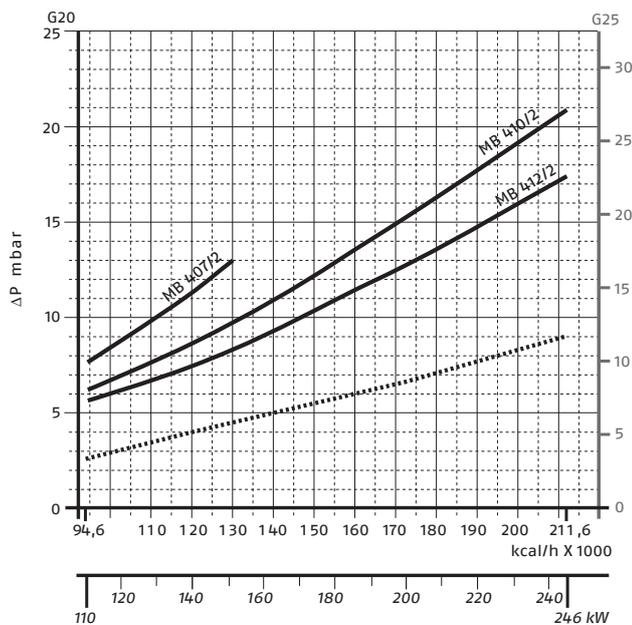
## BS3DF (NATURAL GAS)



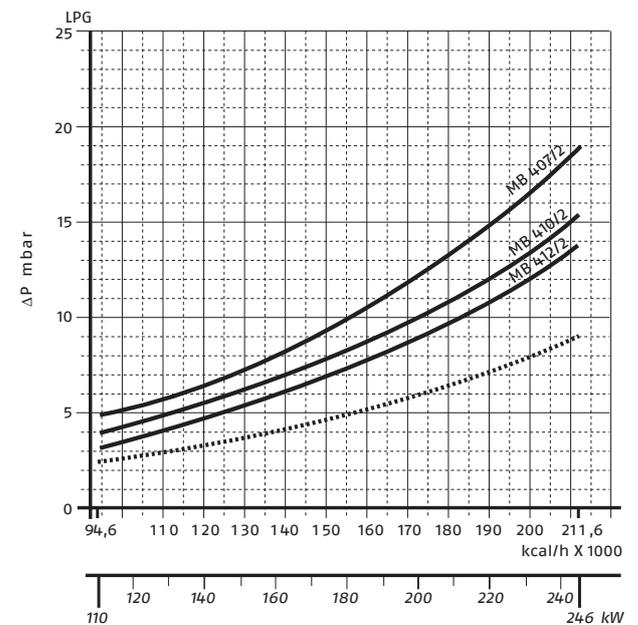
## BS3DF (LPG)



## BS4DF (NATURAL GAS)



## BS4DF (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**

<b>CODE</b>	<b>MODEL</b>	<b>BURNER MODEL</b>	<b>OUTPUT</b>	<b>PLUG AND SOCKET</b>
3970541	MB 407/2 - F3SD 20	BS3DF - BS4DF	≤ 150 kW *	●
3970542	MB 410/2 - F3SD 20	BS3DF - BS4DF	-	●
3970543	MB 412/2 - F3SD 20	BS3DF - BS4DF		●

Key to layout

\* with natural gas

## 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.

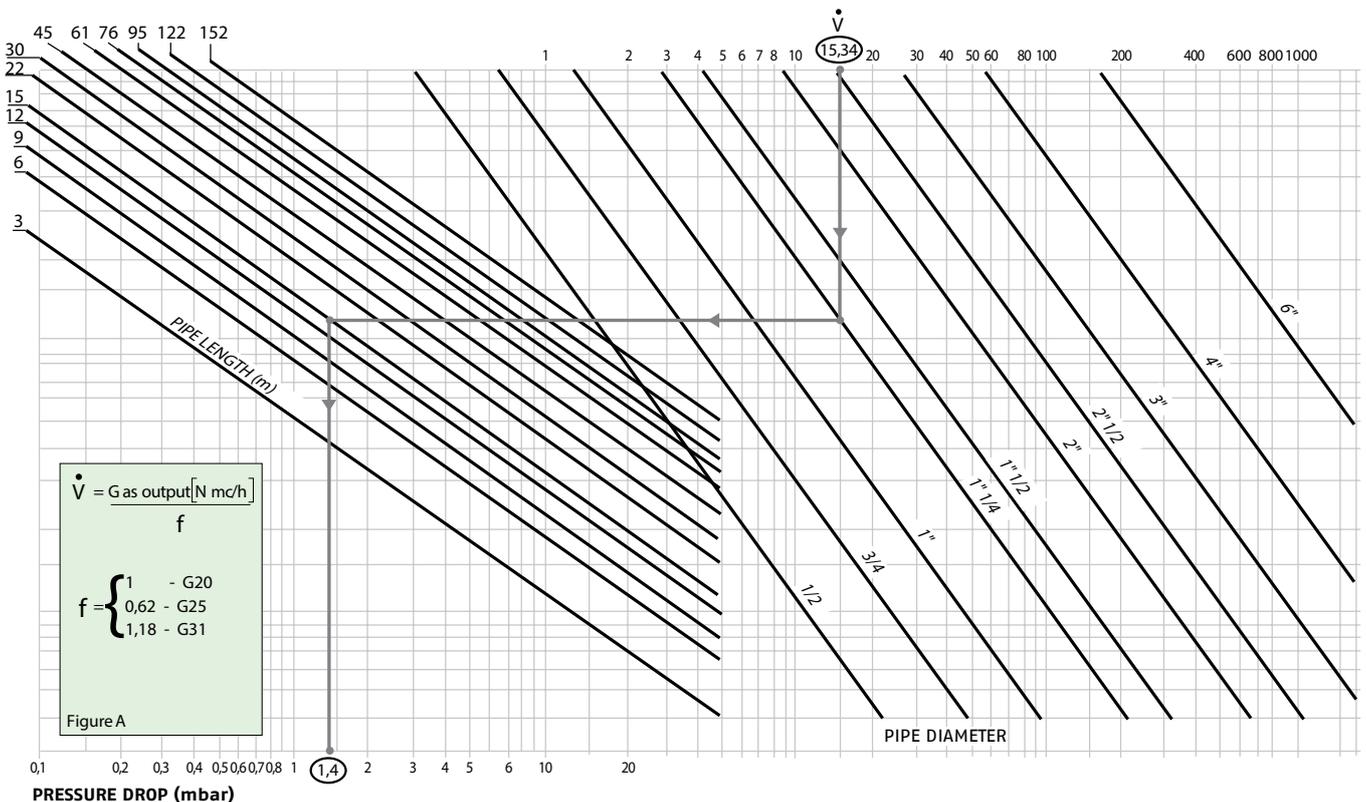
Once the equivalent output has been determined on the delivery scale ( $\dot{V}$ ), shown at the top of the diagram, move vertically downwards until you cross the line that represents the pipe diameter; at this point, move horizontally to the left until you meet the line that represents the pipe length.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



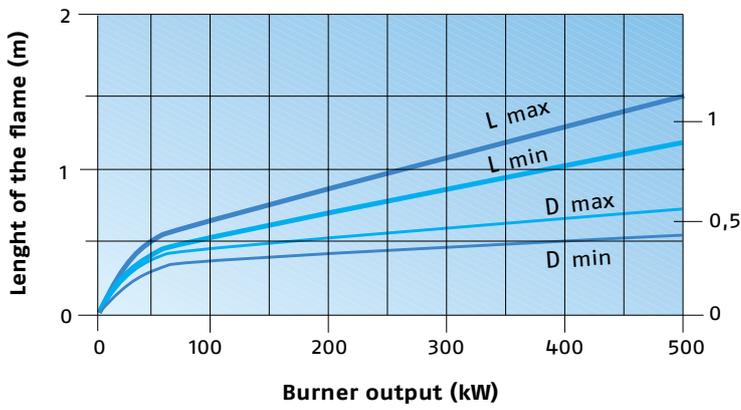
Combustion head



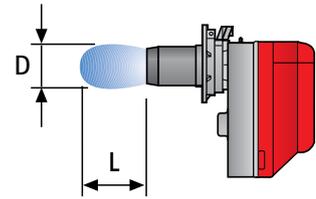
Mobile flange



### DIMENSIONS OF THE FLAME



Diameter of the flame (m)

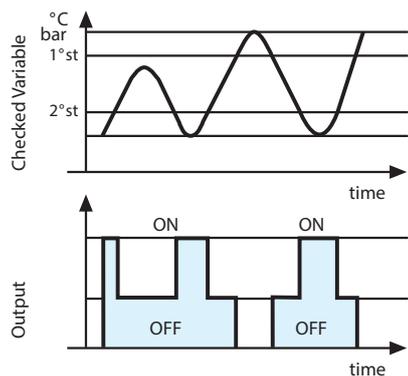


Example:  
Burner thermal output = 350 kW;  
L flame (m) = 1.2 m (medium value);  
D flame (m) = 0.6 m (medium value)

# Operation

## BURNER OPERATION MODE

All these models are two stage operation. The Gulliver BSDF 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 operation



Air damper adjustment



Air damper opening mechanism



All Gulliver BSD series burners are fitted with a new microprocessor control panel for the supervision during intermittent operation. For helping the commissioning and maintenance work, there are two main elements:



The lock-out reset button is the central operating element for resetting the burner control and for activating / deactivating the diagnostic functions.

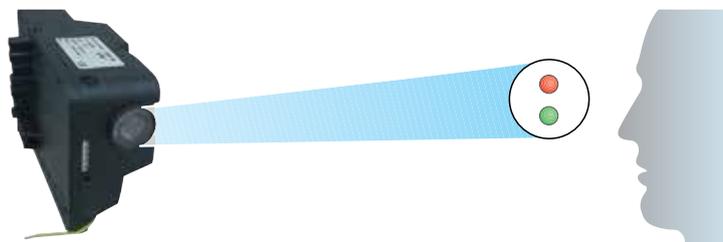


The multi-color LED is the central indication element for visual diagnosis and interface diagnosis.

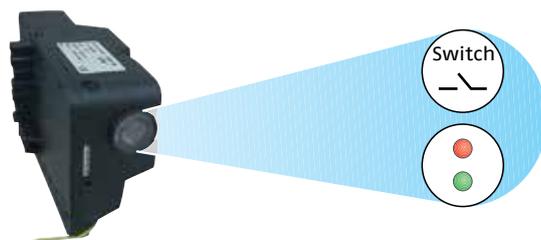
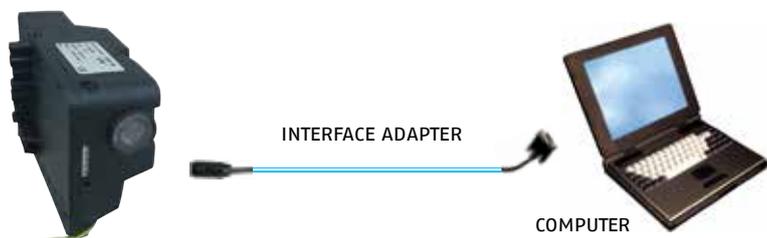
Both elements are located under the transparent cover of lock-out reset button, as showed.

There are two diagnostic choices, for indication of operation and diagnosis of fault cause:

### - visual diagnosis:



### - interface diagnosis:



By the interface adapter and a PC with dedicated software.

**Indication of operation**

In normal operation, the various statuses are indicated in the form of colour codes according to the table below.

**Diagnosis of fault causes**

After lock-out has occurred, the red signal lamp is steady on.

In this status, the visual fault diagnosis according to the error code table can be activated by pressing the lock-out reset button for > 3 seconds.

The control box sends a sequence of pulses that are repeated at 2 second intervals.

The interface diagnosis (with adapter) can be activated by pressing again the lock-out button for > 3 seconds.

**Color code table**

Operation statuses	Color code
Stand-by	○ Led off
Pre-purging	● Green
Ignition phase	● Green
Flame OK	● Green
Post purge	● Green
Undervoltage, built-in fuse	○ Led off
Fault, alarm	● Red

Example of blinks sequence:



**Error code table**

Blink code	Possible cause of fault
2 blinks 	No flame at the end of safety time: - faulty or soiled gas valves - faulty ionisation probe - poor adjustment of burner, no gas - faulty ignition - neutral / phase exchange
3 blinks 	Air pressure switch does not close or is already closed before heat demand: - faulty air pressure switch - air pressure switch incorrectly regulated
4 blinks 	Presence of flame: - in stand-by position - with thermostat of heat demand in idle or working position - during pre-purge - during post-purge
6 blinks 	Loss of air pressure: - during pre-purge - during or after safety time
7 blinks 	Loss of flame during operations after n°3 attempts of re-cycle: - faulty or soiled gas valves - faulty ionisation probe - short circuit between ionisation probe and earth of the burner - poor adjustment of burner, no fuel

The MG569 digital control box gives some other advantages:

**Post ignition (during safety time)**

The spark ignition is present during all safety time.

**Adjustable post purge**

The Post-purge is a function that maintains air ventilation even after the burner is switched off.

Post-purge time can be set to a maximum of 6 minutes.

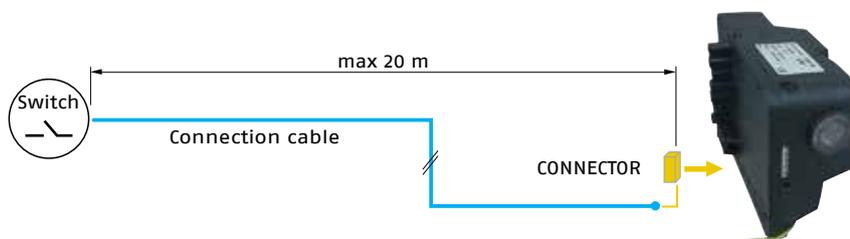
This function can be activated and set in a very easy way by pressing repeatedly the reset button; after 5 seconds the control box automatically shows the minutes set by the red LED flashing (1 pulse = post-ventilation for 1 minute). If during post-purge there is a new request for heat, it is halted and a new operating cycle starts.

The control box leaves the factory with the setting 0 minutes (no post-ventilation).

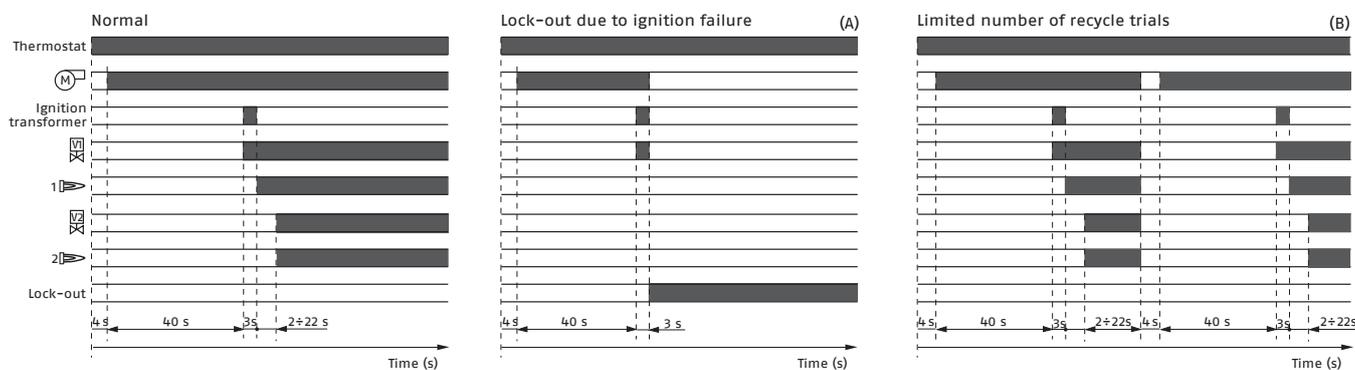
**Remote lock-out reset**

The "Remote lock-out reset" is a function that allows to reset the control-box operation from a remote position. In the burner packages will be included a particular connector to remote the reset signal.

The maximum length of connection must be 20 m.



**START UP CYCLE**



**(A)** Lock-out is shown by a led on the appliance.

**(B)** Total number of recycle trials is 3.

**Correct operation**

- 0s Start of heat demand the burner begins the ignition cycle
- 0s-4s The burner is in stand-by
- 4s-44s Pre-purge with opened air damper
- 44s Ignition 1st stage
- 49s-69s Ignition 2nd stage

**Lock-out due to ignition failure**

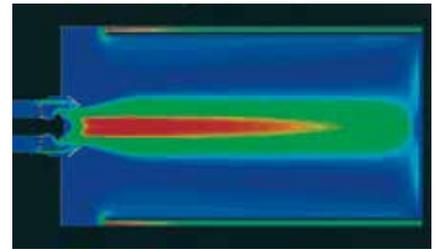
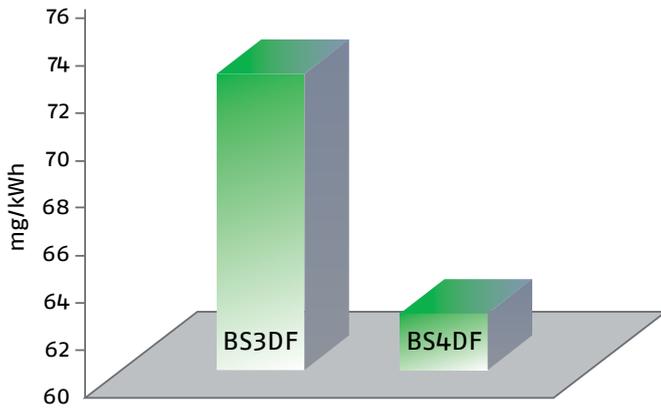
If the flame does not light within the safety limit (~ 3s) the burner locks-out.

**Re-cycle**

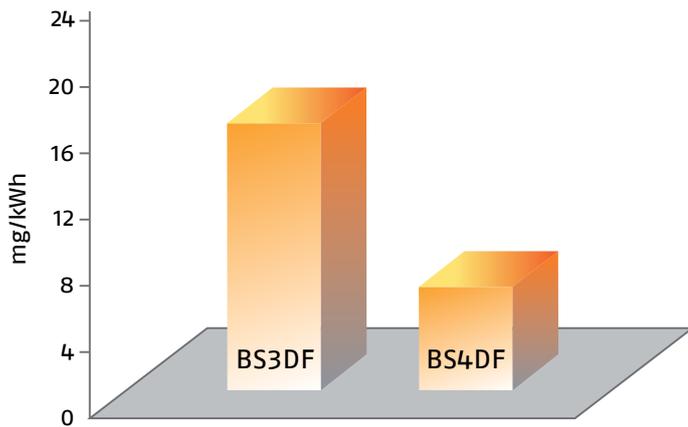
The burner permits maximum three repetitions of complete ignition cycle if there is flame failure during operation. The burner goes in safety shut-down within one second. The final action at the last trial following at last flame failure is a lock-out.

The burners in the Gulliver BSDF 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).

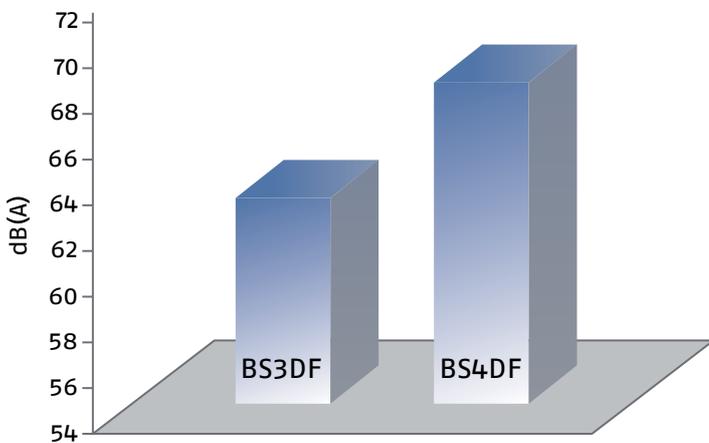
**NO2 EMISSIONS**



**CO EMISSIONS (gas G20)**



**NOISE EMISSIONS**

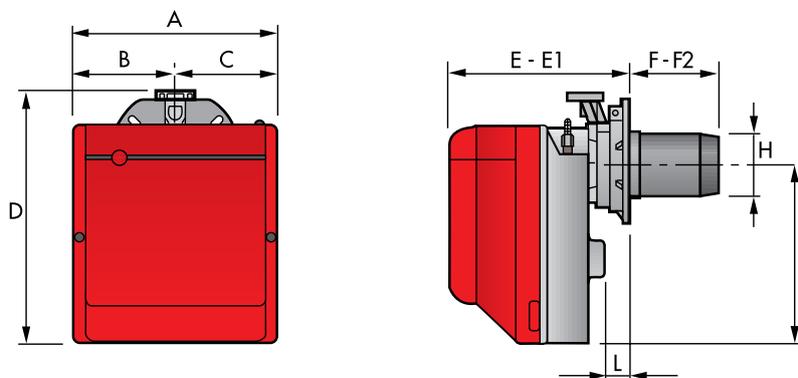


The emission data have been measured in the various models at maximum output, in conformity with EN 676 standard.

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

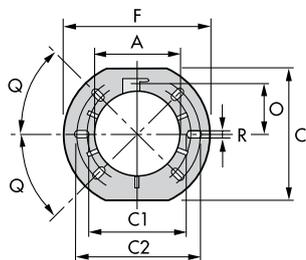
## Overall Dimensions (mm)

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.



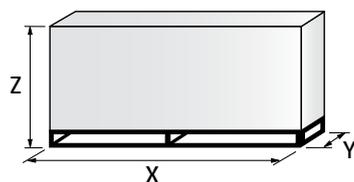
MODEL	A	B	C	D	E	E1	F	F2	H	I	L
BS3DF	300	150	150	391	262	280	128	110	129	285	45
BS4DF	300	150	150	392	278	301	168	145	137	286	45

### BURNER - BOILER MOUNTING FLANGE



MODEL	A	C	C1	C2	F	O	Q	R
BS3DF	129	201	160	190	216	76.5	45°	11
BS4DF	137	203	170	200	218	80.5	45°	11

### PACKAGING

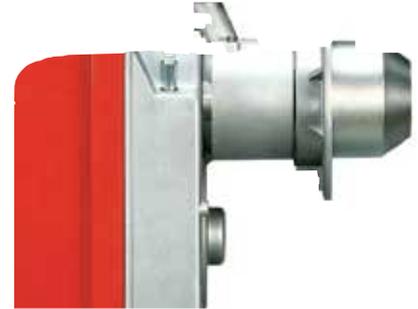


MODEL	X	Y	Z	kg
BS3DF	450	345	440	16
BS4DF	510	345	440	18

## 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 adjustment of the first stage air damper position can be easily carried out by setting the air damper motor and following the manual instruction.



The second stage position of the air damper can be adjusted without removing the burner cover.



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



Gulliver BSDF 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 AND ELECTRICAL CONNECTIONS

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

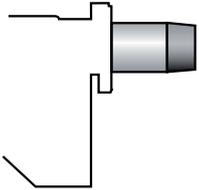
The 7-pole socket is incorporated in the control box, the 4-pole socket (for connecting the 2nd stage thermostat to the hour meter) and the 6-pole socket (for connection to the gas train) are already connected to the equipment and fixed into the burner.

The 7 and 4-pin plugs are also supplied for connection to the boiler.



## Burner accessories

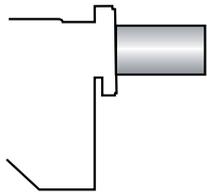
### EXTENDED HEAD KIT



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
BS3DF	110 ÷ 128	267 ÷ 282	3001009
BS4DF	145 ÷ 168	302 ÷ 317	3001016

### 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 BSD burners to any sort of application, alternative combustion heads have been developed. These heads cause a very limited increase in NOx emissions, due to the slower air flow.

BURNER	CODE
BS3DF	3001060
BS4DF	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.

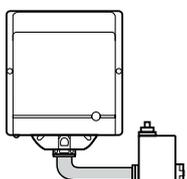
BURNER	CODE
BS3DF – BS4DF	3002731

### 7-PIN PLUG KIT

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

BURNER	CODE
BS3DF – BS4DF	3000945

### MULTIBLOC ROTATION KIT



There is a special kit available that can be used to install the burner turned 180°. This kit is designed to ensure the gas train valve properly.

BURNER	CODE
BS3DF – BS4DF	3001178

**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
BS3DF	3001005	3001005
BS4DF	3001011	3001011

**TOWN GAS KIT**



For burning Town 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 (*)
BS3DF	3002729	3002729

(\*) Without CE certification

**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
BS3DF - BS4DF	3001180

(\*) Without CE certification

**Gas train accessories**

**SEAL CONTROL KIT**



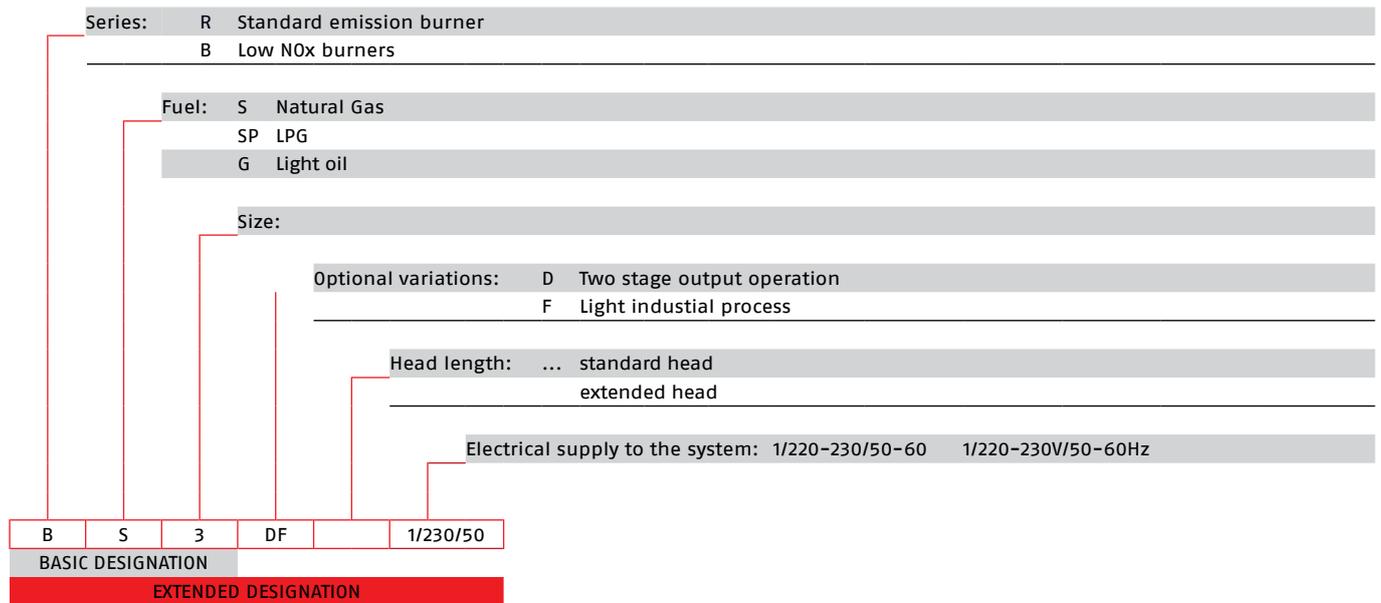
To test the valve seals on the gas train a special "seal control kit" is available.

GAS TRAIN	CODE for 50Hz operation	CODE for 60Hz operation
MB/2 type	3010123	20050030

# Specification

## DESIGNATION OF SERIES

A specific index guides your choice of burner from the various models available in the RS/M C13 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 <sup>3</sup> /h)			
BS3DF	1/220-230/50-60	65/75 - 189	6.5/7.5 - 19	0.355 (50 Hz) 0.485 (60 Hz)	-	(1)
BS4DF	1/220-230/50-60	110/140 - 246	11/14 - 24.6	0.420 (50 Hz) 0.600 (60 Hz)	-	(1)

Net calorific value G20: 10 kWh/Nm<sup>3</sup> – Density: 0,71 kg/Nm<sup>3</sup>.  
 The burners of BS series are in according to EN 676.  
 (1) With plug and socket.

## SPECIFICATION

### STATE OF SUPPLY

Monoblock, gas burners, completely automatic, two stage operation, made up of:

- Fan with forward curve blades
- Cover lined with sound-proofing material
- Air damper, completely closed in stand by, driven by an electric servomotor
- Air damper with 1st and 2nd stage adjustment (2nd stage external adjustment, with no need to remove the cover)
- Single phase electric motor 220-230V, 50-60Hz
- 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
- Microprocessor-based burner safety control box, with diagnostic and remote reset functions
- Protection filter against radio interference (included into burner safety control box)
- IP X0D (IP 40) electric protection level.

### Standard equipment:

- Sliding flange
- Flange insulation screen
- Screws and nuts for fixing the flange to the boiler
- 7-pin plug
- 4-pin plug
- Remote control release kit
- 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)
- EN 746-2 Standard (for the part of the working field that is depressurised)

### Available accessories to be ordered separately:

- Extended head kit
- Alternative extended head kit
- LPG kit
- Town gas kit
- Ground fault interrupter kit
- Multibloc rotation kit
- 7-pin plug kit
- PC interface kit
- Seal control kit

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

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T50098UK00



[ 1 ]

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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