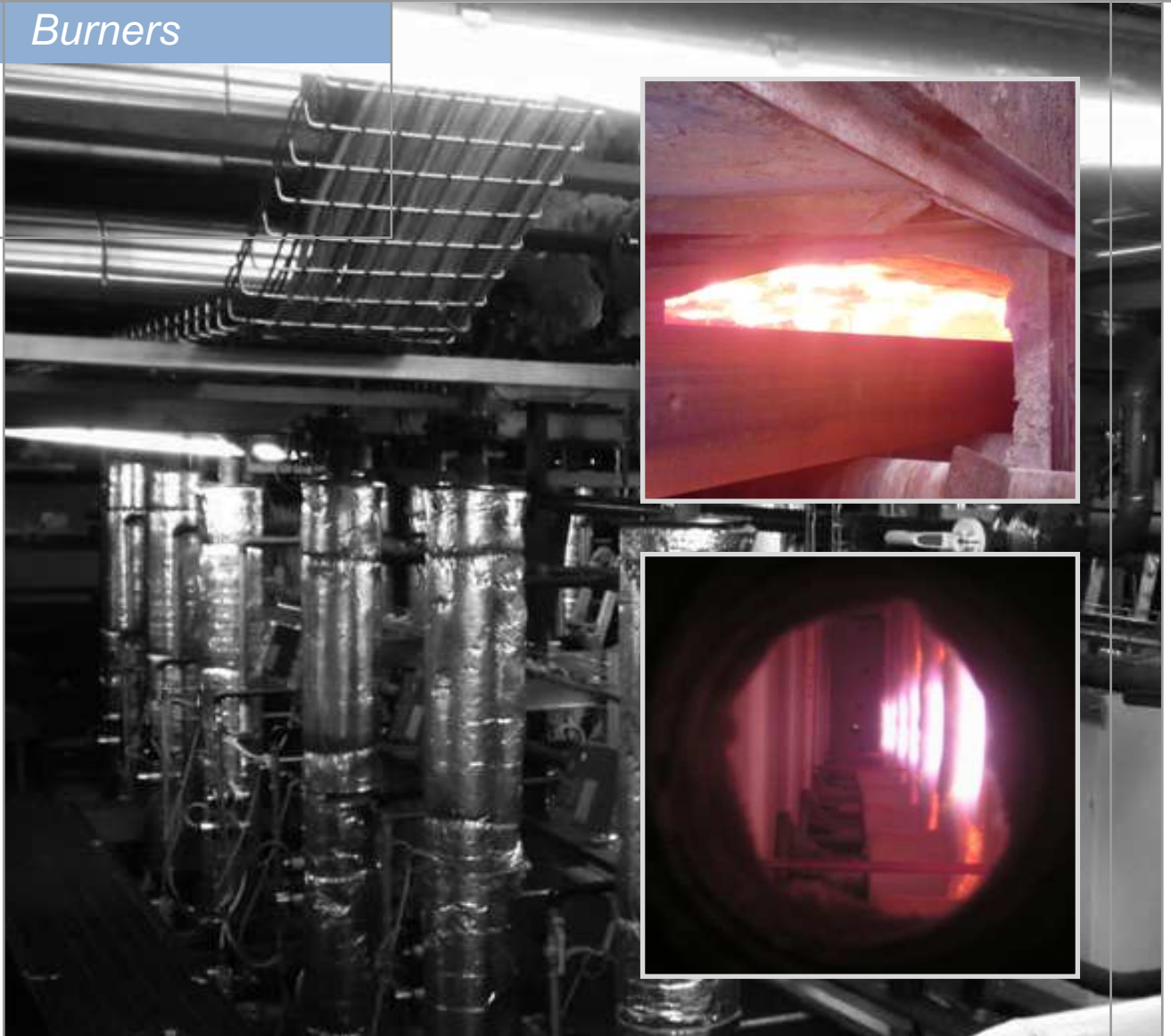


## Burners



### Flat flame burners

ESW (E3500 rev. 01 - 19/04/2016)

## GENERAL WARNINGS:



- All installation, maintenance, ignition and setting must be performed by qualified staff, respecting the norms present at the time and place of the installation.
- To avoid damage to people and things, it is essential to observe all the points indicated in this handbook. The reported indications do not exonerate the Client/User from observing general or specific laws concerning accidents and environmental safeguarding.
- The operator must wear proper DPI clothing (shoes, helmets...) and respect the general safety, prevention and precaution norms.
- To avoid the risks of burns or high voltage electrocution, the operator must avoid all contact with the burner and its control devices during the ignition phase and while it is running at high temperatures.
- All ordinary and extraordinary maintenance must be performed when the system is stopped.
- To assure correct and safe use of the combustion plant, it is of extreme importance that the contents of this document be brought to the attention of and be meticulously observed by all personnel in charge of controlling and working the devices.
- The functioning of a combustion plant can be dangerous and cause injuries to persons or damage to equipment. Every burner must be provided with certified combustion safety and supervision devices.
- The burner must be installed correctly to prevent any type of accidental/undesired heat transmission from the flame to the operator or the equipment.
- The performances indicated in this technical document regarding the range of products are a result of experimental tests carried out at ESA-PYRONICS. The tests have been performed using ignition systems, flame detectors and supervisors developed by ESA-PYRONICS. The respect of the above mentioned functioning conditions cannot be guaranteed if equipment, which is not present in the ESA-PYRONICS catalogue, is used.

## DISPOSAL:



To dispose of the product, abide by the local legislations regarding it.

## GENERAL NOTES:



- In accordance to the internal policy of constant quality improvement, ESA-PYRONICS reserves the right to modify the technical characteristics of the present document at any time and without warning.
- It is possible to download technical sheets which have been updated to the latest revision from the [www.esapyronics.com](http://www.esapyronics.com) website.
- The ESW products have been designed, manufactured and tested according to the most correct construction practices and following the applicable requirements described in **UNI EN 746-2-2010** "Industrial heating process equipment - Part 2: Safety requirements for combustion and for the handling and processing of fuels". We emphasize that the burners described in this data sheet **are provided as independent units and are excluded from the scope of the Machine Directive 2006/42/EC** not having any mobile items that are not exclusively manual.
- Certified in conformity with the **UNI EN ISO 9001** Norm by DNV GL.



- For ESA-PYRONICS, the NxT symbol has the following two meanings which are connected to each other: **NEXT GENERATION**, or new generation burners that maintain functionality, reliability and performance. **NOx TECHNOLOGY** energy saving and low polluting emissions.

## CERTIFICATIONS:



The products conform to the requests for the Euroasia market (Russia, Belarus and Kazakhstan).

## CONTACTS / SERVICE:



### Headquarters:

Esa S.p.A.  
Via Enrico Fermi 40  
24035 Curno (BG) - Italy  
Tel +39.035.6227411  
Fax +39.035.6227499  
[esa@esacombustion.it](mailto:esa@esacombustion.it)

### International Sales:

Pyronics International s.a.  
Zoning Industriel, 4ème rue  
B-6040 Jumet - Belgium  
Tel +32.71.256970  
Fax +32.71.256979  
[marketing@pyronics.be](mailto:marketing@pyronics.be)

[www.esapyronics.com](http://www.esapyronics.com)

The ESW series identifies a family of flat flame burners called "nozzle mix" : the high velocity combustion air flow produces a vortex inside the refractory block where the gas mixes producing high combustion. The parabolic shape of the block and the centrifugal force generated by the rotating movement of the air spread the flame against the cone wall and against that of the surrounding furnace transferring heat only radially to the refractory block.

## APPLICATIONS

- Annealing furnaces
- Melting basins in reverb
- Aluminum melting and holding furnaces
- Zinc melting furnaces.
- Bell furnaces.
- Pit furnaces.
- Billet heating furnaces

## CHARACTERISTICS

### GENERAL:

- |                               |                   |
|-------------------------------|-------------------|
| ■ Capacity:                   | from 90 to 1400kW |
| ■ Preheated air up to:        | 450°C             |
| ■ Air pressure to the burner: | 70mbar            |
| ■ Gas pressure to the burner: | 80mbar            |
| ■ Turn down:                  | 1 : 8             |
| ■ Maximum temperature used:   | 1400°C            |

### MATERIAL COMPOSITION:

- |                         |               |
|-------------------------|---------------|
| ■ Burner body:          | Cast iron G25 |
| ■ Plate:                | Cast iron G25 |
| ■ Gas tube:             | AISI304       |
| ■ Pre-heated air up to: | 450°C         |
| ■ Gas group:            | Class 1/2/3   |



F3500I03



F3500I04

## CAPACITY PARAMETERS AND FLAME LENGTH

The ignition of the ESW burners takes place via an electrode, whilst the detection is done via a UV-2 scanner. Neither of these elements are provided with the supply.

The adoption of flame control systems is highly recommended in all plants operating at temperatures below 750°C (UNI EN746-2 Norm).

Model	Capacity kW	Ignition	Detection
ESW-3	90	DSP	UV-2
ESW-4	180	DSP	UV-2
ESW-5	290	DSP	UV-2
ESW-6	350	DSP	UV-2
ESW-7	700	DSP	UV-2
ESW-8	1400	DSP	UV-2

The flame sizes are approximate and refer to a natural gas fed burner placed in open air, operating in stoichiometric ratio at nominal capacity. When two burner models are

assembled next to each other a minimum distance expected for the larger burner must be kept between them.

Model	Mx pilot mixture pressure with max air to the burner (mbar)	Max % excess air 70 mbar	Estimated flame diameter (mm) at maximum capacity		Minimum distances (stoichiometric combustion)	
			$\lambda = 1$	$\lambda = 0,75$	between burners (mm)	between burners and material (mm)
ESW-3	6,3	600	600	800	910	200
ESW-4	6,3	900	650	920	1000	300
ESW-5	7,5	700	750	1200	1150	300
ESW-6	8,7	540	900	1400	1400	350
ESW-7	15	700	1500	2300	1800	350
ESW-8	15	400	1800	-	2100	450

## DESCRIPTION



The ESW burners are suitable for those applications in which the flame does not have to be transferred axially inside the chamber. In this way the load that is inserted in front of the burner is preserved. They create a very high heat exchange between furnace and load due to the high flame turbulence of the flat flame and to its radiant component.

## BURNER PERFORMANCE

The air and gas flow capacities refer to a natural gas fed burner (8600Kcal/Nm<sup>3</sup>) placed inside the combu-

stion chamber at zero pressure above sea level and operating with 15% excess air.

- MIN/MAX (ON/OFF) Functioning
- Chamber temperature 1000°C
- Ambient air temperature 30°C

### MAXIMUM CAPACITY

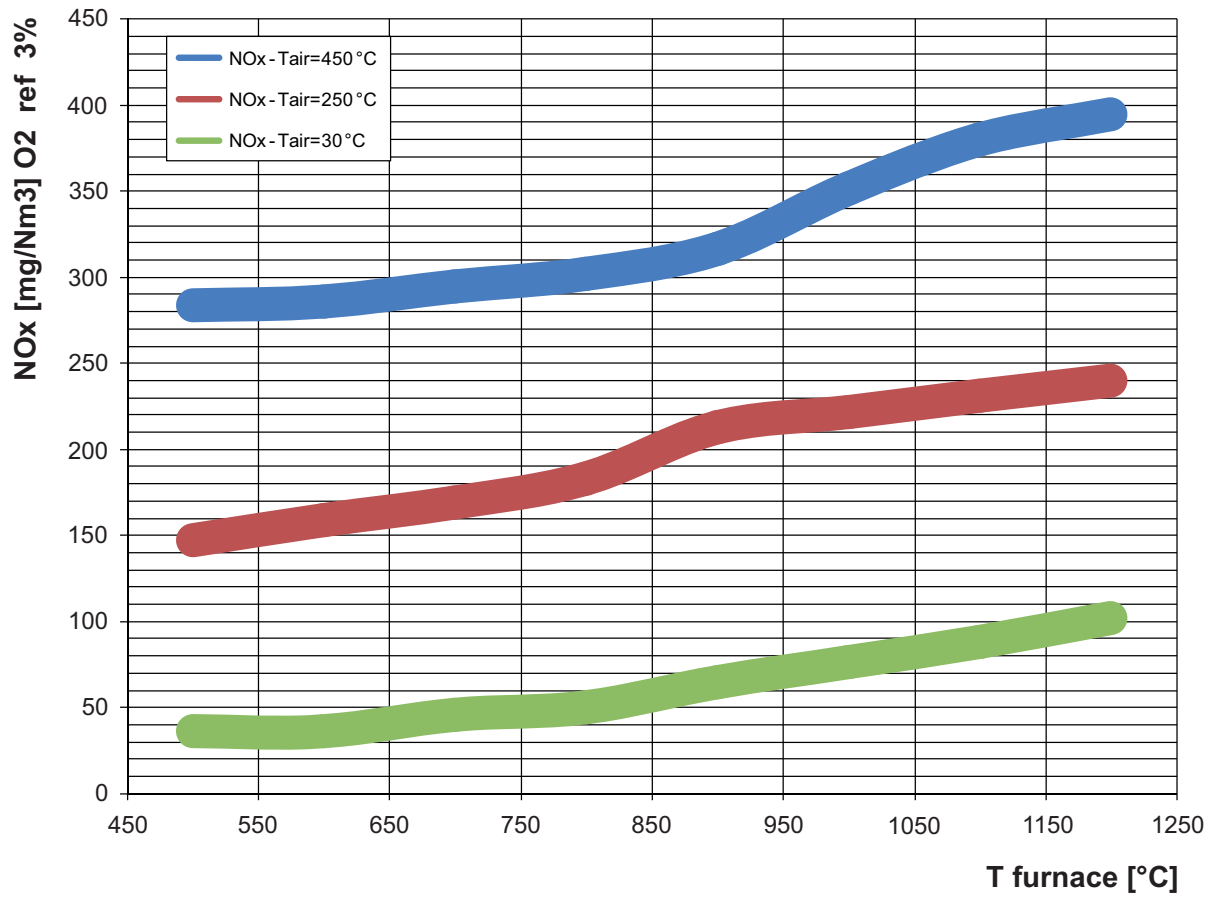
Parameter			Burner model					
			ESW-3	ESW-4	ESW-5	ESW-6	ESW-7	ESW-8
Max. capacity	Burner capacity (3% O <sub>2</sub> )	[kW]	90	180	290	350	700	1400
	Combustion air flow	[Nm <sup>3</sup> /h]	104	207	334	403	805	1610
	Gas flow	[Nm <sup>3</sup> /h]	9	18	29	35	70	140
	Burner inlet air pressure	[mbar]	70					
	Line inlet gas pressure	[mbar]	80					

### MINIMUM CAPACITY

Parameter			Burner model					
			ESW-3	ESW-4	ESW-5	ESW-6	ESW-7	ESW-8
Min. capacity	Burner capacity (2% O <sub>2</sub> )	[kW]	9	18	29	35	70	140
	Combustion air flow	[Nm <sup>3</sup> /h]	11	21	34	41	81	161
	Gas flow	[Nm <sup>3</sup> /h]	0.9	1.8	2.9	3.5	7	14
	Burner inlet air pressure	[mbar]	0.7					
	Line inlet gas pressure	[mbar]	80					

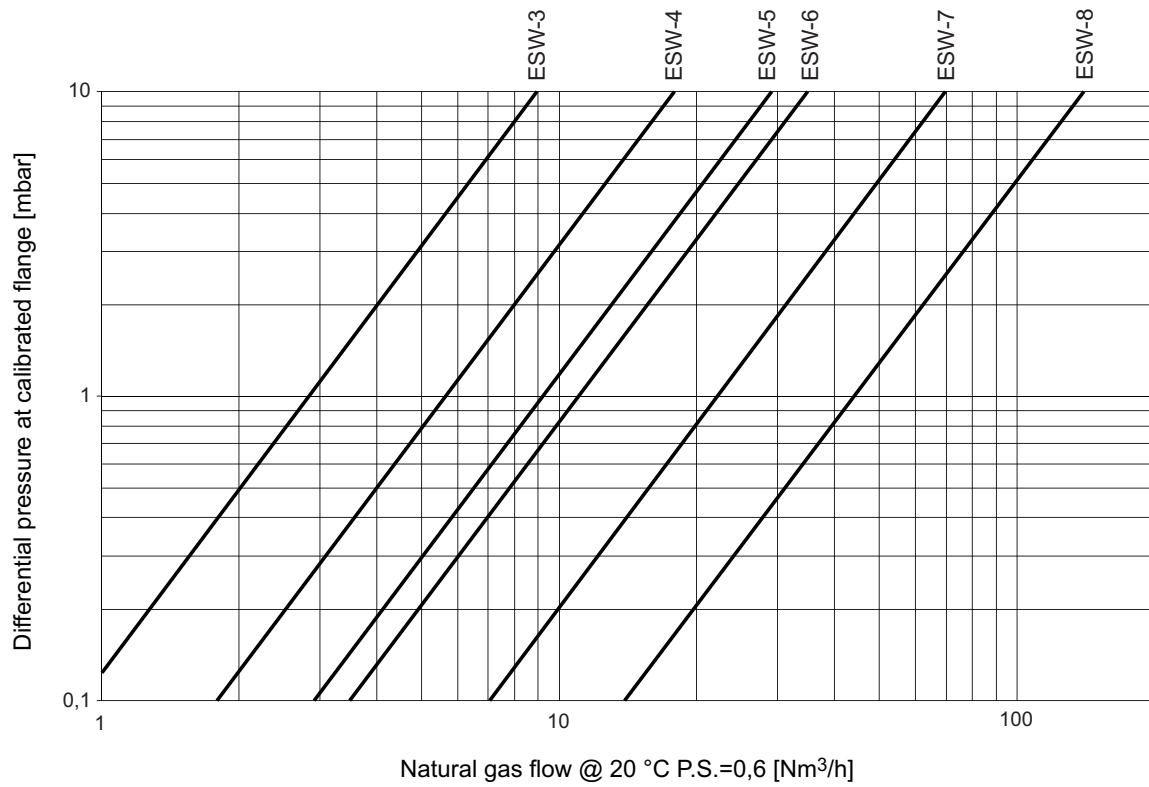


### NOx EMISSIONS TABLE



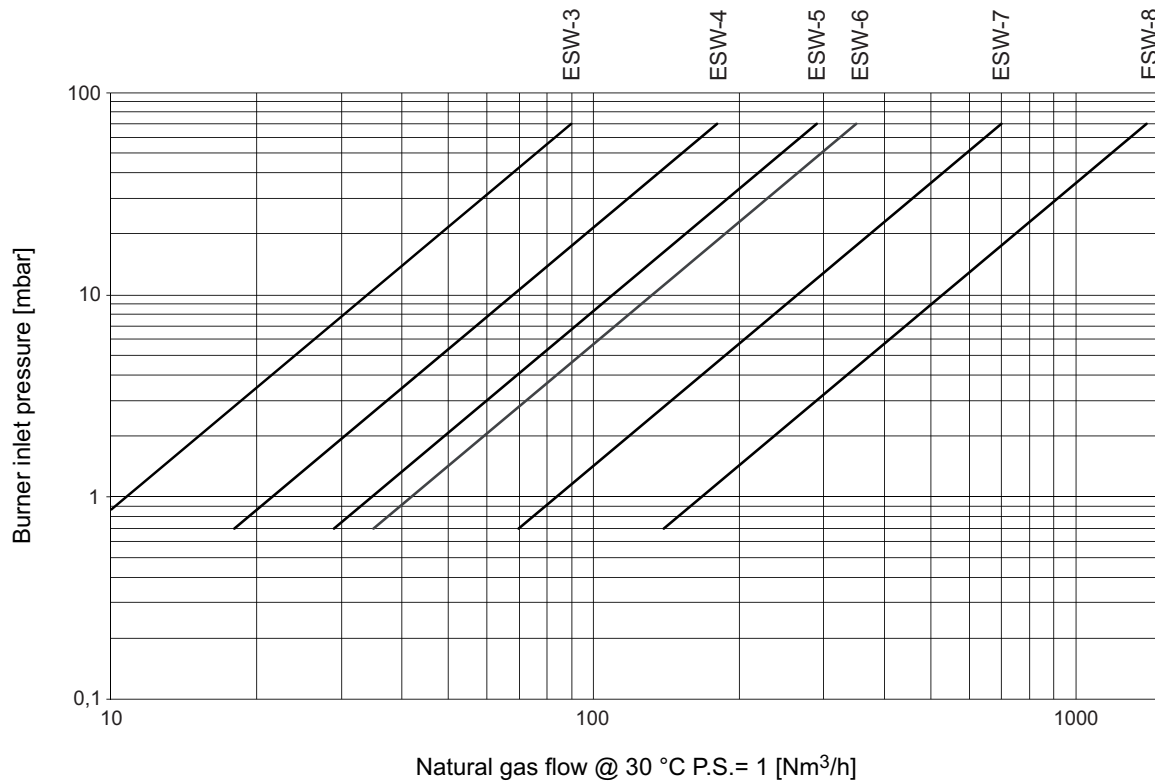
G3500I01

**METHANE GAS FLOW CHART - ESW**



G3500i01

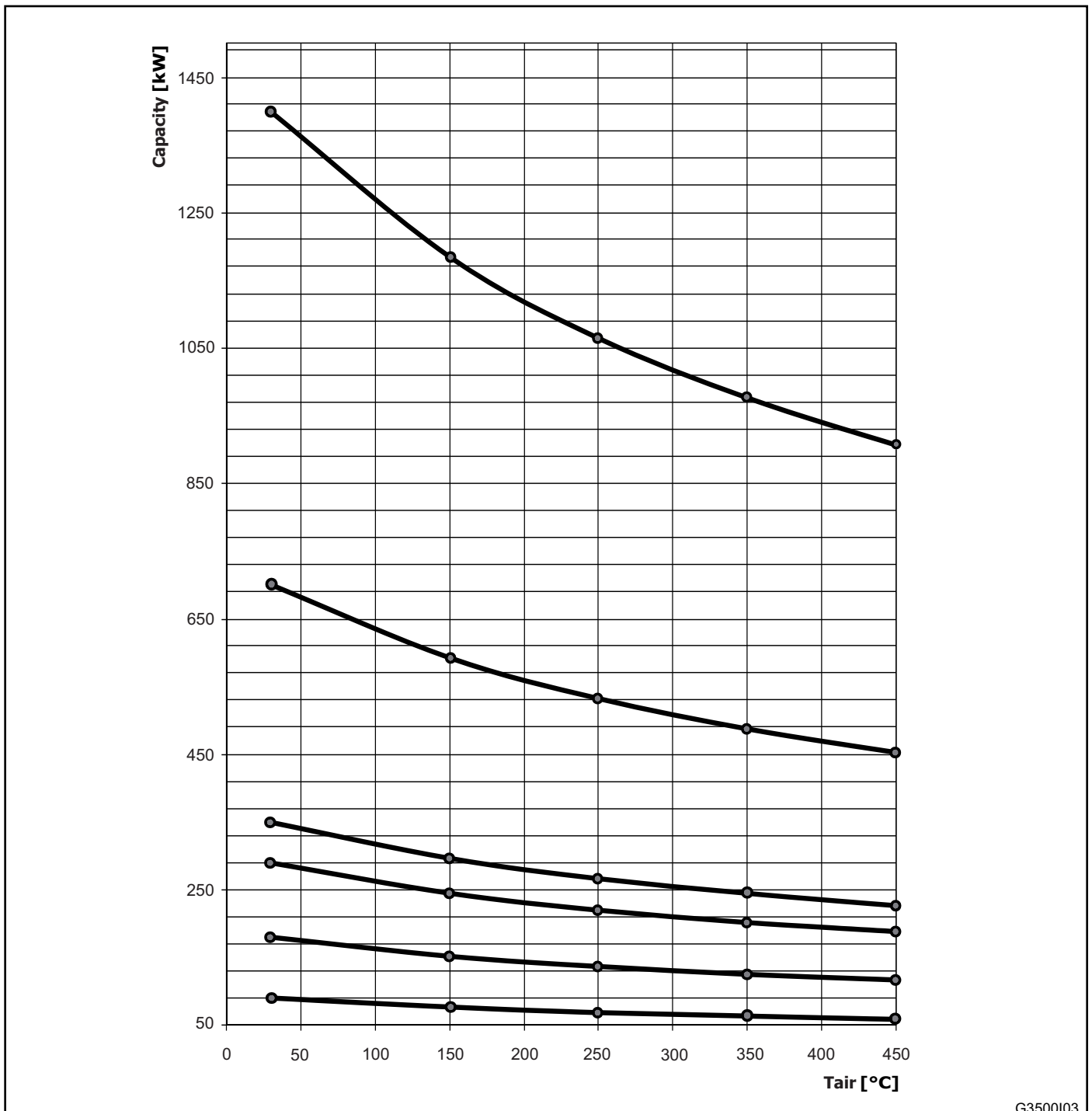
**AIR FLOW CHART - ESW**



G3500i02

**BURNER CAPACITY ACCORDING TO THE PREHEATED AIR TEMPERATURE**

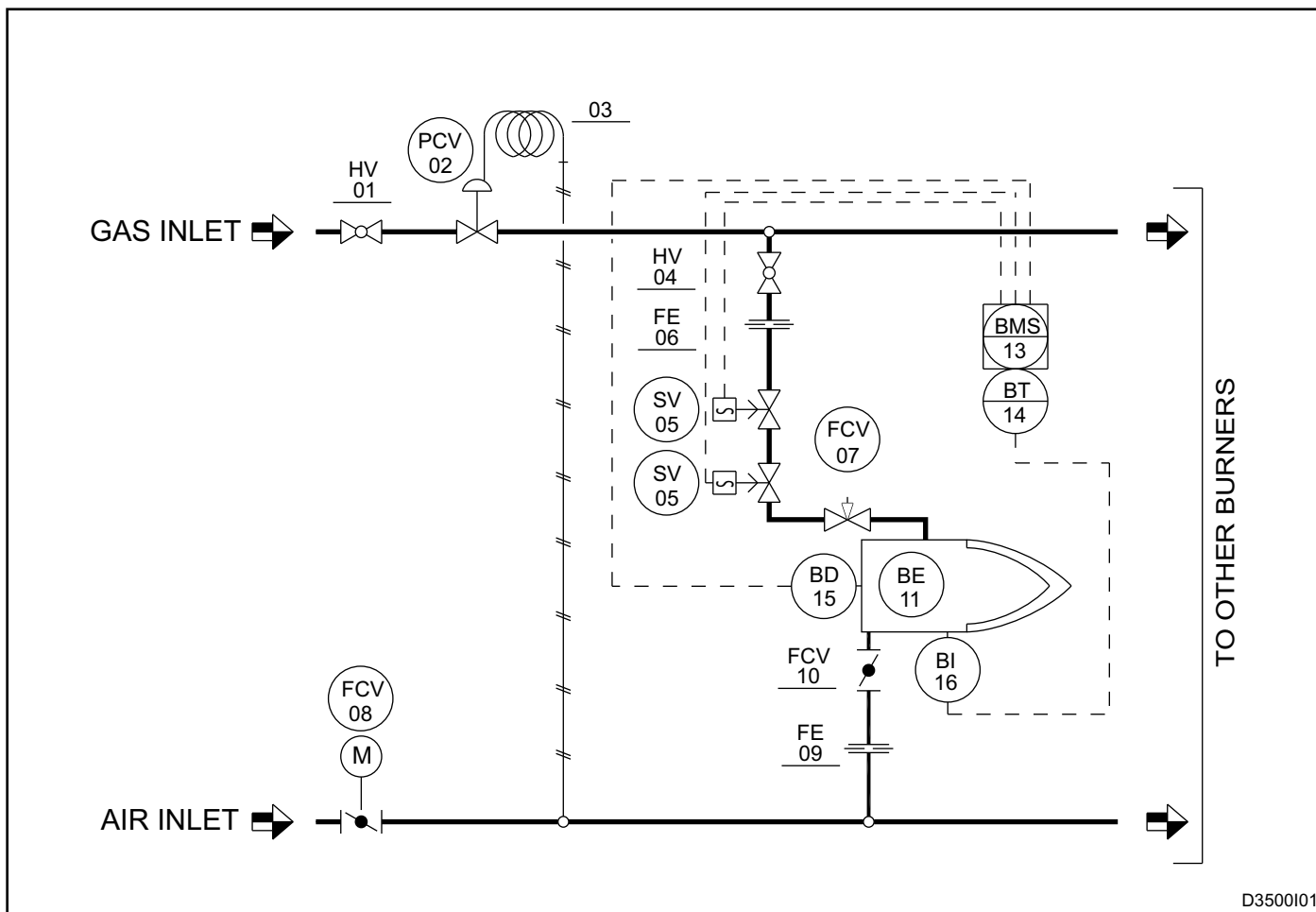
Tair [°]	Capacity [kW]					
	ESW-3	ESW-4	ESW-5	ESW-6	ESW-7	ESW-8
30	90	180	290	350	700	1400
150	76	152	245	296	592	1185
250	69	137	221	266	533	1066
350	63	126	202	244	488	976
450	58	117	188	227	453	906



G3500I03



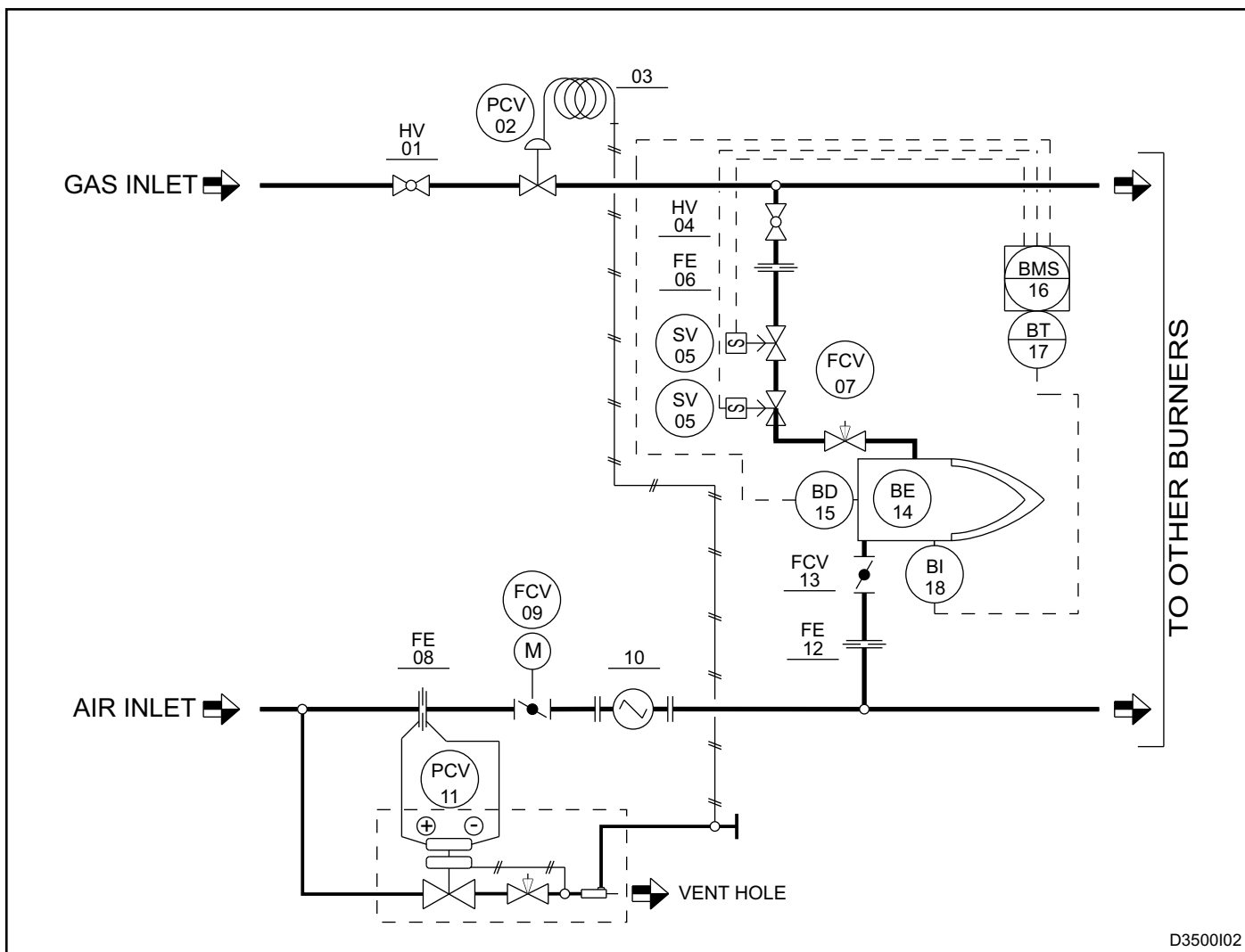
**APPLICATION EXAMPLE - ZONE REGULATION**



D3500101

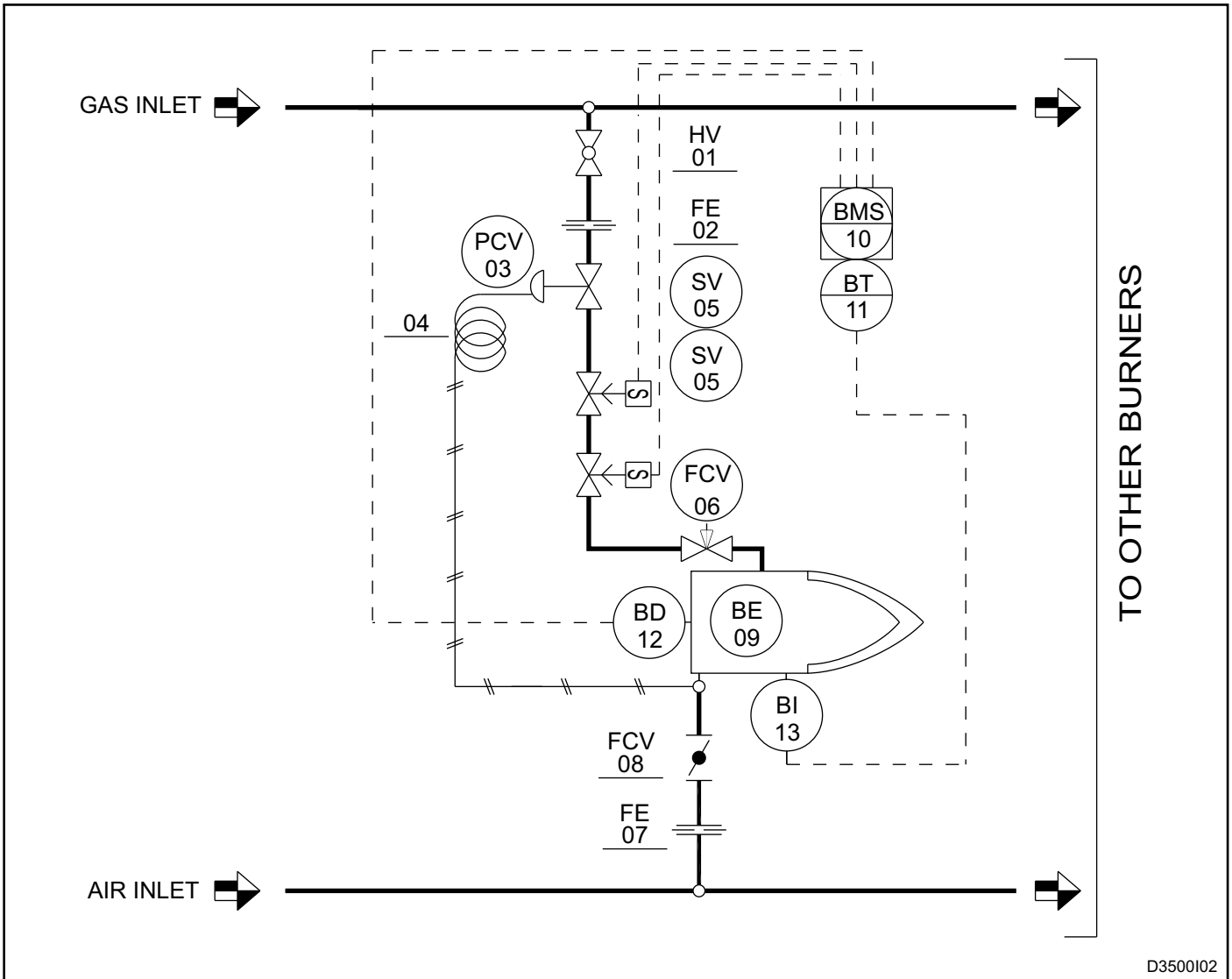
Pos.	Description	Included	Not Included
HV 01	General gas shut off valve		X
PCV 02	Zero governor		X
03	Impulse line		X
HV 04	Single gas interception valve		X
SV 05	Gas safety valve		X
FE 06	Gas calibrated flange		X
FCV 07	Gas adjuster		X
FCV 08	Zone air motorized valve		X
FE 09	Air calibrated flange		X
FCV 10	Manual air regulation valve		X
BE 11	Burner	X	
BMS 13	Flame control		X
BT 14	Ignition transformer		X
BD 15	Flame detetion		X
BI 16	Burner ignition		X

**APPLICATION EXAMPLE - FUNCTIONING WITH PREHEATED AIR AND ZONE REGULATION**



Pos.	Description	Included	Not Included
HV 01	General gas shut off valve		X
PCV 02	Zero governor		X
03	Impulse line		X
HV 04	Single gas interception valve		X
SV 05	Gas safety valve		X
FE06	Gas calibrated flange		X
FCV07	Gas adjuster	X	
FE 08	Air calibrated flange		X
FCV 09	Zone air motorized valve		X
10	Heat exchanger		X
PCV 11	Air/gas ratio regulator		X
FE 12	Single burner air calibrated flange		X
FCV 13	Manual air regulation valve		X
BE 14	Burner	X	
BMS 16	Flame control		X
BT 17	Ignition transformer		X
BD 18	Flame detection		X
BI 18	Burner ignition		X

**APPLICATION EXAMPLE - INDEPENDENT BURNER**



D3500102

Pos.	Description	Included	Not Included
HV 01	General gas shut off valve		X
FE 02	gas calibrated flange		X
PCV 03	Zero governor		X
04	Impulse line		X
SV 05	Gas safety valve		X
FCV 06	Gas adjuster	X	
FE 07	Air calibrated flange		X
FCV 08	Air regulation valve		X
BE 09	Burner	X	
BMS 10	Flame control		X
BT 11	Ignition transformer		X
BD 12	Flame detection		X
BI 13	Burner ignition		X

## WARNINGS

- The ESW series burners are intended to be used for fixed installations. If mobile installations are necessary (Bell furnaces etc) it is necessary to consider possible damage that the movement of the actual furnace could cause.
- Burner ignition must always be carried out at minimum power modulation towards the maximum, facilitating ignition and reducing outlet over pressure.
- The passing from minimum to maximum power and vice versa must be gradual and not instantaneous.
- For all the low temperature applications (up to 750°C) burner ignition and the fuel gas solenoid valve command must be carried out via a certified burner control device.
- The use of flexible joints is always necessary in the presence of preheated air.
- To avoid damage to the burners, make sure that the blower does not send them air that is polluted by combustion products, oils, solvents or other substances. To avoid this from happening, possibly install the blower of the suction duct outside the establishment and far from the exhaust ducts.
- Check the correct connection of the feeding lines after installation. Before switching on the burner, check the correct pressure values of the combustion air and fuel gas.
- The burner can only operate within the indicated power range. Operation with excessive power could compromise the burner performance and lifespan. In this case the general warranty conditions will automatically expire and ESA-PYRONICS will not be held responsible for any possible damage to persons and objects,
- If there is trouble with other devices during the burner start up phase, use the connector with anti disturbance filter for the high-tension (HT) cable connection of the ignition electrode.
- If using preheated air flame detection via a UV-HT probe is preferable (high temperature version).
- Avoid burner ignition close to each other so as not to heat the ignition command system devices (solenoid valves and transformers). Prewash time lapse + first safety time lapse + min. of 5 sec. = time lapse between one ignition and another. (however, do not attempt more than 2 ignitions during a 30sec. time lapse).
- Make sure the power supply is TURNED OFF when intervening on the burner and its devices. In case of burner malfunctioning, follow the indications in the 'Maintenance' chapter of the present manual or contact ESA-PYRONICS assistance.
- Any modification or repair done by third parties can compromise the application safety and automatically cause the general warranty conditions to expire.

## INSTALLATION

The ESW series may be installed in any position. Wall mounting flanges are available to fasten the block holder to the furnace shell. Lifting eye-bolt hangers are available for furnace roof suspension installations.

The inside flared face of the refractory block must be flush with the interior furnace wall. The furnace refractory should be set to leave free space on all sides of the block. This space should be packed with flexible, refractory, ceramic fiber protected by 20 mm of refractory concrete on all sides to allow for expansion of the walls.

Flexible connectors are recommended for air and gas connections at the burner to allow slight movement or misalignment of piping and are required when pre-heated air is involved. Air and gas connections are threaded or welded flanges as Pyronics' standard. They may rotate at 90°.

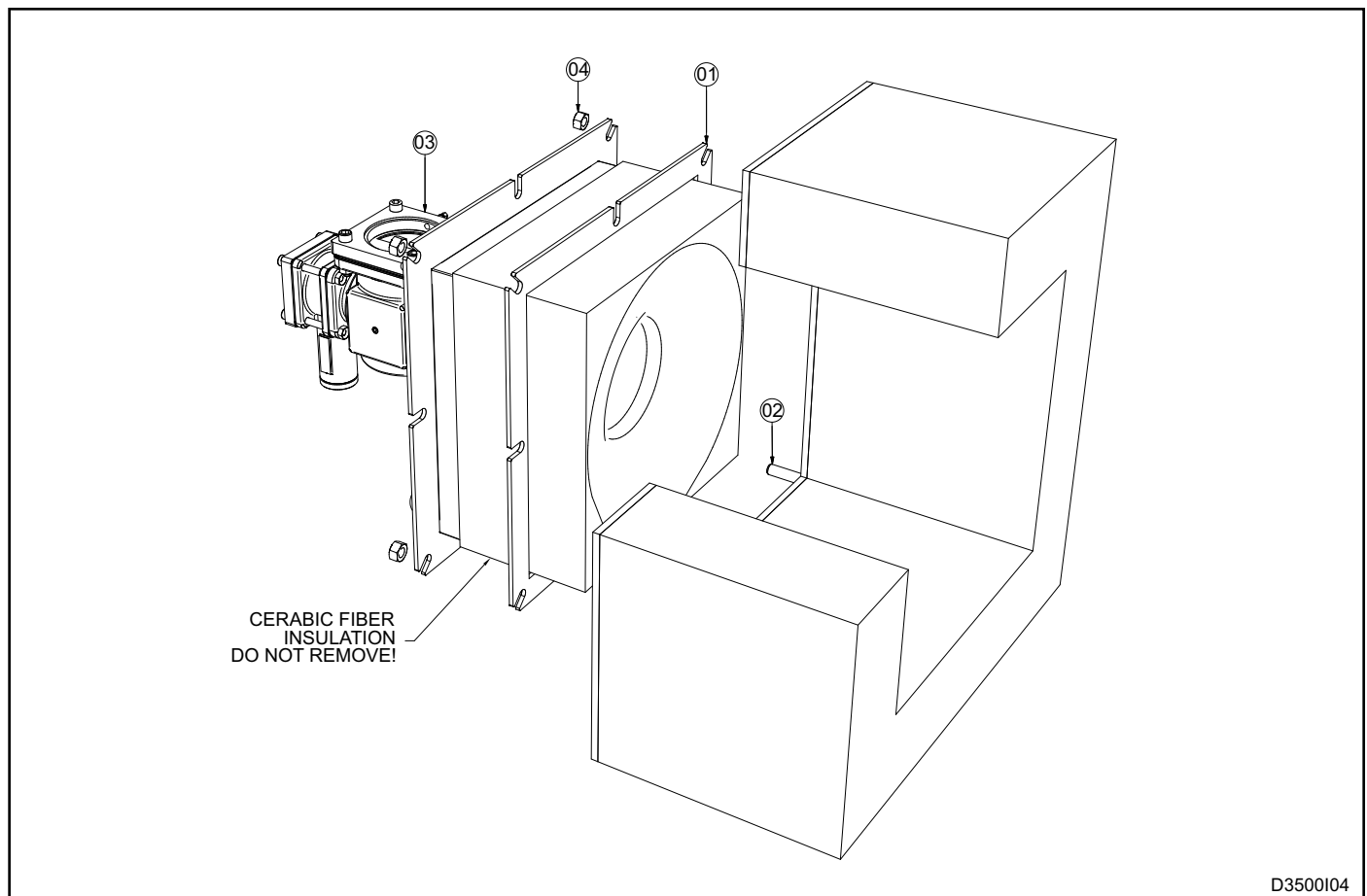
For installation carefully follow the instructions:

- 1** - insert the burner body gasket on the furnace wall (**pos.01**).
- 2** - lift the burner (**pos.03**) and fix it to the studs (**pos.02**),

checking that the gasket (**pos.01**) has not moved and is not deformed.

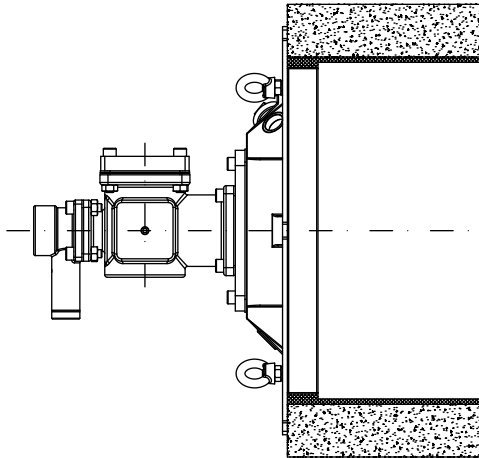
- 3** - tighten the fixing bolts (**pos.04**).
- 4** - connect the air and gas lines to the burner via the welded or threaded flanges.
- 5** - heat up the furnace following the specific drying curves of the refractory material.
- 6** - once the maximum operating temperature is reached, fasten the mounting nuts permanently.
- 7** - After the first heat up, immediately repair any cracks or damage. Generally the furnace walls surrounding the burner should be checked regularly and all cracks must be repaired or patched up. This avoids hot gas from leaking through the cracks and damaging the metallic parts of the furnace and burner.

- 8** - The burner housing must consist of suitable burner supports to avoid possible subsidence of the refractory block. The refractory block must not protrude from the wall. If it does, use special spacers to draw it back in line with the internal furnace wall.

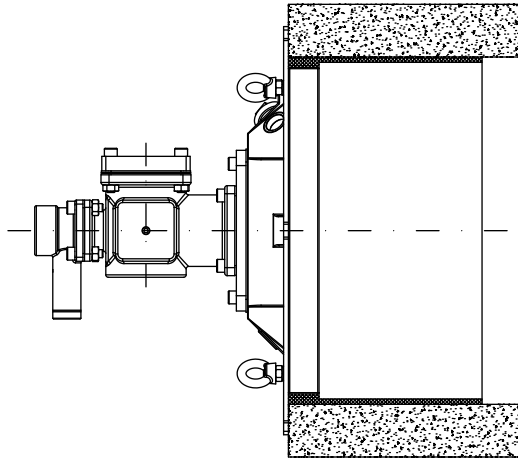


## FURNACE WALL RISER BOARD

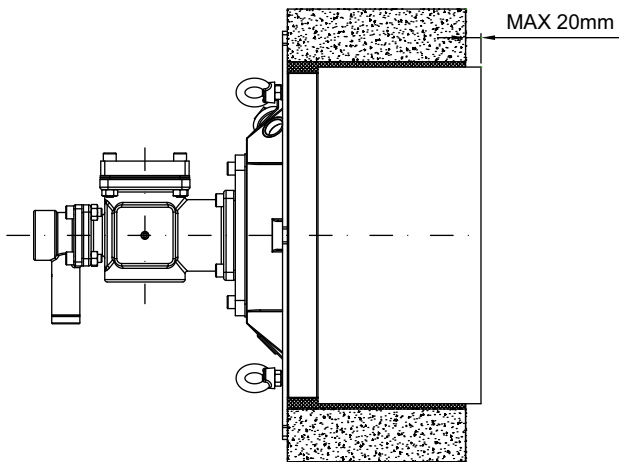
PROPER INSTALLATION



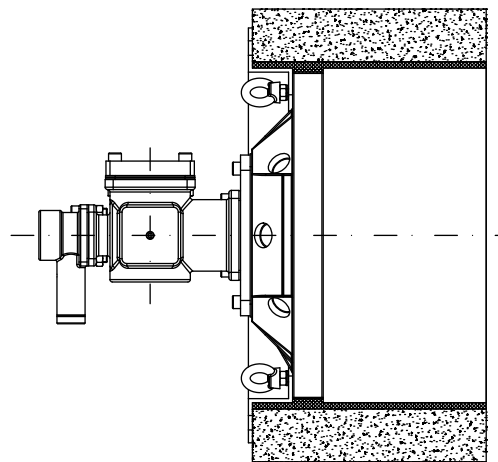
WRONG INSTALLATION



PROPER INSTALLATION



PROPER INSTALLATION  
WITH SPACER



D3400105

## POWER - SETTING

The operations indicated in the following chapter must be carried out by expert technicians. Failure to follow instructions may cause dangerous conditions.

**1** - Check that the combustion air pressure exiting the blower and the fuel gas feeding pressure are within the admitted range.

**2** - Regulate the working pressures and the safety device intervention pressures of the combustion plant, whether there is one per burner or one general device for the combustion plant such as: gas pressure regulator, shut off valve, relief valve, pressure switches etc. Simulate the intervention of all the safety devices, including the intervention of the high temperature safety, checking that the fuel shut off devices act correctly.

**3** - Place the motorized air regulation valve in the maximum opening position and regulate the burner inlet pressure according to the indications in the "Burner Performance" chapter.

**4** - Place the motorized air regulation valve in the minimum opening position and regulate its opening to obtain (on the burner and ejector inlet) the minimum power pressure.

**5** - Screw on the burner control device and attempt ignition. During the ignition attempt, act on the gas regulation valve and starting from the totally closed position, open it gradually until reaching main burner ignition.

**6** - Place the motorized air regulation valve at maximum opening and regulate, via the gas regulation valve, the maximum fuel capacity. Check the differential pressure created on the gas flange.

**7** - Double check that at minimum and maximum power, the burner inlet air pressure corresponds to what is indicated in the "Burner Performance" chapter. The values with the burner running may differ from those with the burner off.

**8** - If necessary with all the burners running at the same power, analyze the combustion products in the chamber (where possible).

**9** - Attempt ignition at minimum burner power, with maximum temperature range to check the ignition reliability and the flame stability during regulation.



### GENERAL MAINTENANCE PLAN

Operation	Type	Advised time	Notes
High voltage pilot burner electrode connector	O	anual	check the outer plastic integrity and oxidation of the internal connector and the terminal electrode
Pilot burner ignition electrode	O	anual	replace in case the Kanthal terminal is worn
Refractory block integrity	E	every six months	each time the furnace is stopped for maintenance, from the inside check that there are no cracks in the refractory material. Any crack should be filled with special refractory material or sealant.
Cleaning of photocell glass	O	every six months	reduce to every three months in dusty environments.
Replacement of the photocell	O	10.000 h. of operation	in any case, every two years
Replacement of gaskets on gas side (*)	O	every two years	see note
Burner setting	O	anual	repeat all the steps in the "Ignition and setting".

**NOTES**

Key: O = ordinary / E = extraordinary

(\*) We advise you to replace the gaskets on the gas side every time the gas feeding line is disassembled and use high temperature gaskets.

## ORDINARY MAINTENANCE

For correct mounting and better maintenance of the ESW burners, carefully follow the instructions below with the plant off.

### CLEANING OF PHOTOCELL GLASS

- 1 - Make sure the burner control device is not connected.
- 2 - Disconnect power supply to the photocell (**pos. 01**) and the cooling line (where present **pos. 07**).
- 3 - Unscrew the aluminum pipe fitting (**pos. 06**) at the base of the gas collector, removing the photocell with its

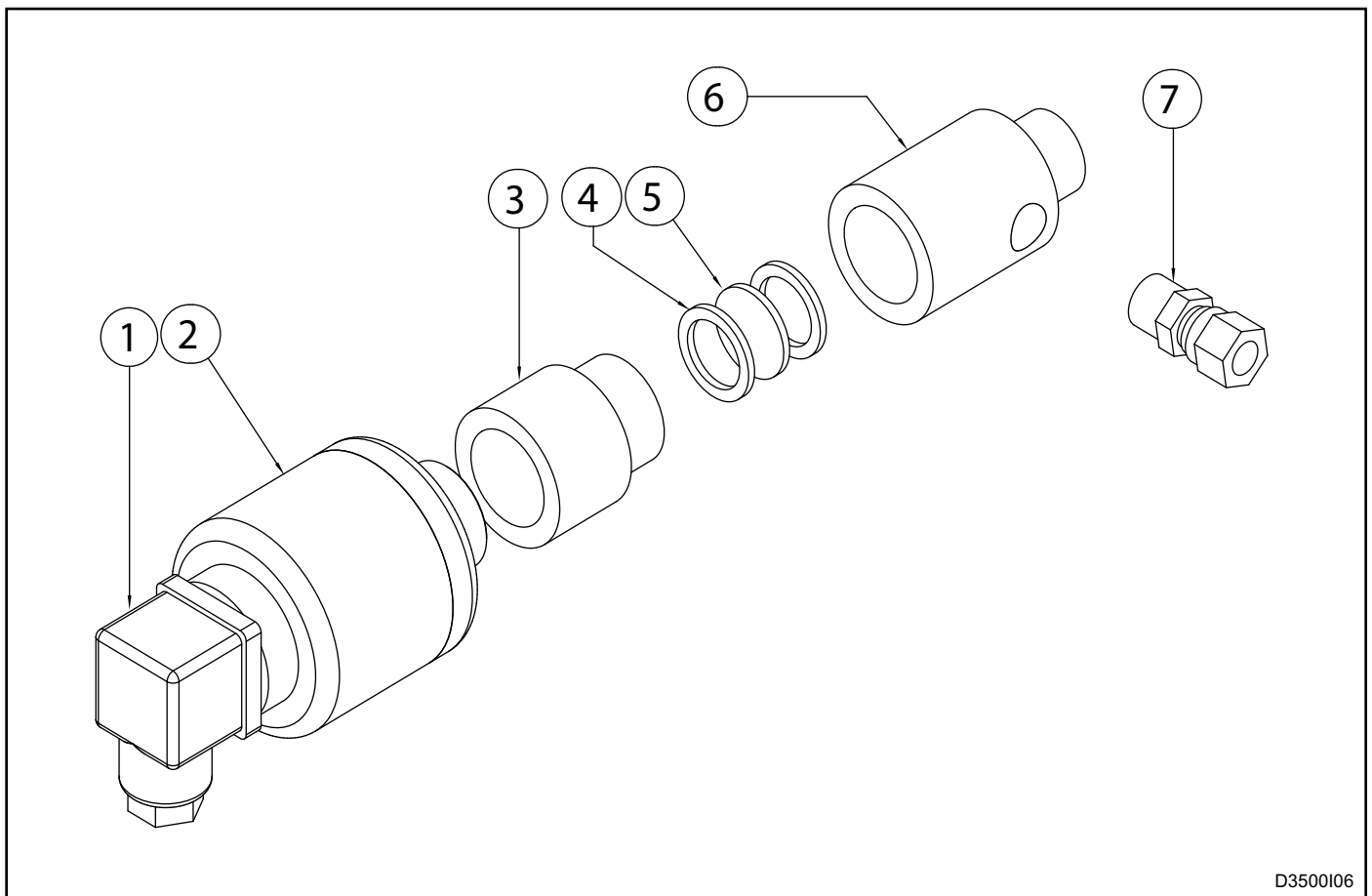
spacer.

**4** - Unscrew the aluminum pipe fitting from the insulation teflon connector (**pos. 03**) and pull out the quartz watch glass (**pos. 05**).

**5** - Clean the quartz watch glass with a soft cloth and reassemble everything, taking care to check the correct position of the watch glass and gaskets (**pos. 04**) between the aluminum and teflon spacer, before tightening.

**6** - Restore the cooling hoses and electrical connection.

**7** - Check the correct flame detection of the uv-scanner.



D3500I06

## EXTRAORDINARY MAINTENANCE

For correct dismantling and better maintenance of the ESW burners, meticulously follow the instructions below with the plant turned off.

### BURNER IN LOCKOUT

**In burner lockout conditions refer to the instructions of the burner control device and the relative manual to identify the cause. The following are the main cases:**

■ **Illegal flame detection:** Lockout due to the detection of an illegal flame signal during the phases prior to ignition or after shut down. The causes can be found in the detection system (broken probe or presence of humidity), or in the leakage of gas from the gas safety solenoid valve that allows the burner to remain on.

■ **Failed ignition:** Lockout due to the missing flame formation during start up. The causes can be found in the ignition system (no spark, broken or badly positioned electrodes), in bad regulation of the flow of fuel and combustion agents or in the detection system (broken probe or interrupted cables). Specifically, in the first two cases

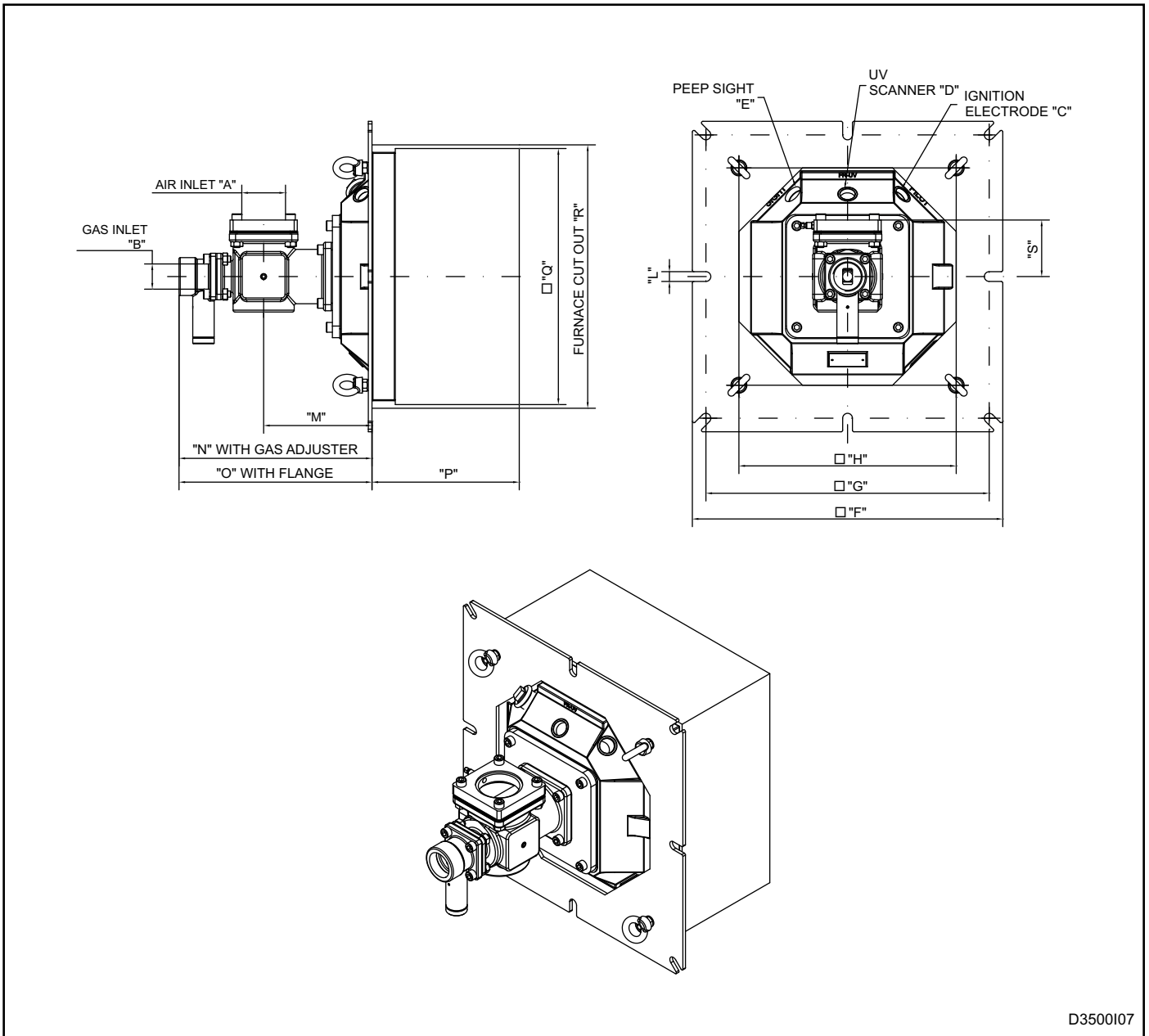
the flame does not ignite, while in the last case the flame forms but the burner control device is not able to detect it.

■ **Flame signal loss:** Lockout is due to the loss of the flame signal during normal burner operation. The causes can be found in the regulation of the flow of the fuel and combustion agent (rapid flow variation, regulation out of admitted range) or in the detection system (broken, dirty or badly positioned probes).

### PHOTOCELL REPLACEMENT

- 1 - Make sure the burner control device is not connected.
- 2 - Disconnect power supply to the photocell (**pos. 01**) and the cooling line (where present).
- 3 - Unscrew the aluminum pipe fitting at the base of the gas collector (**pos. 02**), removing the photocell with its spacer.
- 4 - Screw the new component in the same position after checking the correct position of the insulating glass between the aluminum and teflon spacer.
- 5 - Restore the cooling pipe and the electrical connection.
- 6 - Check the correct flame detection by the photocell.

**OVERALL DIMENSIONS - ESW**



D3500107

Burner Model	Air inlet "A"	Air inlet "B"	"C"	"D"	"E"	"F"	"G"	"H"	"L"	"M"	"N"	"O"	"P"	"Q"	"R"	Mass [Kg]
ESW-3	G 1.1/2"	G 1"	G 3/4"	G 3/4"	G 3/4"	430	400	286	16	151	253	226	241	343	355	88
ESW-4	G 2"	G 1"	G 3/4"	G 3/4"	G 3/4"	430	400	286	16	164	274	247	241	343	355	85
ESW-5	DN65	G 1.1/2"	G 3/4"	G 3/4"	G 3/4"	508	464	356	16	171	310	280	247	419	432	136
ESW-6	DN80	G 1.1/2"	G 3/4"	G 3/4"	G 3/4"	508	464	356	16	171	310	280	247	419	432	136
ESW-7	DN100	DN65	G 1"	G 1"	G 1"	508	464	356	16	188	371	309	247	419	432	142
ESW-8	DN150	DN80	G 1"	G 1"	G 1"	610	566	406	16	208	448	-	241	533	545	250

**ORDERING CODE - COMPLETE BURNER**

ESW -  -  -  -  -  -  -   
01 02 03 04 05 06

Model		01
ESW-3	3	
ESW-4	4	
ESW-5	5	
... (see capacity table)	.....	

Gas adjuster		02
With gas adjuster	GA*	
Without gas adjuster	F	

Fuel		03
Methane	CH4 *	
LPG	GPL	
Poor gas (1)	GP	

04 Ignition	
Electrode	E*
Pilot	P
Without ignition	NI

05 Flame detection	
UV flame detection	UV*
Without flame detection	ND

06 Flange Type	
according to ESA dwg	E*
according to Client dwg	C

The initials with an (\*) indicate the ESA standard product

Notes:

<sup>1</sup> Particular performance carried out according to gas characteristics