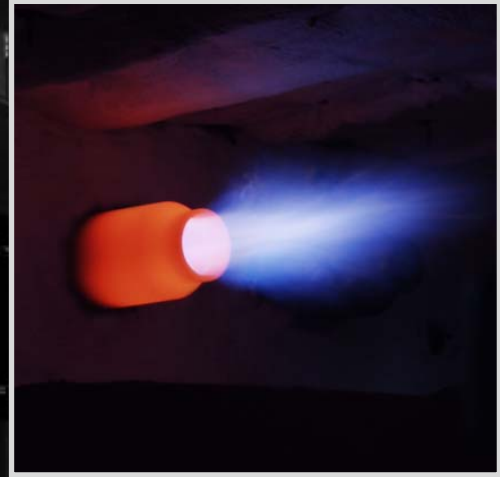


## Burners



High velocity burners with  
flame tube in SiC

EMB-SIK (E3506 rev. 11 - 21/02/2011)



## 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** website.

## CERTIFICATIONS:



### EN746-2

The products manufactured by ESA-PYRONICS have been created in conformity to the **UNI EN 746-2** Norms: Equipment for industrial thermal process - Part 2: Safety requirements for combustion and the movement and treatment of combustible elements. This norm is in harmony with the Machine Directive **98/37/CE**. It is certified that the products in question respect all the requirements prescribed by the above mentioned Norms and Directives. These have been designed, produced, controlled and tested in accordance to the company's internal procedures for quality control, certified in conformity with the **UNI EN ISO 9001** Norm by DNV Italia s.r.l.



The products conform to the Russian market requirements according to the **GOST** and **GOSGORTEKHNAZDOR** certification.

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**marketing@pyronics.be**

**www.esapyronics.com**

The EMB-SIK burners are gas burners used for direct heating. The shape of the silicon carbide flame tube produces a tense flame that allows high heat penetration and better temperature uniformity inside the combustion chamber, due to the high velocity of the combustion products.

Depending on the size and use, this type of burner can be used for natural gas or LPG combustion (in the standard version), and other types of gaseous combustive agents with different heating properties (special versions on request).

## APPLICATIONS

- Fibre cover treatment furnaces.
- Tunnel or chariot furnaces.
- Treatment furnaces.
- Stretching furnaces.
- Ceramic furnaces.

## CHARACTERISTICS

### GENERAL:

- Capacity: from 30 to 900 kW
- Maximum Temperature: 1.300°C
- Air and gas pressure to burner: 45mbar
- Flow ratio: 8 : 1
- Flame speed: from 50 m/s to 120 m/s
- Low CO e NOx content
- Excess air: upto 400%

### MATERIAL COMPOSITION:

- Burner body: cast iron G25
- Gas collector: cast iron G25
- Flame tube: SiC
- Combustion head: AISI310
- Fixing flange: Fe360



F3506I03



F3506I04

## IGNITION AND DETECTION

The EMB-SIK burner flame ignition and detection takes place via the use of two separate electrodes: both are included with the supply. The adoption of a flame control

system is **highly recommended** in all plants operating at temperatures lower than 750°C (UNI EN746/2 Regulation).

Model	Electrode ignition	
	Lighter	Detector
EMB-0-SIK	WAND	WAND
EMB-1-SIK	WAND	WAND
EMB-2-SIK	WAND	WAND
EMB-3-SIK	3EN / IS-4	3EN / IS-4
EMB-4-SIK	3EN / IS-4	3EN / IS-4
EMB-5-SIK	3EN / IS-4	3EN / IS-4
EMB-6-SIK	3EN / IS-4	3EN / IS-4
EMB-7-SIK	3EN / IS-4	3EN / IS-4

## PARAMETER CAPACITY AND FLAME LENGTH

The flame lengths and velocities are approximate, and refer to burners fed by natural gas that are placed in open air and function in stoichiometric ratio at nominal capacity. In special applications, mono-electrodes for ignition

and detection are used or else an electrode for flame ignition and a UV photocel for the flame detection is used.

Model	Flame type (*)	Capacity [kW]	Flame length [mm]	Flame tube outlet diameter [mm]	Combsution gas outlet speed @1500°C [m/s]						
					at 0m	at 0,5m	at 1m	at 1,5m	at 2m	at 2,5m	at 3m
EMB-0-SIK	H0	20	150 ÷ 300	19	140	118	65	47	36	28	23
EMB-1-SIK	M1	30	200 ÷ 400	30	80	30	13	9	7	6	5
EMB-2-SIK	L2	80	400 ÷ 600	60	55	35	18	13	9	7,5	6
	M2			50	80	45	22	15	11	9	7,5
	H2			40	120	55	28	18	14	11	10
EMB-3-SIK	L3	150	600 ÷ 900	85	50	45	23	16	12	10	8
	M3			70	80	55	30	20	15	12	10
	H3			57	120	66	35	24	18	15	12
EMB-4-SIK	M4	300	900 ÷ 1200	85	95	70	45	30	23	18	16
	H4			70	150	105	55	38	29	23	20
EMB-5-SIK	H5	400	1200 ÷ 1500	85	140	115	62	42	32	26	22
EMB-6-SIK	H6	600	1500 ÷ 1800	120	105	85	62	45	35	26	22
EMB-7-SIK	H7	900	1800 ÷ 2000	140	115	70	38	27	20	18	15

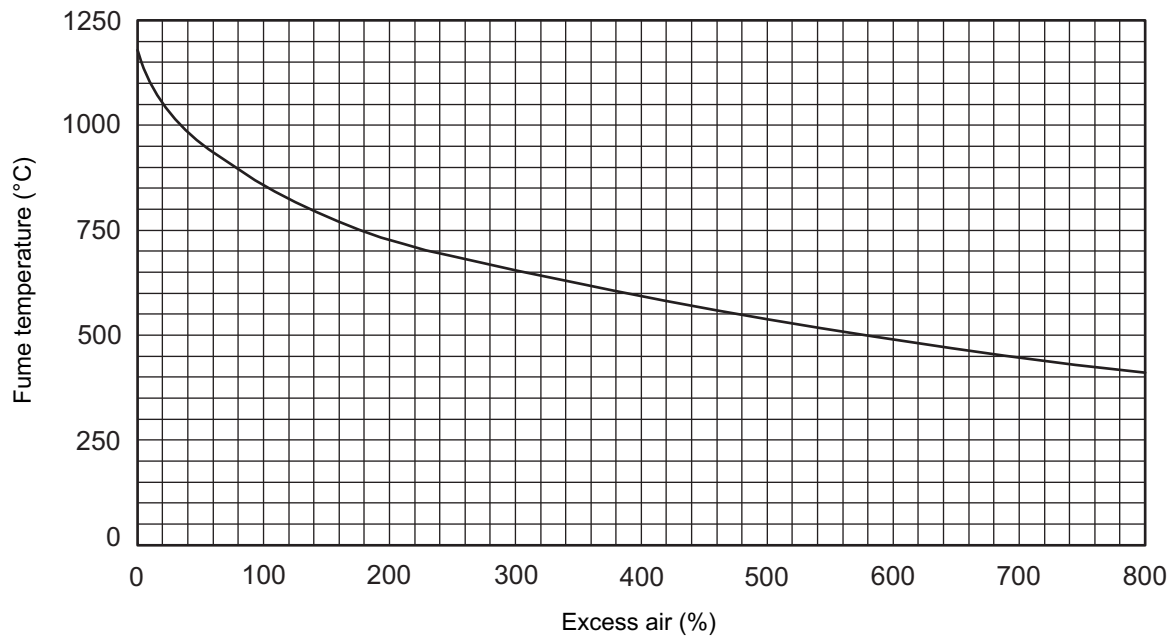
(\*)

L: low flame tube (V<60 m/s)

M: medium flame tube (60<V<90 m/s)

H: high flame tube (V>90 m/s)

## EXCESS AIR AND FUME TEMPERATURE GRAPH

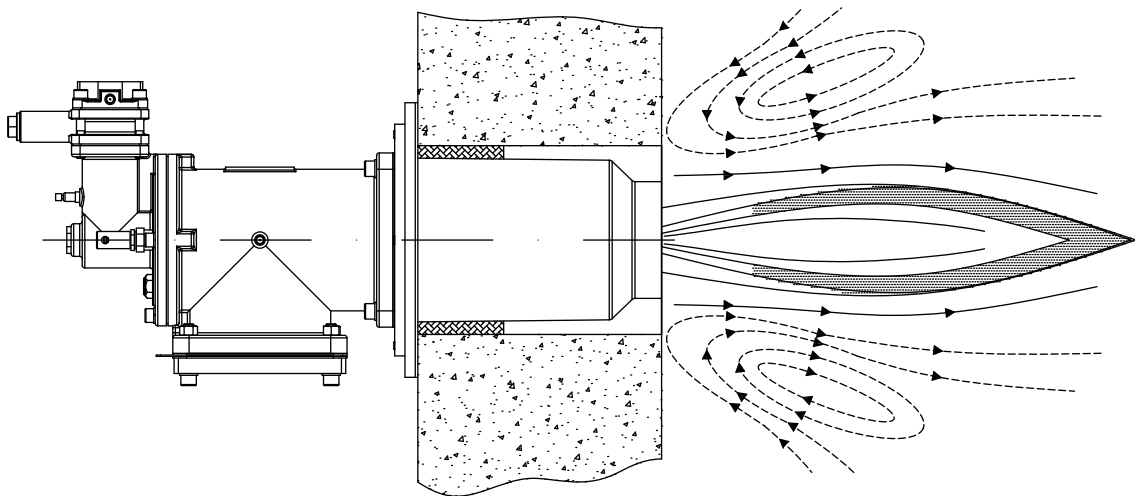


D3400DFI01

## DESCRIPTION

The EMB-SIK burners are “nozzle mix” type burners. The fuel and combustion agents are mixed at the combustion head to avoid dangerous flame flashbacks. Furthermore, the special shape of the combustion head allows regulation in stoichiometric, oxidant or reducing ratio. The EMB-

SIK burners develop the maximum capacity in stoichiometric ratio with 45mbar of air pressure; the setting is thus simplified by special absolute and differential pressure plugs that allow the measurement of air and gas flow.



D3506I01

## BURNER PERFORMANCE

The flame capacity, length and speed refer to a natural gas fed burner (8600 Kcal/Nm<sup>3</sup>), placed in a com-

bustion chamber at zero pressure above sea level, functioning with 10% excess air.

- Functioning MIN/MAX (ON/OFF)
- Chamber temperature 1000°C
- Room air temperature
- NO<sub>x</sub> < 180 mg/Nm<sup>3</sup> [O<sub>2</sub> = 3% ref.]

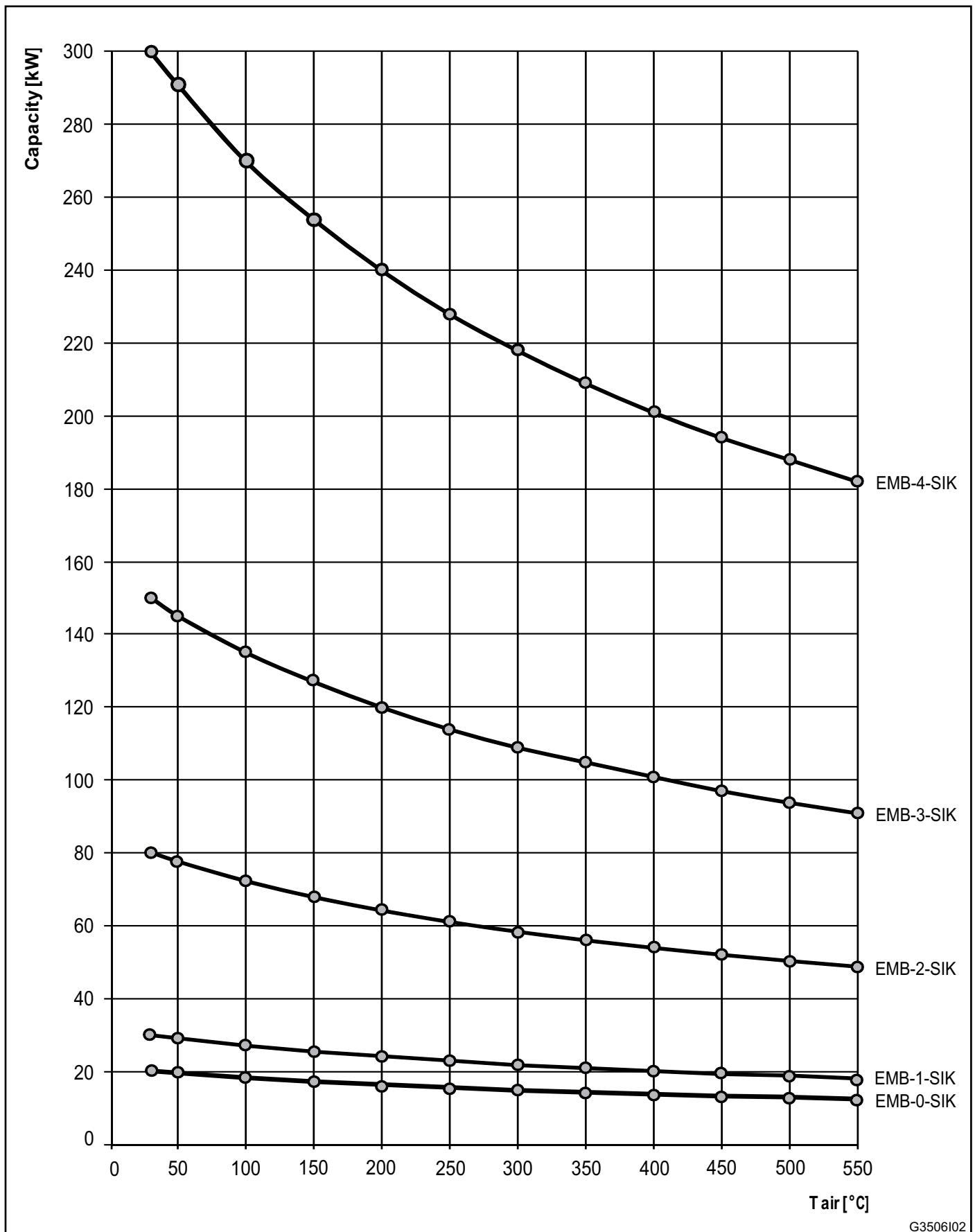
### MAXIMUM CAPACITY

Free flame application			Burner model							
			EMB-0-SIK	EMB-1-SIK	EMB-2-SIK	EMB-3-SIK	EMB-4-SIK	EMB-5-SIK	EMB-6-SIK	EMB-7-SIK
Max. capacity	Burner capacity (2% O <sub>2</sub> )	[kW]	20	30	80	150	300	400	600	900
	Combustion air flow	[Nm <sup>3</sup> /h]	22	33	88	165	330	440	660	990
	Gas flow	[Nm <sup>3</sup> /h]	2	3	8	15	30	40	60	90
	Burner air inlet pressure	[mbar]	45							
	Δp flange gas measurement	[mbar]	10							

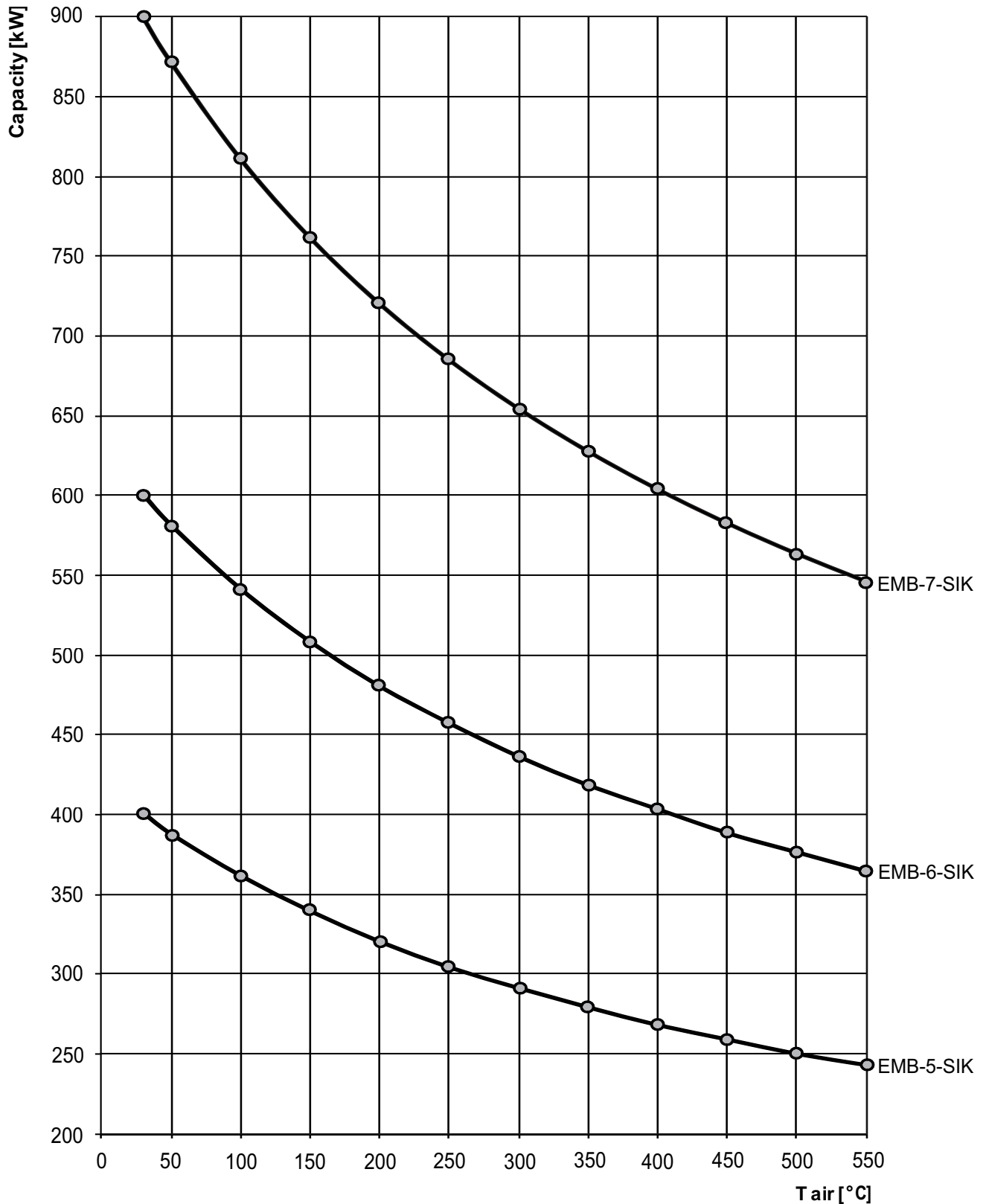
### MINIMUM CAPACITY

Free flame application			Burner model							
			EMB-0-SIK	EMB-1-SIK	EMB-2-SIK	EMB-3-SIK	EMB-4-SIK	EMB-5-SIK	EMB-6-SIK	EMB-7-SIK
Min. capacity	Burner capacity (2% O <sub>2</sub> )	[kW]	2,5	3,75	10	19	38	50	75	112
	Combustion air flow	[Nm <sup>3</sup> /h]	2,8	4,2	11	21	42	55	83	123
	Gas flow	[Nm <sup>3</sup> /h]	0,25	0,38	1	1,9	3,8	5	7,5	11,2
	Burner air inlet pressure	[mbar]	0,7							
	Δp flange gas measurement	[mbar]	0,2							

## BURNER CAPACITY DEPENDING ON PREHEATED AIR TEMPERATURE



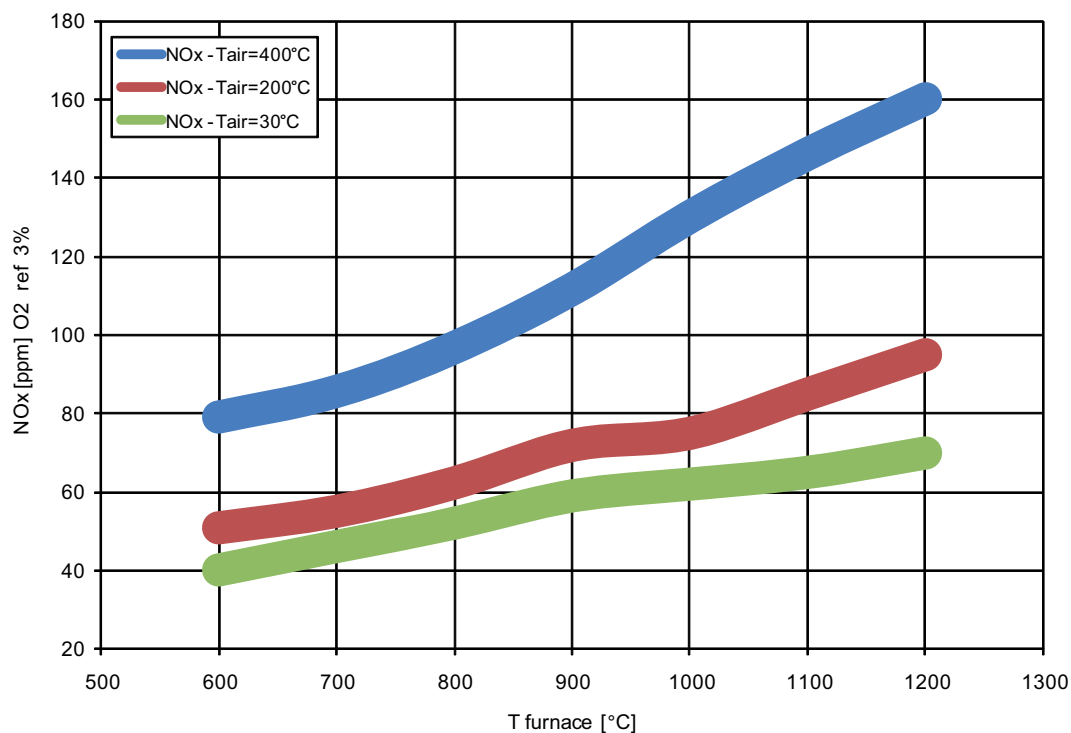
## BURNER CAPACITY DEPENDING ON PREHEATED AIR TEMPERATURE



G3506I03



## NO<sub>x</sub> EMISSION TABLE



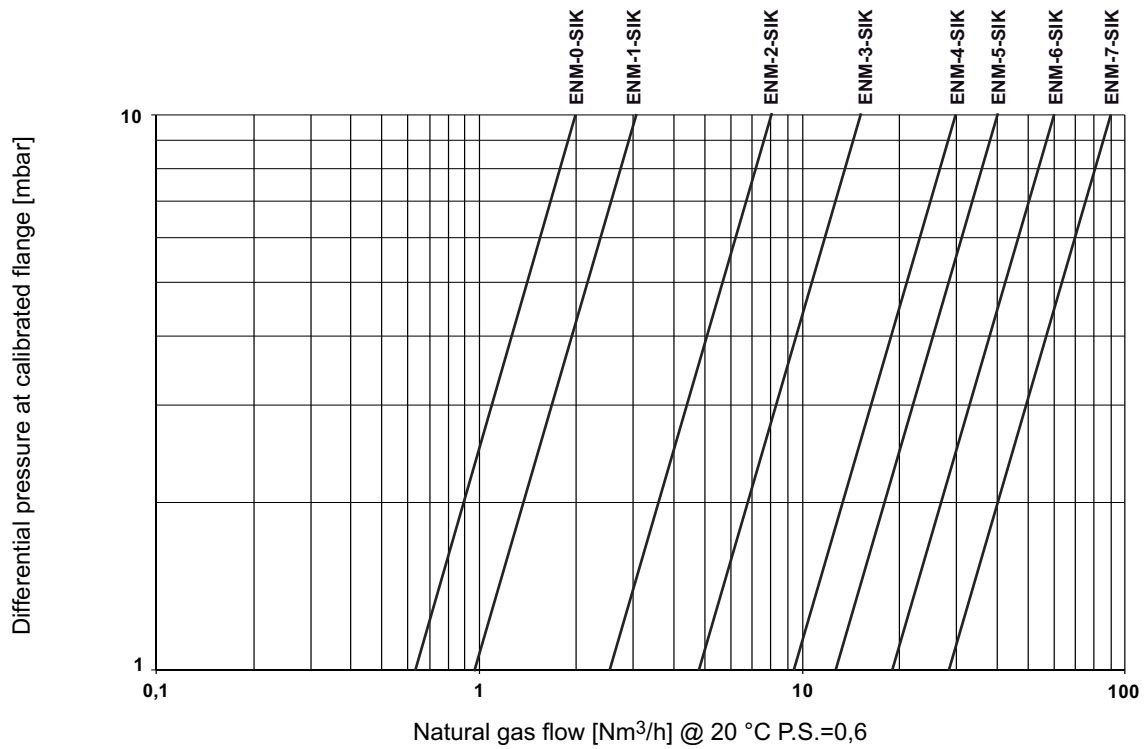
G3506I04

Burner at 100% capacity with 10% excess air

The emission value is subject to variations depending on different factors such as:

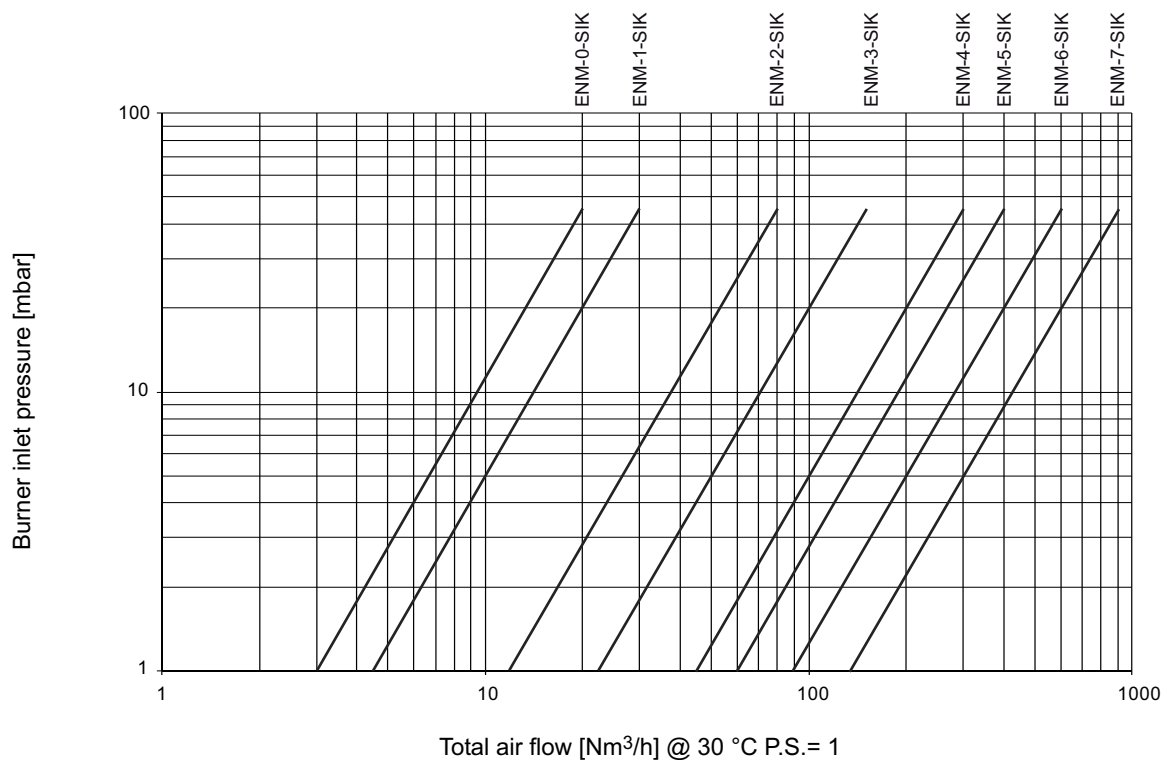
- Furnace working temperature.
- Heated air temperature.
- Excess air.
- Fuel chemical composition. The guaranteed value will thus be fixed, case by case, according to the conditions given by the client.

## METHANE GAS FLOW DIAGRAM



G3506105

## AIR FLOW DIAGRAM

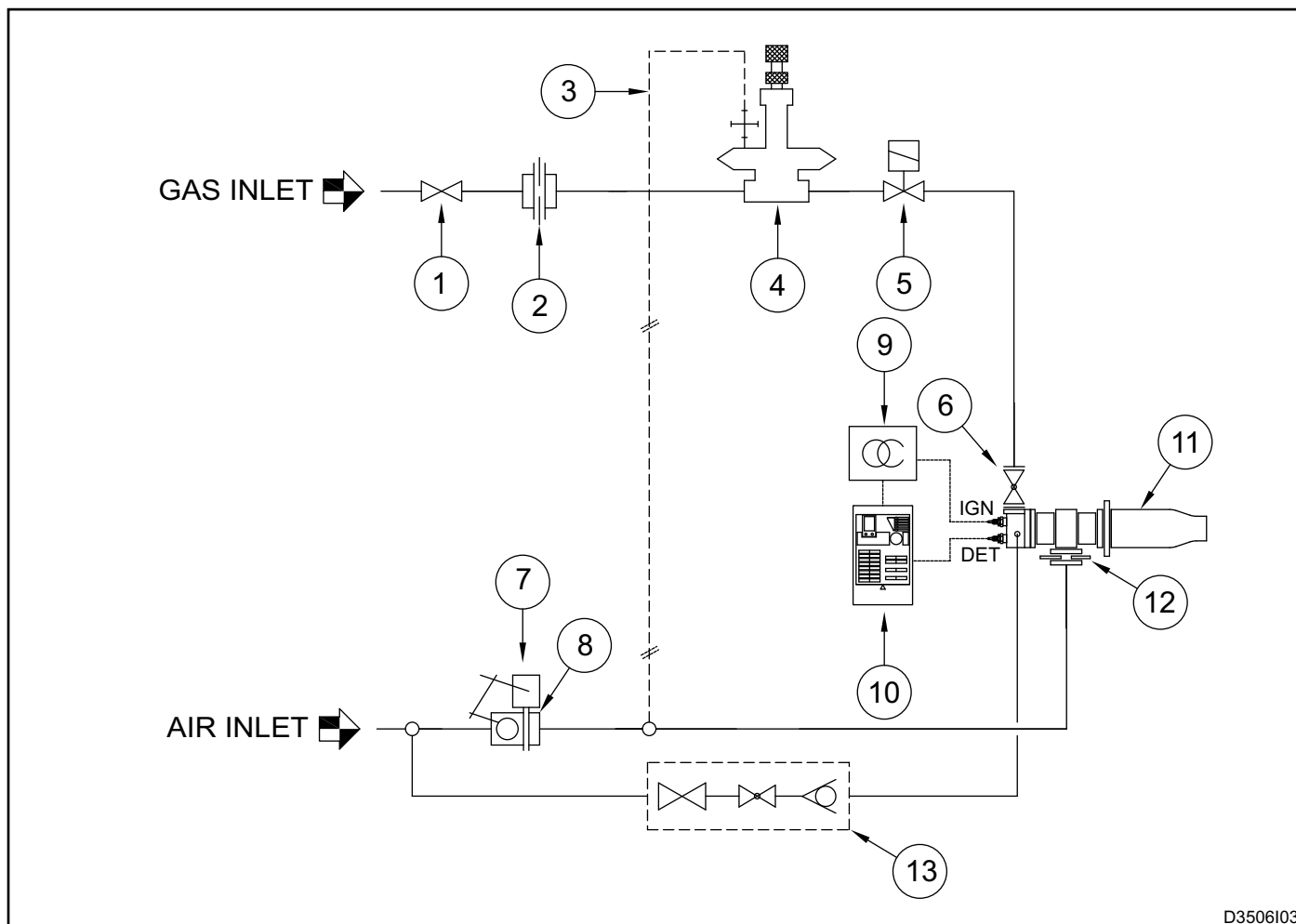


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[illegible]

Pos.	Description	Included	Not Included
1	Main gas interception ball valve		X
2	Zerogovernor		X
3	Impulse line		X
4	Servo-controlled air regulation valve		X
5	Electric servo-control		X
6	Single burner gas interception ball valve		X
7	Main burner safety gas solenoid valve		X
8	$\Delta P$ Calibrated measuring flange	X	
9	Gas passage limiting device	X	
10	Manual air regulation butterfly valve		X
11	Air inlet orifice	X	
12	High velocity burner	X	
13	Ignition transformer		X
14	Flame control		X
15	Premix air regulation kit (only LPG version)	X	

## FLOW SCHEME - SINGLE BURNER REGULATION



D3506I03

Pos.	Description	Included	Not included
1	Main gas interception ball valve		X
2	Calibrated flange for $\Delta P$ gas measurement	X	
3	Impulse line		X
4	Zerogovernor		X
5	Safety gas solenoid valve		X
6	Gas passage limiting device	X	
7	Servo motor		X
8	Motorized air regulation valve		X
9	Ignition transformer		X
10	Flame control		X
11	High velocity burner	X	
12	Air inlet orifice	X	
13	Premix air regulation kit (only LPG version)	X	

## WARNINGS

- The EMB-SIK burner ignition must always be carried out at minimum power, modulating towards the maximum. facilitating the ignition and reducing the outlet overpressures. Thus it is opportune to use slow opening solenoid valves on the fuel line.
- The passing from minimum to maximum power and vice-versa must be gradual and not instantaneous.
- The vertical mounting of burners with flame pointing upwards is NOT advised. Burners mounted in this position could suffer the lack of ignition or bad flame detection due to the presence of external objects depositing on the combustion head and electrodes.
- For all low temperature applications (up to 750°C), the burner ignition and fuel gas solenoid valve commands must be performed via a certified burner control device.
- To avoid possible damage to burners, make sure that the blower does not send them air that may be fouled by combustion products, oils, solvents or other. To avoid these phenomena from taking place, possibly install the blower or the scution duct outside the establishment and far from the exhaust pipes.
- Check the correct connection of the feeding lines after installation. Before switching the burner on, check that the combustive air and fuel gas pressure values are correct (pag 06).
- The burner can only function within the indicated power range. Functioning at lower or higher powers could compromise the burner performance as well as its lifespan, in which case, the general warantee conditions will automatically expire and ESA - PYRONICS will not be held responsible for any damage to persons or things.
- 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.
- 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 on ignition and another (however to not attempt more than 2 ignitions during a 30 sec. 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 could compromise the application safety and automatically cause the general warantee conditions to expire.

## INSTALLATION

The EMB-SIK burners are supplied with a special furnace wall-fixing flange. The light obtained for the burner housing must leave open space around the burner. This space has then to be filled with ceramic fibre.

For the installation, carefully follow the instructions below:

**1** - Place the EMB-SIK burners far from heat sources and products such as: liquids, solvents or corrosive gases.

**2** - Make sure that the housing dimensions and the distance between the centres of the feeding pipes correspond to what has been specified in the "Overall Dimensions" chapter.

**3** - Assemble the burner onto the furnace wall (pos.01), interposing a ceramic fibre gasket between the attachment flange and the furnace wall (pos. 02). Once the burner has been fixed to the furnace, from the inside of the combustion chamber, using ceramic-fibre, seal any possible cracks that may be left between the wall and the silicon carbide flameguard according to the indications given in the "Overall dimensions" chapter.

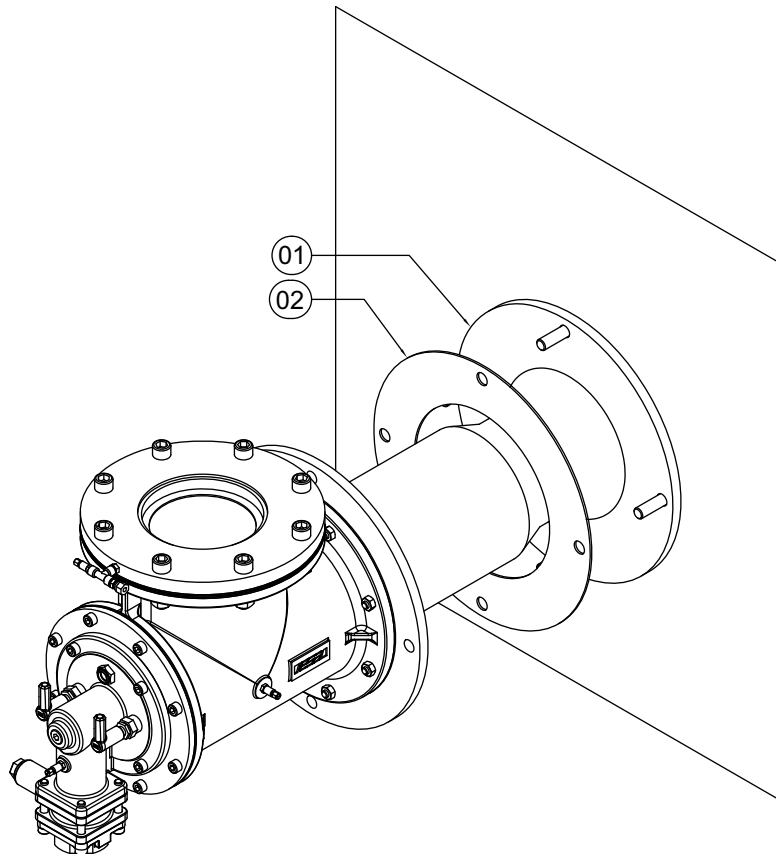
**4** - Connect the combustion air and fuel gas piping, interposing, if possible, dilation joints with suitable diameters.

**5** - Connect electrical current to the ignition and detection electrode and to the UV-scan detector, making sure not to pass the conductors near heat sources.

**6** - Make sure that the burner body and all the connected metallic elements are connected to the plant's earthing system with suitable conductors.

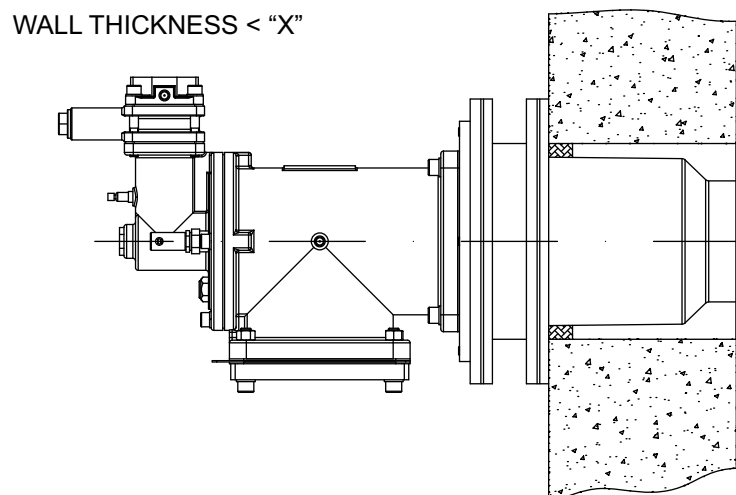
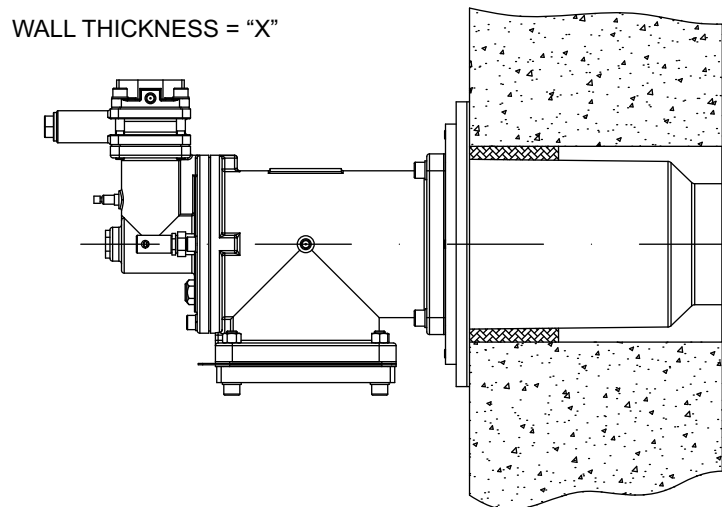
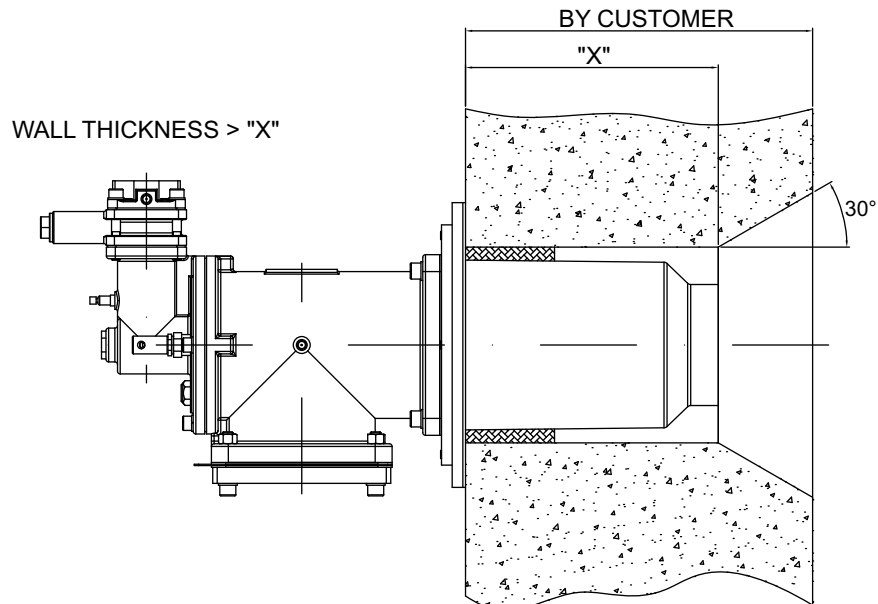
**7** - The connecting cable from the ignition transformer to the electrode must be specific for high tension and not screened. It must not be more than 1 metre long; otherwise the ignition transformer must be positioned near the burner. The high tension cable must be placed far from the power cables and not in metallic ducts. Ideally it should be left in open air.

**8** - For Further information please consult the technical data sheet concerning ignition transformers.



D3506104

## FACT SHEET FOR FURNACE WALL MOUNTING



D3506105

## START-UP - SETTING

The procedures indicated in the following chapter must be carried out by expert technicians. The non-observance of the instructions given could provoke dangerous conditions.

- 1** - Check that the combustion air pressure exiting the blower and the fuel gas feeding pressure are both within the allowed range.
- 2** - Regulate the working pressures and the combustion plant's safety device pressure, whether there is one per burner or one for the whole combustion plant, i.e. gas pressure reducer, block valve, relief valve, pressure switches etc. Simulate the intervention of all the safety devices, including the intervention of the safety overtemperature, checking that the fuel safety block devices act properly.
- 3** - Referring to the maximum capacity values indicated in the "Burner Performance" chapter, position the motorized air regulation valve.
- 4** - Referring to the minimum capacity values indicated in the "Burner Performance" chapter, position the motorized air regulation valve.

**5** - Activate the burner control device and attempt ignition until the burner switches on. During the first burner ignition phases, act on the gas regulation valve and, starting from the totally closed position, open it gradually until the burner ignites.

**6** - With burner on, place the motorized air regulation valve as described in point 3. Via the gas regulation valve, regulate the maximum fuel capacity, checking the differential pressure created on the calibrated gas flange.

**7** - Double check that, at minimum and maximum power, the burner inlet pressure corresponds to the values in the "PARAMETER CAPACITY" chapter. These values may differ depending on whether the burner is on or off.

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

**9** - Repeatedly attempt ignition at minimum burner power, with maximum amplitude, to check the ignition reliability and flame stability during the regulation.

## PREMIX AIR FLOW SETTING WHERE SCHEDULED (LPG BURNERS)

The premix line is supplied with the LPG burners. The setting must be carried out with burner off and in minimum flow conditions. The premix line must be fed by an inlet necessarily placed upstream the air flow regulation valve, whether it is in zone or interlocked by the single burner.

- 1** - Place the burner in the minimum combustion air flow conditions.
- 2** - Open the premix air tap upstream the general regulation valve (the flow must be fixed).
- 3** - Regulate the air flow using the micrometric pin valve consulting the appropriate setting table. The aim is to have a relatively tense bluish flame.
- 4** - Check however, that at minimum capacity, the burner does not create black smoke on the combustion head nor on the electrodes. Should this occur, increase the premix air setting.

EMB-0-SIK: Gas body pressure = 2 mbar  
EMB-1-SIK: Gas body pressure = 2 mbar  
EMB-2-SIK: Gas body pressure = 2 mbar  
EMB-3-SIK: Gas body pressure = 2 mbar  
EMB-4-SIK: Gas body pressure = 2 mbar  
EMB-5-SIK: Gas body pressure = 2 mbar  
EMB-6-SIK:  $\Delta p = 6.5$  mbar  
EMB-7-SIK:  $\Delta p = 2.5$  mbar



## GENERAL MAINTENANCE PLAN

Operation	Type	Advised time	Notes
High tension electrode connection	O	annual	check integrity of external plastic and oxidization of internal connector and electrode terminal.
Electrode ignition / detection	O	annual	replace if kantal terminal is worn or if ceramics are damaged.
Combustion head	O	annual	during furnace shut down, check that the element does not show any signs of oxidation due to high temperature or material deposits on its surface.
SiC flame tube	O	annual	during furnace shut down check that there are no cracks or ruptures in the ceramic material. If necessary replace it.
Replacement of gas side gaskets	E	annual	See note (*) and note (**)
Burner settings	O	annual	Repeat all the steps in the "START-UP AND SETTING" section.
Premix air settings (where scheduled)	O	annual	Repeat all the steps in the "PREMIX AIR SETTING" section.

### NOTES:

Key: O = ordinary / E = extraordinary

(\*) replacement of the gaskets on the gas side is suggested after each time the gas feeding line is dismantled.

(\*\*) use high temperature gaskets.

## EXTRAORDINARY MAINTENANCE

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

### IGNITION AND FLAME DETECTION ELECTRODE REPLACEMENT

1 - Check that the burner control device is off.

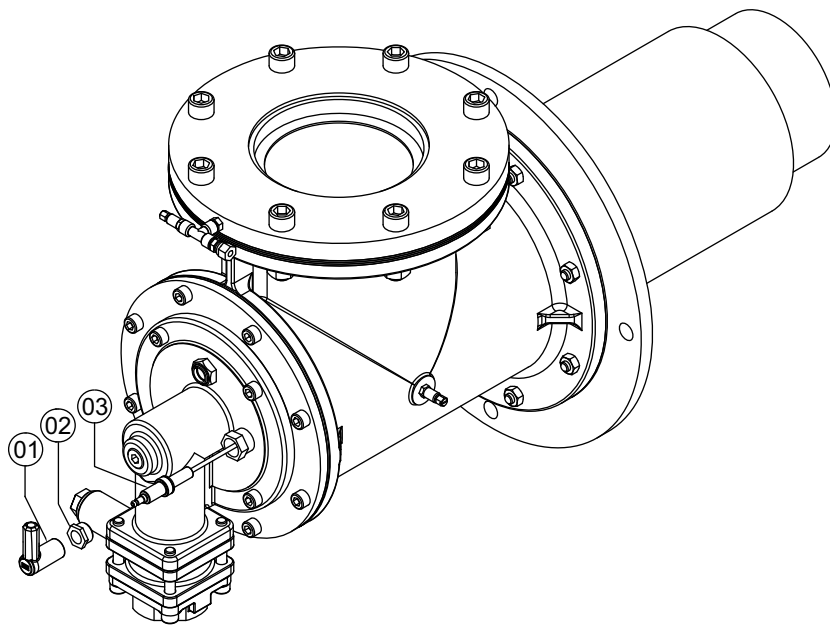
2 - Disconnect electrical supply to the electrodes (**pos. 01**).

3 - Unscrew the connector (**pos. 02**) at the base of the gas collector, removing the electrode (**pos. 03**).

4 - Replace the faulty electrode (**pos. 03**) paying attention to the positioning of the new electrode.

5 - Reconnect the electrical supply (**pos. 01**).

6 - Check the electrode's correct flame ignition/detection.



D3506106

### BURNER IN LOCKOUT

In burner lockout conditions refer to the burner control device indications and to the relative manual to identify the cause. The main cases have been indicated here below:

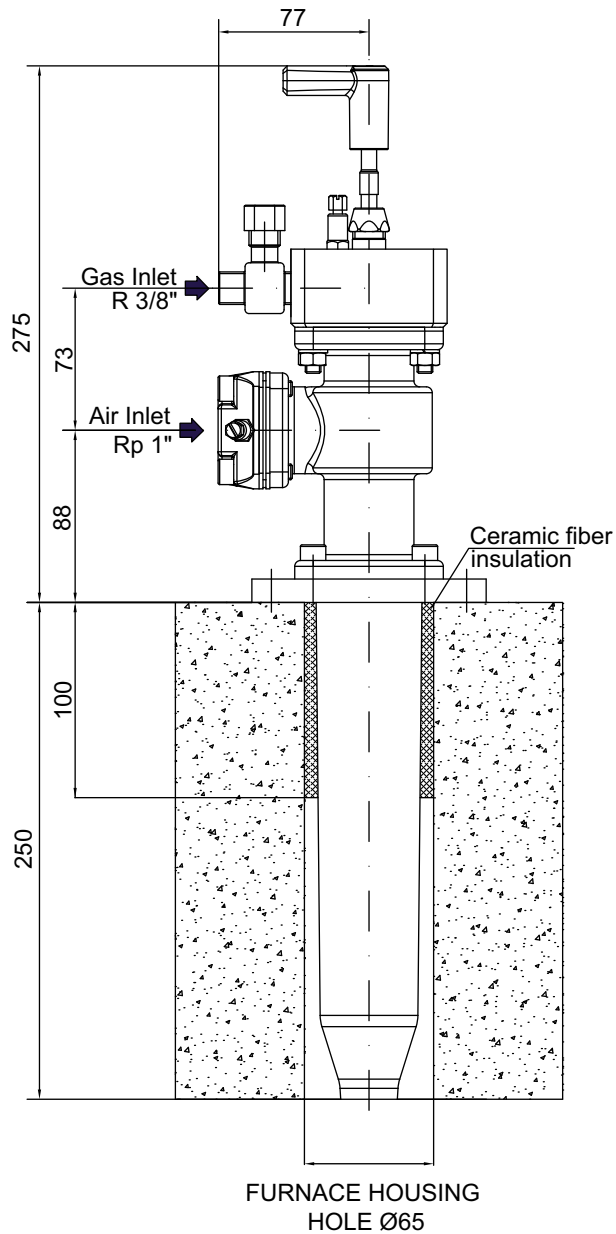
■ **Illegal flame detection:** shutdown is due to an illegal flame detection during the phases prior to ignition or after the turning off. The causes are within the detection system (broken or faulty sensor or presence of humidity), or in the gas draw from the solenoid safety valve, which allows the burner to remain turned on.

■ **Failed ignition:** shutdown is caused due to the fact

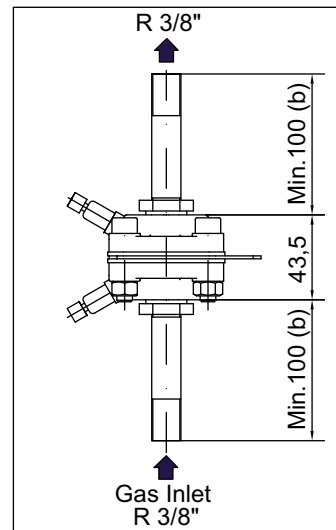
that no flame has been created during the starting process. The causes can be found in the start-up system (spark absence, faulty electrodes or incorrect position), in the bad setting of the fuel and combustion flow or in the detection system (faulty sensor or interrupted cables). More precisely, in the first two cases the flame is not ignited, while in the last case the flame is created but the burner control device is unable to detect it.

■ **Flame signal loss:** shutdown due to the flame signal loss during the normal functioning of the burner. The causes can be found in the combustion air flow regulation (rapid flow variations, adjustment out of allowed range). They can also be found in the detection system (faulty, dirty or badly positioned sensors).

## OVERALL DIMENSIONS - EMB-0-SIK

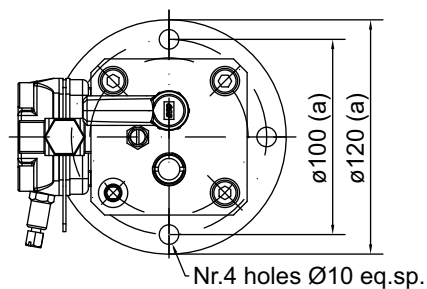


Gas orifice flowmeter (included)  
Assembly by customer



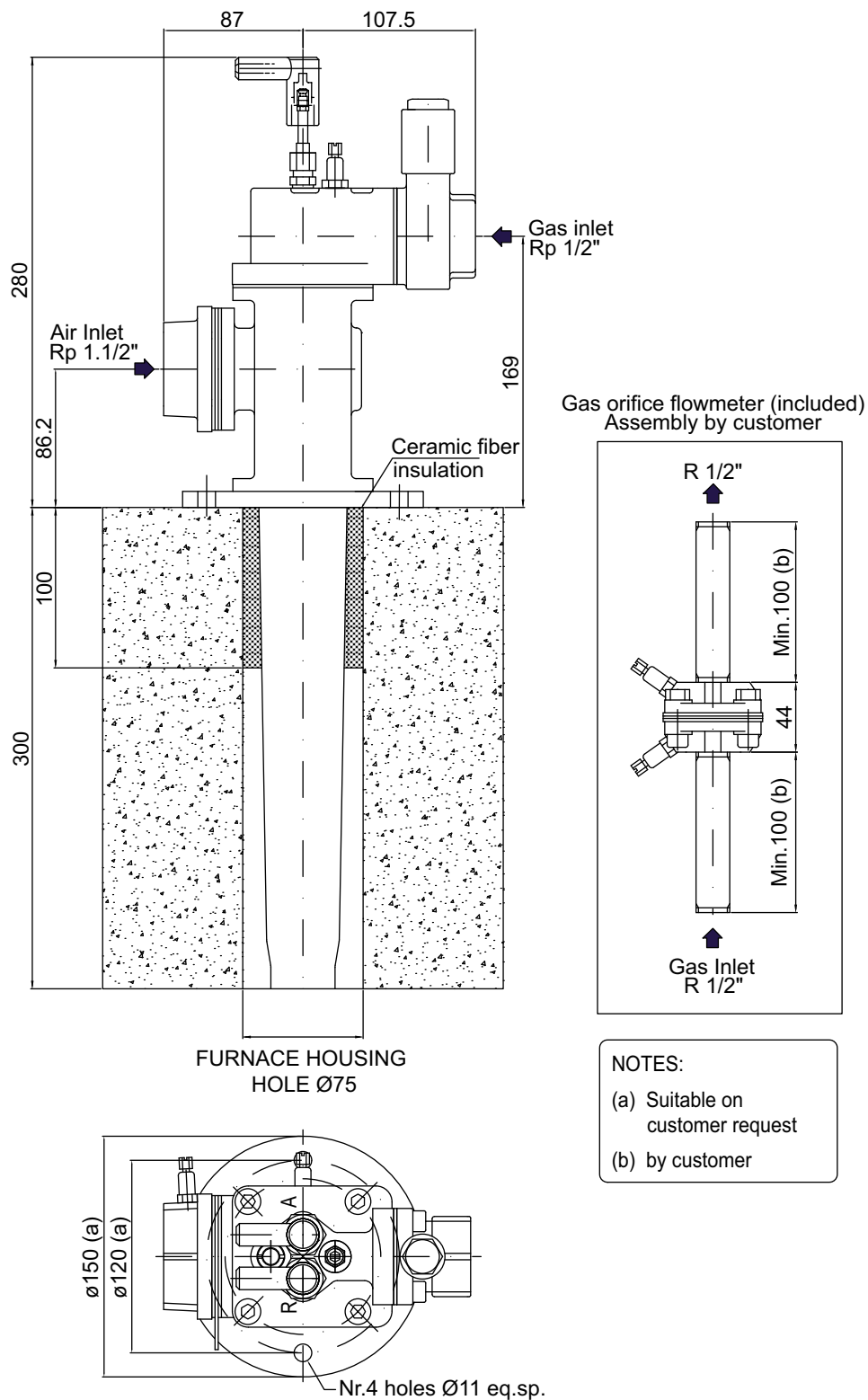
### NOTES:

- (a) Suitable on customer request
- (b) by customer



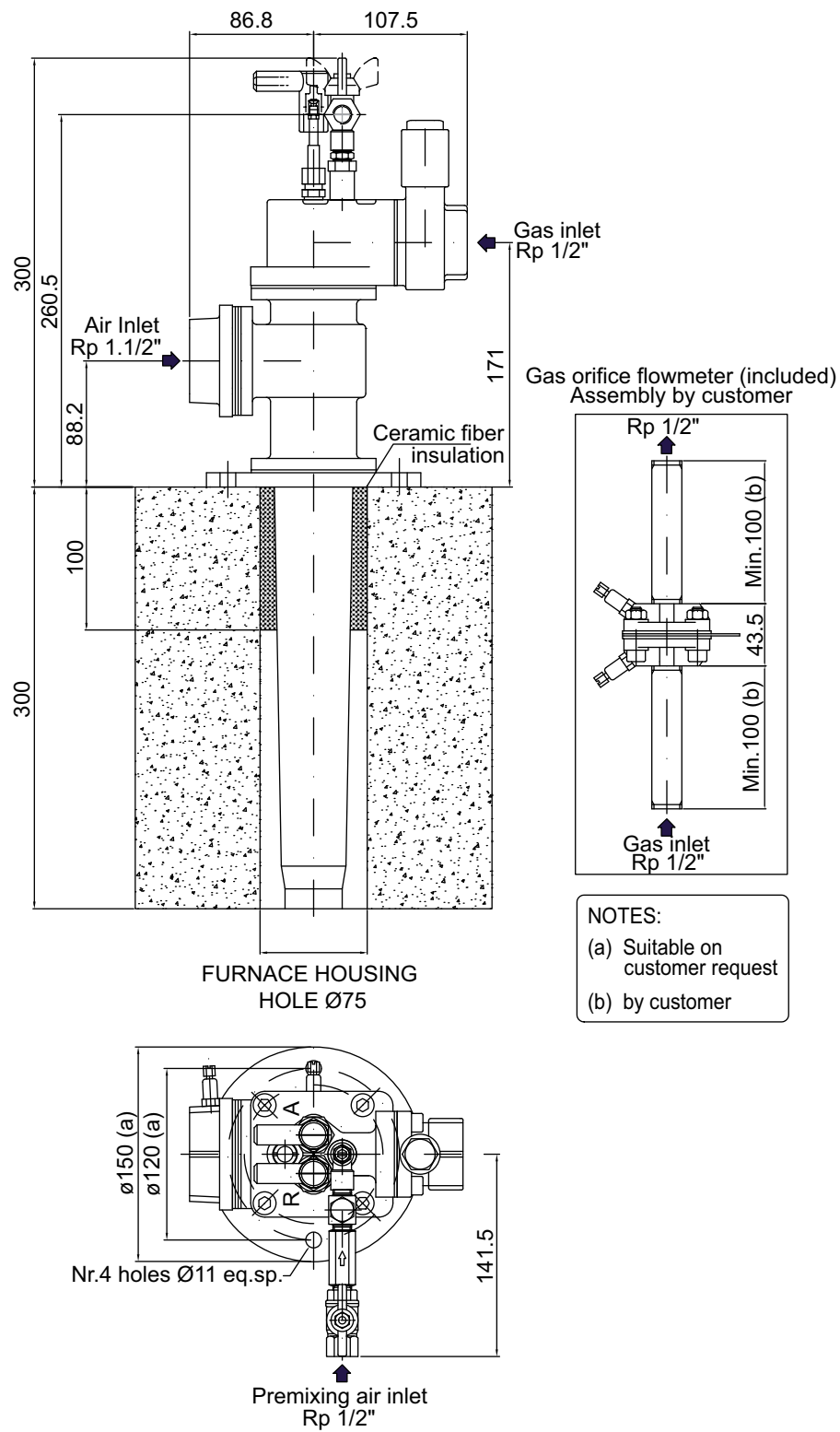
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## OVERALL DIMENSIONS - EMB-1-SIK-CH4



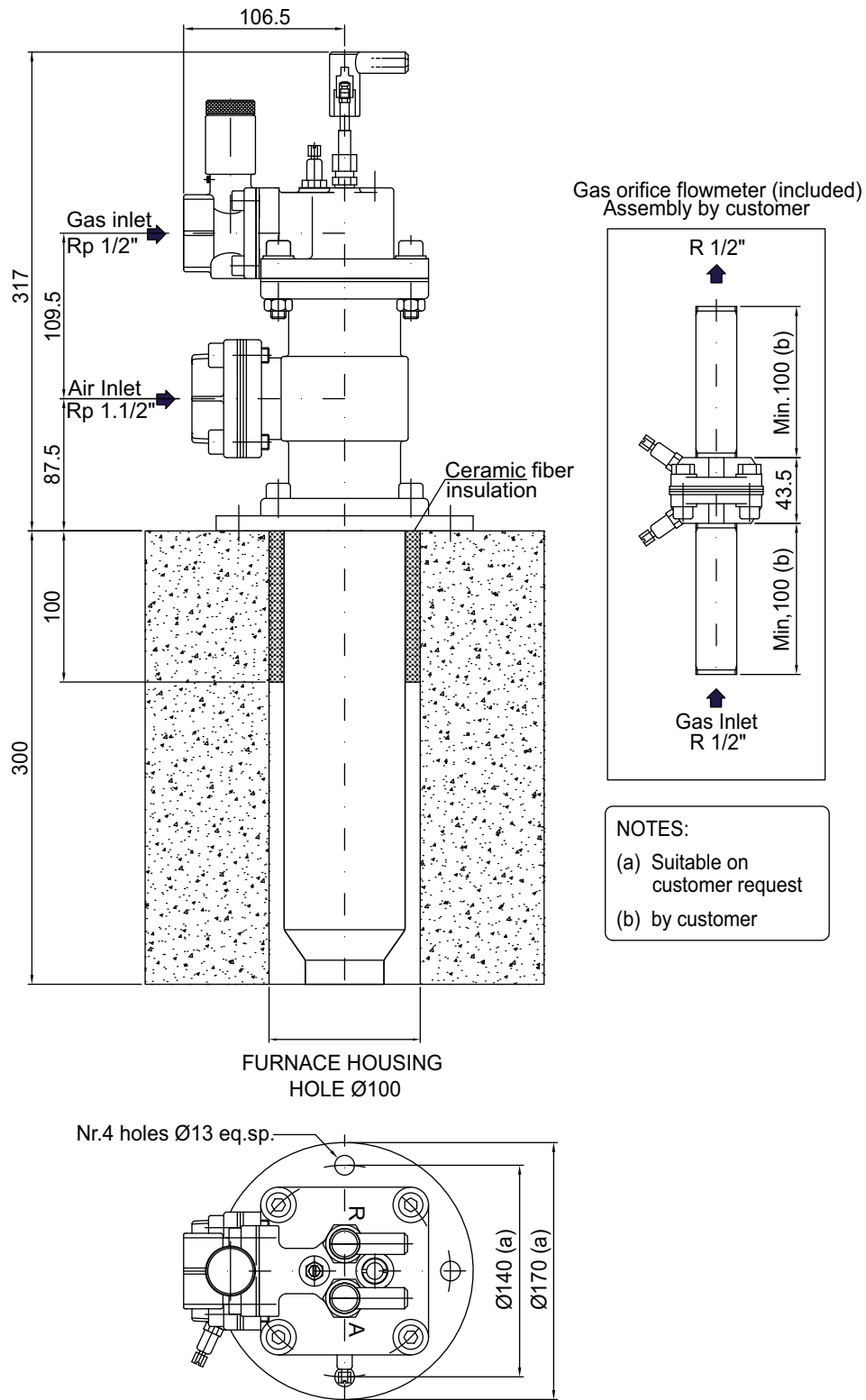
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## OVERALL DIMENSIONS - EMB-1-SIK-LPG



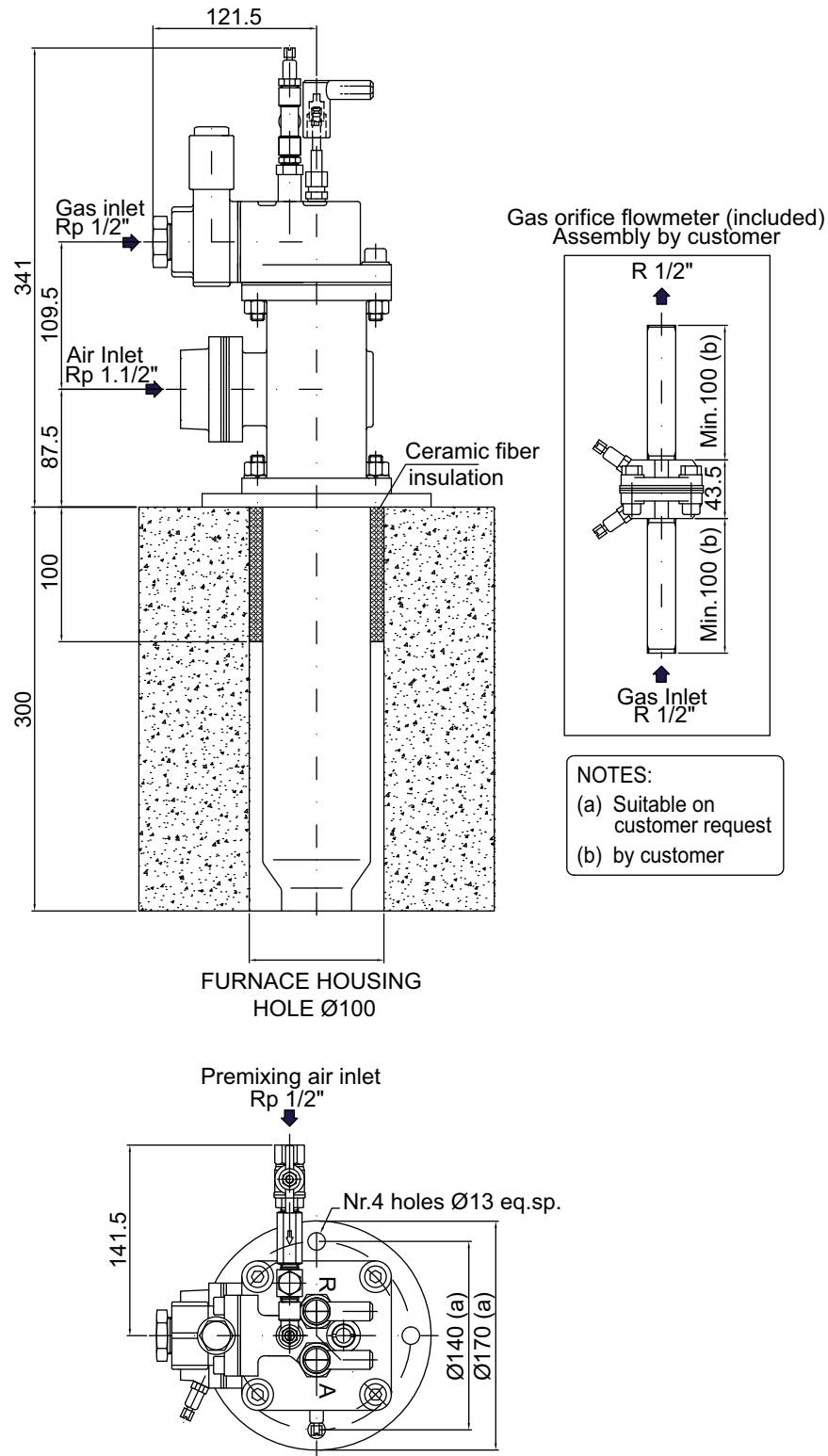
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## OVERALL DIMENSIONS - EMB-2-SIK-CH4



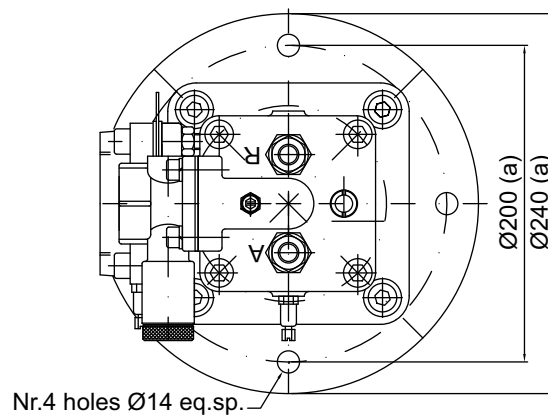
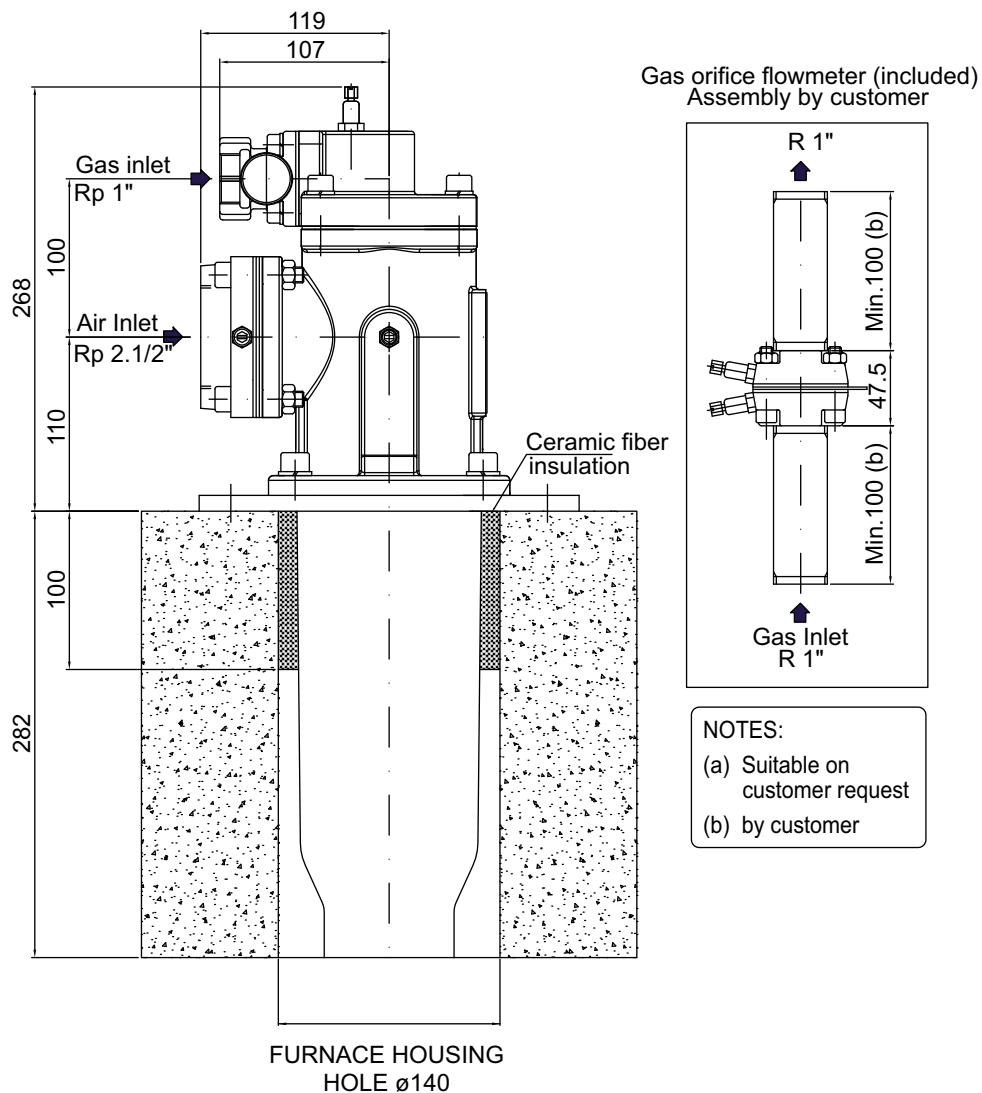
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## OVERALL DIMENSIONS - EMB-2-SIK-LPG



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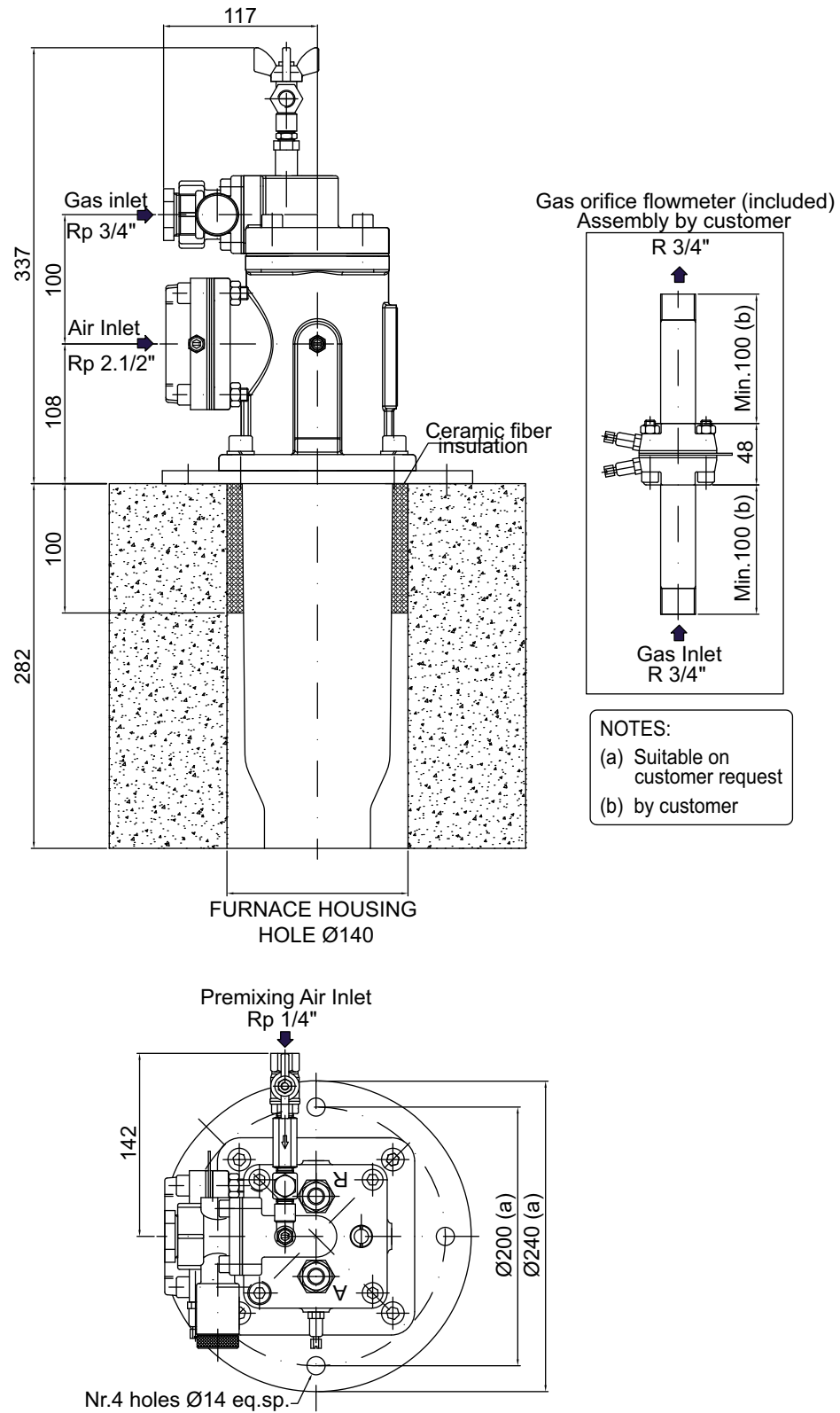
## OVERALL DIMENSIONS - EMB-3-SIK-CH4



D3506112

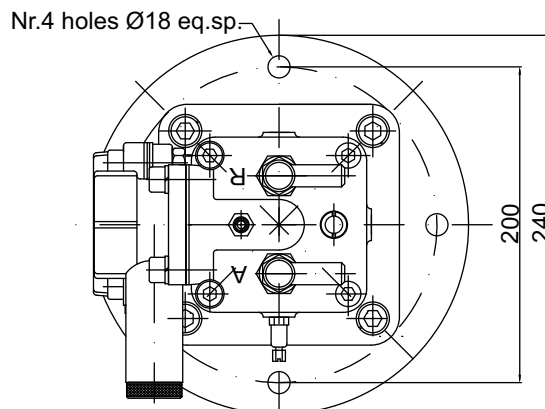
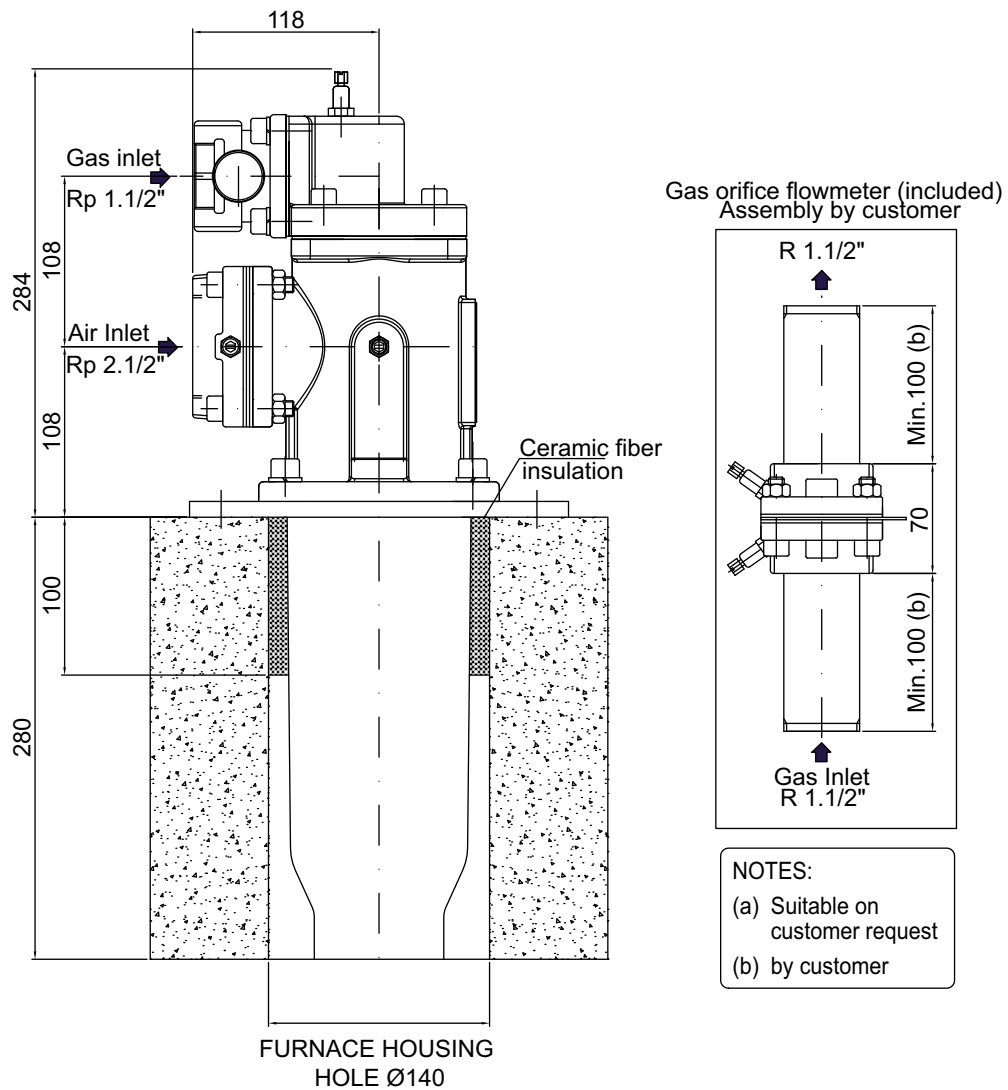


## OVERALL DIMENSIONS - EMB-3-SIK-LPG



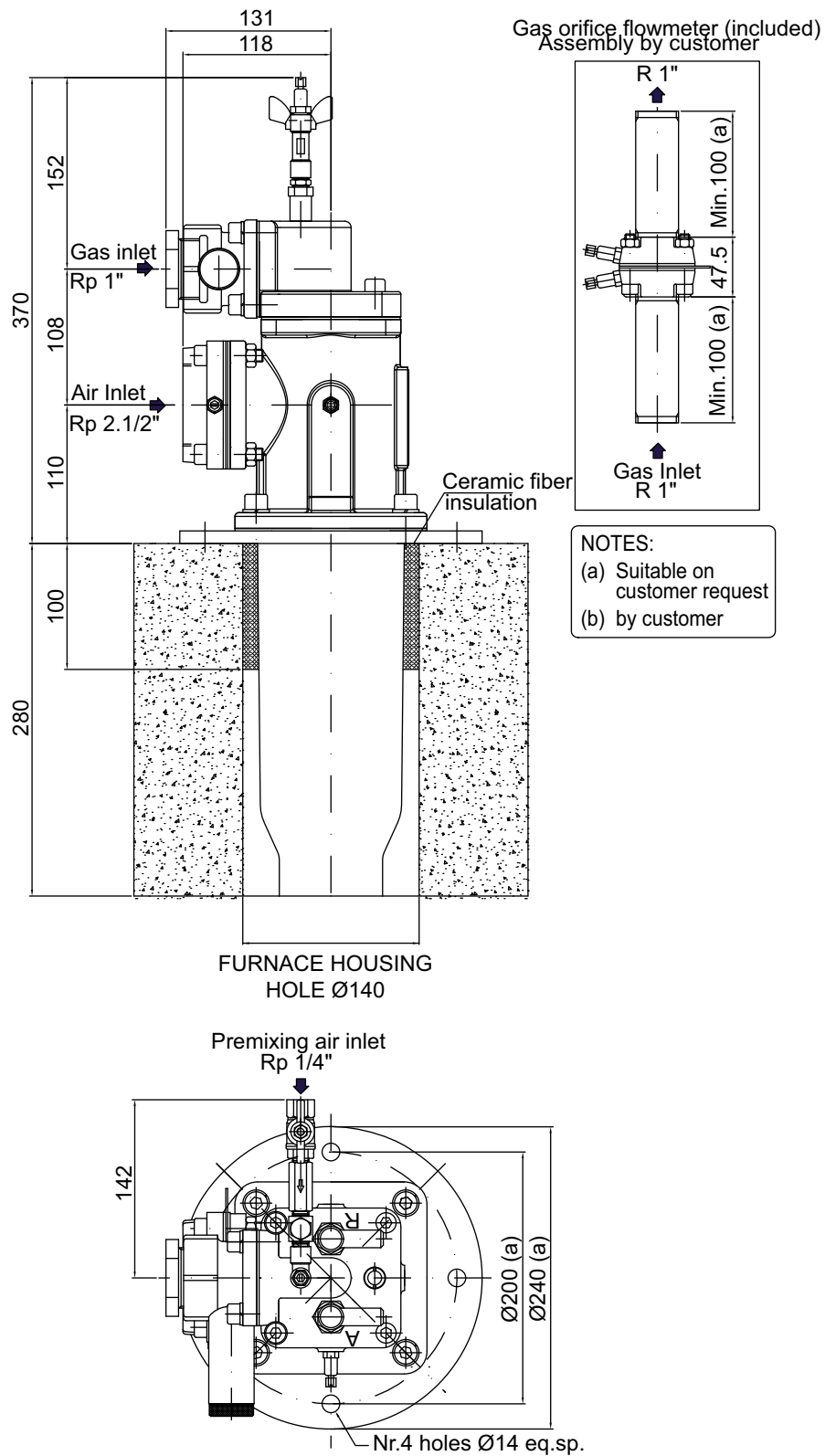
D3506113

## OVERALL DIMENSIONS - EMB-4-SIK-CH4



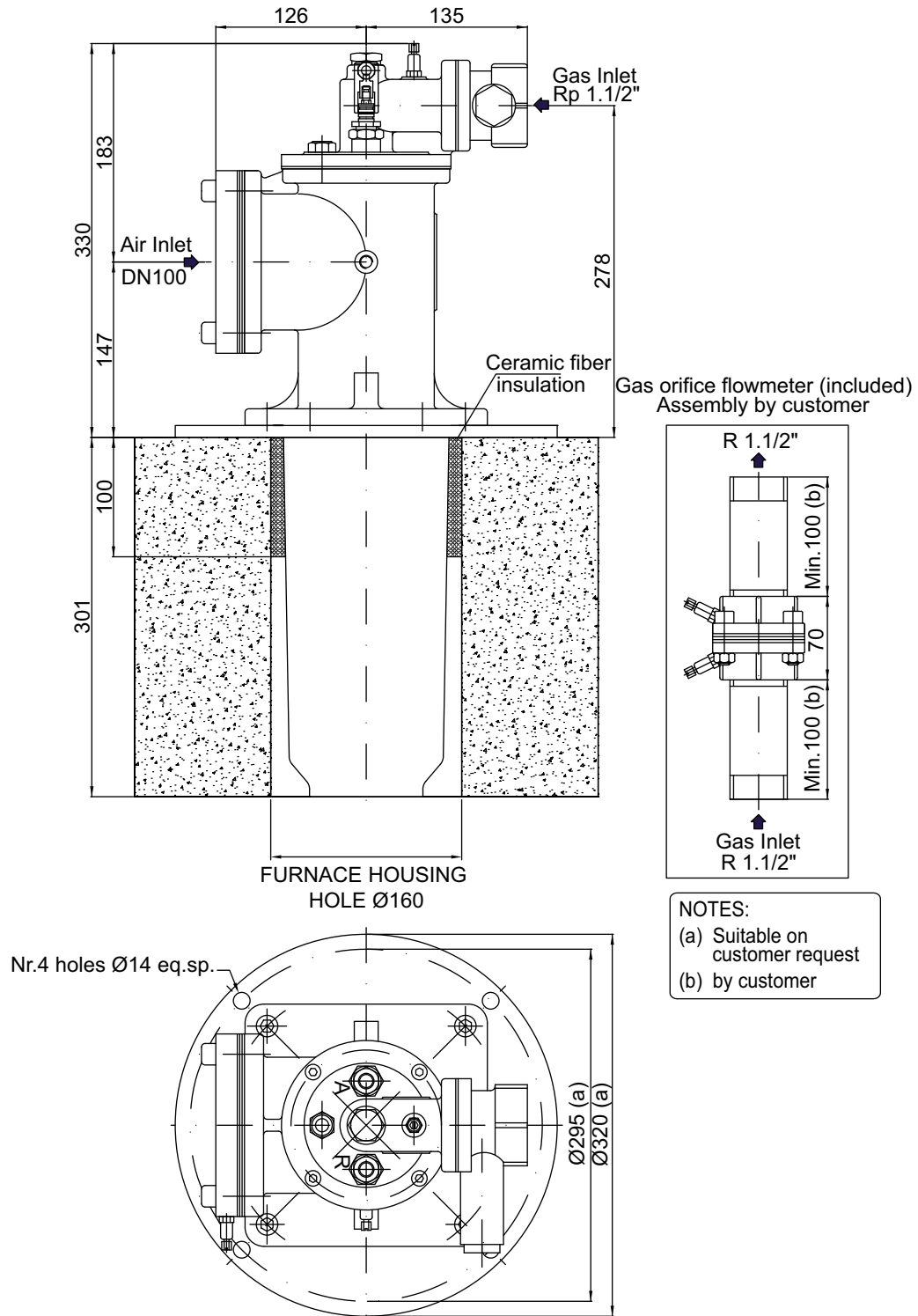
D3506114

## OVERALL DIMENSIONS - EMB-4-SIK-LPG



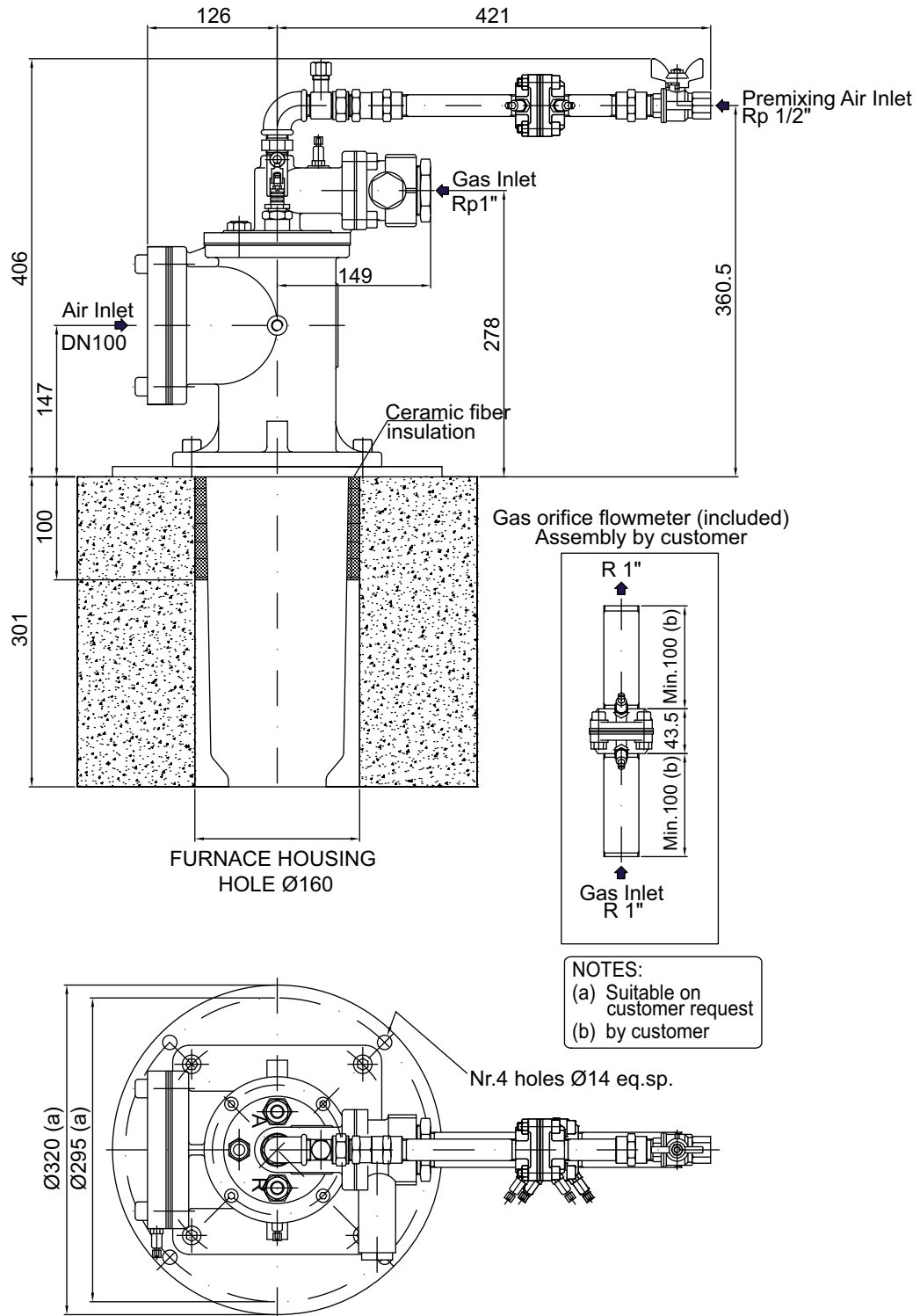
D3506115

## OVERALL DIMENSIONS - EMB-5-SIK-CH4



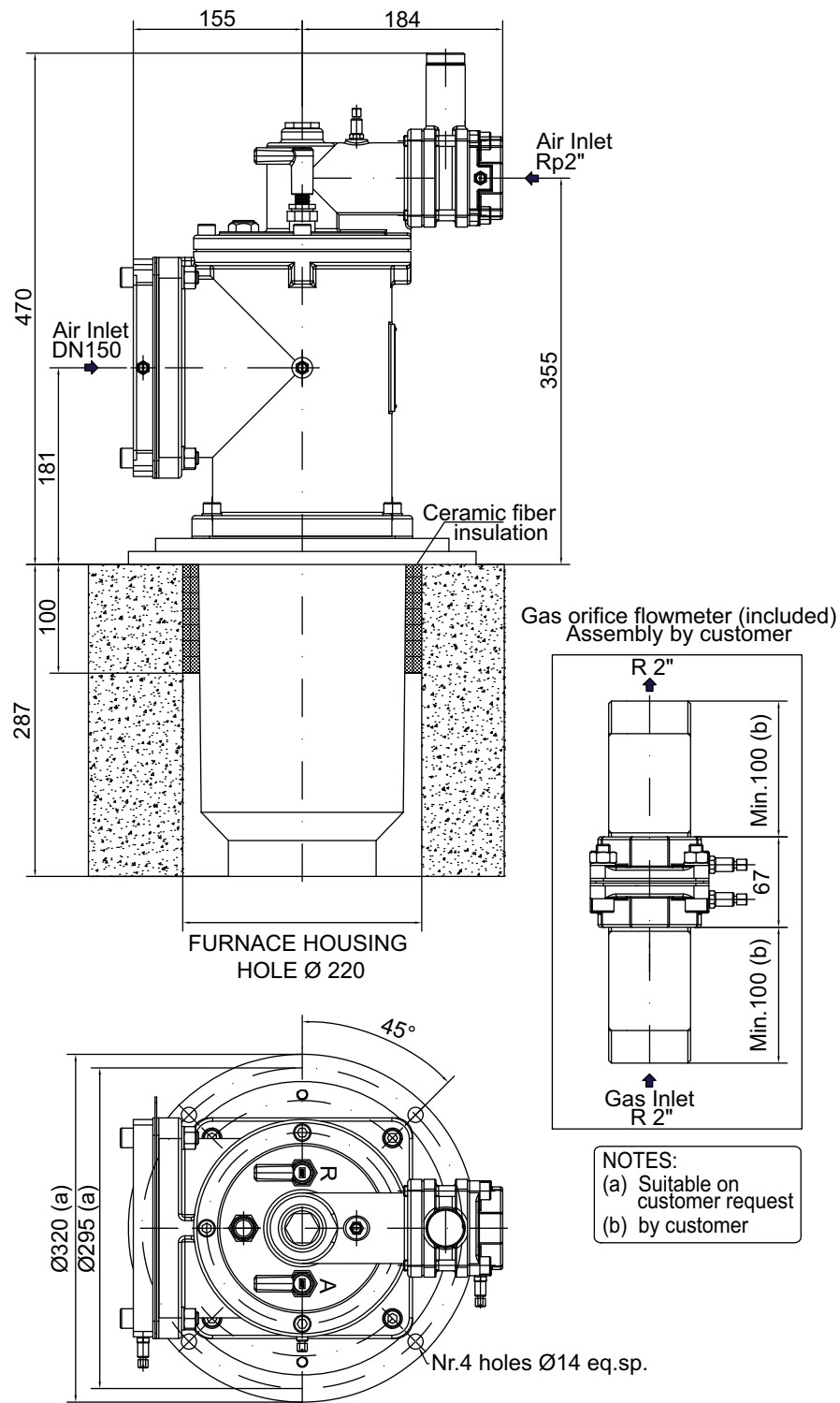
D3506116

## OVERALL DIMENSIONS - EMB-5-SIK-LPG



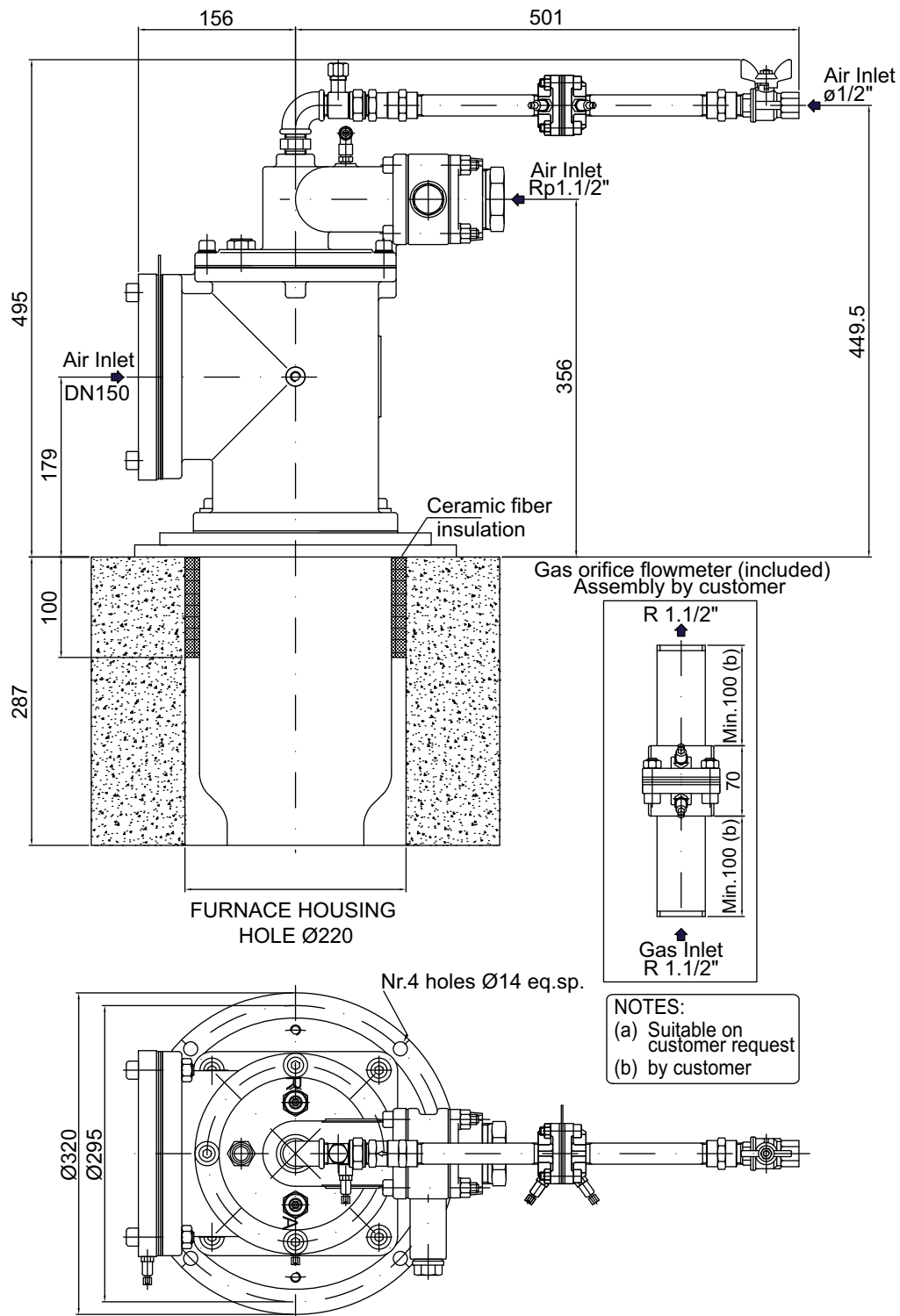
D3506117

## OVERALL DIMENSIONS - EMB-6-SIK-CH4



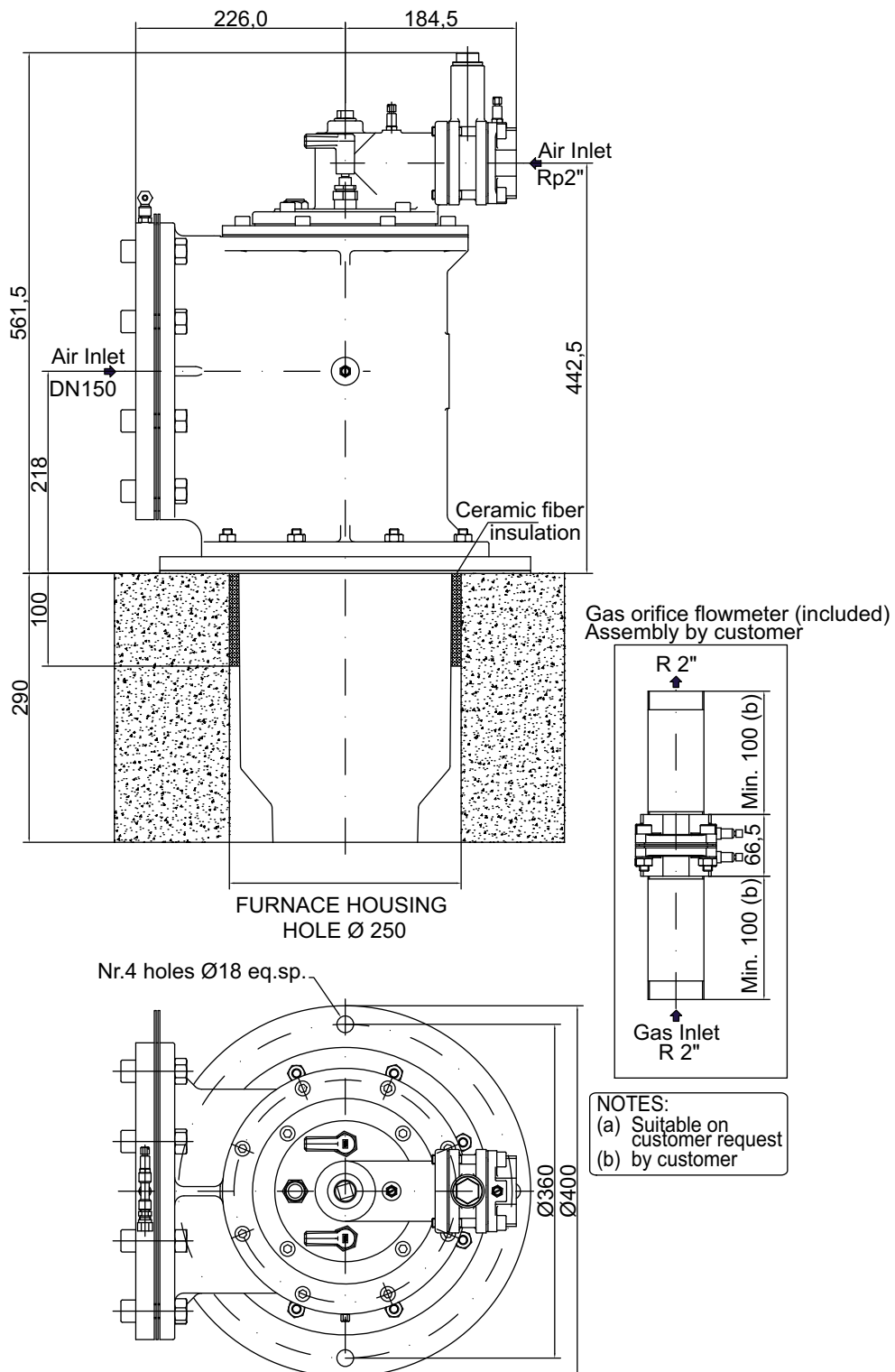
D3506118

## OVERALL DIMENSIONS - EMB-6-SIK-LPG



D3506I19

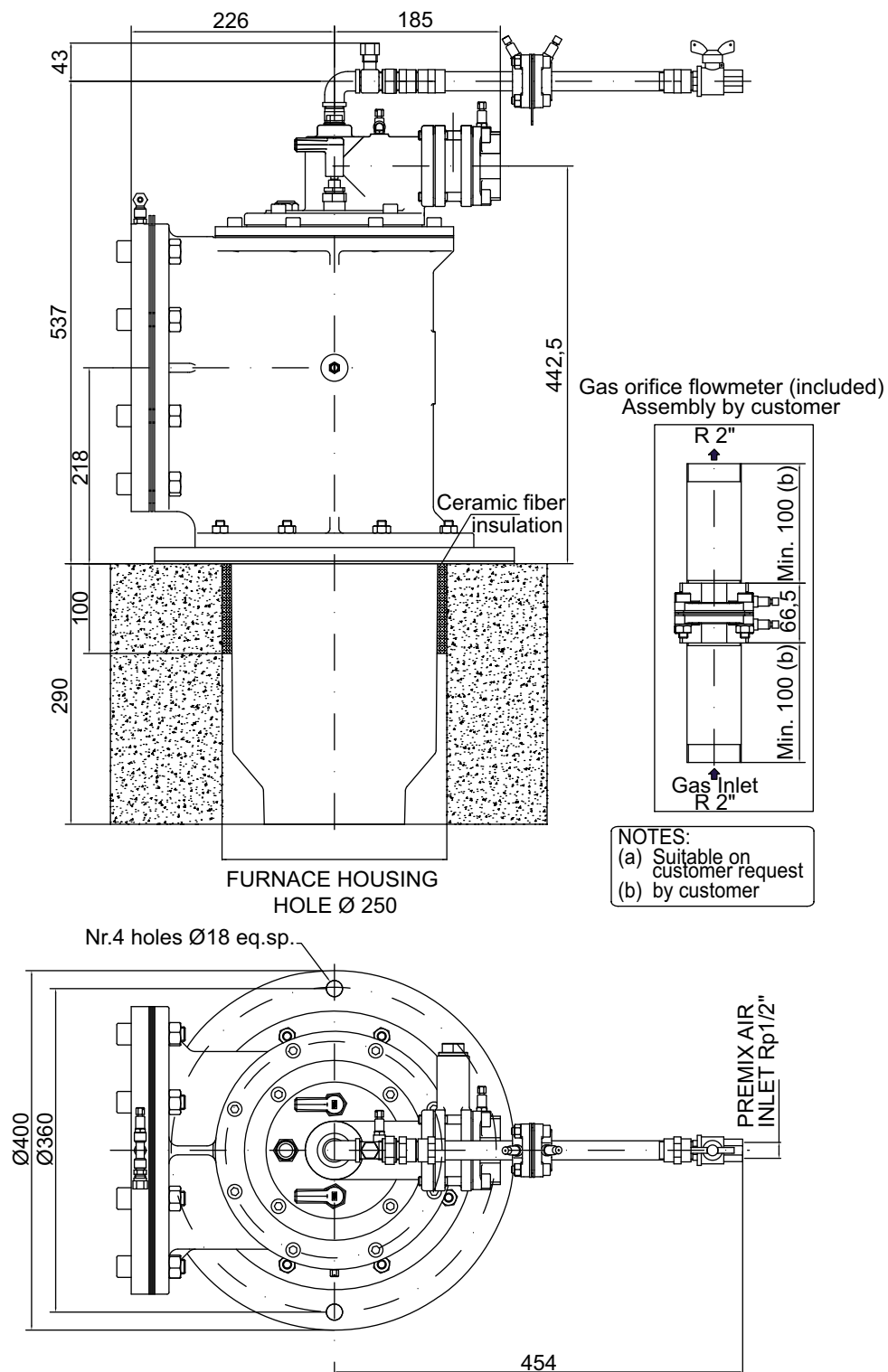
## OVERALL DIMENSIONS - EMB-7-SIK-CH4



D3506I20



## OVERALL DIMENSIONS - EMB-7-SIK-LPG



D3506I21

## ORDERING CODE - COMPLETE BURNER

EMB -   - SIK -   -   -   -   -  

**01                      02                      03                      04                      05                      06**

Model <b>01</b>	
EMB-0-SIK	<b>0</b>
EMB-1-SIK	<b>1</b>
EMB-2-SIK	<b>2</b>
... (see capacity table)	<b>.....</b>

Ignition <b>04</b>	
Ign. electrode + det. electrode	<b>E*</b>
Monoelectrode	<b>M</b>
Pilot burner <sup>(2)</sup>	<b>P</b>

Gas adjuster <b>02</b>	
With gas adjuster	<b>GA*</b>
Without gas adjuster	<b>F</b>

SiC Flame tube type <sup>(3)</sup> <b>05</b>	
Carbide low velocity	<b>L...</b>
Carbide medium velocity	<b>M...</b>
Carbide high velocity	<b>H...</b>
Carbide by Client <sup>(4)</sup>	<b>C</b>

Fuel <b>03</b>	
Natural gas	<b>CH4*</b>
LPG	<b>LPG</b>
Poor gas <sup>(1)</sup>	<b>GP</b>

Flange type <b>06</b>	
Acc. to ESA drawing	<b>E*</b>
Acc. to Client's drawing	<b>C</b>

The codes marked with an asterisk (\*) identify the standards.

Notes:

- <sup>1</sup> Particular performance according to gas characteristics
- <sup>2</sup> Available in the 3, 4, 5 and 6 models (see paragraph "Ignition and Detection")
- <sup>3</sup> See "Capacity parameters and flame length" table
- <sup>4</sup> Specify construction characteristics and overall dimensions of the carbide SiC flame tube