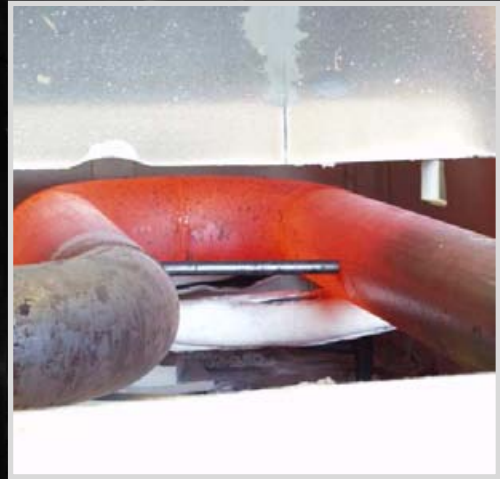


Burners



Radiant tube burners

RT (E3900 rev. 09 - 23/01/2018)



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.

■ The RT 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.

CERTIFICATIONS:



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

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The abbreviation RT identifies a series of burners for radiant tube combustion systems. This type of process consists of using a stainless steel tube to exploit the useful effect derived from heat exchange through the irradiation mechanism. To achieve this, it is necessary to connect the pipe to a burner. The radiant tubes can have different shapes, the most common are "I", "U", "W" or "M", "double P".

APPLICATIONS

- Tanks immersed at high temperature in salt bath furnaces or in the melting of light alloys.
- Quenching furnaces.
- Bell or pit furnaces.
- Furnaces for processing ferrous, synthetic material, glass and porcelain.
- Food cooking furnaces.



F3900I03

CHARACTERISTICS

GENERAL:

- Operation with preheated air up to: 500 °C
- Potential: from 30 to 300 kW
- Air pressure and gas at the burner: 45 mbar
- Operation with various types of gas: CH4/LPG Propane/etc.
- Flow ratio: 4:1
- Excellent flame stability with: excess of air excess of stoichiometric combustion gas
- Low noise.
- Easy replacement electrodes.
- Separate gas air inlets, mixing with the nozzle impossibility of backfire.

MATERIAL COMPOSITION:

- Mixer body: Cast iron G25
- Collector: Cast iron G25
- Flame pipe: AISI304/AISI310
- Combustion head: AISI310
- Fixing flange: Iron



F3900I04

DESCRIPTION

The main characteristic of RT burners consists in double air mixing. The primary air is mixed on the cross-flow head developing a twisting flame; the secondary air, guaranteed by special holes placed on the flame arrester pipe, completes the mixing by extending the flame itself. This type of device ensures less wear of the initial part of the radiating tube, normally more stressed, and allows the maximum heat exchange of the radiant tube flame; more efficiency and long life of the radiant tube follows.

The calibration of the RT series burners is simplified by pressure taps that allow to identify the gas and air flow rates; the volumetric air/gas ratios normally used in radiant tube burners are 12:1, 13:1. The radiant tube burners of the RT series can work with cold air and, using special smooth or finned exchangers with preheated air up to 500°C, allowing energy savings calculated around 25-30%.

CAPACITY PARAMETERS

Model	Capacity [kW] @ 30 °C	Capacity [kW] @ 400 °C	Flame length [mm]*	Radiant tube diameter [mm]	Flame speed [m/s]
RT-1	30	20	250 ÷ 300	70 ÷ 114	40
RT-2	70	46	350 ÷ 500	90 ÷ 150	42
RT-3	150	100	550 ÷ 700	130 ÷ 165	51
RT-4	200	140	700 ÷ 1000	150 ÷ 210	44
RT-5	300	195	1000 ÷ 1250	168 ÷ 250	52

Capacity referring to volumetric air/gas ratios of 12:1

* Flame length in free air.

IGNITION AND DETECTION

The RT burners are ignited mainly by high voltage discharge supplied by an EN or WAND series electrode. Flame detection takes place through a special EN or WAND series electrode and the UV-2 series ultraviolet

photocell can always be used on request. The flame controls are strongly recommended in all plants operating at temperatures below 750°C.

Model	Ignition with electrode	
	Ignitor	Detector (*)
RT-1	WAND	WAND
RT-2	WAND	WAND
RT-3	3EN / IS-4	3EN / IS-4
RT-4	3EN / IS-4	3EN / IS-4
RT-5	3EN / IS-4	3EN / IS-4

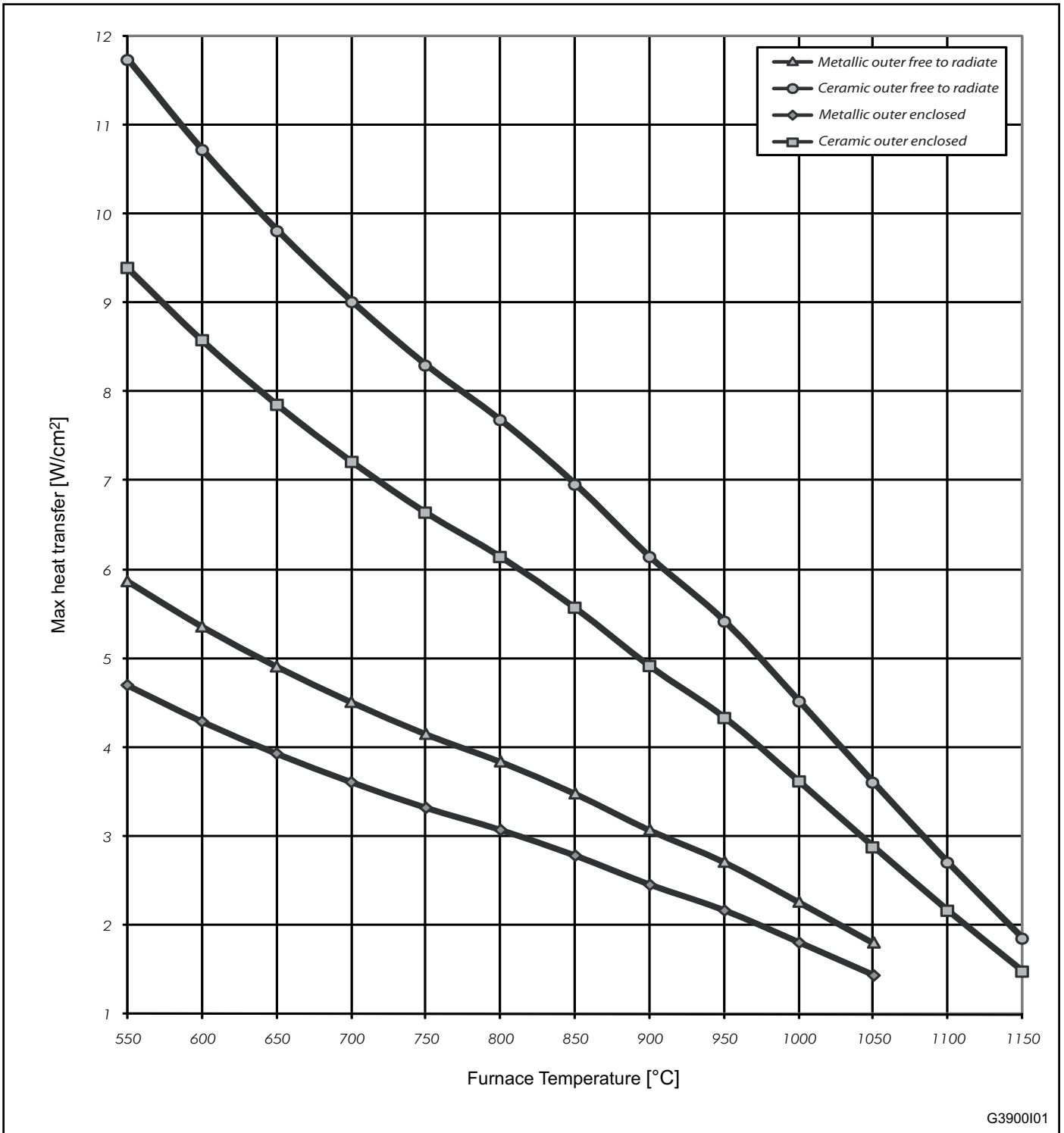
(*) UV 2 optional

THERMAL EFFICIENCY

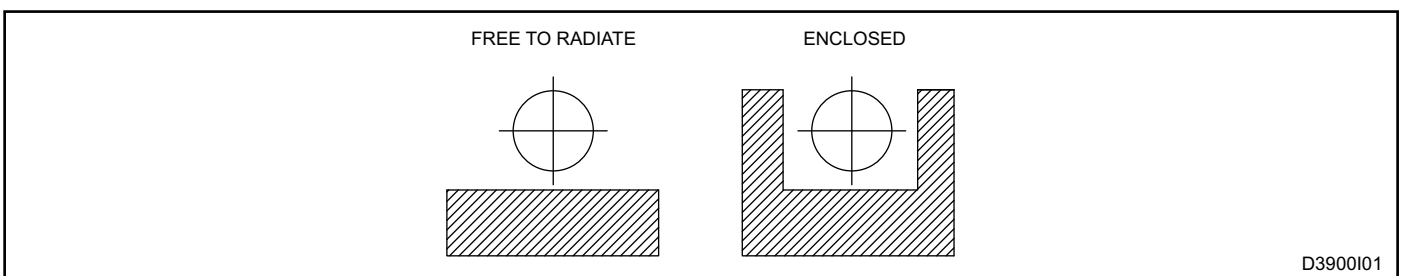
Operating temperature of the furnace in °C	Straight and U-shaped non-recovery pipes		Tubi recuperativi diritti e ad U		Inlet and outlet recovery pipes on one side only	
	At maximum dissipation	Dissipation = 22.6 kW/m ² per hour	At maximum dissipation	Dissipation = 22.6 kW/m ² per hour	At maximum dissipation	Dissipation = 22.6 kW/m ² per hour
1050	42%	-	56%	-	64%	-
1000	43%	-	56%	-	65%	-
950	44%	45%	57%	58% *	67%	68%
900	45%	47%	58%	60%	68%	70%
850	47%	49%	59%	61%	68%	70%
800	48%	51%	60%	63%	69%	72%
750	49%	52%	61%	64%	71%	74%
700	50%	54%	62%	65%	74%	74%

* Actual tested data - Other calculated data.

RADIANT TUBE DISSIPATION

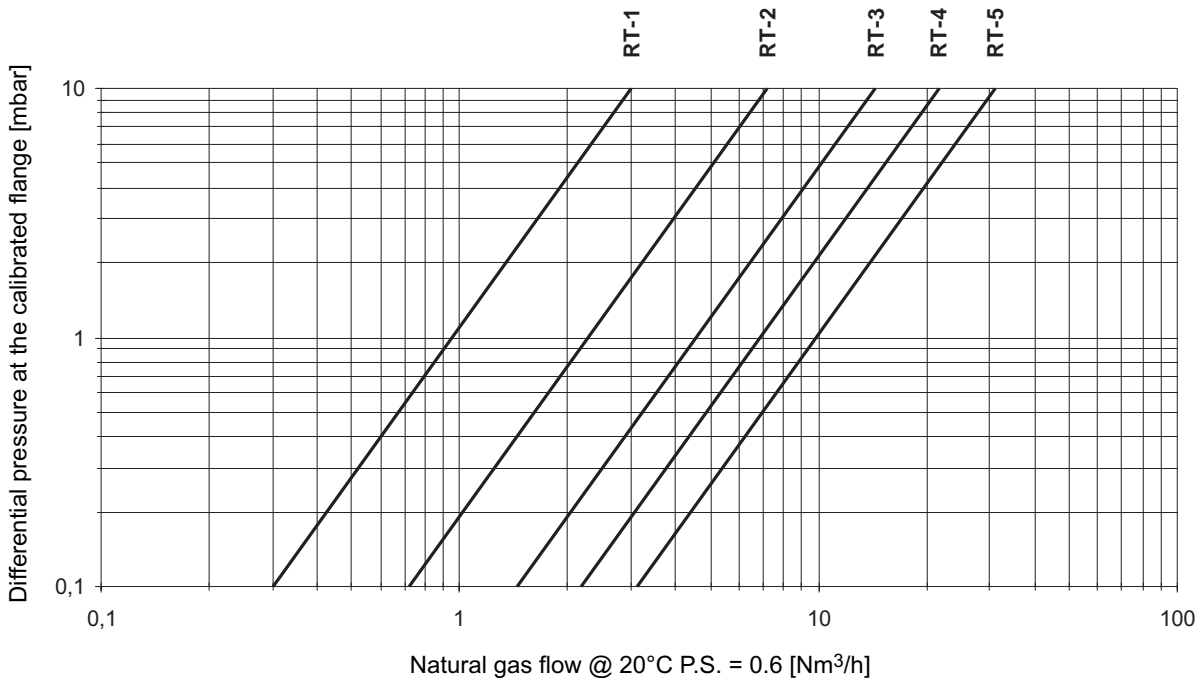


G3900I01



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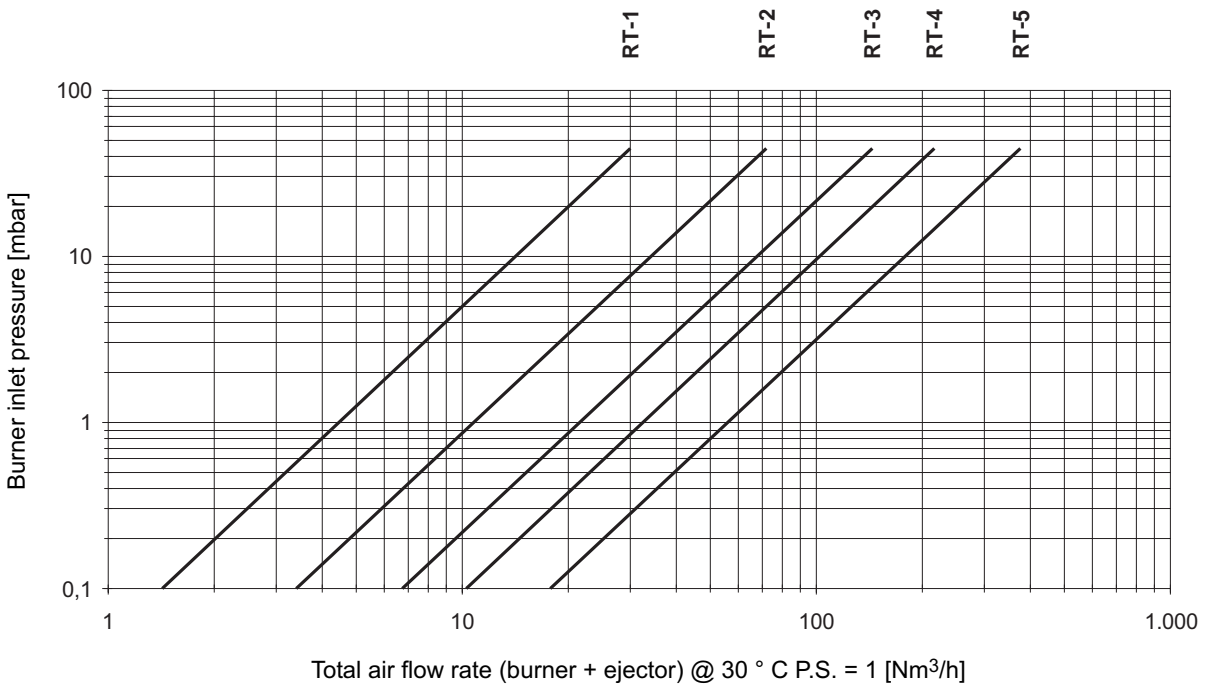
NATURAL GAS FLOW CHART



G3900102

N.B. The volumetric air / gas ratios normally used in radiant tube burners are 12:1, 13:1.

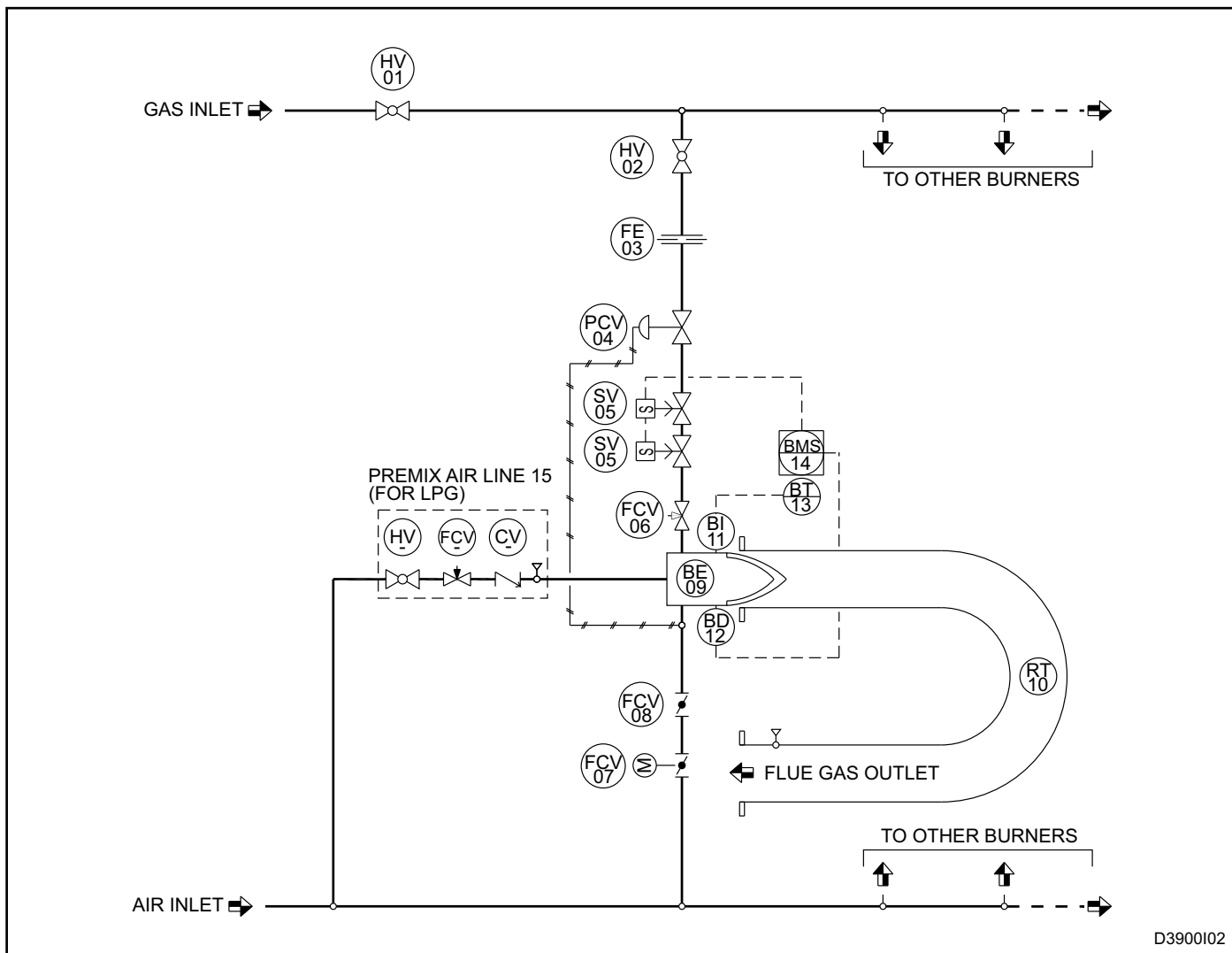
AIR FLOW CHART



G3900103

N.B. the volumetric air / gas ratios normally used in radiant tube burners are 12:1, 13:1.

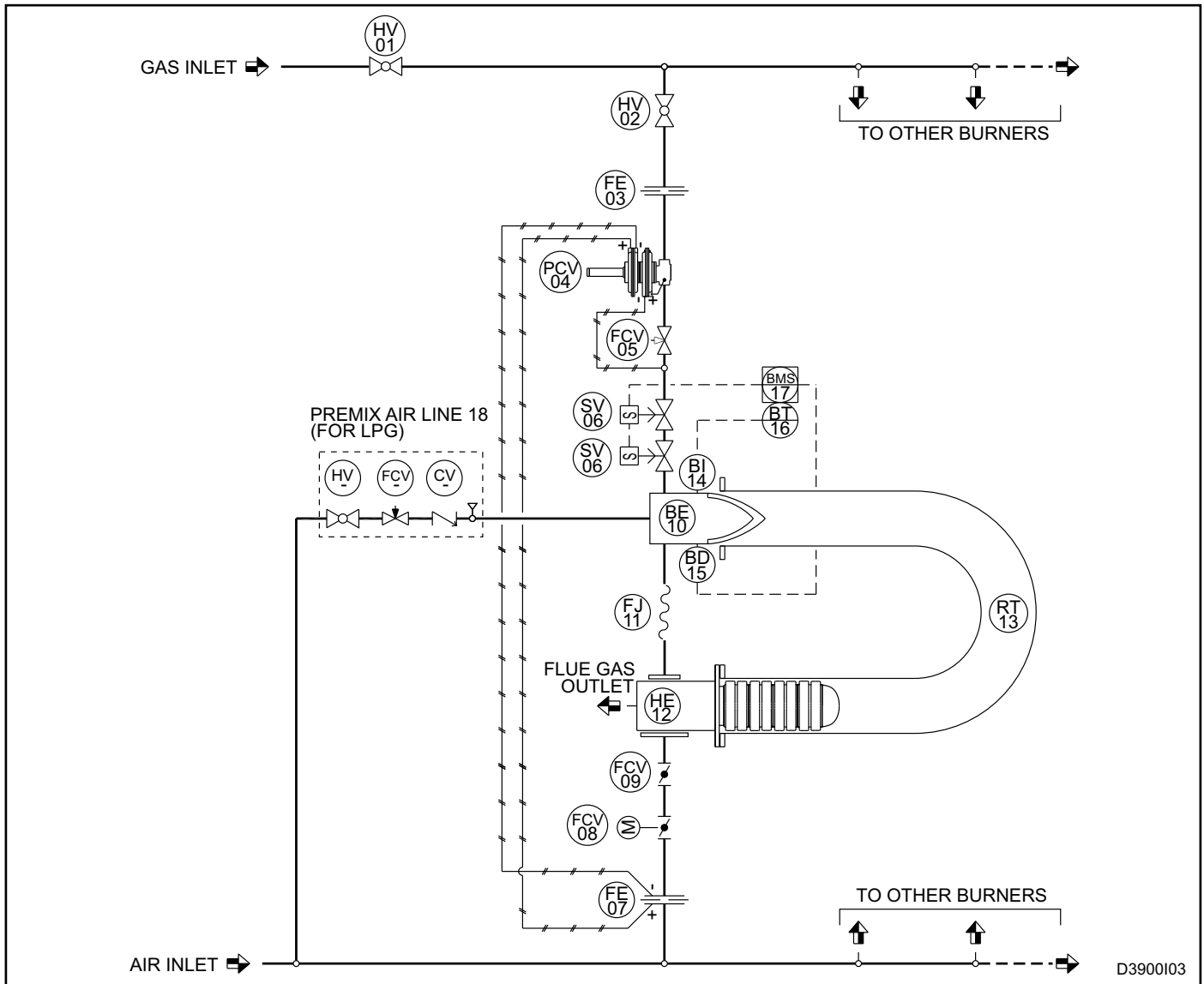
FLOW DIAGRAM - WITHOUT RECUPERATOR



D3900I02

Pos.	Description	Included	Not included
HV 01	General gas interception valve		X
HV 02	General gas interception valve		X
FE 03	Gas calibrated flange		X
PCV 04	Pressure regulator		X
SV 05	Safety solenoid valve		X
FCV 06	Gas adjuster	X	
FCV 07	Motorized air valve		X
FCV 08	Manual regulation valve		X
BE 09	Burner	X	
RT 10	Radiant tube		X
BI 11	Ignition electrode	X	
BD 12	Detection electrode	X	
BT 13	Transformer		X
BMS 14	Flame control		X
15	Premix line (LPG only)	X	

FLOW DIAGRAM - WITH RECUPERATOR



D3900103

Pos.	Description	Included	Not included
HV 01	General gas shut-off valve		X
HV 02	Gas shut-off valve		X
FE 03	Gas calibrated flange		X
PCV 04	Ratio regulator		X
FCV 05	Gas adjuster		X
SV 06	Safety solenoid valves		X
FE 07	Air calibrated flange		X
FCV 08	Motorized air valve		X
FCV 09	Manual regulation valve		X
BE 10	Burner	X	
FJ 11	Flexible		X
HE 12	Heat exchanger		X
RT 13	Radiant tube		X
BI 14	Ignition electrode	X	
BD 15	Detection electrode	X	
BT 16	Ignition transformer		X
BMS 17	Flame control		X
18	Premix line (LPG only)	X	

WARNINGS

- The ignition of the RT burners must always be performed at minimum power, and then modulated towards the maximum, facilitating the ignition and reducing the output overpressures. It is therefore advisable to use slow opening solenoid valves on the fuel.
- The transition from minimum to maximum power, and vice versa, must be gradual and not instantaneous. In this regard, MRBV regulating valves (data sheet E1302) are recommended for two-stage adjustments.
- For all low temperature applications (up to 750°C), the ignition of the burner and the control of the fuel gas solenoid valves must be carried out using a certified burner control device.
- To avoid any damage to the burners, make sure that the blower does not send them stale air from combustion products, oils, solvents or other. To prevent these phenomena from occurring, possibly install the blower or the suction pipe outside the building and away from the exhaust ducts.
- Check the correct connection of the power lines after installation. Before lighting the burner, check that the combustion air and fuel gas pressure values are correct (page 05).
- The burner can only work in the indicated power range. Operation with reduced or excessive power can compromise the efficiency and life-span of the burner. In this case, the general warranty conditions will automatically expire and ESA-PYRONICS will not be held responsible for any damage to property or persons.
- If there are disturbances to other equipment during the burner start-up phase, use the connector with anti-interference filter to connect the HT (High Voltage) cable to the ignition electrode.
- Do not carry out close ignitions of the burner in order not to overheat the control devices of the ignition system (solenoid valves and transformers). Consider a minimum time between one ignition and the next equal to the sum of the prewash time and the first safety time, increased by at least 5 seconds (in any case, do not perform more than 2 ignitions in a period of 30 seconds).
- Operate on the burner and connected devices only in the absence of supply voltage. In case of malfunctioning, follow the instructions in this manual in the Maintenance chapter, or contact the ESA-PYRONICS assistance service.
- Any modification or repair carried out by third parties can compromise the application safety and automatically invalidate the general warranty conditions.

INSTALLATION

The RT series burners can be installed in any position, the installation is simplified as the radiator burner-tube fixing flanges can be adapted according to specific needs.

For the connections of the air and gas pipes to the burner it is mandatory to use flexible fittings that must compensate the expansion of the radiant tube with respect to the attachment flange on the mechanical structure of the furnace. The air and gas inlets can be freely rotated through 90° and are fitted with threaded or welded ESA Pyronics flanges.

For installation, carefully follow the instructions below:

1 - Place the RT burners away from heat sources and products such as: liquids, solvents or corrosive gases.

2 - Make sure that the dimensions of the radiant tube and the distances of the supply pipes correspond to what is specified in the "overall dimensions".

3 - Assemble the burner on the radiant pipe connection flange corresponding to the position reserved for the burner (refer to the construction drawing of the radiant pipe itself.) Place a gasket made of fibro-ceramic material between the flange of the burner and that of the radiant tube (pos.01) Use stainless steel screws (pos.02) taking care to lubricate the screw threads with adequate high temperature lubricant.

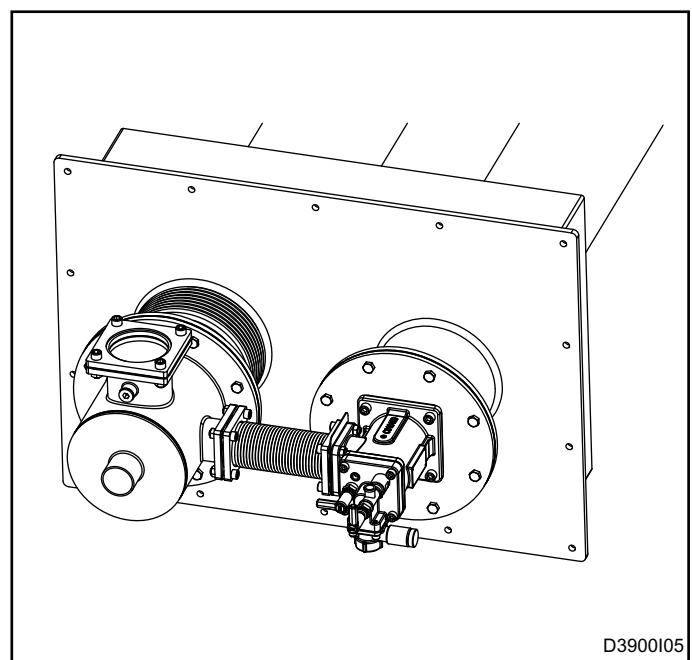
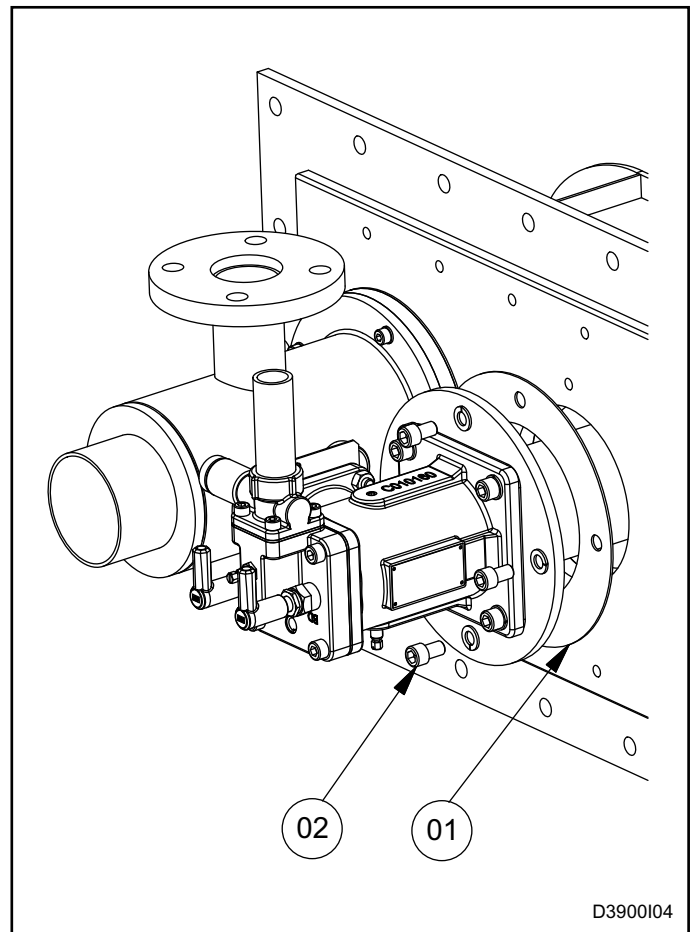
4 - Connect the combustion air and fuel gas inlet pipes, adequately protecting the sensitive parts of these lines from the exhaust pipe coming out from the radiant tube. If using a radiant tube equipped with a recuperator, connect the preheated air outlet to the combustion air inlet of the burner using a stainless steel compensation joint with suitable temperature-resistant gaskets.

5 - Make the electrical connections to the ignition and detection electrodes (or to the UV photocell where provided), taking care to make the conductors pass far away from heat sources.

6 - Make sure that the burner body and all connected metal elements are connected to the system grounding with appropriate conductors.

7 - The connection cable from the ignition transformer to the electrode must be specific for high voltage and unshielded. The length should not exceed about one meter; otherwise the ignition transformer must be positioned near the burner. The HV cable must be laid away from power cables and not in metal conduits, ideally it should be left in the open air.

8 - For more details, see the technical data sheet for ignition transformers.



9 - Make the electrical connections to the ignition electrode and the detection photocell, taking care to make the conductors pass far from heat sources.

IGNITION - SETTING

The operations indicated in the following chapter must be performed by expert or qualified technical personnel. Failure to follow the instructions can generate dangerous conditions.

- 1 - Check that the combustion air pressure at the outlet of the blower and of the fuel gas supply are in the permitted range.
- 2 - Adjust the working and intervention pressures of the combustion system safety devices, whether they are single burner or general for the combustion system, such as: gas pressure reducer, blocking valve, relief valve, pressure switches, etc. Simulate the intervention of all the safety devices, including the intervention of the safety high temperature, verifying that the fuel blocking devices act correctly.
- 3 - Position the motorized air regulation valve in the maximum opening position and adjust, through the gate valves, the air pressures entering the burner, referring to the values indicated in the "Burner Performance" chapter for maximum capacity (page 06).
- 4 - Position the motorized air regulation valve in the minimum opening position and adjust the opening of the same to obtain (at the input to the burner and the ejector) the pressures relative to the minimum power.

5 - Activate the burner control device and perform a few ignition attempts until the burner ignites. During the ignition attempts, act on the gas control valve and, starting from the fully closed position, open it gradually until the burner ignites.

6 - Position the motorized air regulation valve at the maximum opening and adjust, through the gas regulation valve, the maximum fuel flow rate, checking the differential pressure created on the calibrated gas flange.

7 - Check again that, at minimum and maximum power, the air input pressure to the burner corresponds to what is indicated in the "Capacity parameters" chapter. It is possible that, with the burner on, they are different compared with when the burner is off.

8 - Perform repeated ignition attempts at the minimum power of the burners, with maximum temperature ranges, to verify the reliability of the ignition and the flame stability during the adjustment.

9 - Carry out an analysis of the combustion fumes with a suitable analyzer. The oxygen value must comply with the following adjustment ranges:

Maximum capacity: O₂ 3÷4%

Minimum capacity: O₂ 6÷8%

PREMIX AIR FLOW SETTING WHERE SCHEDULED (LPG BURNERS)

The premix line is supplied with the LPG burners. The calibration must be performed with the burner off and in minimum flow conditions. The premix line must be powered by an outlet necessarily located upstream of the air flow control valve, whether it is in the area or controlled by the single burner.

1. Position the burner in conditions of minimum combustion air flow.
2. Open the premix air cock.
3. Adjust the micrometric needle valve according to the following indications:

4. In any case, check that at minimum capacity the burner does not create carbon black on the combustion head and on the electrodes. If necessary, increase the premix air setting.

RT-1: Gas body pressure = 2 mbar

RT-2: Gas body pressure = 2 mbar

RT-3: Gas body pressure = 2 mbar

RT-4: Gas body pressure = 2 mbar

RT-5: Gas body pressure = 2 mbar

RT-5: $\Delta p = 5$ mbar

GENERAL MAINTENANCE PLAN

Operation	Type	Advised period	Notes
High voltage electrode connector	O	annual	verify the integrity of the external plastic and oxidation of the internal connector and of the electrode terminal
Ignition/detection electrode	O	annual	replace in case the kanthal terminal is consumed.
Flanged pipe combustion head	O	annual	during furnace stop, check that the two parts do not show signs of oxidation due to high temperature.
Burner settings	O	annual	check the correctness of air and gas pressures or oxygen content with a suitable analyzer
Pre-mix air calibration (where expected)	O	annual	check the correctness of the calibration of the premix line with the burner off.
Replacement gas gaskets on the gas side (**)	S	every two years	verify that there are no deformations or breakages.

NOTES:

Key: O = ordinary / E = extraordinary

(*) it is advisable to replace the gas-side gaskets after each disassembly of the gas supply line.

(**) use high temperature gaskets.

ORDINARY MAINTENANCE

For correct dismantling and better maintenance of the RT burners, scrupulously follow the instructions below with the system switched off.

REPLACEMENT OF IGNITION ELECTRODES AND FLAME DETECTION

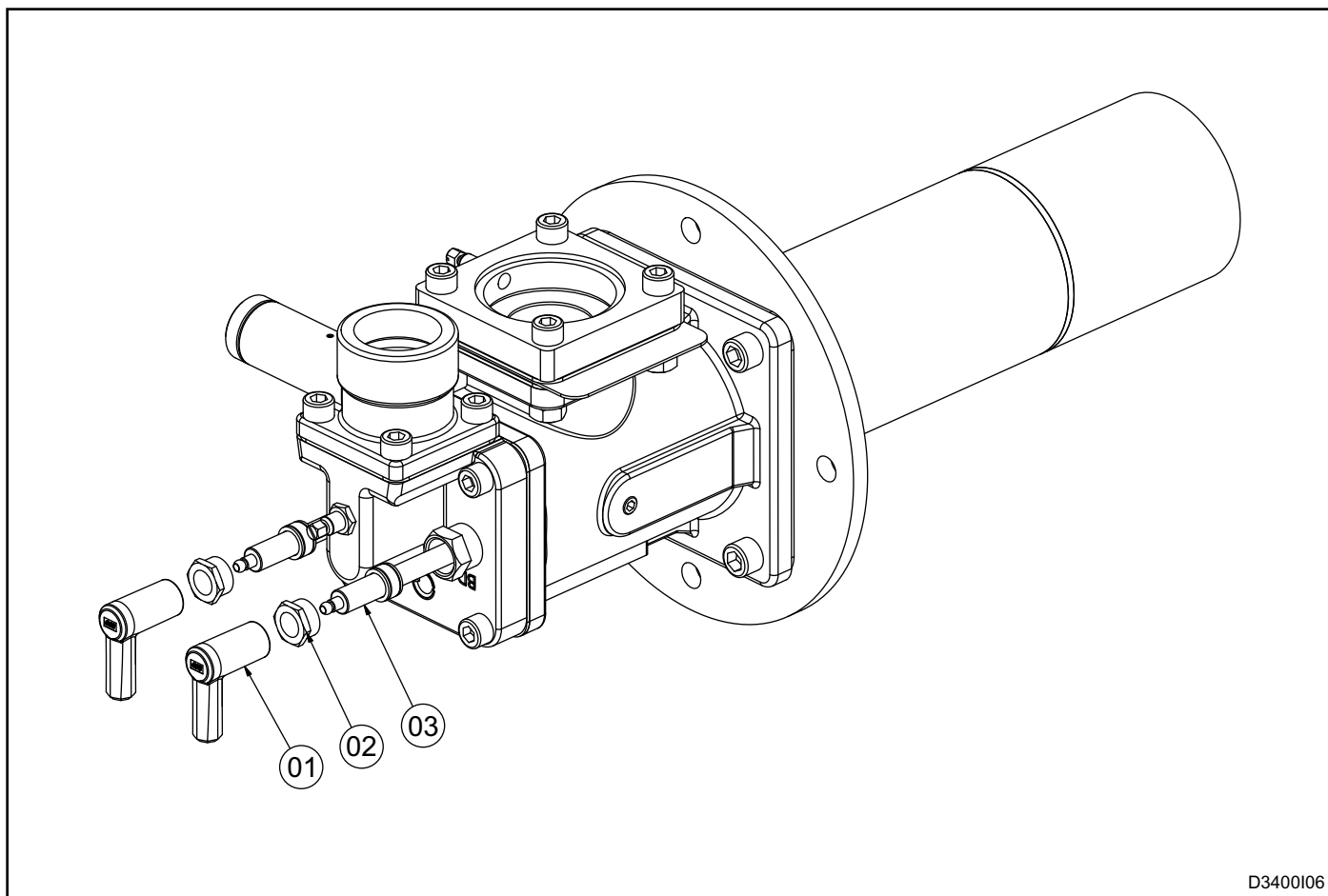
- 1 - Check that the burner control device is switched off.
- 2 - Disconnect the electrodes (**pos. 01**).

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

4 - Replace the defective electrode (**pos. 03**) paying attention to the correct repositioning of the electrode you are replacing.

5 - Reset the electrical connection (**pos. 01**).

6 - Check the correct ignition/detection of the flame by the electrode.



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EXTRAORDINARY MAINTENANCE

For correct dismantling and better maintenance of the RT burners, carefully follow the instructions below with the system switched off.

BURNER LOCKOUT

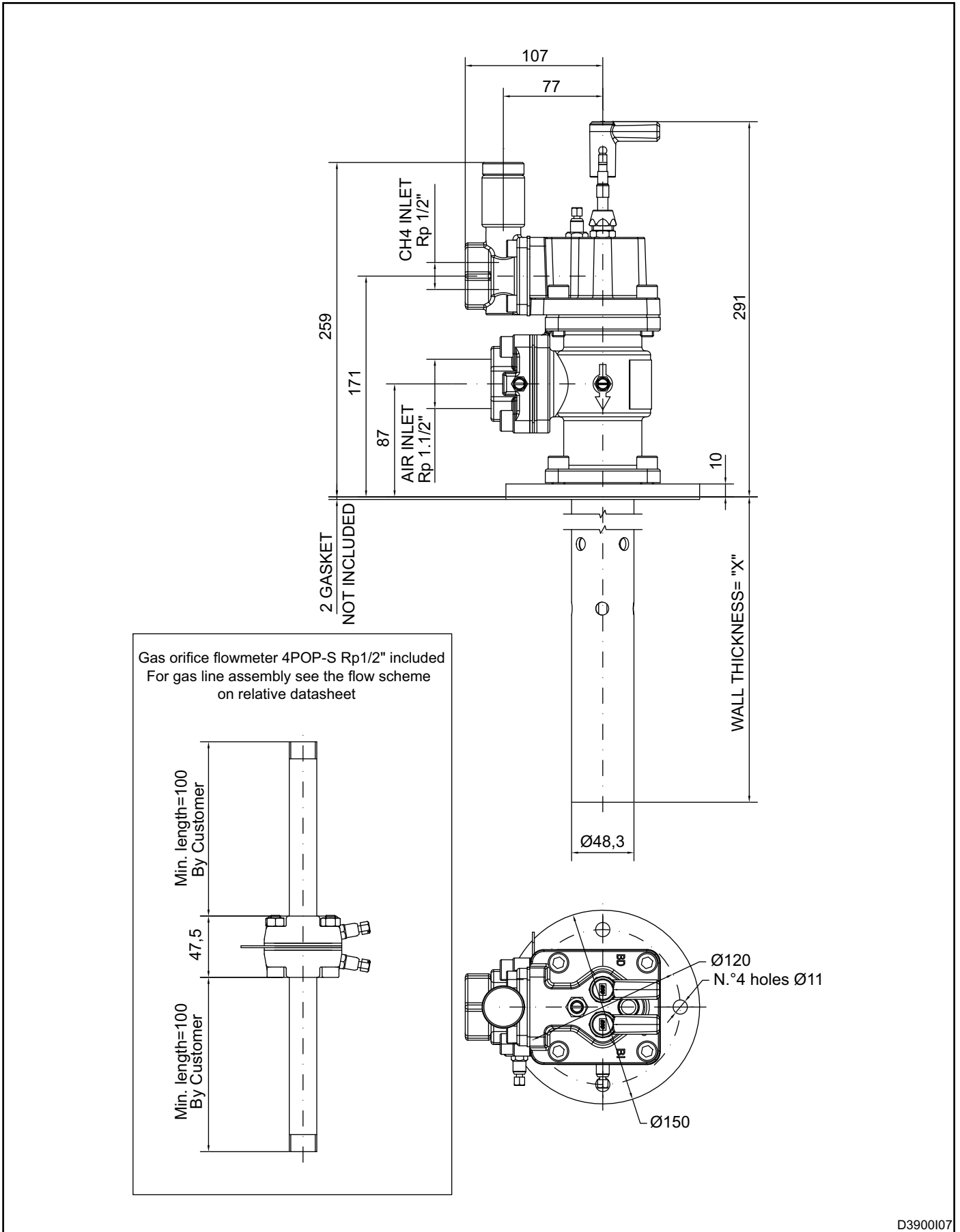
For correct dismantling and better maintenance of the RT burners, carefully follow the instructions below with the plant switched off. In burner lockout conditions, refer to the burner control device indications and to the relative manual to identify the cause. The main cases are shown below:

■ **Illegal flame detection:** Lockout due to the detection of an illegal flame signal during the phases preceding ignition or after they go off. The causes are to be found in the detection system (faulty probe or humidity), or in a gas leakage from the safety solenoid valve that allows the burner to remain on.

■ **Ignition failed:** Lockout due to lack of flame formation during start-up. The causes are to be found in the ignition system (absence of spark, broken electrodes or not in the correct position), in poor regulation of fuel and combustion flow or in the detection system (faulty probe or interrupted cables). Specifically, in the first two cases the flame does not ignite, while in the last case the flame is formed but the burner control device is not able to detect it.

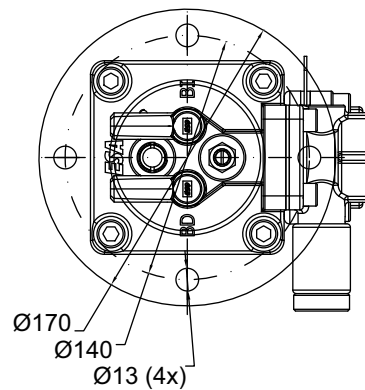
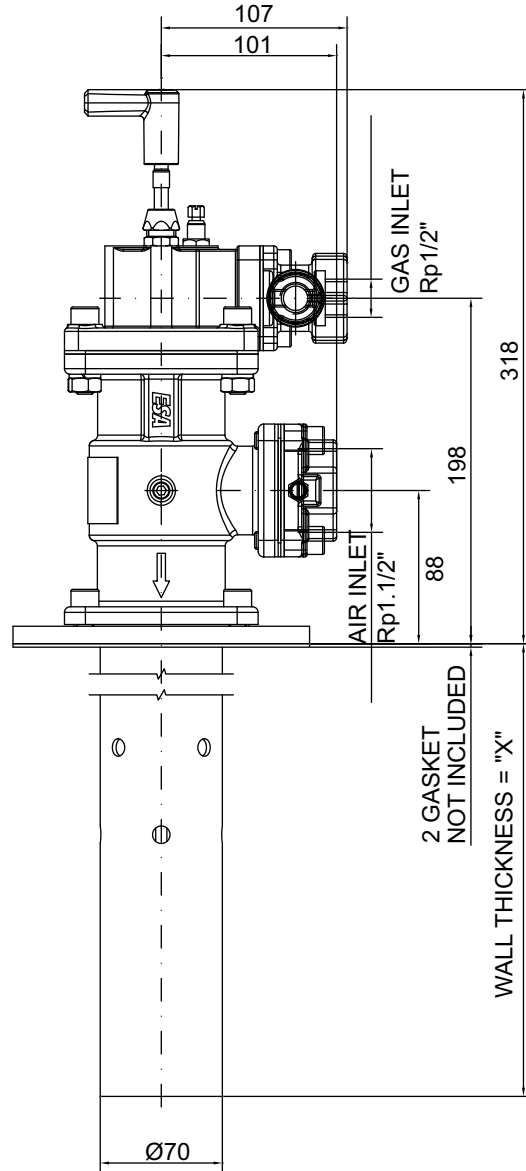
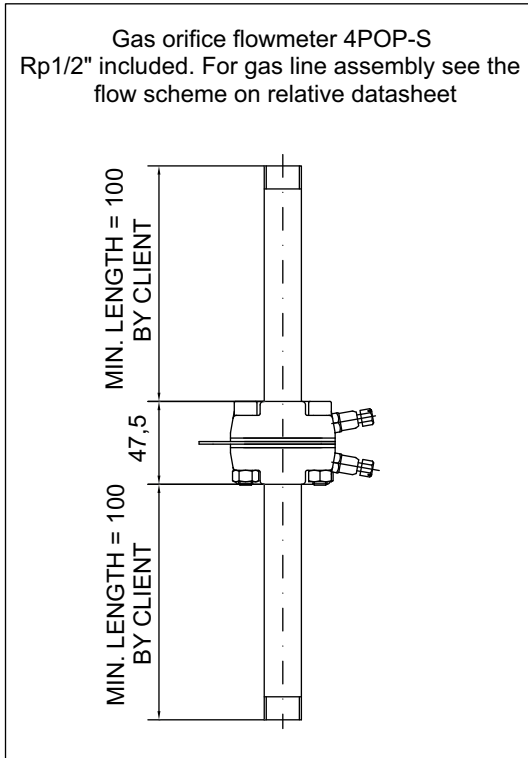
■ **Loss of flame signal:** Lockout due to the loss of the flame signal during normal burner operation. The causes are to be found in the regulation of combustion air and fuel flow (rapid variations in flows, regulation out of permitted range) or in the detection system (faulty, dirty or badly positioned probes).

OVERALL DIMENSIONS - RT-1-CH4



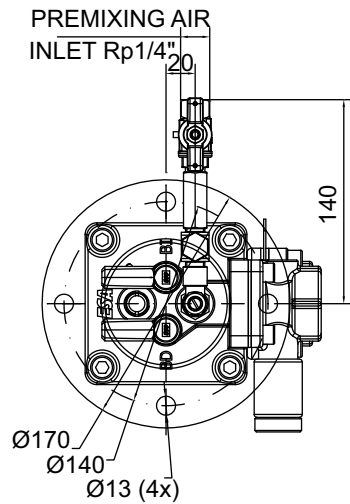
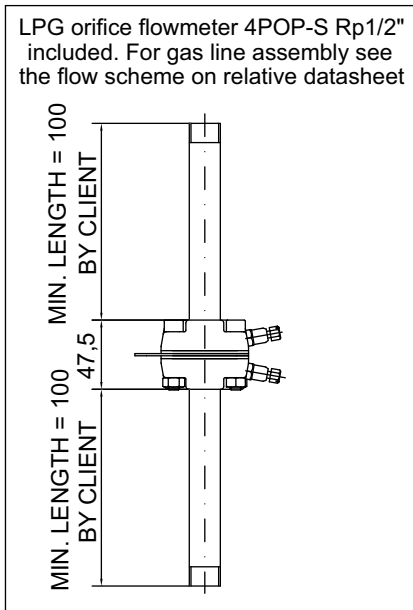
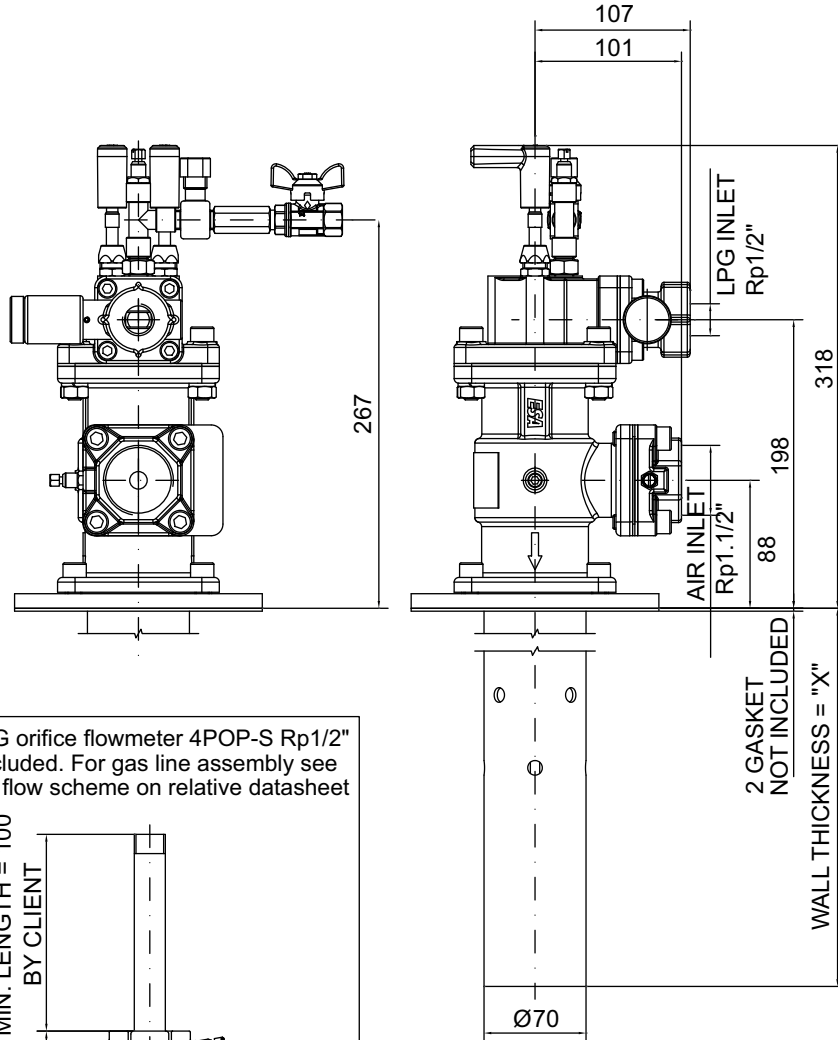
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OVERALL DIMENSIONS - RT-2-CH4



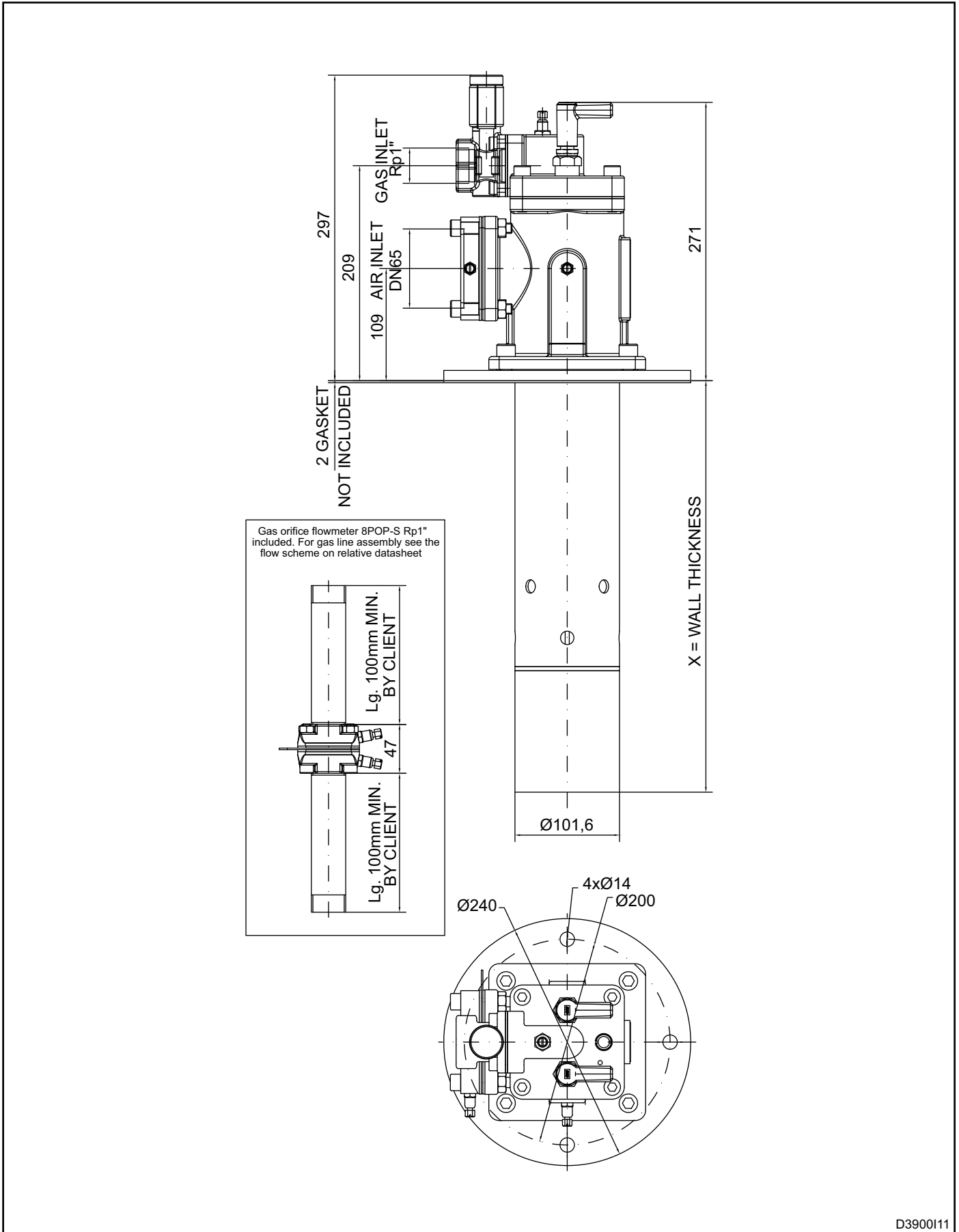
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OVERALL DIMENSIONS - RT-2-GPL



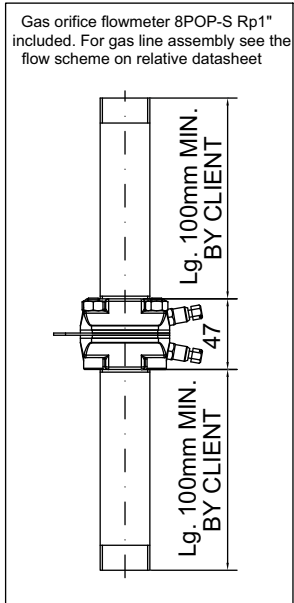
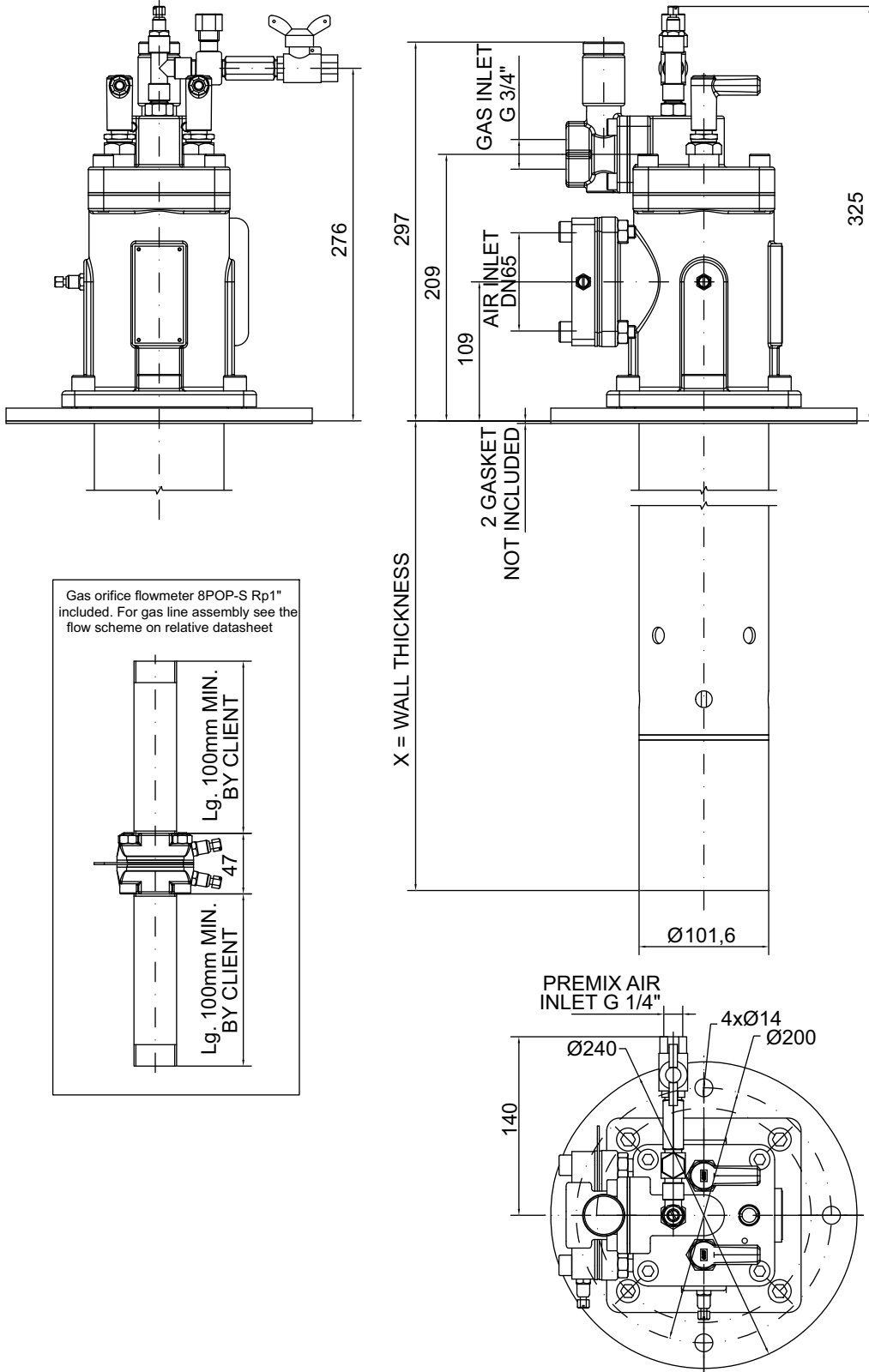
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OVERALL DIMENSIONS - RT-3-CH4

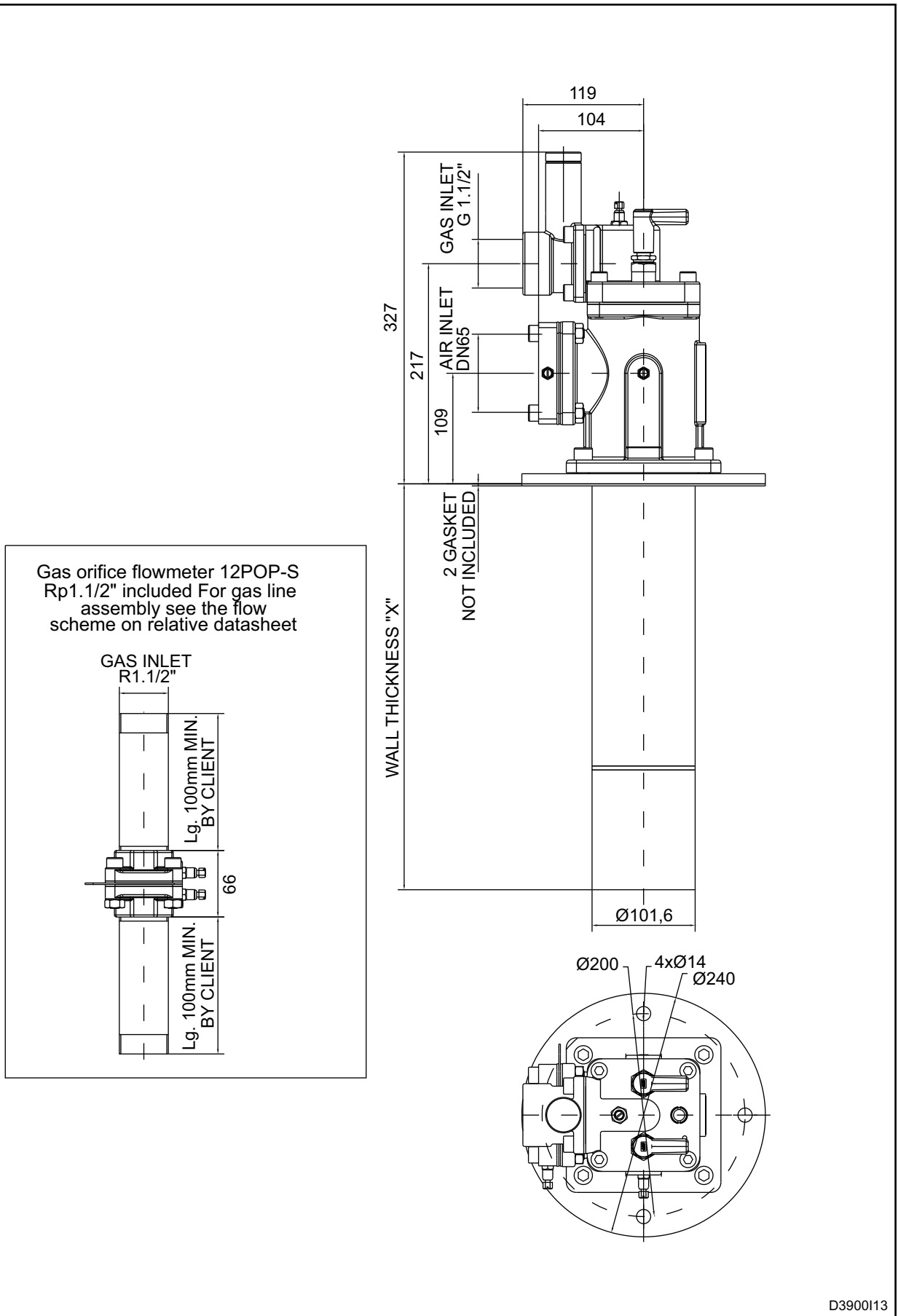


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OVERALL DIMENSIONS - RT-3-GPL

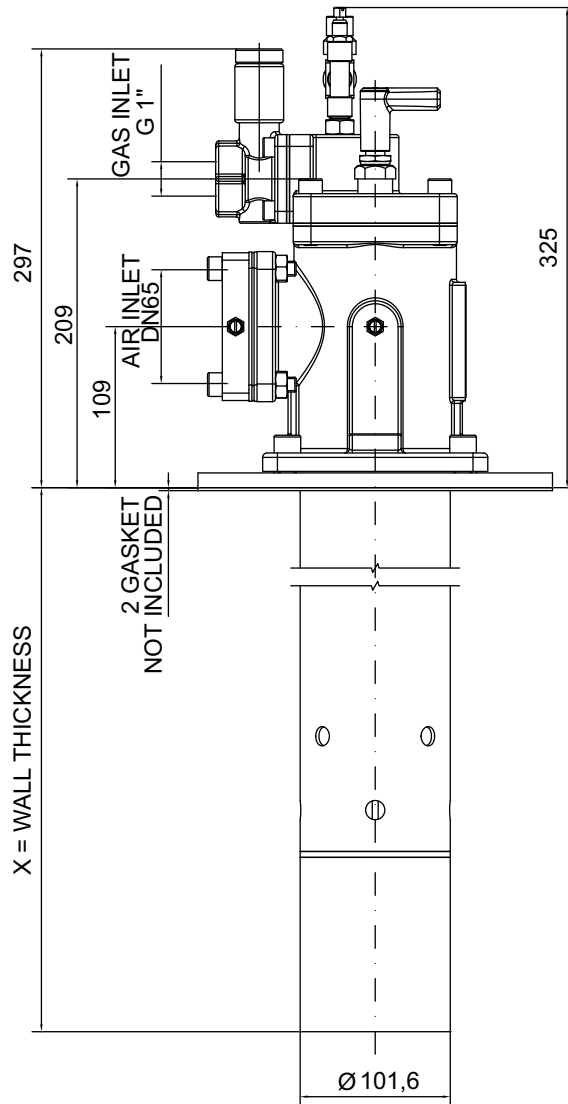
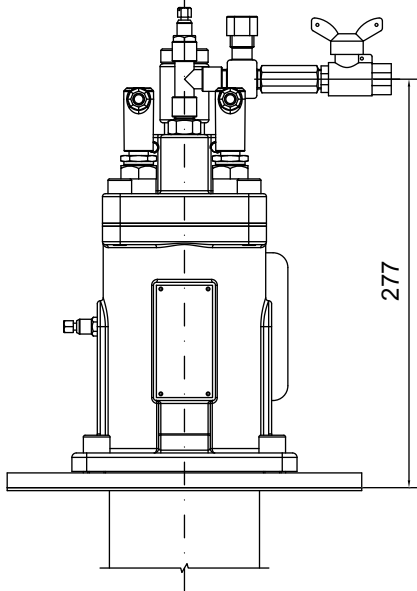


OVERALL DIMENSIONS - RT-4-CH4

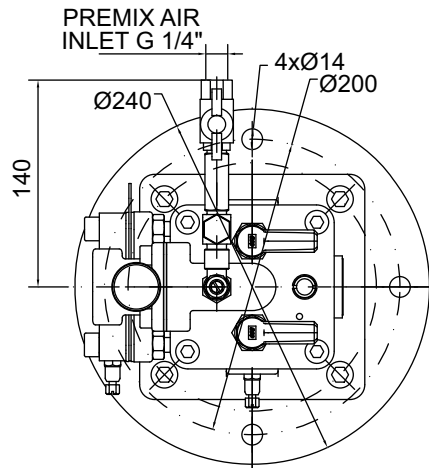
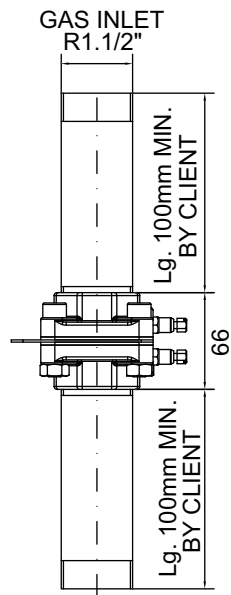


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OVERALL DIMENSIONS - RT-4-GPL

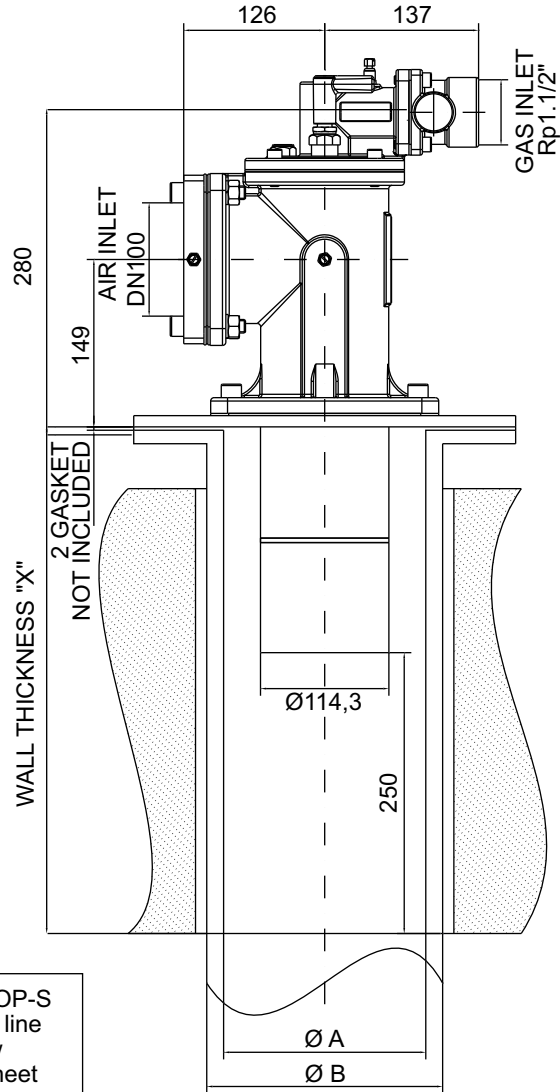


Gas orifice flowmeter 12POP-S
Rp1.1/2" included For gas line
assembly see the flow
scheme on relative datasheet

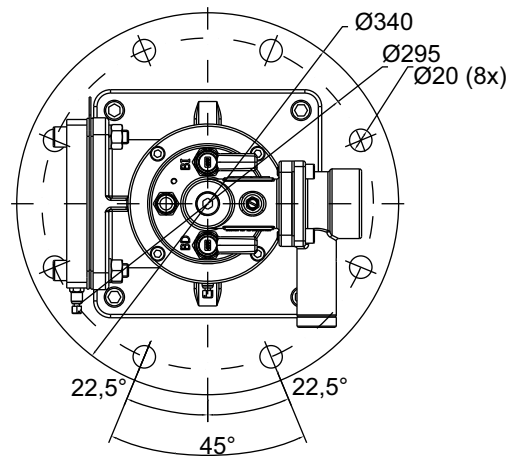
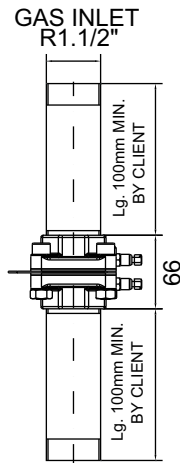


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OVERALL DIMENSIONS - RT-5-CH4

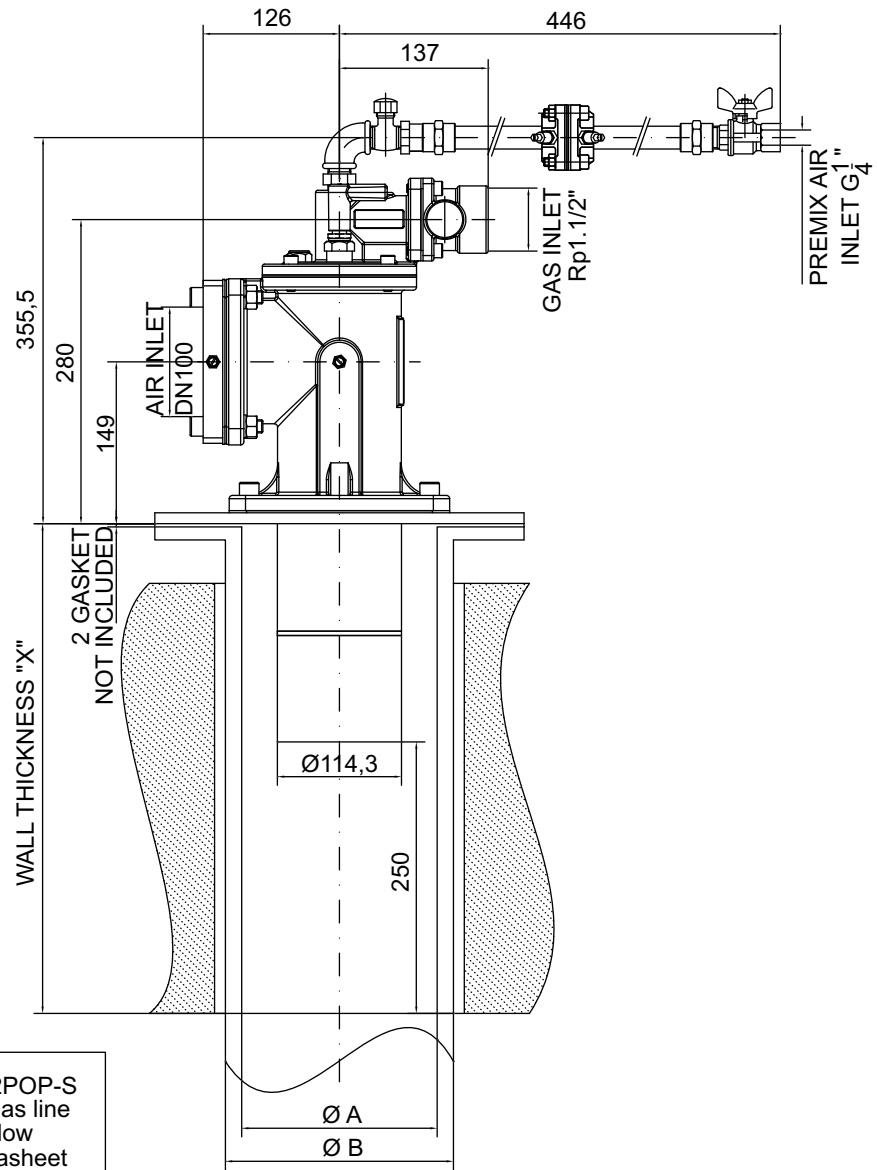


Gas orifice flowmeter 12POP-S
Rp1.1/2" included for gas line
assembly see the flow
scheme on relative datasheet

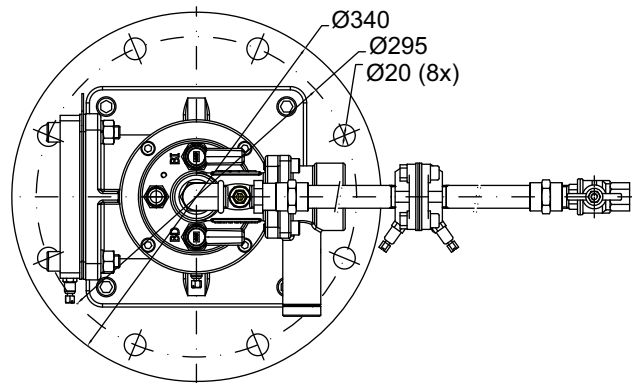
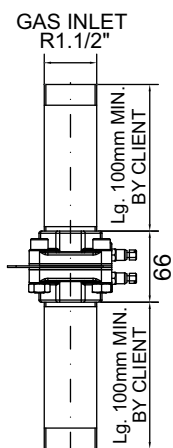


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OVERALL DIMENSIONS - RT-5-GPL

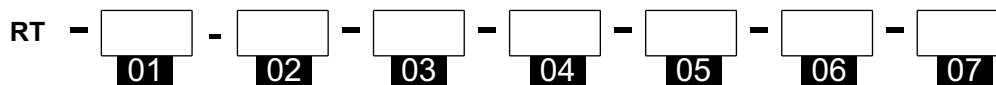


Gas orifice flowmeter 12POP-S
Rp1.1/2" included for gas line
assembly see the flow
scheme on relative datasheet



D3900116

ORDERING CODE - COMPLETE BURNER



Model		01
RT-1	1	
RT-2	2	
RT-3	3	
RT-4	4	
RT-5	5	

05 Ignition and detection	
Ign. + det. electrode	E*
Unirod	M
Pilot burner (4)	P

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

06 Flanged tube length "X"	
Indicate length see "overall dimensions"	...

Fuel		03
Natural gas	CH4	
LPG	GPL	
Poor gas (1)	GP	

07 Flanging type	
According to ESA dwg	E*
According to client dwg	C

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

Note:

- ¹ Special performance according to the characteristics of the gas
- ² Available in models 3 and 4 (see paragraph "Ignition and Detection")