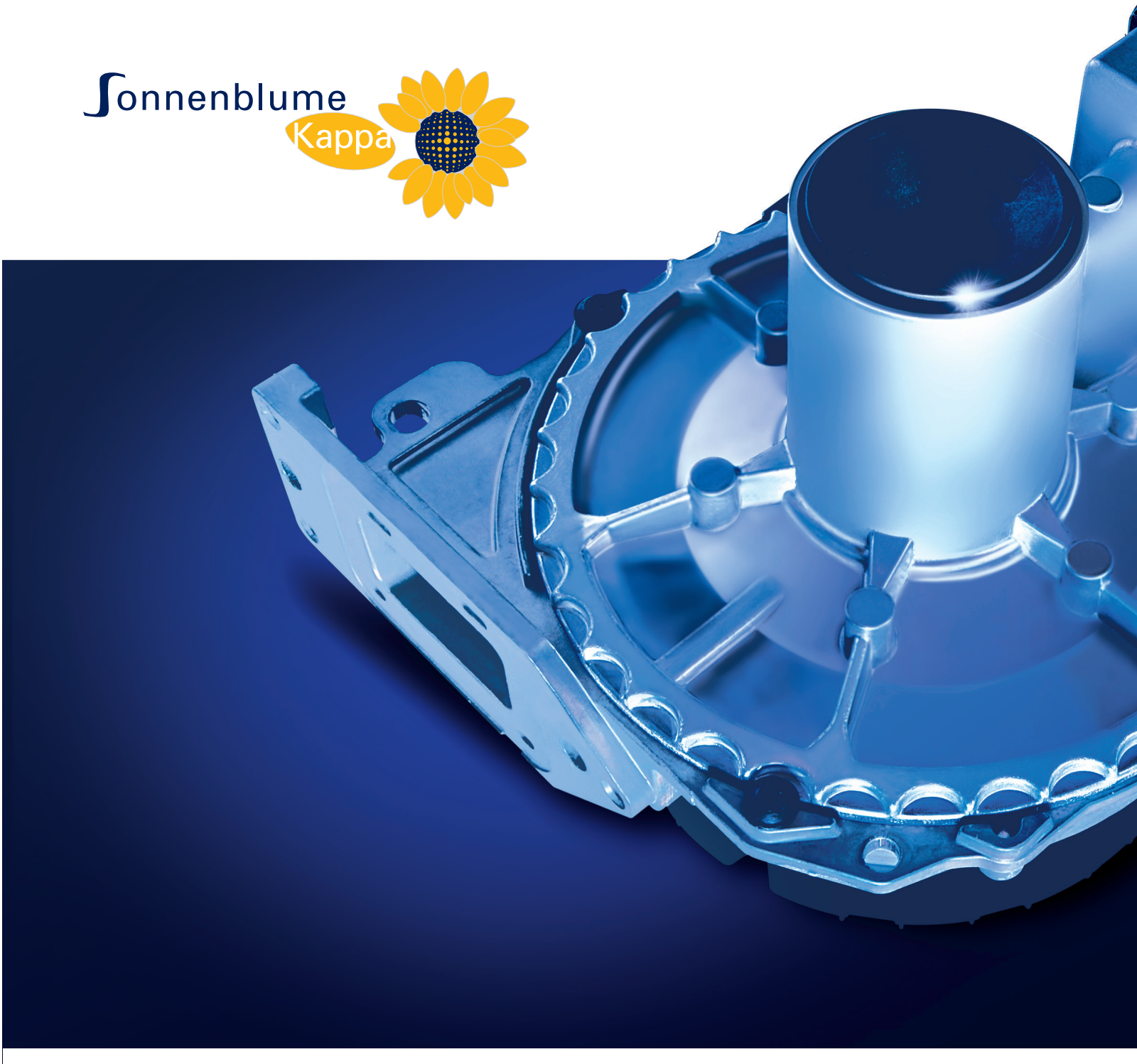
Sonnenblume Kappa



SITGroup

MULTIFUNCTIONAL CONTROL FOR GAS BURNING APPLIANCES

SIT 480 SONNENBLUME KAPPA

A new generation of integrated systems

Multifunctional control for gas burning appliances

Application

Domestic gas appliances: central heating boilers, combi boilers, instantaneous water heaters using premix burner with automatic ignition system

Main features

- Brushless fan
- Mixer
- Two automatic shut-off valves
- Servo pressure regulator
- Gas-air pressure modulator

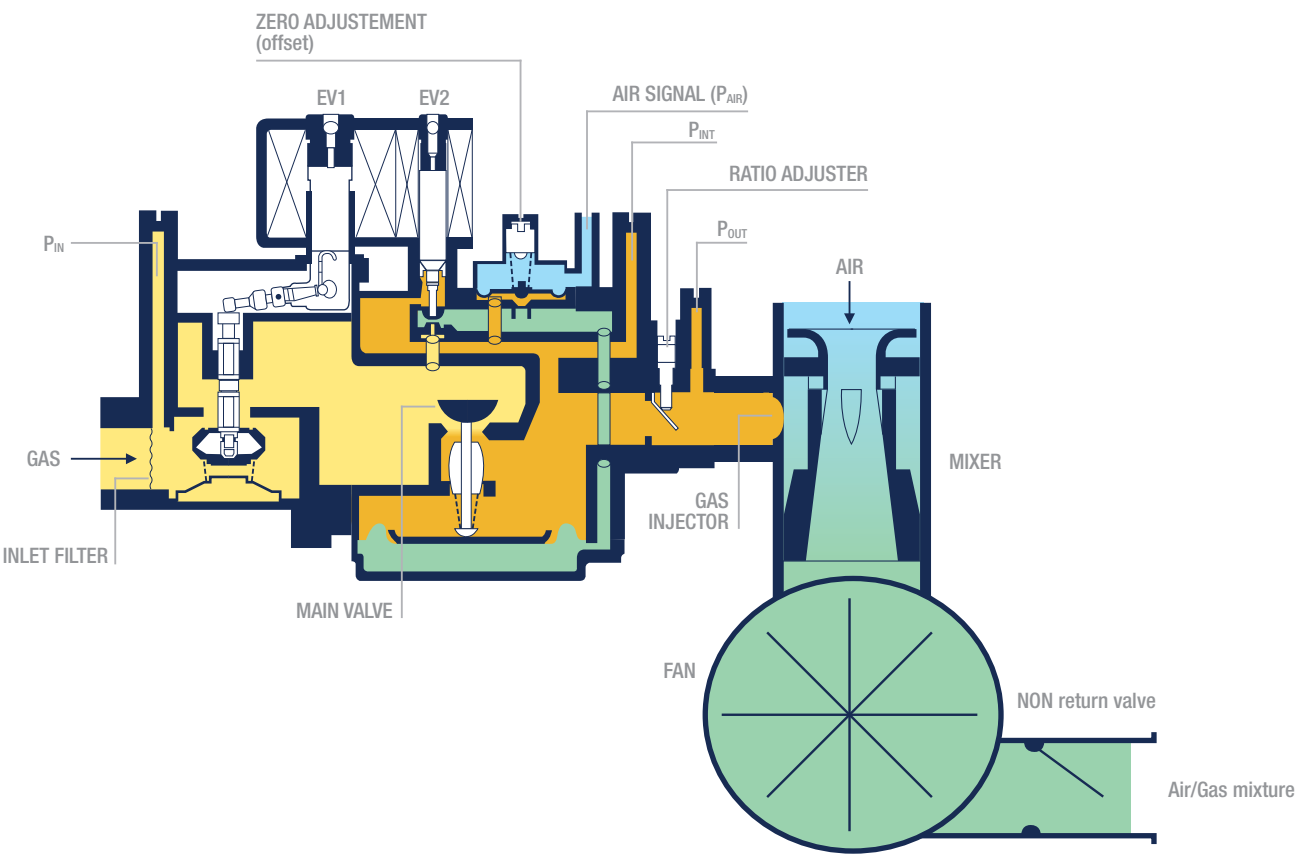
Normative reference

- **EN 126** - Multifunctional controls for gas burning appliances
- **EN 60335-1** - Household and similar electrical appliances- safety. Part 1: General requirements
- **ISO 5801** - Industrial fans - Performance testing using standardized airways

Functional Description

SIT 480 Sonnenblume Kappa is an multifunctional control consisting of a fan with brushless motor (FAN), a mixing device (Mixer) coupled with the 848 SIGMA gas valve. 848 SIGMA consists of one direct acting automatic shut-off valve, one servo controlled automatic shut-off valve, a servo pressure regulator and a 1:1 gas/air pressure ratio modulating control. The fan generates the air necessary for the combustion and can be operated at variable speed due to the brushless motor. The air flow passes through the mixer with venturi shaped air passage generating the underpressure necessary to operate the gas valve in "zero governor" configuration.
When the shut-off valves are de-energized, it is possible to measure the inlet pressure on the inlet pressure test point (P_{IN}).

When the solenoid EV1 is energized the first gas valve opens. Energizing the second solenoid EV2, the servo valve opens and allows the gas to flow through the servo circuit. The pressure behind the main diaphragm increases and consequently the main valve opens.
Since 848 SIGMA has a 1:1 gas/air pressure ratio modulating control, the opening of the main valve is function of the gas flow required with the objective to keep the outlet pressure (P_{INT}) equal to the air pressure signal (P_{AIR}) that is close to the atmospheric pressure.
The ratio between gas flow and air flow is fine adjusted by mean of the Ratio Adjuster. The gas pressure downstream the Ratio Adjuster can be measured on the outlet pressure test point (P_{OUT}).



480 Sonnenblume Kappa is a system specifically designed to operate premix burners and consists of a fan driven by a brushless motor with electronic controller, a mixing device and a multifunctional gas control with two automatic shut-off valves, a servo pressure regulator and a 1:1 gas/air pressure ratio modulator.

With reference to the schematic blocks in Fig. 1:

- FL is the inlet filter
- EV1 is a direct acting automatic shut-off valve
- PR is a servo pressure regulator with offset adjustment
- G/A is the pneumatic device for the control of the gas pressure according to the air pressure signal
- EV2 is the second automatic shut-off valve servo operated
- RA is a gas/air ratio adjuster (optional)
- MX is the mixing device
- FAN is the brushless fan with brushless motor
- NRV is the non return valve (optional)

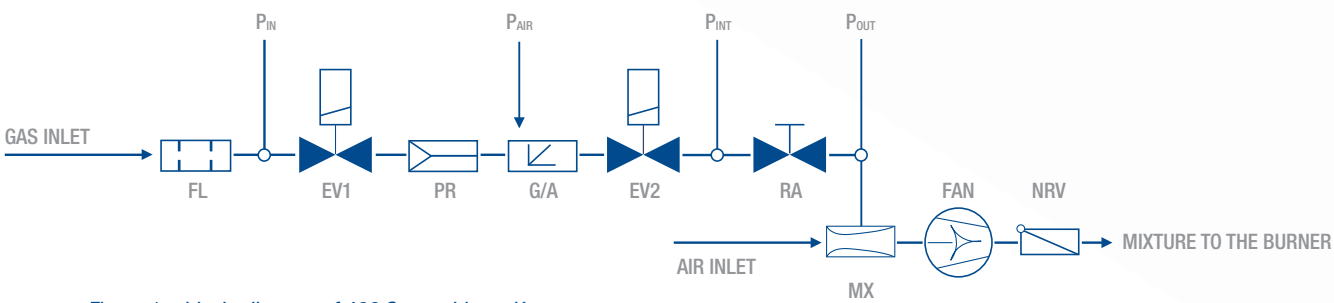
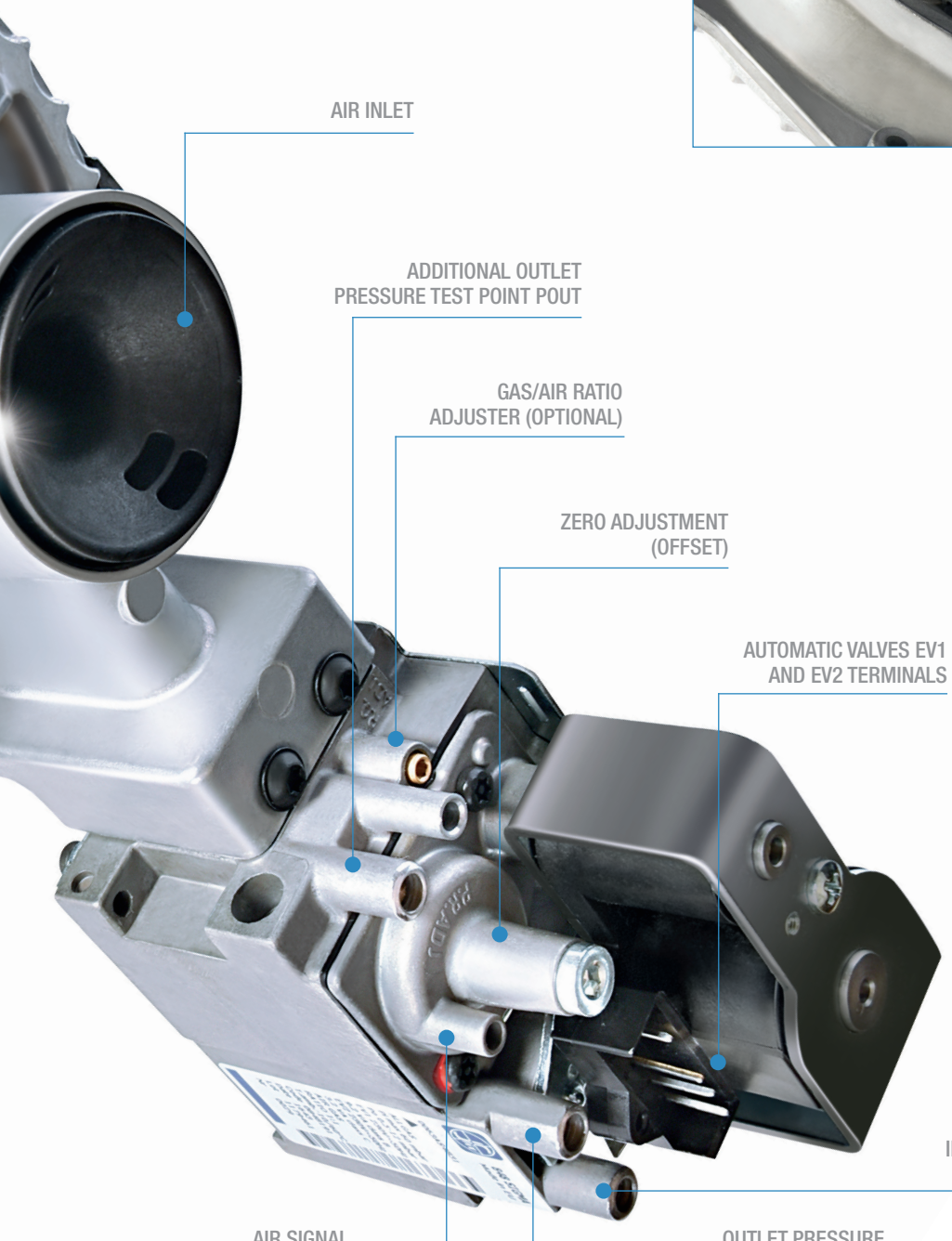


Figure 1 – block diagram of 480 Sonnenblume Kappa

Back view



Front view

Construction Characteristics

- Integrates the brushless fan, the mixer, the gas valve and fan electronic controller, as an option, the full boiler electronics in a single assembled and tested product
- Flexible configuration to match different boiler design and heat exchanger types
- Die-cast aluminum alloy body
- Various sizes of venturi are available to fit the maximum appliance power
- Optional non return valve device

Specification

- Gas families — 2nd and 3rd
- Ambient temperature — -15 to +60 °C
- Maximum valve inlet pressure — 60 mbar
- Maximum appliance power — 40 kW
- Modulating range — up to 1:6
- Valve torsion and bending resistance — group 2 according to EN 126

Mechanical Connection

- Gas Inlet — flanged ½ according to ISO 7 alternative G¾ according to ISO228
- Pressure test point — ⌀ 9 mm
- Air signal — ⌀ 6.4 mm
- Mixture outlet — Customized manifold interfaces for any heat exchanger

Electrical Connections

- Automatic shut-off valves — Male contact 3003 Molex compatible, suitable for female Molex series 3001 or equivalent — Fig. 3
- Fan power supply — 3644 03 K01 LUMBERG RAST-5 (230 V version) — Fig. 2a
  TYCO I-350943-0 (120 V version) — Fig. 2b
- Fan driving interface — MOLEX minifit 5569 – 05 — Fig. 4

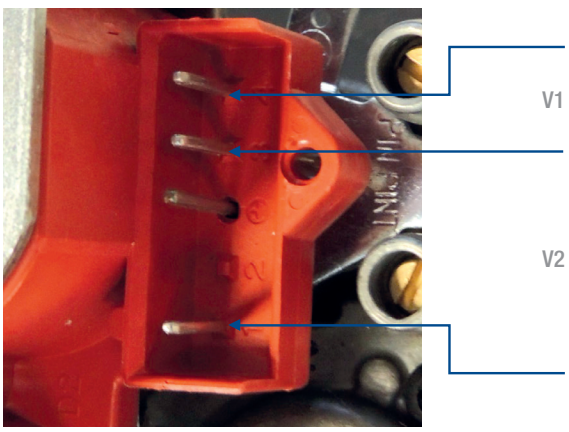


Figure 3 - automatic shut-off valves

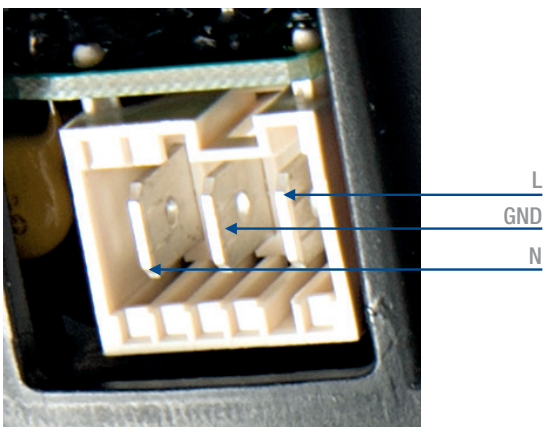


Figure 2a - fan power supply connector 3644 03 K01 LUMBERG RAST-5

Electrical data

Automatic shut-off valves

Nominal supply voltage	Current @ nominal voltage [mA]		Power @ nominal voltage [W]		Coils colour
	EV1	EV2	EV1	EV2	
230 V – 50 Hz	40	12	4.3	2.0	Black
120 V – 60 Hz	83	32	5.8	2.6	Green
24 V – 60 Hz	470	96	5.8	2.6	Red
24 Vrac	270	120	6.5	2.9	Blue

Other versions are available

Fan power supply

Rated voltage/ frequency	Maximum power	Maximum current
230 V / 50-60 Hz	75 W	0.5 A
120 V / 50-60 Hz	90 W	1.3 A

Fan interface supply

Rated voltage	Current
18 to 30 Vdc	10 mA @ 24 Vdc

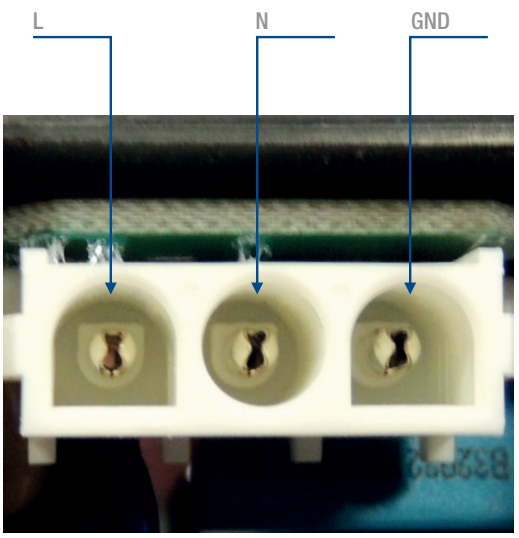


Figure 2b - fan power supply connector TYCO I-350943-0

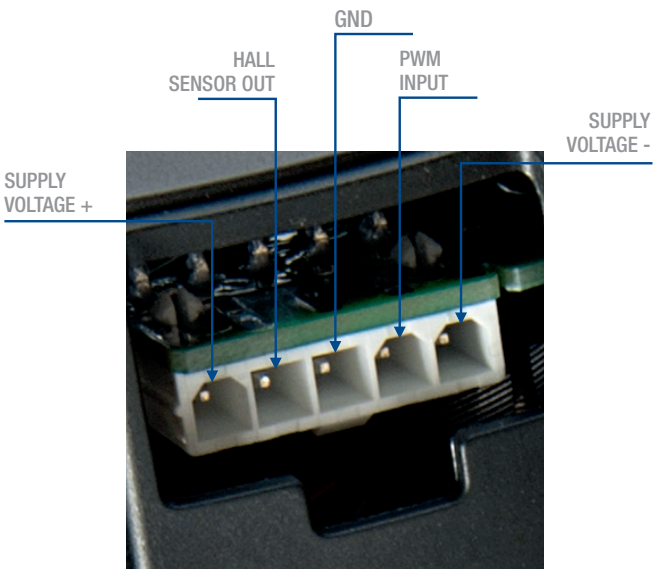
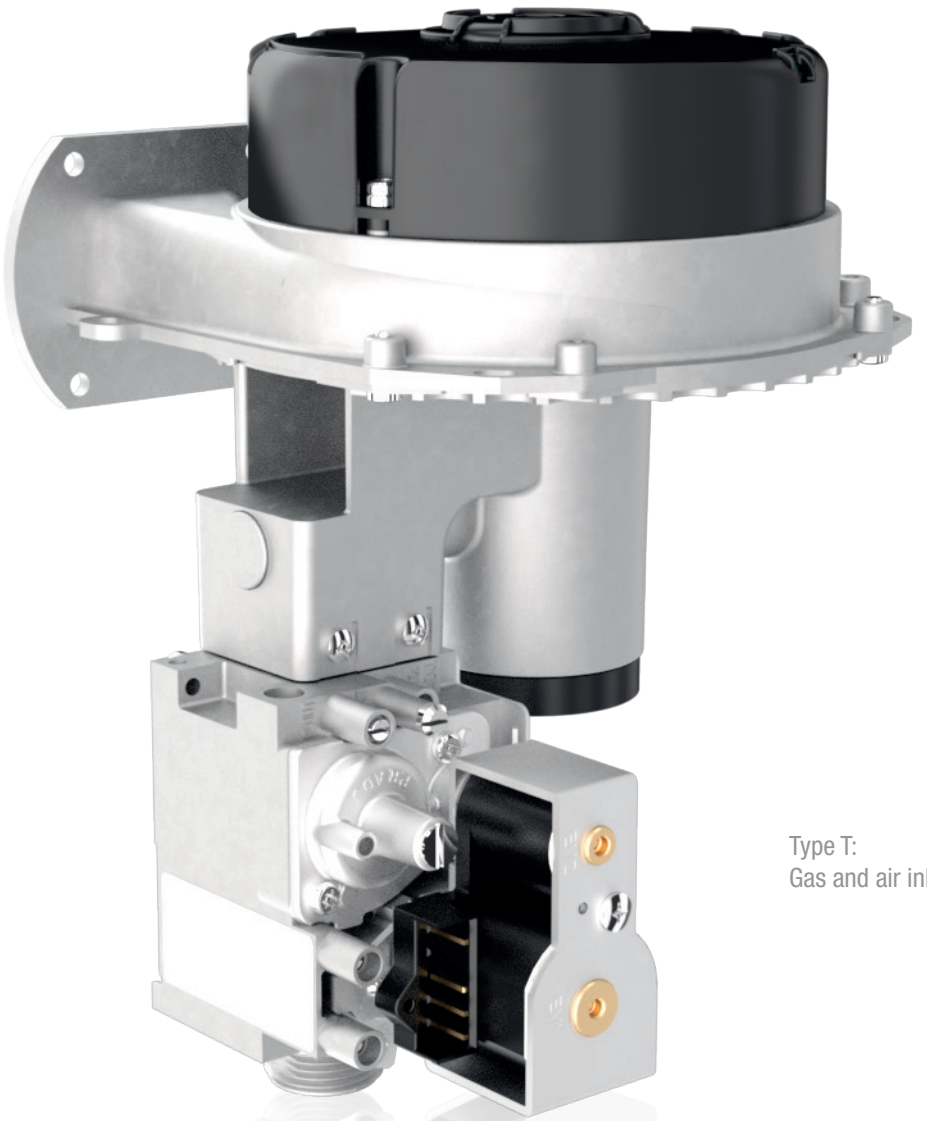


Figure 4 - fan driving interface

Gas valve connection layout Type T



Type T:
Gas and air inlet axes are parallel

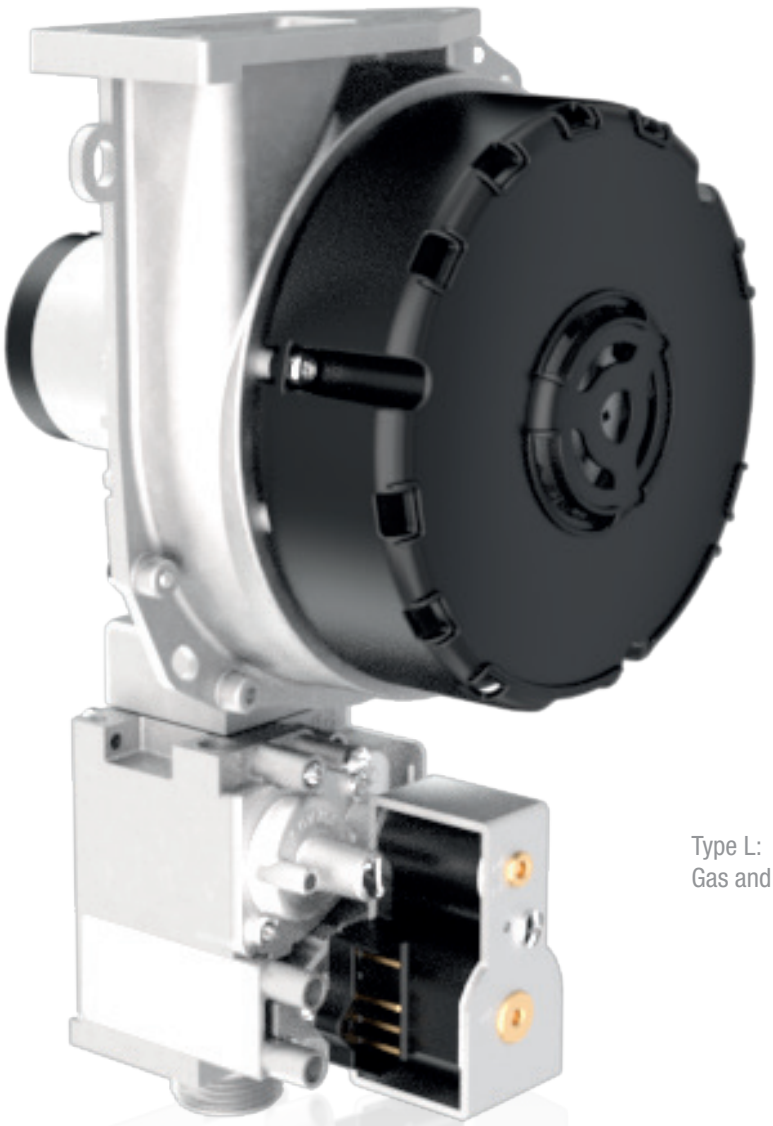
Figure 6 – connection layout type T

Gas valve position

Figure 9 - valve position for configuration T

Type 0 *Type 90* *Type 180*

Gas valve connection layout Type L

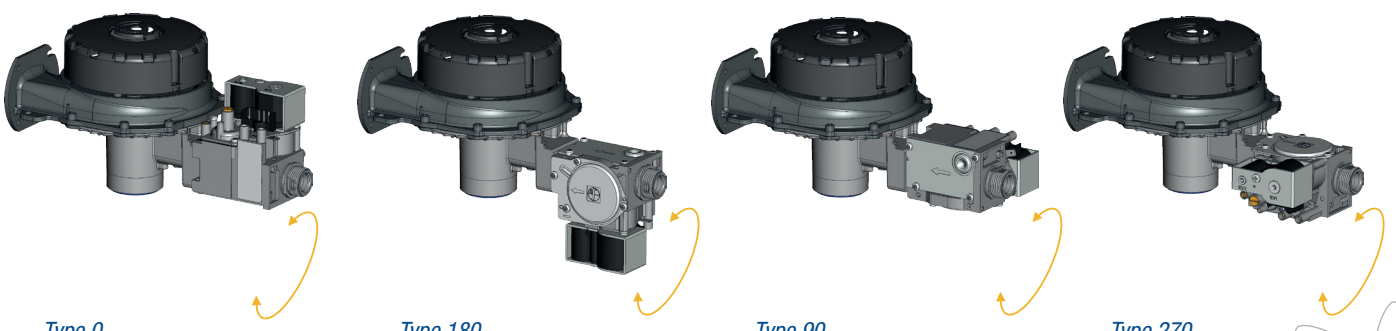


Type L:
Gas and air inlet axes are orthogonal

Figure 7 - connection layout type L

Gas valve position

Figure 8 - valve position for type L layout

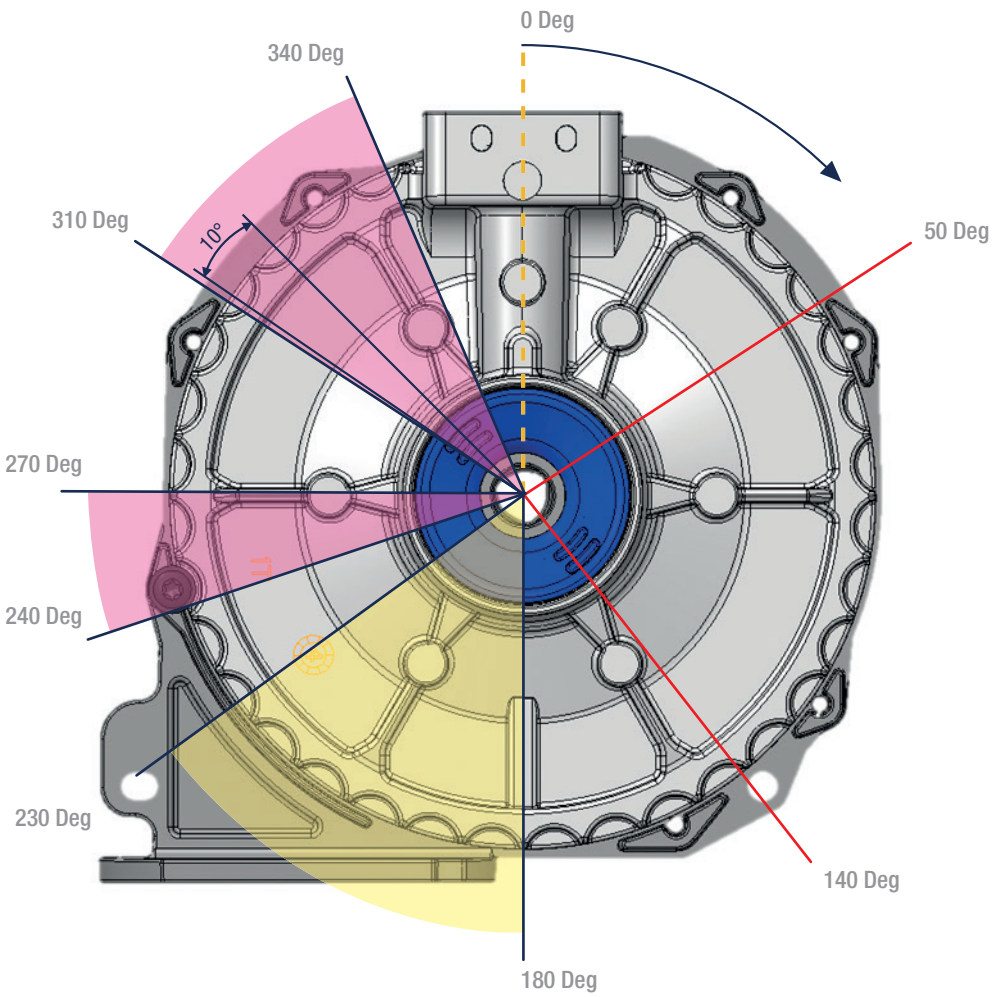


Type 0 *Type 180* *Type 90* *Type 270*

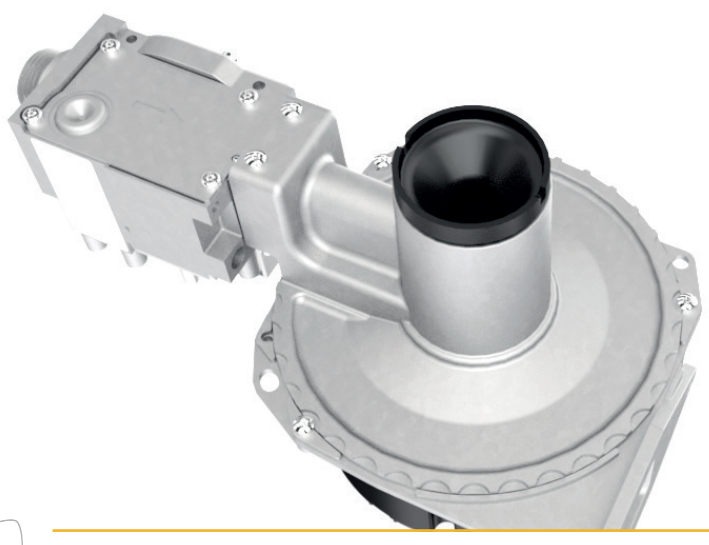
Relative position of valve and fan

Relative position between the gas valve axis and the fan (for gas valve position type L and type T) is possible every 10°. It is not allowed to position the valve (yellow centerline): at 50° and 140°; from 240° to 270°; from 310° to 340° (in pink shade) .

The position from 180° to 230° (in yellow shade) will require a specific evaluation depending on the fan and gas valve connection layout that is chosen.



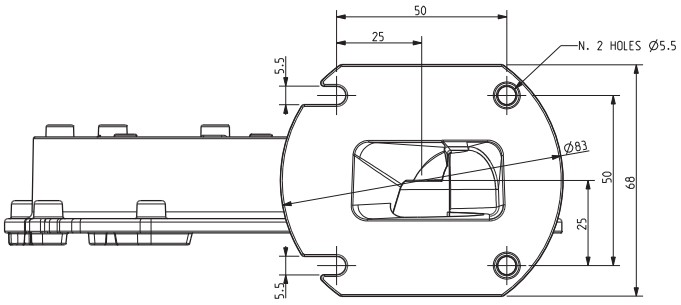
Mixer layout

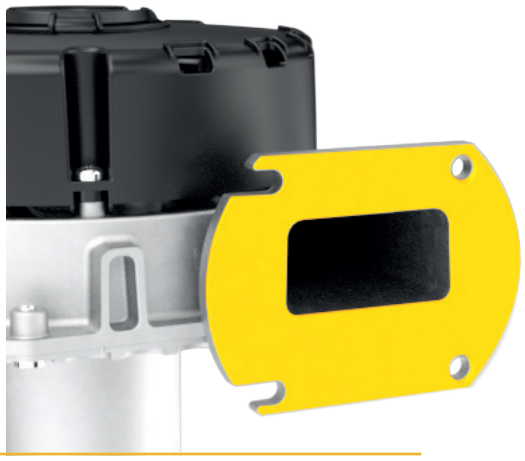


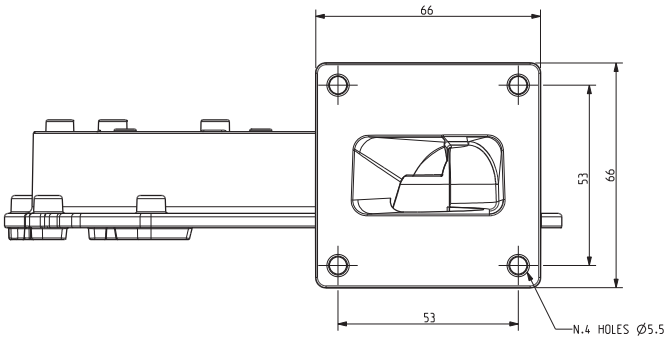
Type A - Straight Version

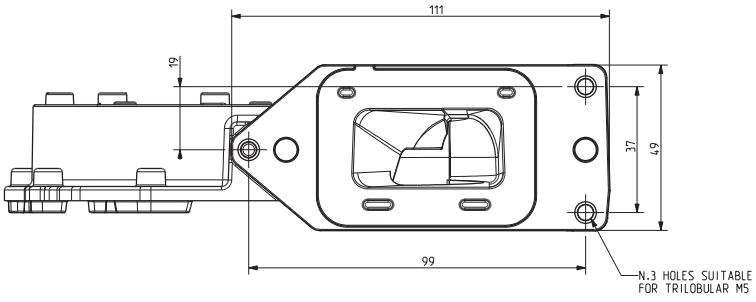
Type B - 90° Version

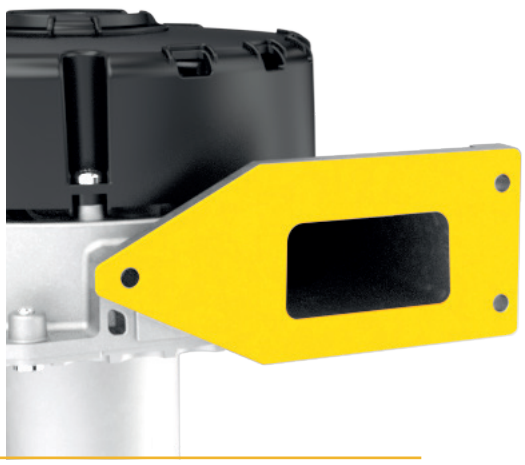
Outlet interface options









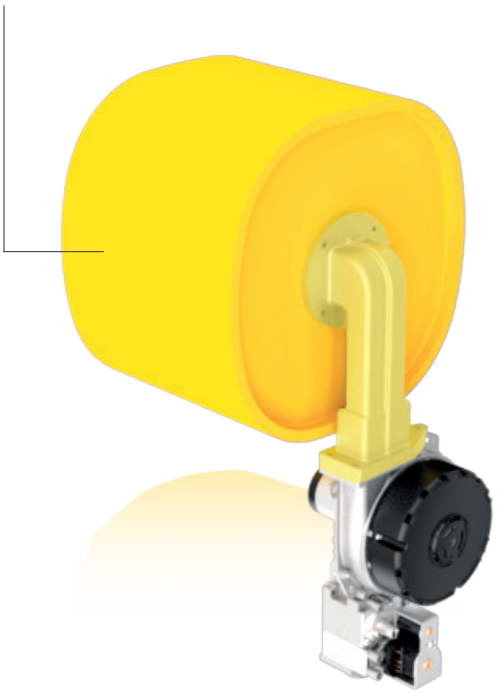


Non return valve

Optional device - To be added for certain field installations, as required by standards

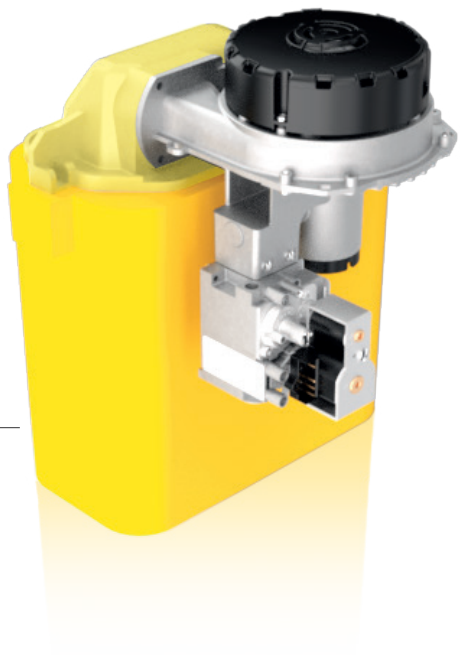
Cylindrical heat exchangers

Horizontal axis cylindrical heat exchanger

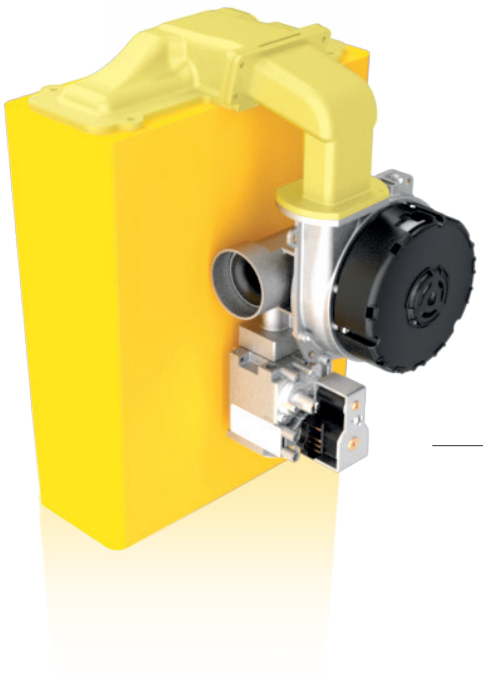


Vertical axis cylindrical heat exchanger

Rectangular heat exchangers



Gas and air inlet axes are parallel



Gas and air inlet axes are orthogonal

Modulation

Gas/air modulation is given by the combined actions of the fan coupled with the mixer and 848 SIGMA gas valve.
SIGMA 848 valve is a 1:1 gas/air pressure ratio control.

The operation principle consists of maintaining the outlet pressure P_{INT} equal to the air pressure signal P_{AIR} that is left open to the pressure surrounding the gas valve in the appliance (approximately equal to the atmospheric pressure). P_{INT} can also be increased or decreased according to the value chosen on the offset: $P_{INT} = P_{AIR} + Os$ where Os is the offset value that can be set by a screw

When the offset value is set to zero, and assuming the relation of volumetric flow/pressure drop is similar for air and gas, the gas/air ratio is kept constant despite any variation of P_{AIR}. In other terms, the Qg/Qa ratio is kept constant for any value of Qg and Qa, where Qg and Qa are the rate of flow of gas and air respectively. This allows to have a constancy of the combustion parameter CO_2 (or excess of air) along the modulating characteristic of the appliance.
The Qg/Qa ratio can be accurately adjusted by a screw (Ratio Adjuster). By setting the offset to a value different from zero, the Qg/Qa ratio can be changed only at minimum power, fig. 10.

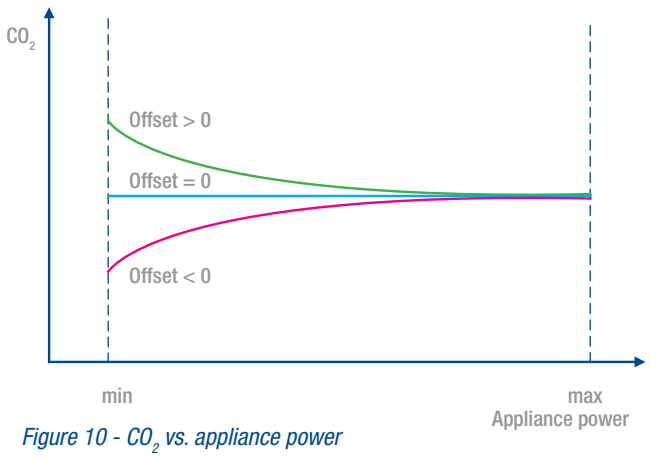


Figure 10 - CO_2 vs. appliance power

Fan

- Brushless DC motor
- Anti-spark impeller
- Silent block mounts for vibration dampening
- PWM signal input for speed modulation, frequency range 2 - 6 kHz, opto-isolated
- Speed range 1000 - 9500 rpm
- Hall sensor rpm output signal - 2 pulses per revolution, opto-isolated
- Long life maintenance free ball bearing system
- Driving electronics with programmable microcontroller
- Low overall noise

Shut-Off

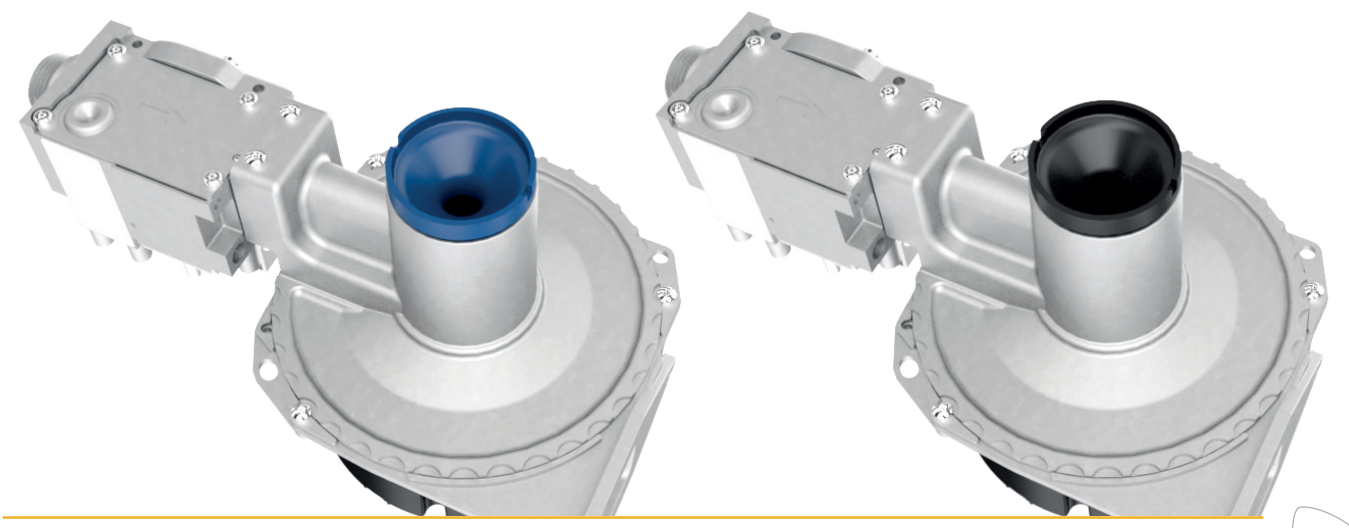
- First automatic shut-off valve (EV1) class B according to EN 126
- Second automatic shut-off valve (EV2) class C or J according to EN 126

Pressure Regulation

- Servo pressure regulator class B according to EN 126

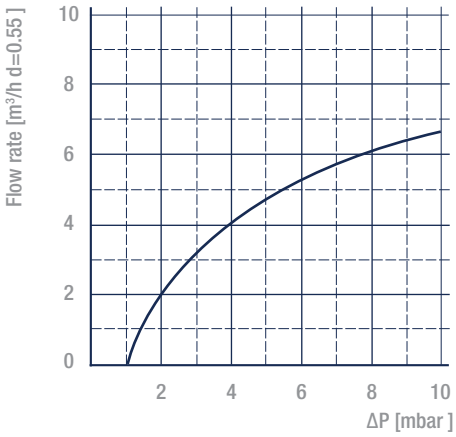
Mixer

Various sizes of venturi are available to fit the maximum appliance power.

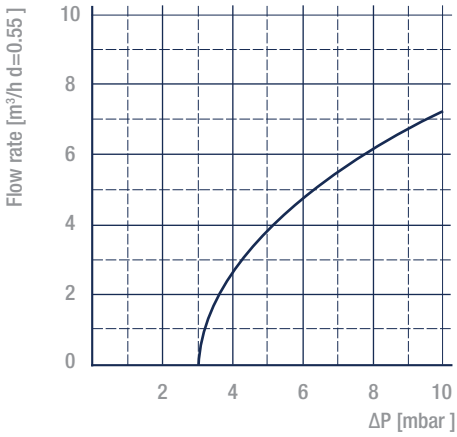


Valve flow rate as function of pressure drop

Valves class B+J

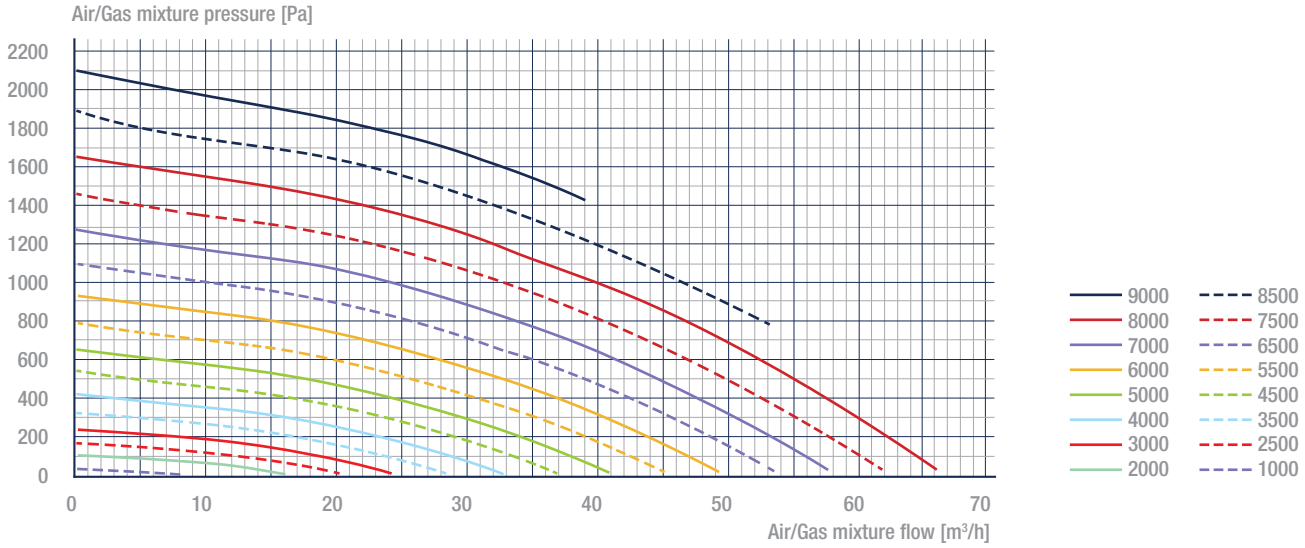


Valves class B+C

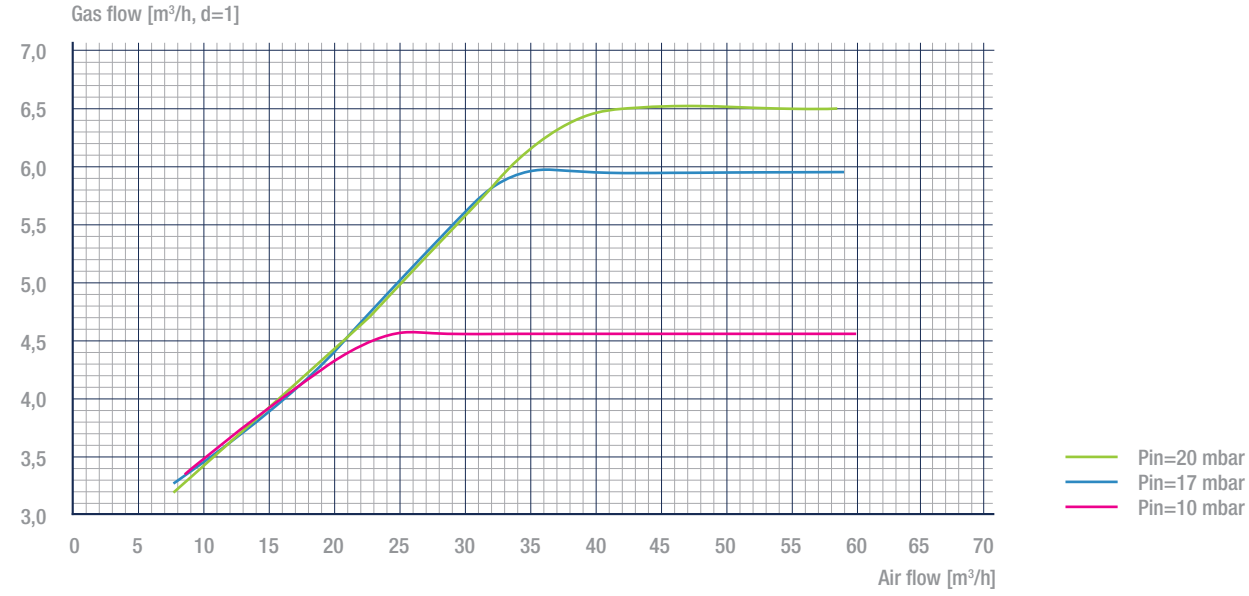


Sonnenblume kappa with mixer d20.3

Air/gas mixture flow vs. pressure @ constant rpm

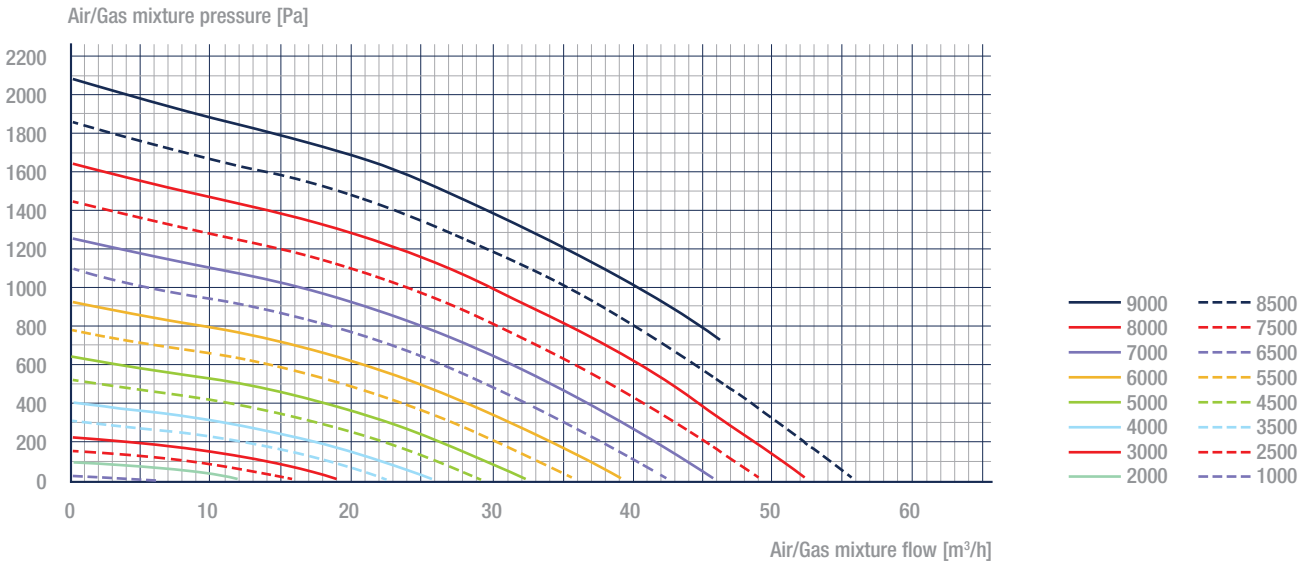


Maximum gas flow vs. air flow @ constant inlet gas pressure

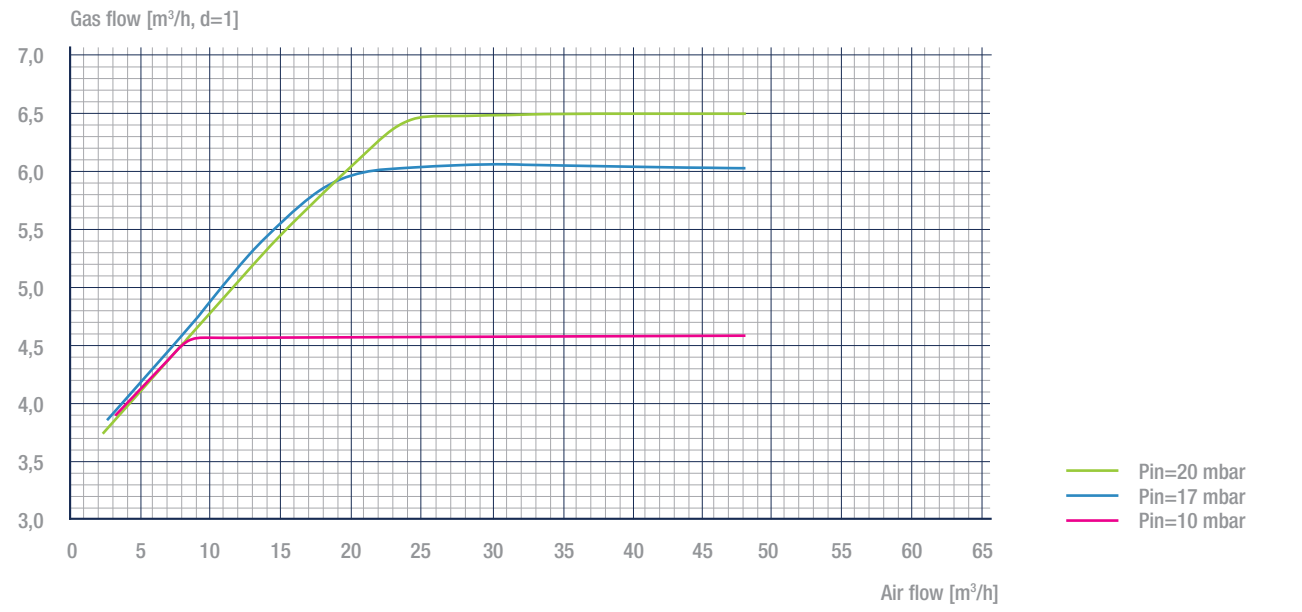


Sonnenblume kappa with mixer d18.2

Air/gas mixture flow vs. pressure @ constant rpm

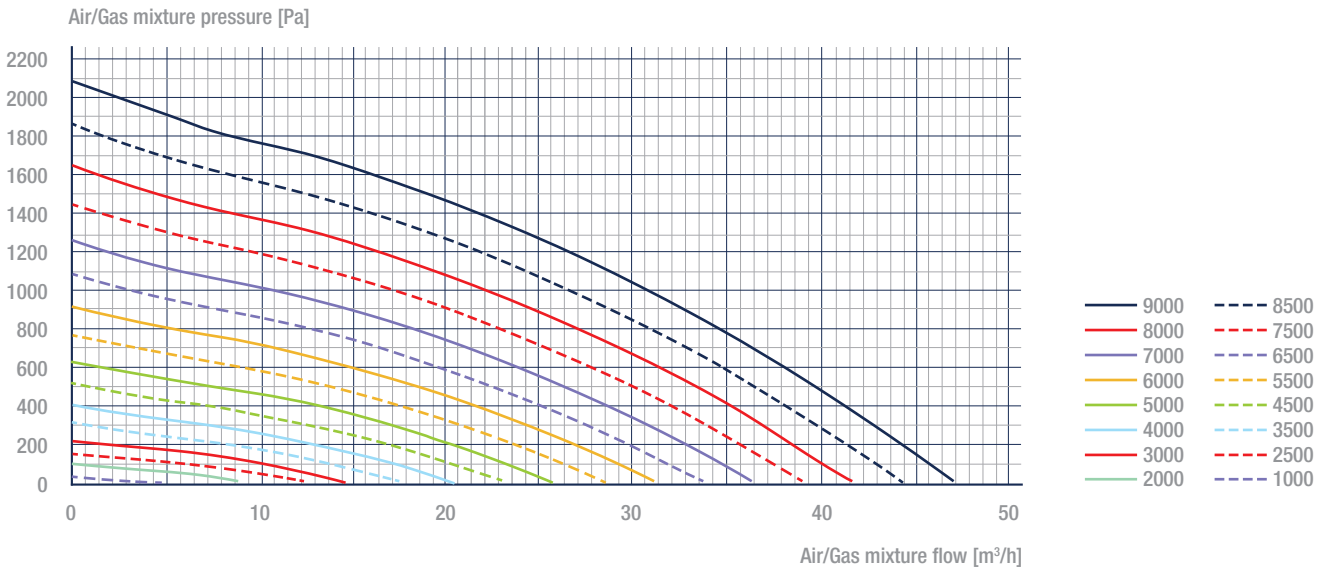


Maximum gas flow vs. air flow @ constant inlet gas pressure

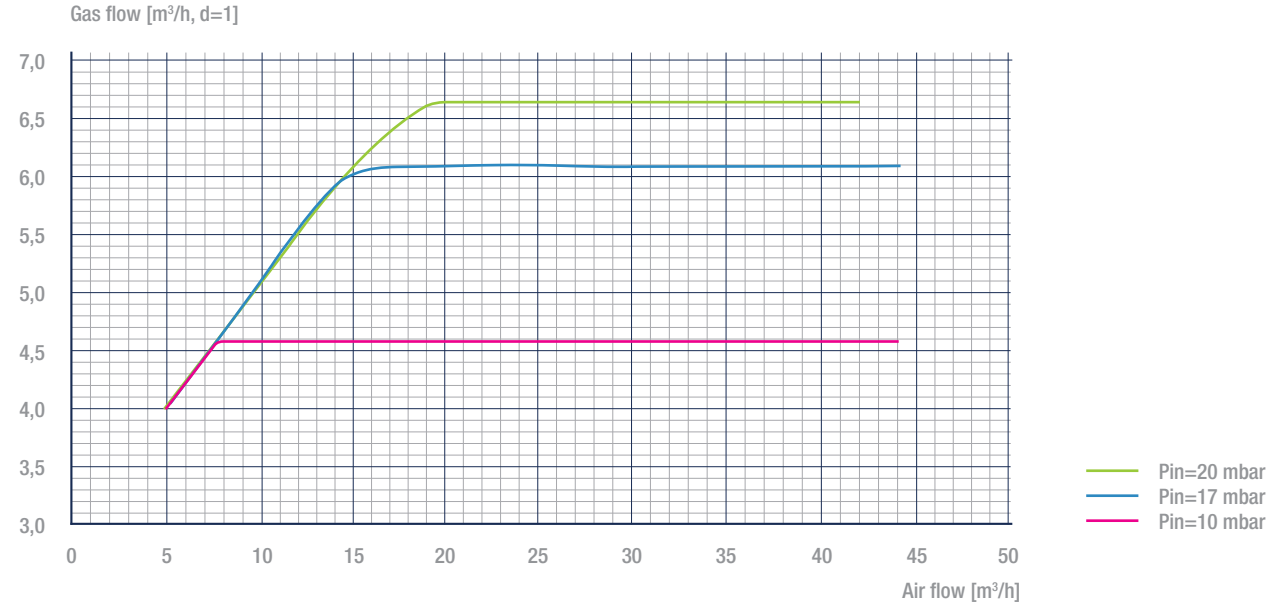


Sonnenblume kappa with mixer d16

Air/gas mixture flow vs. pressure @ constant rpm



Maximum gas flow vs. air flow @ constant inlet gas pressure



Type T

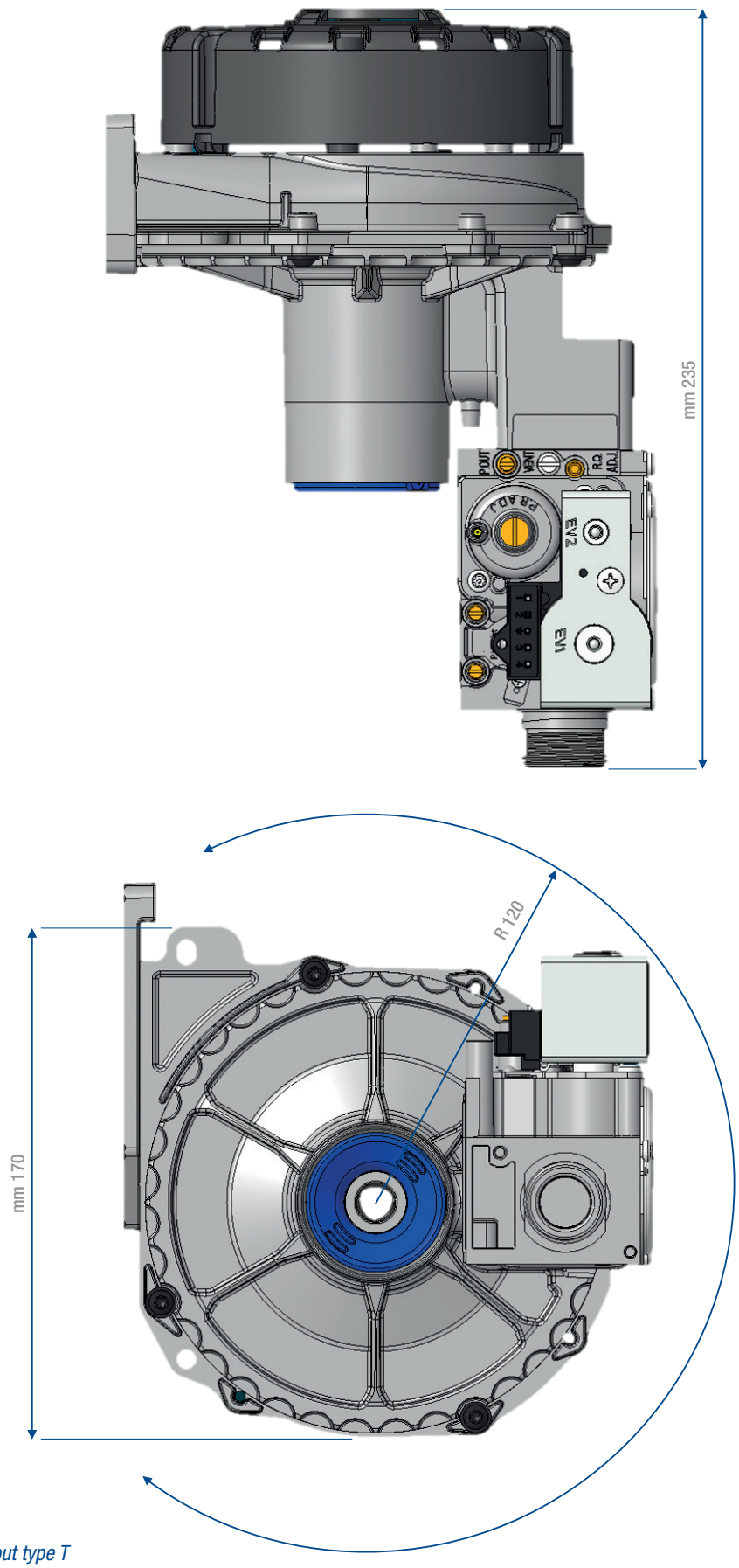
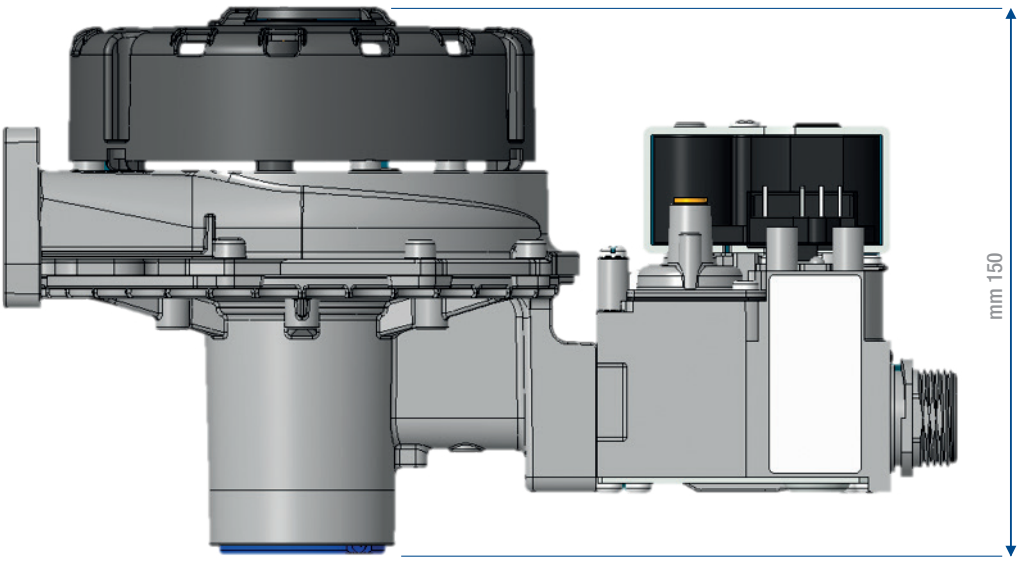


Figure 6 – connection layout type T

Type L



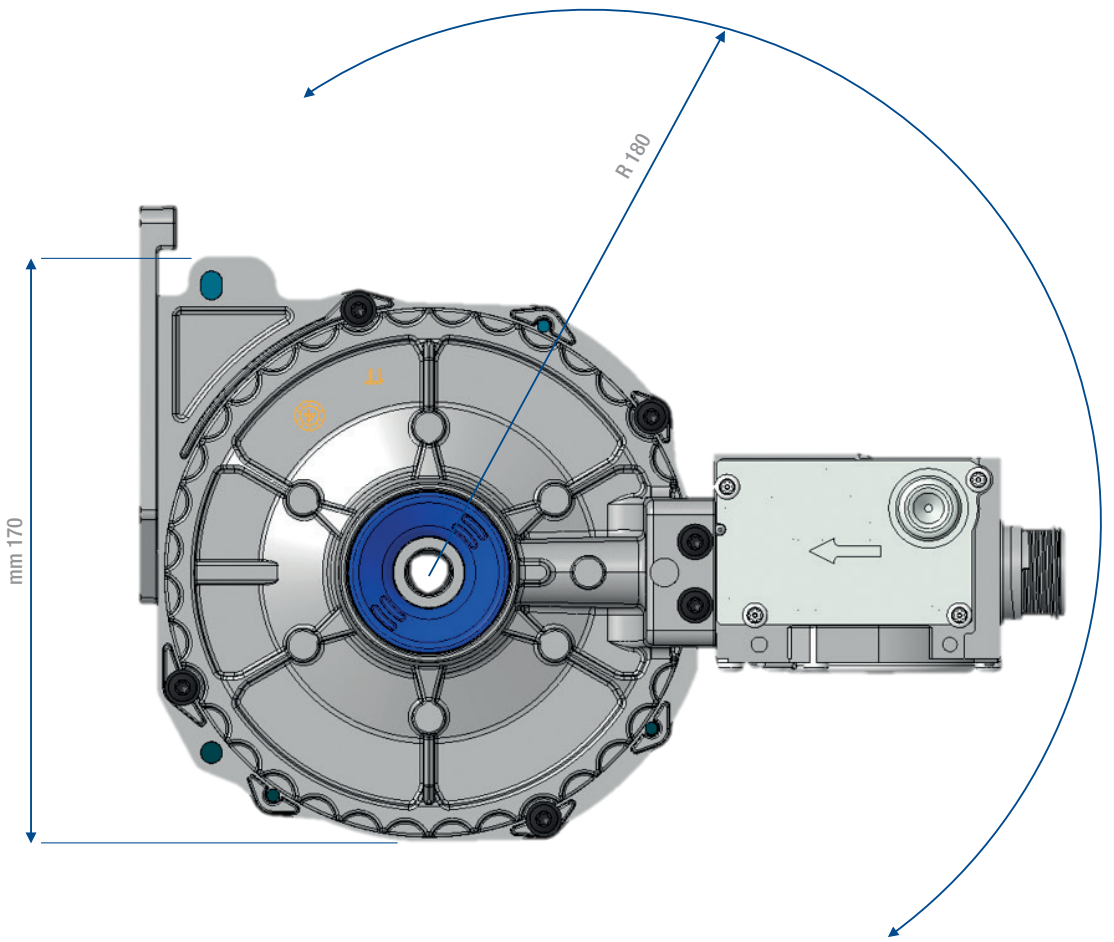


Figure 7 - connection layout type L

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SITGroup

Viale dell'Industria, 31-33 - 35129 Padova - ITALY
Tel. +39 049 8293111 - Fax +39 049 8070093
www.sitgroup.it - info@sitgroup.it