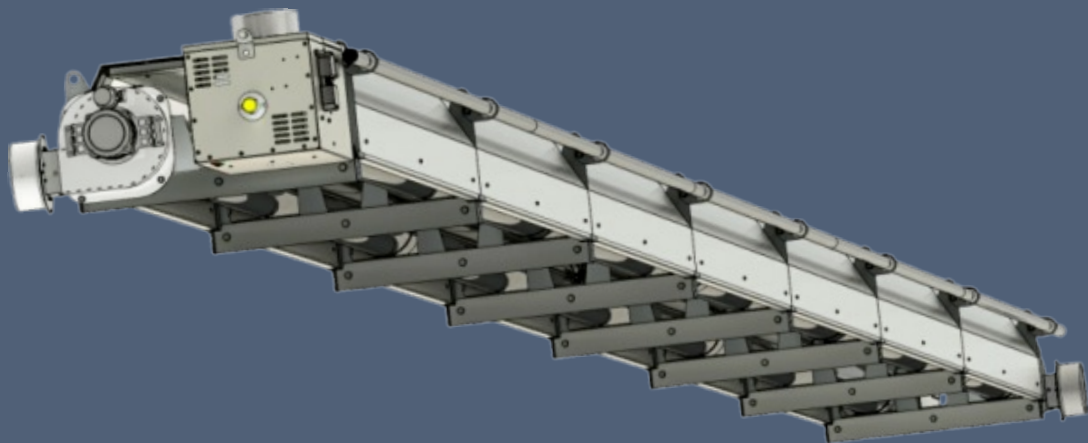


MANDÍK[®]

DARK TUBE INFRARED HEATER HELIOS-S

INSTALLATION, OPERATION INSTRUCTIONS AND MAINTENANCE MANUAL



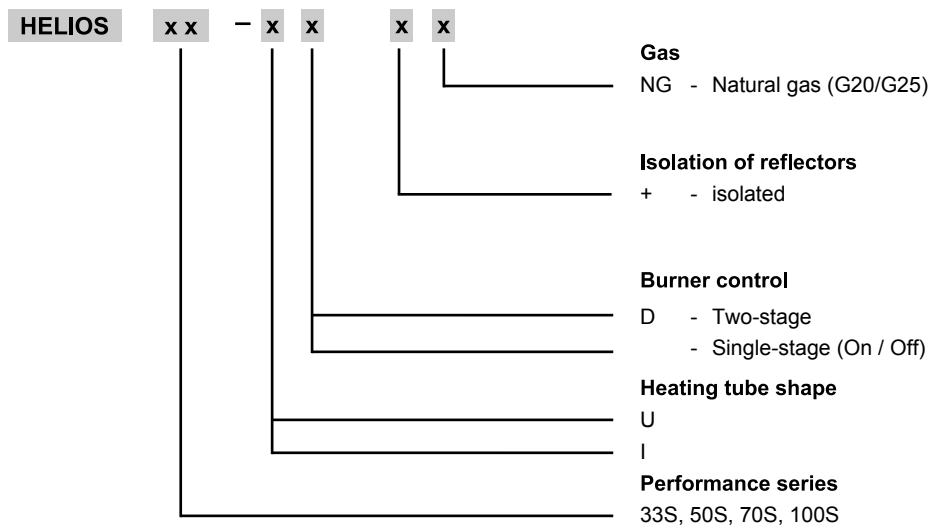
This manual is an part of the product and must be handed over to the end user together with the equipment.

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II. ORDERING DATA

1. Ordering key



III. GENERAL

2. Description of infrared heater HELIOS

Dark tube infrared heater HELIOS-SI (single-stage) and HELIOS-SID (two-stage) is a modern ecological gas heater. It can be supplemented with an economizer to utilize the residual heat of the flue gas.

In terms of operating temperature of active surfaces and thus in terms of the particular wavelength of the emitted radiation, the device belongs to the category of so-called "dark" infrared heaters. The active surface is formed by radiant pipes and a reflector. In the radiant pipes there is the process of fuel gas burning and there are also burnt gases flowing through the pipes to the mouth of the exhaust fan. Fuel burning is carried out by an atmospheric burner which is automatically controlled. The reflector prevents the pipes from cooling by the process of convection. The reflector itself warms up by the radiant pipes and radiates the heat in the required direction.

Normal operating fuel of the HELIOS infrared heaters:

- natural gas – NG (G20/G25)

Product category:

- II_{2E3B/P}, II_{2ELL3B/P}, design A₂, B₂₂, C₁₂, C₃₂, C₆₂. Třída NO_x 3 (acc. EN 416-1/A1).

Infrared heaters HELIOS are intended for environment protected against weather impacts with the classification of climatic conditions class 3K5 acc. EN 60721-3-3 with temperature range from 0° to 35°C, for BNv premises acc. EN 1127-1. Installing infrared heaters as design C is possible, except of normal spaces also in areas intended for decommissioning and maintenance of vehicles. Such installation must be assessed by the competent authorities in accordance with the applicable regulations.

Infrared heaters cannot be installed in individual, row and collective garages, motor vehicle garages and operating rooms of fuel filling stations with fuel dispensers. Infrared heaters cannot also be installed in places where there is a risk of fire or explosion or high levels of flammable dust.

Infrared heaters are suspended under the ceiling or on the walls in the upper areas of the buildings so that the radiated beams point to the floor towards the heated residential zone. The surfaces of floors, walls, machines and other objects are heated by radiation and the surrounding air is heated from them.

The infrared heater HELIOS consists of the following main parts:

- **Burner box**
- **Exhaust box**
- **Reflector** with hinges and the radiant heating tubes "U" or "I"

The basic design of the burner box is scalded by the throat for the external suction in the upper part of the burner box. If the combustion air supply system is not connected, it is an open gas appliance. Thus, infrared heaters can only be used in a basic (normal) environment according to the according to the relevant standard. In order to be considered as a closed gas appliance, the radiator must be connected to outdoor air intake system.

3. Description of function

- Infrared heater operation is controlled by the **automatics** located in the burner box.
- After connecting to the el. network, first the basic test of the connected devices to the automatic is performed and if everything is OK, the exhaust fan is activated.
- After the fan starts and a vacuum is evoked in the burner chamber, the differential air manostat is switched. The manostat senses the pressure differential caused by the exhaust fan.
- When the manostat is switched on, the venting time (approx. 50 s) starts to run, this is used to ventilate the flue gas exhaust pipe and heating tubes.
- After this ventilation time, the electromagnetic double valve is opened and gas is injected into the burner. At the same time, the ignition system is put into operation by the automatic system.
- The ignition of the gas mixture in the burner is detected by the ionisation electrode.
- If the gas mixture in the burner is not ignited within 5 seconds, the valve closes the gas supply and the unburned gas / air mixture is vented through the exhaust fan during the next ventilation time. After it has elapsed, the automation runs two more ignition cycles.
- If no flame is detected during the third ignition cycle, the automatic switches into the fault mode and the red indicator "Burner Failure" light on.
- Further start is possible after unlocking the fault condition by disconnecting and reconnecting to the power supply.
- After putting the burner into operation and igniting the gas mixture, the green indicator "Power supply" and orange indicator "Burner Operation" lights up.

4. Versions

According to power control of the burner, the infrared heaters are single-stage or two-stage.

The atmospheric burner control is single-stage or two-stage.

Infrared heater with single-stage burner works in on-off mode, two-stage burner of the infrared heater operates in off mode - reduced power - full power.

The main advantages of the two-stage burner control include reducing burner start-up frequency, better temperature distribution in the heated space and reduced energy consumption.

Reflectors are supplied with insulation (thermal insulation, covered by a cover made of galvanized sheet metal).

5. Dimensions and weights

Tab. 5.1 Weights of infrared heaters HELIOS-S

Type of infrared heater	Helios 33 SU(D)+	Helios 50 SU(D)+	Helios 70 SU(D)+	Helios 100 S(D)+	Helios 70 SI(D)+
Weight [kg]	244,0	392,5	392,5	547,5	304,7
Length [m]	10,8	14,8	14,8	21,5	20,2

Dimensions and weights of two-stage heaters (U+, U/15+, LU+, LU/15+) are the same as for single-stage heaters (On-Off).

Fig. 1 Reflector cross section of HELIOS SU(D)+

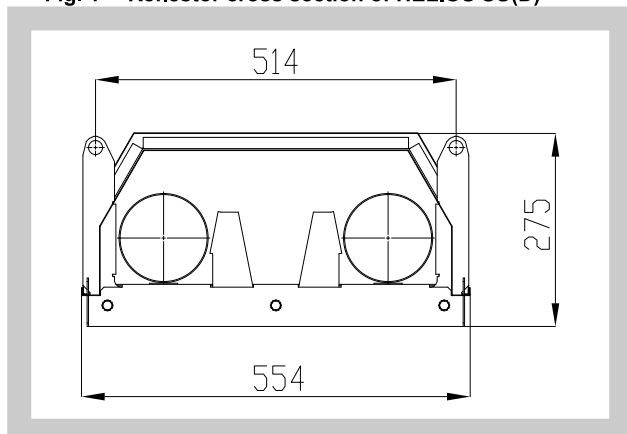
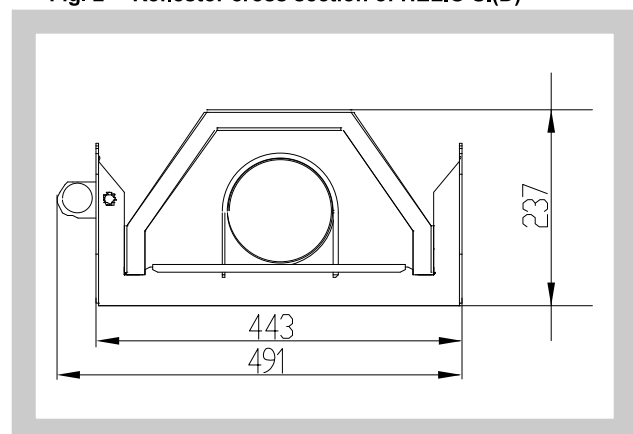
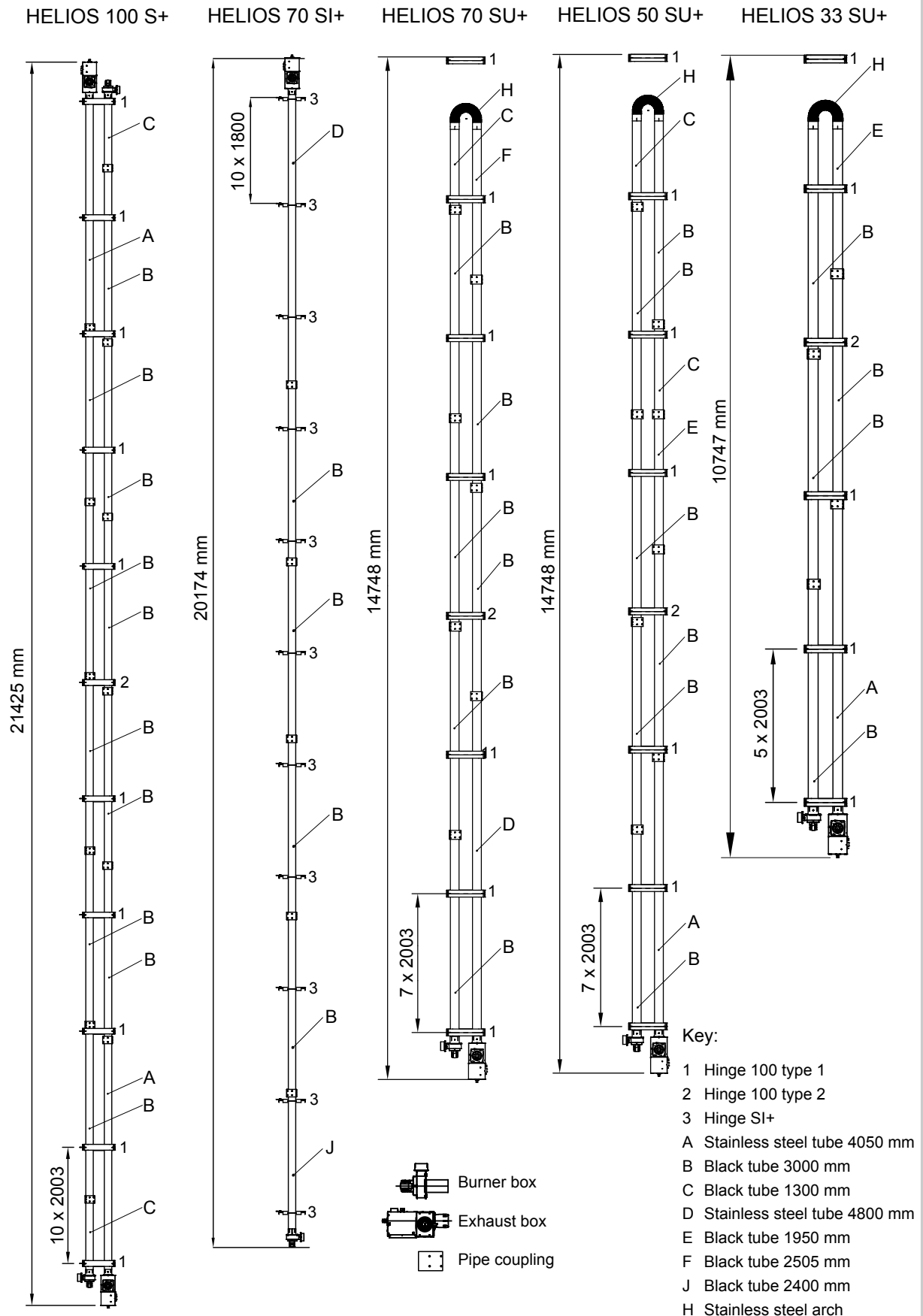


Fig. 2 Reflector cross section of HELIO SI(D)+



6. Scheme of infrared heaters

Fig. 3 Scheme of infrared heaters HELIOS-S

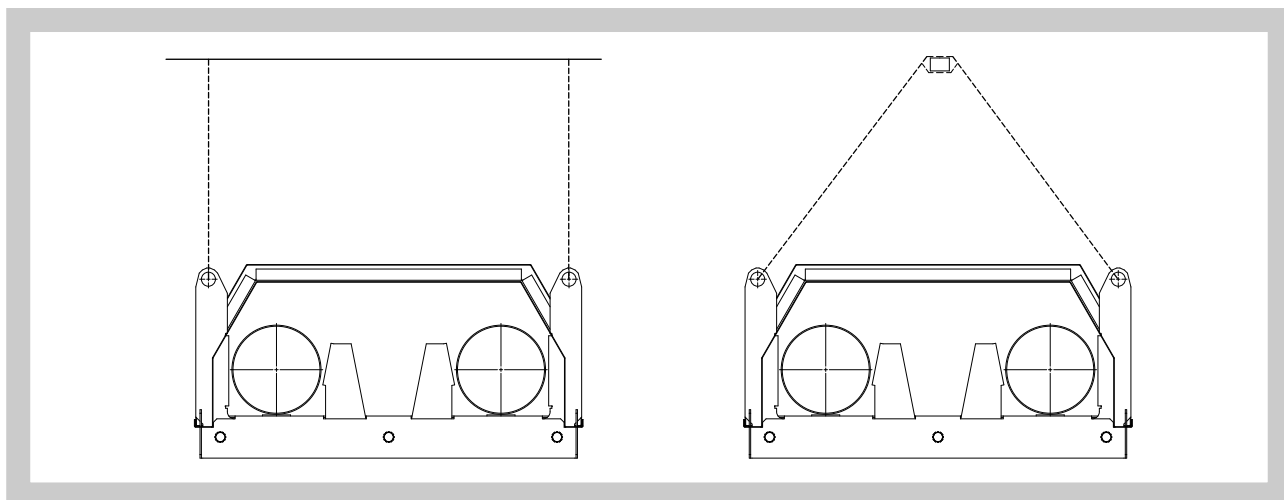


IV. INSTALLATION

Suspension methods:

1. Dark tube infrared heaters can be suspended on suitable structure by means of chains or strings and snap-hooks or tie rods.
2. According to the picture 4 it is necessary to fix the infrared heater at least on two places by using an appropriate way so that the device cannot be turned around.
3. Due to the thermal expansion, the infrared heater can not be fixed directly to the supporting structure.
4. It is necessary to keep safe distance from flammable objects and walls (Fig. 5, 6).

Fig. 4 Suspension of infrared heaters HELIOS-S



Special causes of installation

When installing the heater over the runway of bridge crane, it is necessary to use the protection of electrical power installation of the crane against excessive heat. **If installed in gyms, we recommend installation of safety grille - it can be ordered with the heater from the manufacturer.**

Fig. 5 Minimal safe distance of the infrared heater from walls, ceilings and flammable objects

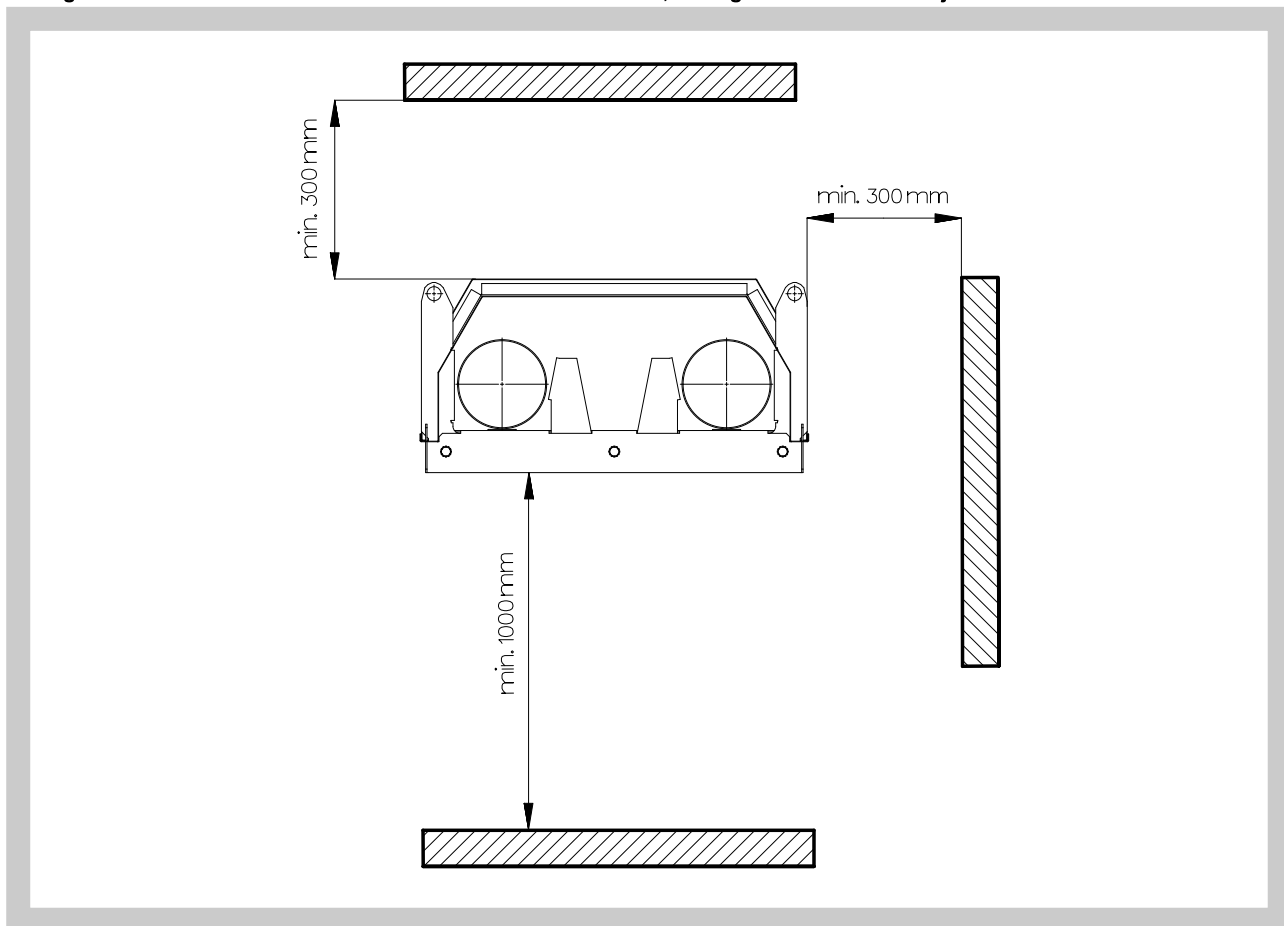
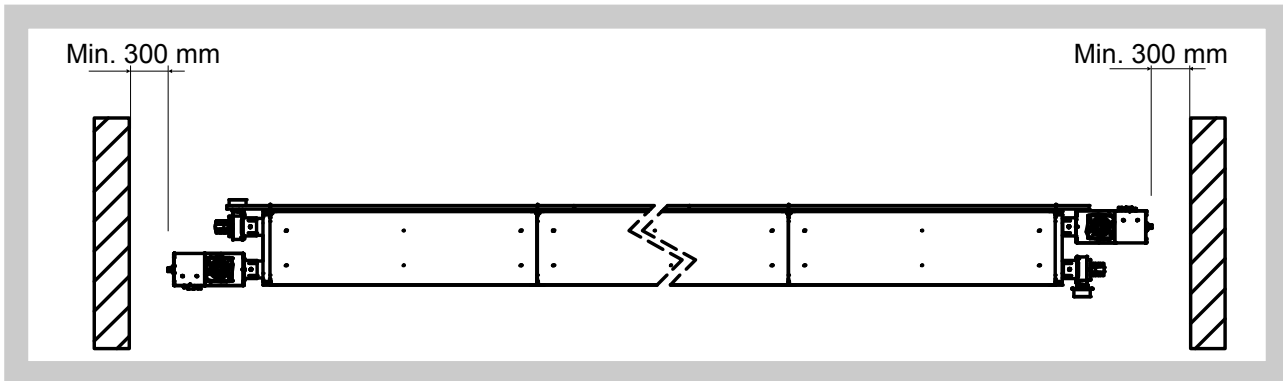


Fig. 6 Minimum safe distance of the infrared heater from walls and flammable objects



V. FLUE GAS EXHAUST – CONNECTION PRINCIPLES

The flue gas duct must be in accordance with applicable standards and regulations.

1. Minimum internal diameter of the pipeline is 125 mm.
2. Connecting of the combustion gases to the ventilator must be demountable.
3. The duct system must prevent the condensate from penetration into the exhaust pipeline.
4. The duct system must be terminated freely in the exposed position so that the flue gases cannot face any resistance, and also that combustion cannot return back to the building through windows.
5. The material of flue gases exhaust must be resistant to corrosion and against flue gases temperature according to relevant standards.
6. Opening for flue gases measurement is placed according to heater configuration, for heaters without economizer the opening is in the first part of the duct immediately after the heater, for heaters with economizer, the opening is in the first part of the flue duct immediately after the economizer.

Tab. 6.1 Table for selection of minimum diameter of flue gas and combustion air supply duct

Type of infrared heater	Coaxial chimney - Aluminium	Separate pipeline - Aluminium	Coaxial chimney - Stainless steel	Separate pipeline - Stainless steel
Helios 33 SU+	DN 125	DN 125	DN 130	DN 130
Helios 50 SU+	-	DN 125	DN 130	DN 130
Helios 70 SU+	-	DN 125	DN 150	DN 130
Helios 70 SI+	-	DN 125	-	DN 130
Helios 100 S+	-	DN 125	DN 130	DN 130

After specifying the exhaust gas components and the combustion air intake components, it is necessary to calculate total pressure loss of the pipeline.

The sum of the pressure loss values of the supply and exhaust pipes must not exceed 50 Pa.

If the total pressure loss of the pipeline is higher, it is necessary to use a larger pipe diameter.

7. Pressure losses

For pressure losses of individual flue system components see following tables.

Total pressure loss of flue system can be calculated as sum of pressure losses of all components used.

Tab. 7.1 Pressure losses of components for exhausting flue gases and suction of the air – stainless steel system

Helios	Nominal dimension (mm)	Pressure loss (Pa)											
		Tube 1 bm	Bend 45°	Bend 90°	Condensate trap 45°	Condensate trap 90°	Coaxial chimney horizont.	Coaxial chimney vertical	Exhaust head Horizont.	Exhaust head vertical	Air intake head	Flexo INOX 1 bm	Flexo AL pipe 1 bm
33 SU+	DN 130	1,0	1,5	3	3,5	7	16	18	4,5	5,5	6,5	3	5
	DN 150	1	1	2	2	4	9	12	3	4	4	2	2
50 SU+	DN 130	2	3	6	6	12	27	32	7	9	12	9	6
	DN 150	1	2,0	3,5	5,0	5,0	17	19	4,0	5,0	6,0	3,5	3,5
70 S+	DN 130	3,5	4,5	7	9	14	33	-	10	12	14	7	9
	DN 150	2,5	3,5	5	6,0	10	25	28	7	9	10	5	6
100 S+	DN 130	2	3	6	6	12	27	32	7	9	12	9	6
	DN 150	1	2	3,5	5	5	17	19	4	5	6	3,5	3,5

Tab. 7.2 Pressure losses of components for exhausting flue gases and suction of the air – Aluminium system

Helios	Nominal dimension (mm)	Pressure loss [Pa]									
		Tube 1 bm	Bend 45°	Bend 90°	Condensate trap 45°	Condensate trap 90°	Coaxial chimney horizont.	Coaxial chimney vertical	Exhaust head Horizont.	Exhaust head vertical	Flexo Al pipe 1 bm
33 SU+	DN 125	2	3,5	5	6,0	10	20	21	8	9	5
50 SU+	DN 125	4	6	9	10	16	-	-	15	16	9
70 S+	DN 125	4,5	6	9	12	18	-	-	13	15,5	9
100 S+	DN 125	4	6	9	10	16	-	-	15	16	9

8. Examples of flue gas exhaust and combustion air supply solutions

Fig. 7 Gases exhaust through the wall with condensate trap

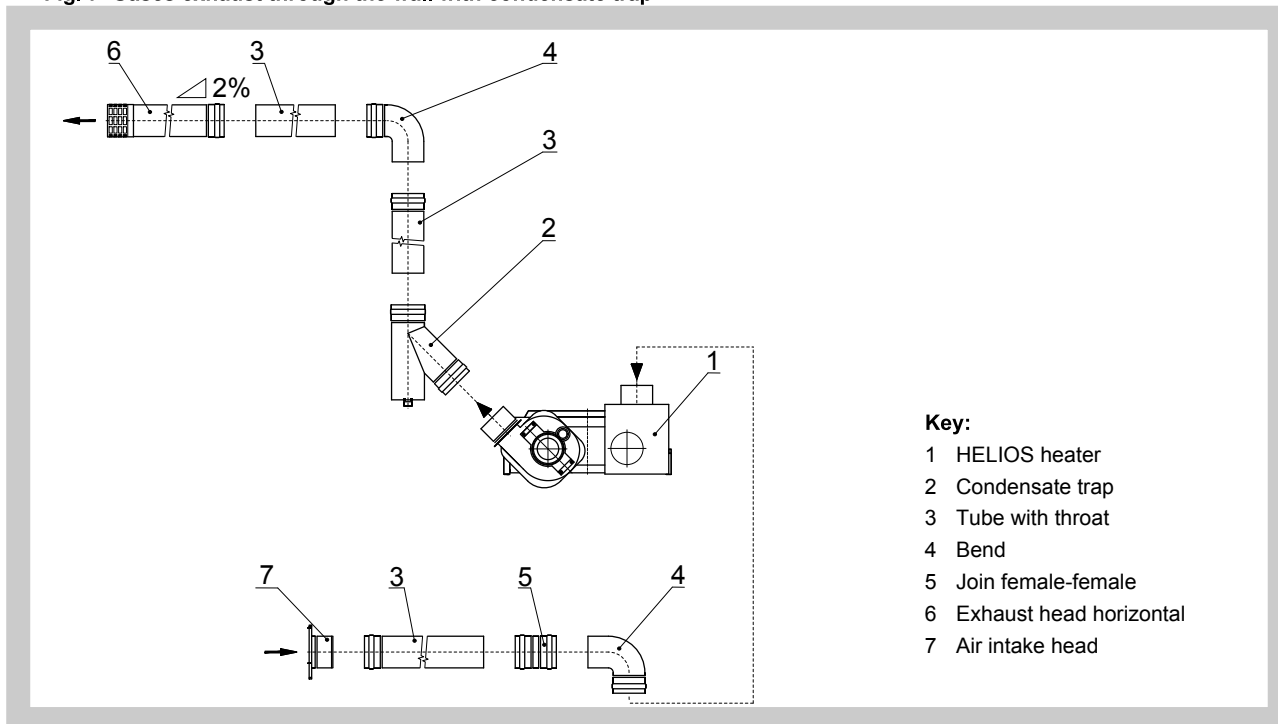


Fig. 8 Gases exhaust and air intake with coaxial chimney over the roof

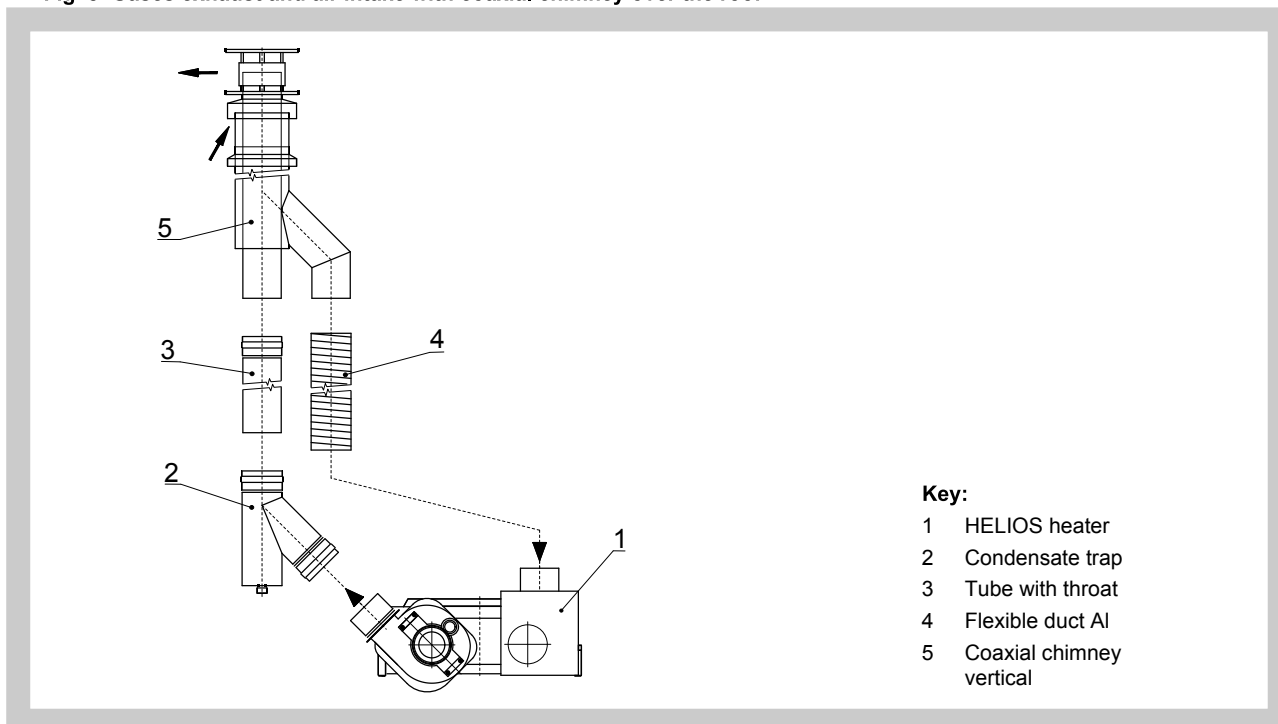
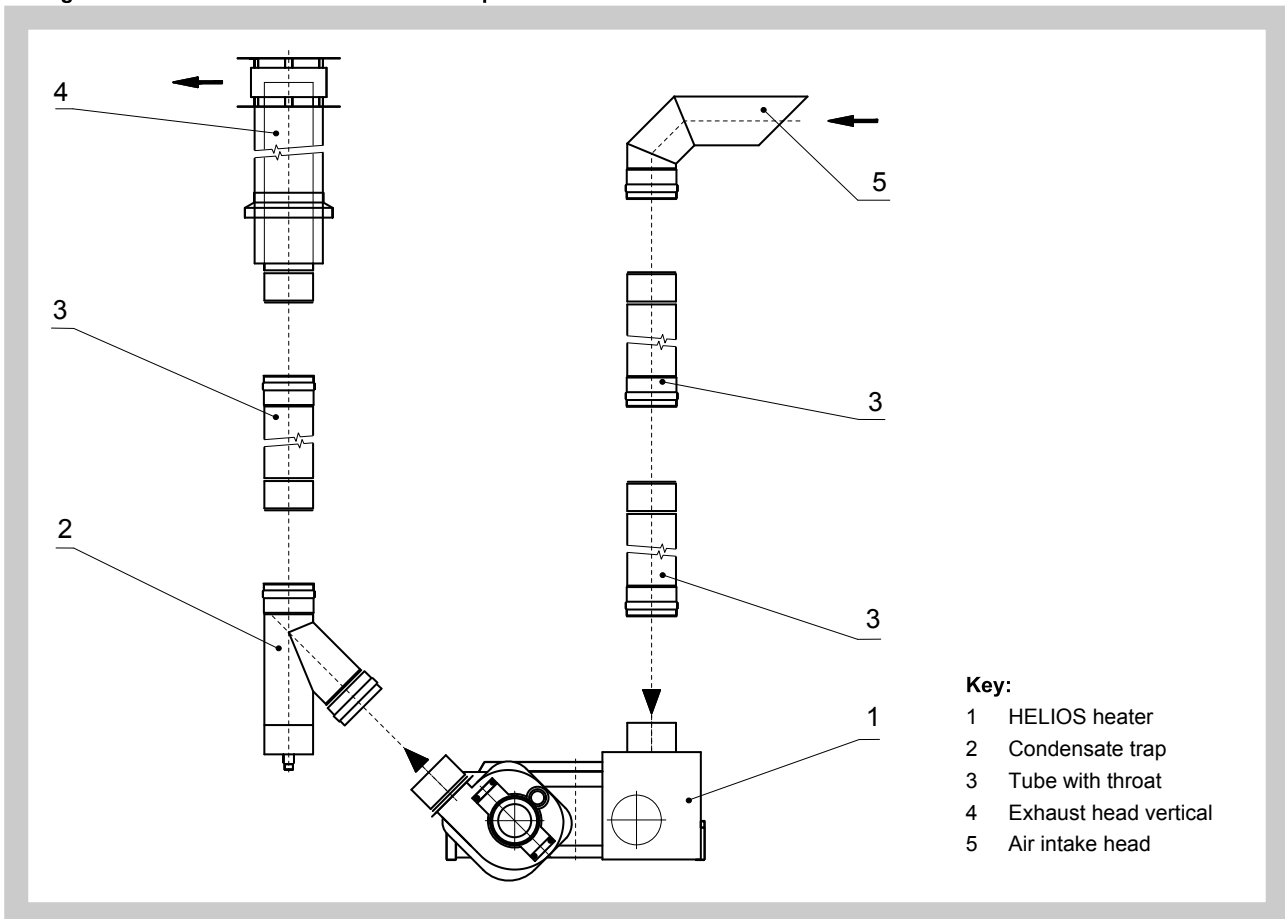
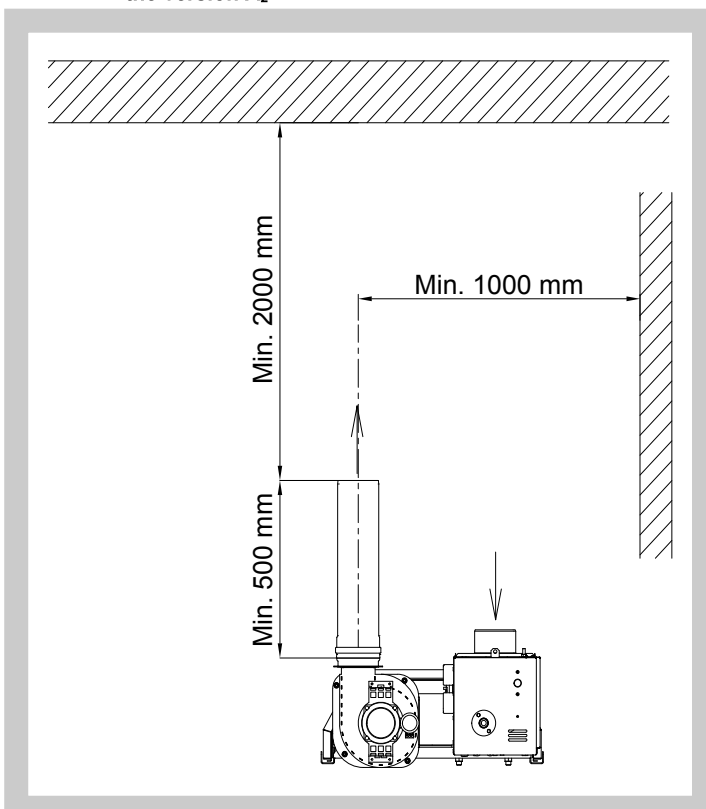


Fig. 9 Gases exhaust and air intake with separate ducts over the roof



Design A₂

Fig. 10 Distances from the flue gas outlet of the infrared heater in the version A₂

The flue gas exhaust is forced by the flue gas duct inside the building. The appliance is classified according to the flue into design version A₂. The design and installation of the flue gas exhaust must comply according to the correct norm.

When installing the heater in design A₂ in enclosed space, it is necessary to ensure forced ventilation with min. 10 m³ / h for each installed kW power consumption of the heater in design A₂ and it is necessary to ensure that the device will stop in the case of non-functional ventilation.

If inclined heaters are installed, rotate the exhaust cabinet so that the flue gas is directed vertically upwards.

VI. TECHNICAL DATA

9. Technical parameters

Tab. 9.1 Technical parameters of two-stage infrared heaters HELIOS-S

Type of infrared heater	100 SD+	70 SUD+	70 SID+	50 SUD+	33 SUD+
Nominal input power ZP G20 [kW]	2 x 49,5	75,2	75,2	49,5	36,0
Nominal input power ZP G25 [kW]	2 x 46,0	60,1	60,1	46,0	33,5
Minimal input power ZP G20 [kW]	2 x 43,5	66,2	66,2	43,5	31,7
Minimal input power ZP G25 [kW]	2 x 43,0	52,9	52,9	43,0	29,5
Nominal output power ZP G20 [kW]	2 x 44,6	67,8	67,7	44,6	32,4
Nominal output power ZP G25 [kW]	2 x 41,4	54,3	54,2	41,4	30,2
Minimal output power ZP G20 [kW]	2 x 38,3	58,3	58,3	38,4	29,5
Minimal output power ZP G25 [kW]	2 x 36,4	46,6	46,6	36,4	27,9
El. connection [V/Hz]	230/50				
El. power input [W]	200	250	250	100	100
Protection [A]	4				
Operating pressure ZP [mbar]	17 - 26				
Gas consumption at nominal output power ZP G20 [m ³ ·h ⁻¹]	10,36	7,81	7,81	5,18	3,75
Gas consumption at nominal output power ZP G25 [m ³ ·h ⁻¹]	10,70	7,81	7,81	5,35	3,89
Gas consumption at minimal output power ZP G20 [m ³ ·h ⁻¹]	9,04	6,87	6,87	4,52	3,30
Gas consumption at minimal output power ZP G25 [m ³ ·h ⁻¹]	9,42	6,87	6,87	4,71	3,42
Nozzle diameter ZP [mm]	6,4	7,4	7,4	6,4	5,0
Nozzle pressure at nominal output power ZP G20 [mbar]	9,0	9,0	9	9	11,5
Nozzle pressure at nominal output power ZP G25 [mbar]	12	9	9	12	14,0
Nozzle pressure at minimal output power ZP [mbar]	7,5	7,5	7,5	7,5	9,0
Nozzle pressure at minimal output power ZP G25 [mbar]	8,5	7,5	7,5	8,5	10,0
Length of infrared heater [m]	21,5	14,8	20,2	14,8	10,8
Weight of infrared heater [kg]	547,5	392,5	304,7	392,5	244,0
Gas connection	2x G 3/4"	G 3/4"	G 3/4"	G 3/4"	G 3/4"
Flue gas connection	2 x DN130	DN 130	DN 130	DN 130	DN 130
Flue gas fan (maximal values)	350 m ³ ·h ⁻¹	650 m ³ ·h ⁻¹	650 m ³ ·h ⁻¹	350 m ³ ·h ⁻¹	350 m ³ ·h ⁻¹
	360 Pa	610 Pa	610 Pa	360 Pa	360 Pa

Tab. 9.2 Technical parameters of one-stage infrared heaters HELIOS-S

Type of infrared heater	100 S+	70 SU+	70 SI+	50 SU+	33 SU+
Nominal input power ZP G20 [kW]	2 x 49,5	75,2	75,2	49,5	36,0
Nominal input power ZP G25 [kW]	2 x 46,0	60,1	60,1	46,0	33,5
Nominal output power ZP G20 [kW]	2 x 44,6	67,8	67,7	44,6	32,4
Nominal output power ZP G25 [kW]	2 x 41,4	54,3	54,2	41,4	30,2
El. connection [V/Hz]	230/50				
El. power input [W]	200	250	250	100	100
Protection [A]	4				
Operating pressure ZP [mbar]	17 - 26				
Gas consumption at nominal output power ZP G20 [m ³ ·h ⁻¹]	10,36	7,81	7,81	5,18	3,75
Gas consumption at nominal output power ZP G25 [m ³ ·h ⁻¹]	10,70	7,81	7,81	5,35	3,89
Nozzle diameter ZP [mm]	6,4	7,4	7,4	6,4	5,0
Nozzle pressure at nominal output power ZP G20 [mbar]	9,0	9,0	9	9	11,5
Nozzle pressure at nominal output power ZP G25 [mbar]	12	9	9	12	14,0
Length of infrared heater [m]	21,5	14,8	20,2	14,8	10,8
Weight of infrared heater [kg]	547,5	392,5	304,7	392,5	244,0
Gas connection	2x G 3/4"	G 3/4"	G 3/4"	G 3/4"	G 3/4"
Flue gas connection	2 x DN130	DN 130	DN 130	DN 130	DN 130
Flue gas fan (maximal values)	350 m ³ ·h ⁻¹	650 m ³ ·h ⁻¹	650 m ³ ·h ⁻¹	350 m ³ ·h ⁻¹	350 m ³ ·h ⁻¹
	360 Pa	610 Pa	610 Pa	360 Pa	360 Pa

VII. INSTALLATION CONDITIONS

Before starting installation, make sure that local condition regarding gas line, fuel and its pressure and heater setting are compatible.

Installation of the heater must be carried out in such way so that an adequate space for servicing and adjustment is maintained (Fig. 9, 10). There must be ensured sufficient air exchange in the building to allow for good combustion of gas. The amount of combustion air for the infrared heaters must meet applicable standards. For installation of heaters in dusty environment, installation of duct supplying the combustion air from outside (Closed appliance) is strongly recommended. The installation must comply with applicable standards and regulations and with this installation manual.

Installation of the infrared heater may be done by authorized person only!

Surface temperature of the radiant pipe may exceed 500°C!

Infrared heaters cannot be installed in places where there is a risk of fire or explosion or high levels of flammable dust. **Using the heaters in a corrosive environment is prohibited!**

Infrared heaters HELIOS-S can be used for heating in public areas where this type of heating is permitted by legislation. It is necessary to comply with the regulations for installation in these areas.

10. Mounting components of infrared heater HELIOS-S

Individual assembly components of the infrared heater HELIOS-S:

- Burner box
- Exhaust (ventilation) box
- Connecting cable with connector
- Radiant pipes
- Pipe connections, arch
- Hinges with fixing straps
- Reflectors
- Connecting material

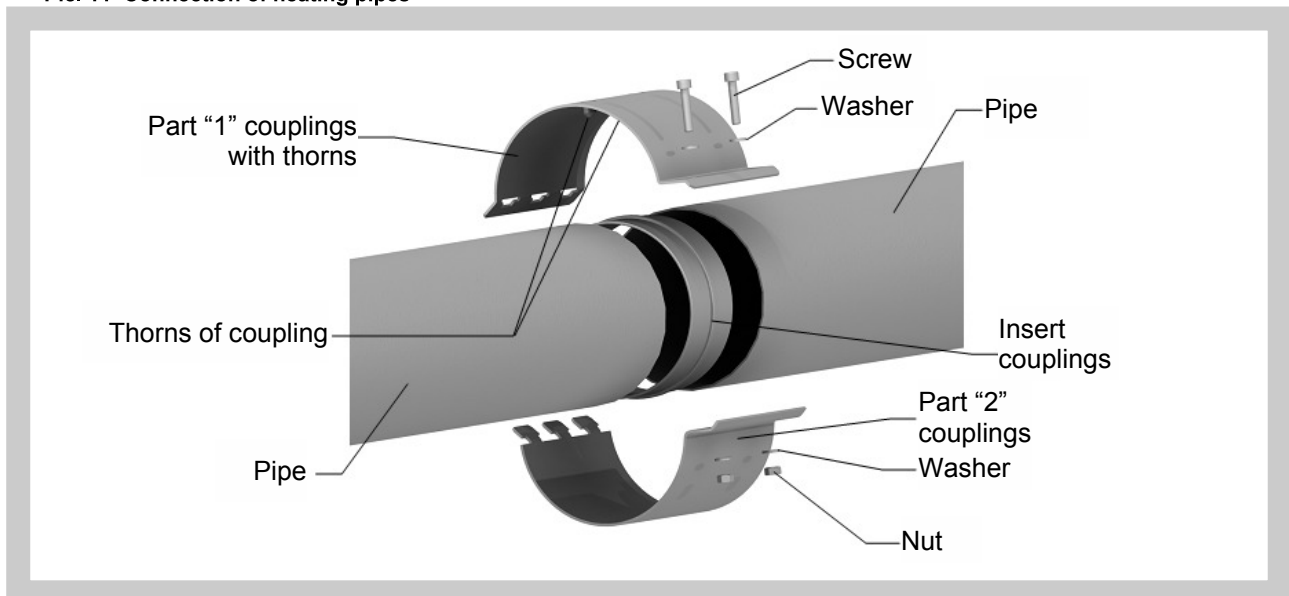
Other components (are not included in the infrared heater supply!):

- Remote control box, connecting cables
- Accessories, auxiliary fastening and connecting material
- Venting or combustion air inlet pipeline

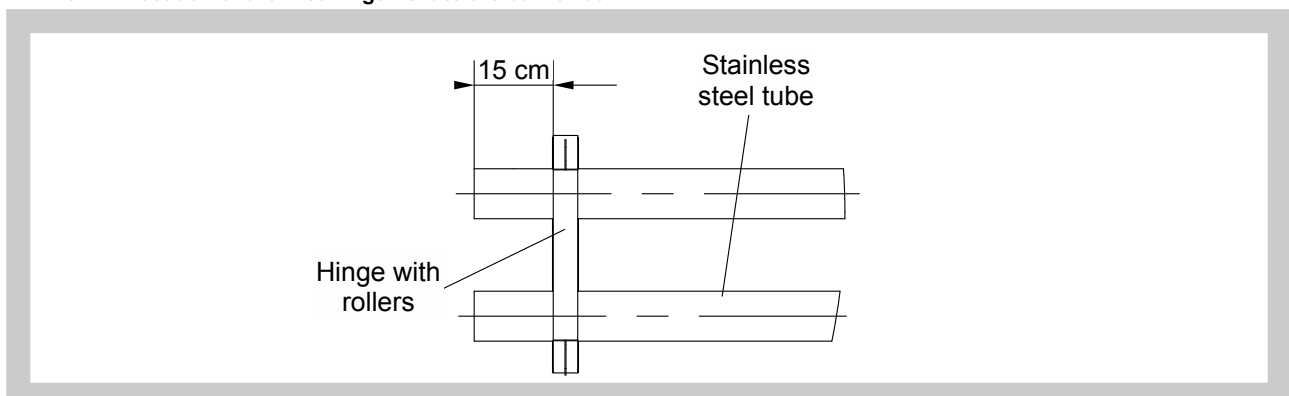
11. Mounting of infrared heater body

1. Lay out the pipes according to the diagram (Fig. 3).
Use the stainless steel (INOX) pipe as the first piece of heater (from the burner box).
2. Hang the hinges to the appropriate height at the exact spacing of 2003 mm (respectively 1800 mm) see Fig. 3. The distance between hinges is given by the holes in the reflectors, which are mounted on the hinge projections and therefore must be respected. Ensure that all fasteners and suspension elements have sufficient load-bearing capacity. All hinges must have the same orientation so that the cable protector between the burner and exhaust boxes can be subsequently mounted.
3. Assemble the heating pipes on the hinges according to the diagram in fig. 3. Connect the heating tubes with the couplings and the coupling insert (fig. 11). Connect the tubes with the coupling insert, align the holes in the tubes together and fit the coupling parts. Secure the connection with screws. The coupling locking pins must fit exactly into the holes in the heating tubes. Pull the coupling bracket firmly - the connection must be rigid and tight.
4. After connecting the heating pipes, fit two rollers into all hinges except the middle one. The Helios 70 SI heater hinges are not fitted with rollers, but the heater is fastened to the hinges with a calliper.
5. Align the heating pipes on the hinges so that the end of the stainless steel pipe overhangs the first hinge by 150 mm - see Fig. 12.
6. Attach the two heating pipes to the middle hanger, without rollers, and tighten the callipers. The callipers serve to secure the heating pipes against rotation.
7. Place expansion inserts and reflectors on the hinges. Expansion inserts cannot be placed on the Helios SI heater hinges.

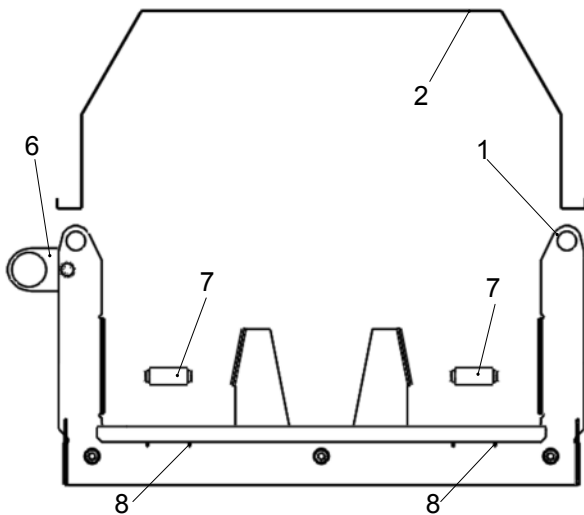
Pic. 11 Connection of heating pipes



Pic. 12 Location of the first hinge next to the burner box



Obr. 13 Hinge Helios 100 S+, type 1



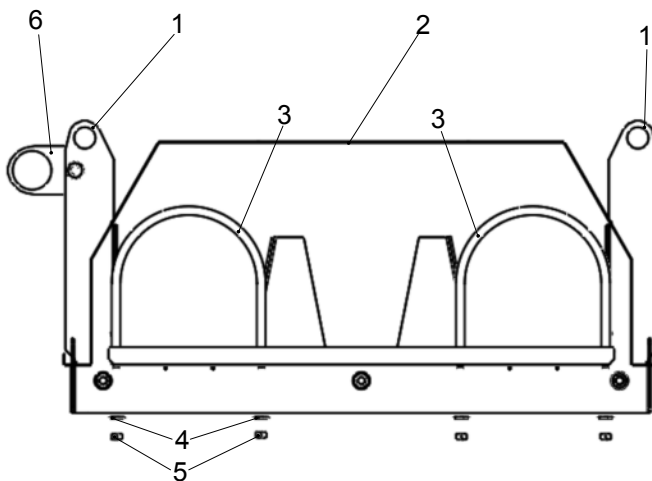
Key:

- 1 Hanging point
- 2 Expansion insert
- 6 Protector holder
- 7 Roller
- 8 Roller bed

Includes:

Hinge 100 S+ type 1	1×
Expansion insert	1×
Roller	2×

Obr. 14 Hinge Helios 100 S+, type 2



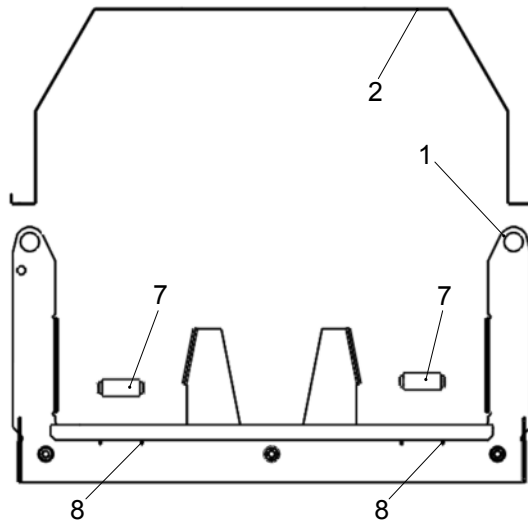
Key:

- 1 Hanging point
- 2 Expansion insert
- 3 Strap
- 4 Washer 6.4
- 5 Nut M6
- 6 Protector holder

Includes:

Hinge 100 S+ type 2	1×
Expansion insert	1×
Strap	2×
Washer 6.4	4×
Nut M6	4×

Obr. 15 Hinge Helios SU+, type 1



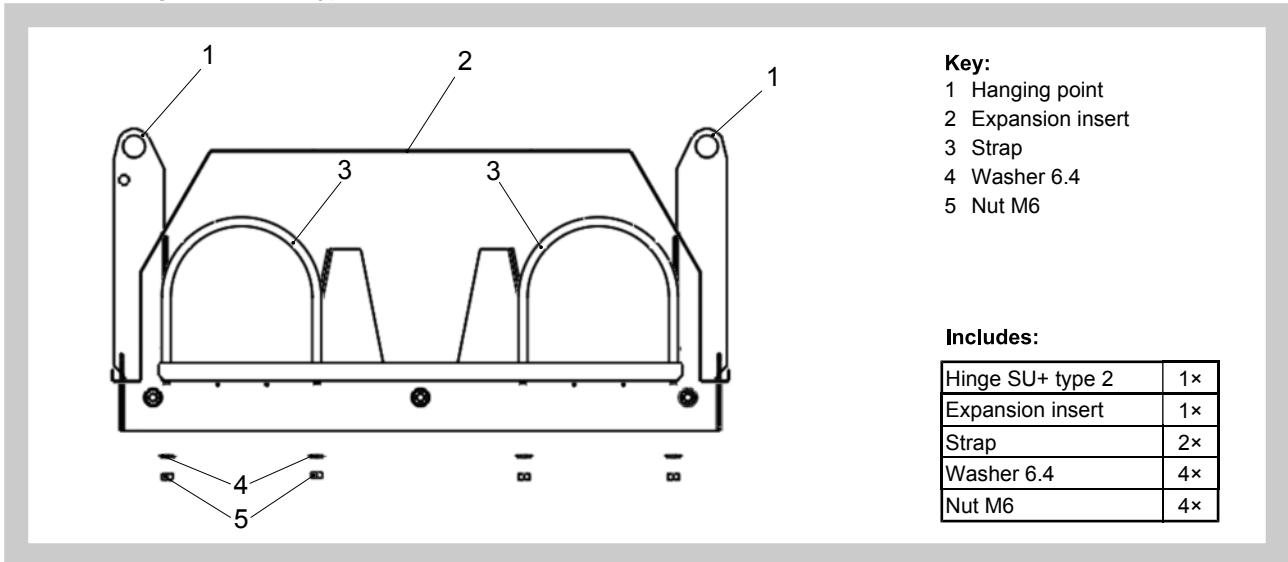
Key:

- 1 Hanging point
- 2 Expansion insert
- 7 Roller
- 8 Roller bed

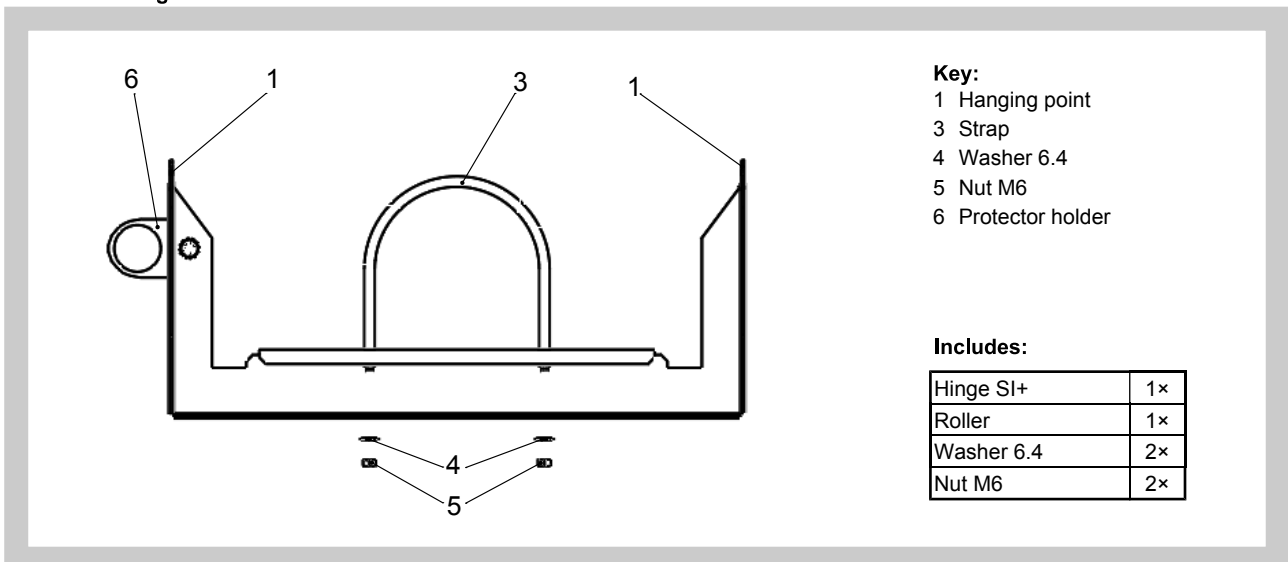
Includes:

Hinge SU+ type 1	1×
Expansion insert	1×
Roller	2×

Pic. 16 Hinge Helios SU+, type 2



Pic. 17 Hinge Helios SI+



8. Attach the cable protection holders (1x M8x16 screw, fan washer, nuts) to all Helios 100 and Helios 70I hinges. The Helios SU hinges are not fitted with a protection bracket.
9. Place armor tube (patch cable holder) into Helios 100 S, (SD) radiator guard holders
10. **Install flue gas spinners in the heating pipe in front of the exhaust box.** The Helios 100 S + infrared heater contains 2x3 spinners - 3 in front of each exhaust box. Helios 70 S + and Helios 50 S + contain 3 spinners, Helios 33 S + contains 2 spinners.
 Connect the spinners with wire eye before inserting them into the tube. After threading the eye through the spinners holes, bend the open end of the eye. Bend the last spinners by 90° before inserting it in the tube so he could not move in it spontaneously.
11. Place the burner and exhaust box on the hanging body (Fig. 20, 21).

Pic. 18 Umístění vířiče spalin u zářičů Helios-SI+

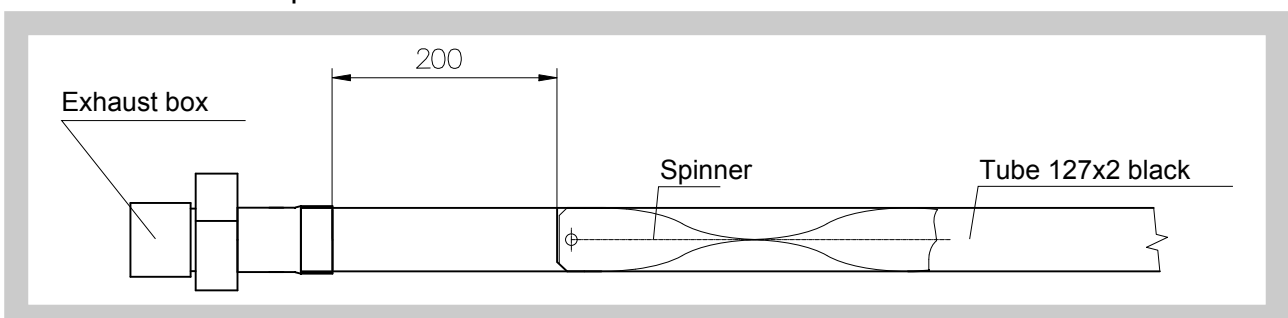
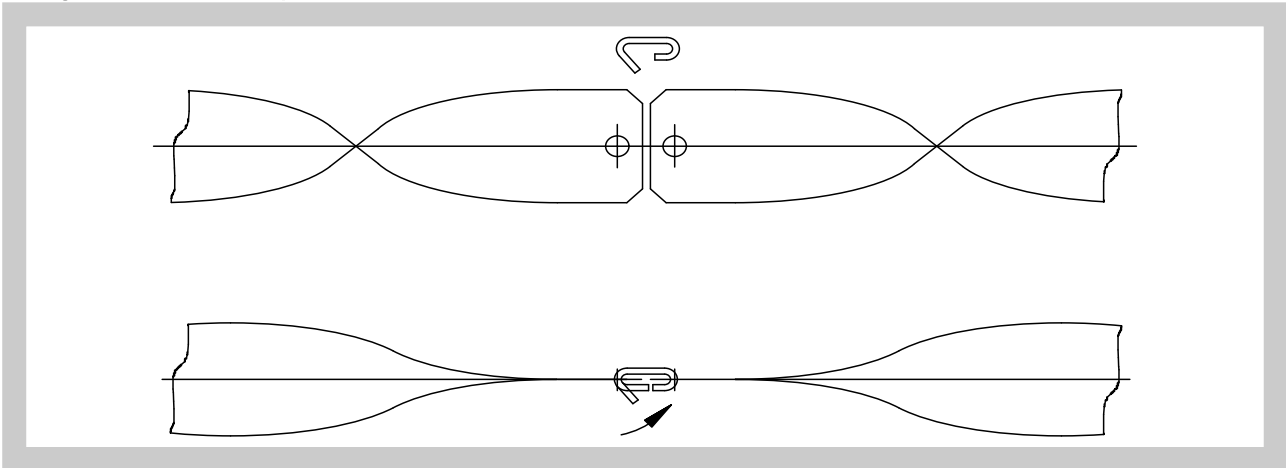


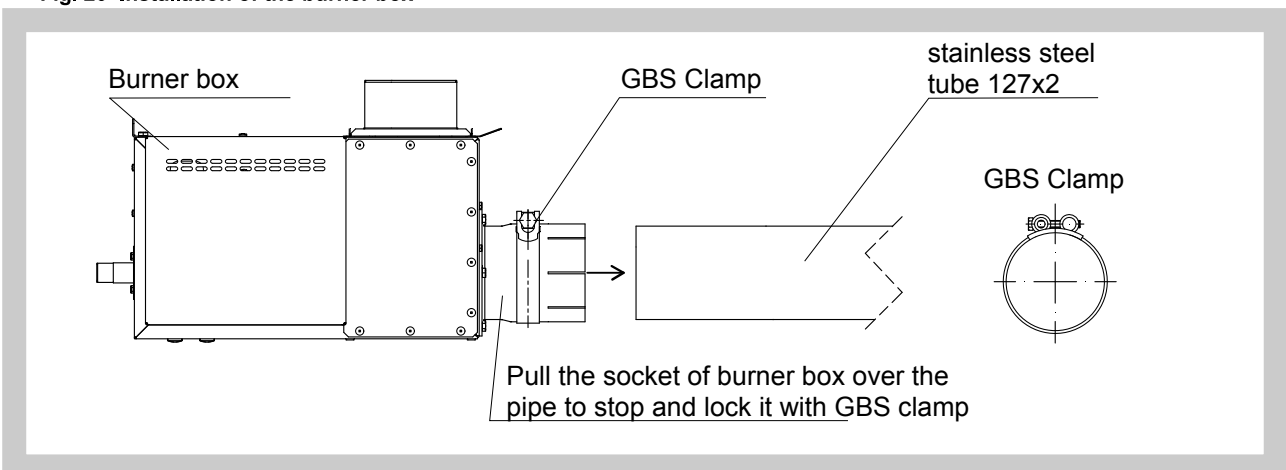
Fig. 19 Connection of spinners



12. Installation of burner box

Pull the socket of burner box over the radiant pipe. By default, the burner box shall be fitted onto the tube in vertical position, i.e. with the neck for air intake located on the top. If the burner cabinet cannot be in this position and needs to be turned, it is necessary to consult MANDÍK, a.s. Secure the burner cabinet after mounting by hanging it by the eye in the back of the cabinet so that the housing neck and the radiant tube are coaxial. Put the GBS clamp over the socket like when connecting radiant pipes and tighten it firmly. The recommended torque is 25 Nm. Connect the burner and the exhaust box with the supplied cable, which, in the I version, is guided by an armored tube placed in the hinges.

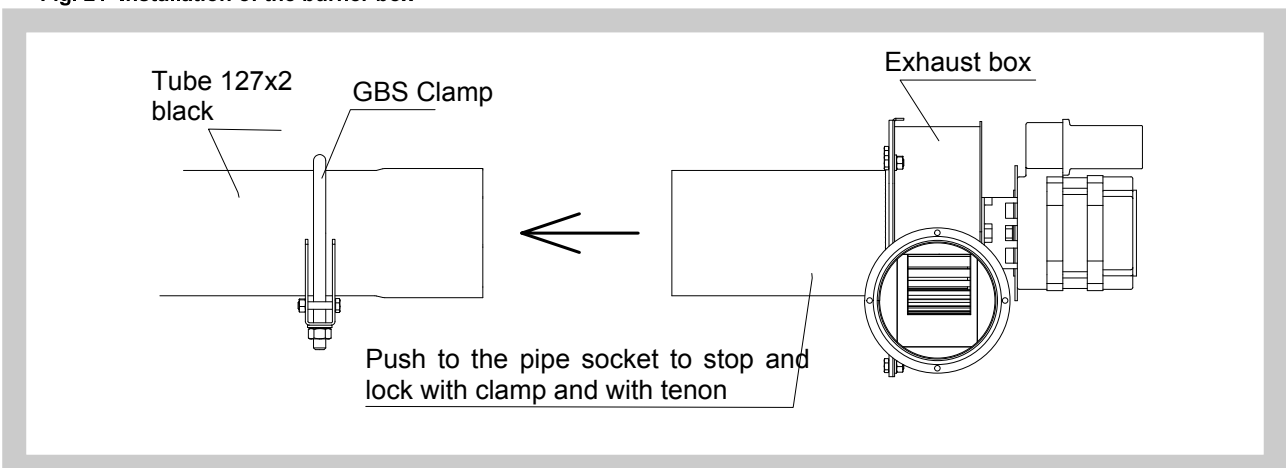
Fig. 20 Installation of the burner box



13. Installation of the exhaust box

In the same way as the burner box, the exhaust box is installed and secured too. It can be angled with the output neck facing the side or top freely. However, it cannot be angled down.

Fig. 21 Installation of the burner box

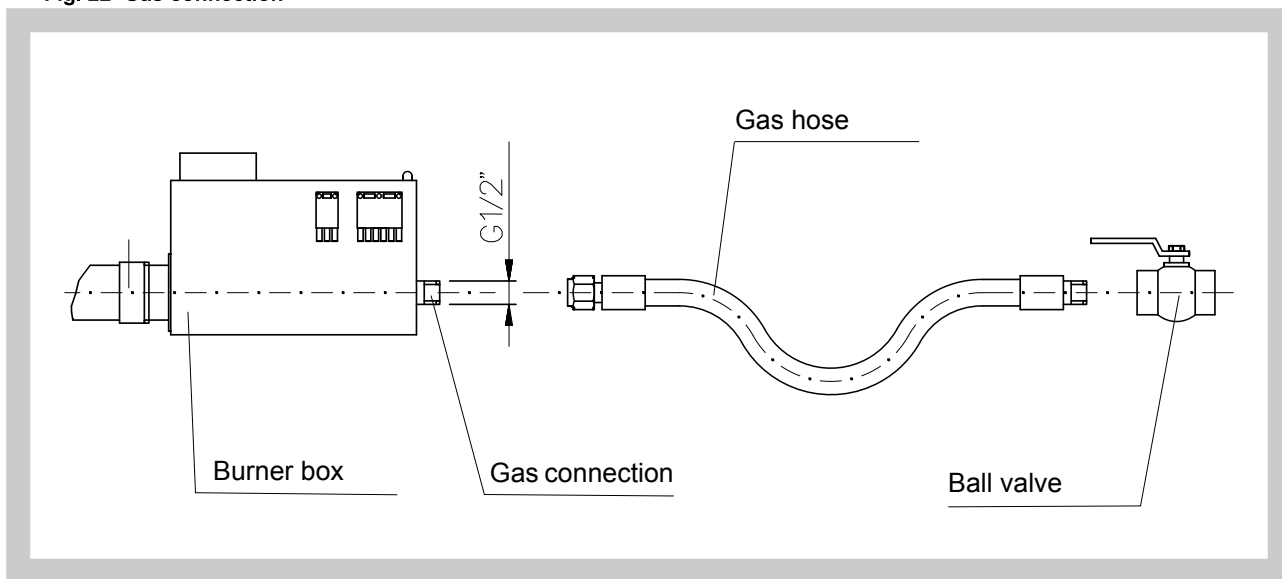


14. Gas connection installation

Installation of gas connection must be carried out according to applicable standards and regulations (see. Chap. XI). Pipeline must be ended by a gas ball valve near the joining point of the infrared heater – max. 1.5 m (Fig. 22). When the infrared heater is in operation, there must be stable and unwavering gas pressure guaranteed in the pipeline - NG, P, see tab. 9.1 and 9.2. For the connection itself, flexible gas hose is used. Since the hose withstands the temperatures up to 100 °C, it is necessary to avoid any contact of the hose with the heater outside the points of connection. The gas lines must be prepared so as to avoid any contact with direct flame and radiant heat.

Connecting the infrared heater can be carried out only by an authorized person. The gas hose is subject to periodic revisions as the gas distributions. It is necessary to protect the hoses from mechanical stresses and aggressive media. The hoses must not be subjected to any tension.

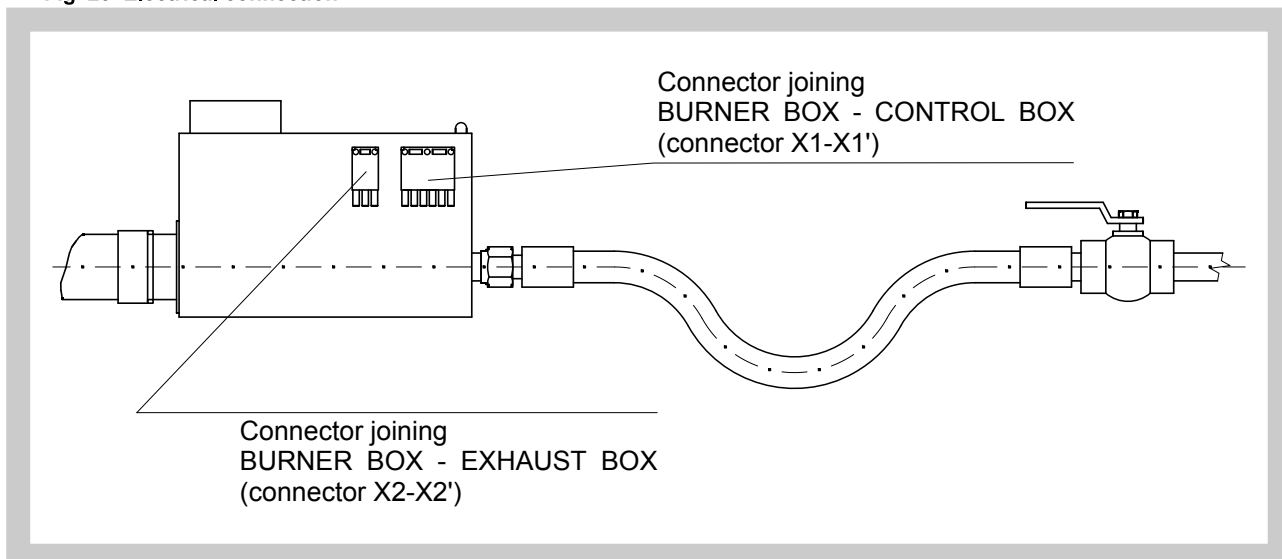
Fig. 22 Gas connection



15. Electrical installation

Place the box of remote control according to the project so that it is freely accessible for the servicing staff. Connection of the box for remote control to the main supply distribution of 230V/50Hz must be carried out firmly using suitable three-wire cable. Connection of the box of remote control to the heater must be carried out firmly by the five-wire cable or seven-wire cable if all signals are to be transferred. Then connect the cable to the terminal piece according to the relevant wiring diagram (Fig. 26-28). Installation of electrical connections must be made by an authorized person according to applicable standards and regulations. The installation must include test of functionality and electric revision.

Fig. 23 Electrical connection



VIII. COMMISSIONING CONDITIONS

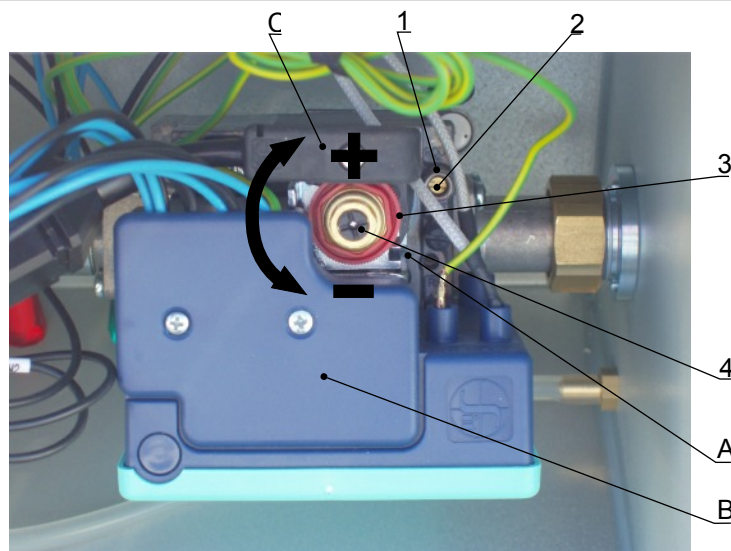
- Infrared heaters HELIOS-S and their accessories may be put into operation only by a person who is trained and authorized by MANDÍK, a.s.
- Infrared heaters and their accessories have to be assembled according to this Instruction Manual.
- Safety and fire regulations must be observed according to applicable standards.
- Before putting into operation, it is necessary to submit a copy of the wiring and gas pipelines revision documents.
- Opening for flue gases measurement: Heaters without economizer have to have opening for flue gases measurement in the first part of flue duct after the heater, heaters with economizer the opening for flue gases measurement have to be immediately after the economizer.
- Infrared heaters and their accessories may only be connected to the mains voltage of 230V/50Hz.
- There must be granted access to junction box in which the heaters are connected.
- Main guard valve of gas must be opened, the gas distribution must be vented and adequate gas overpressure must be assured.
- We recommend presence of a person acting on behalf of assembling company and on behalf of a user for the purpose of training the operation staff.

Installation must comply applicable standards and regulations.

16. Adjustment procedure, adjustment values

1. Check the conformity of assembly of heater, flue gases exhaust and Air-intake duct visually with this manual.
2. Switch the heater on at nominal power (see chapter 17) and after it starts to work, measure the pressure on the jet at nominal power. Check the measured value with the table for the respective heater type bellow and adjust it if necessary.

Fig. 24 Gas valve



Description:

- A Gas valve SIT 843 SIGMA
- B Control automatics SIT 579 DBC
- C Dual cable – two stage heaters only
- 1 Conical throat for manometer hose insertion
- 2 Closing screw for jet pressure measuring (flathead screwdriver 4 mm)
- 3 Setting screw for jet pressure of 2-nd stage (maximum power) with hexagonal head 10 mm
- 4 Setting screw for jet pressure of 1-st stage (minimum power) for cross-point screwdriver

Jet pressure measuring:

1. The heater has to work, switched to maximum power on the control box
2. Loose the screw 2 by two turns
3. Insert the manometer hose (inside diameter of 9 mm) onto conical throat
4. Measure the jet pressure at maximum power
5. With two-stage heater disconnect the dual cable C - this switches the heater to minimum power
6. With two-stage heater measure the jet pressure at minimum power
7. With two-stage heater connect back the dual cable C
8. Remove the manometer hose from conical throat, tighten the screw 2 and perform the gas leakage test with foaming solution or gas detector

Jet pressure adjustment:

1. Start the jet pressure measuring according to the description above
2. Jet pressure at maximum power can be adjusted by turning the brass setting screw 3 with hexagonal head using 10 mm wrench - see fig. 24.
3. Jet pressure at minimum power can be adjusted by turning the black screw 4 using cross-point screwdriver while the brass screw 3 has to be held by 10 mm wrench in order to prevent its movement. For the direction of screw turning in order to rise or decrease jet pressure, see fig. 24.
4. Switch the heater to minimum power by removing the dual cable (marked with the letter C in figure 24) and check the jet pressure, if necessary, for minimum power according to the table for the type of radiator and the procedure above.
5. Switch the heater to rated power by connecting a dual cable and recheck the jet pressure at rated power as described above. The direction of rotation of the screws to increase and decrease the pressure on the nozzle, see Fig. 24.
6. After adjusting the pressures on the jet, let the heater work at nominal power for further 30-60 minutes to heat it up to working temperature. Then adjust the O₂ content in flue gases to values

Note: With one-stage heaters, only the pressure on the jet at nominal power is adjusted. After setting the pressures on the jet and oxygen content according to the above procedure, other values shall be within limits according to the respective table of setting values. If differences are observed, check and repair the pipe connections and connection of burner box and exhaust box.

Tab. 16.1 Setting values for HELIOS-S

Configuration	Helios 100 S+	Helios 70 SU+	Helios 70 SI+	Helios 50 SU+	Helios 33 SU+
Fuel	Zemní plyn	Zemní plyn	Zemní plyn	Zemní plyn	Zemní plyn
Jet diameter [mm]	6,4	7,4	7,4	6,4	5,0
Pressure on the jet at nominal power [mbar]	G20: 9,0	G20: 9,0	G20: 9,0	G20: 9,0	G20: 11,5
	G25: 12,0	G25: 9,0	G25: 9,0	G25: 12,0	G25: 14,0
Nominal input power [kW]	G20: 2 x 49,5	G20: 75,2	G20: 75,2	G20: 49,5	G20: 36,0
	G25: 2 x 46,0	G25: 60,1	G25: 60,1	G25: 46,0	G25: 33,5
Flue temperature [°C]	190 - 200	180 - 190	210 - 230	170 - 185	170 - 185
Content of O ₂ [%]	7,0	7,0	7,0	7,0	7,0
Content of CO [ppm]	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10
Content of NO _x [mg/kWh]	150 - 190	150 - 190	150 - 190	150 - 190	150 - 190
Content of CO ₂ [%]	7,5	7,5	7,5	7,5	7,5
Efficiency [%]	90 - 91	90 - 91	88 - 89	90 - 92	90 - 92
Pressure on the jet at minimal power [mbar]	G20: 7,5	G20: 7,5	G20: 7,5	G20: 7,5	G20: 9,0
	G25: 8,5	G25: 7,5	G25: 7,5	G25: 8,5	G25: 10,0
Minimal input power [kW]	G20: 2 x 43,5	G20: 66,2	G20: 47,9	G20: 43,6	G20: 31,7
	G25: 2 x 43,0	G25: 52,9	G25: 52,9	G25: 43,0	G25: 29,5

17. Operating instruction

- a) Gas tube infrared heaters HELIOS-S may only be used by a person instructed in using the device in a safe manner and who understands possible hazards.
- b) Persons with reduced physical, sensory or mental abilities or person that lack of experience and knowledge may only use the heater under the supervision of a person instructed under point (a).
- c) Children can not use or play with the infrared heater HELIOS-S.

Operation start – applicable generally for control boxes OI, OID

1. Turn the main electric switch „ ① “ to the position „1“.
2. Turn the switch „ STOP - “ to the position „ “ or „ “ (in this case the infra heater operation is performed under the automatic mode which it is necessary to program according to the relevant control box instructions). The green indicator of the electric supply „ ⚡ “ lights up on the control box, also green indicator on the bottom of burner box will light on.
3. After finishing the ventilation time (app. 50 s), the infrared heater will start and the green light " 🔥 " on control box and orange indicator on the bottom of burner box will light on.
4. In case the burner is not fired (the orange lamp of operation on the control box is not alight), the cycle is repeated twice. If it does not ignite even the third time, the red indicator light on the burner box lights up to indicate an error. For unblocking the error state, the power supply of the heater must be disconnected and reconnected (switch " STOP - “ to "STOP" and then back to " “ or " “ . If even after several ignition cycles the infra heater is not started, call the service organisation.
5. The output of the two-stage infrared heaters controlled by the can be changed by the " ▲ " switch. "OID" control box controls the power level of the two-stage heaters automatically.

Breakdown of radiant heaters

1. Turn the switch „ STOP - “ to the position „STOP“.
2. In case of the long-term breakdown it is suitable to close the gas closing valve in front of the heater.

18. Maintenance

Installation, repairs and conversions may be done by qualified and authorised person only.

The annual professional service inspection includes at least:

A) Part 1- General part

- Visual check of the installation in regard of observation all applicable safety standards and regulations.
- Visual check of the appliance and accessories including the flue line.

b) Part 2- Functional check

- Heating tubes and exhaust system permeability, their intactness and tightness.
- Leakage test of gas connection from ball valve to burner incl. gas valve (foaming solution, gas detector).
- Inspection, eventually cleaning of the burner.
- Inspection, eventually cleaning of the vacuum sensor.
- Measuring the ventilation time of the appliance.
- Exchange of the vacuum hose.
- Manostat function check.
- Inspection of ionisation and ignition electrodes, cleaning, and adjustment if necessary.
- Performance check of the heater.
- Measurement of jet pressures, eventually adjustment.
- Flue gases measurement, eventually adjustment of parameters.
- Safety elements of the appliance.

c) Part 3 - Electric inspection

- Solidity check of all electric connections.
- Check of burner control functioning.
- Check of signalization and switching functionality of control box.
- Visual inspection of all electric insulations of the appliance, their exchange if needed.

19. Failure of infrared heaters HELIOS-S and their removal

Troubles of the infrared heater	Cause	Remedy
It is not functional - ventilator does not work (no reaction to the release)	Defective ventilator	Replace the ventilator
	Defective automatics	Replace the automatics
	Faulty electric connection of the burner box	Check the connection – exhaust box
	Defective air manostat	Replace the air manostat
	Defect in the burner box electric connection	Check the connection (cables)
	No connection to the electric supply	Check the connection
	Defective gas manostat <i>- in case it is installed on the burner box</i>	Replace the gas manostat
	Low gas pressure in the distribution lines	Increase the pressure
- ventilator works	Flue gas exhaustion clogged	Clean
	Defective air manostat	Replace the air manostat
	Defective manostat hose – break or locked	Replace or clean
	Defective automatics	Replace the automatics
	Defect of the burner box electric installation (cables)	Check the connection
It is not possible to start it - ventilator works only during the aeration and starting (approx. 50s)	Defective electrodes or their setting or defective electrode cables	Check, replace
	Defective covering (orifice opening)	Check, set
	Defective jet pressure setting	Set
	Defective gas armature regulator	Replace the armature
	Defective automatics	Replace
	Low gas pipeline pressure	Increase the pressure

After each conversion, the appliance must be put back into operation by a service technician trained and authorized by MANDÍK, a.s. Repairs and reconstructions may only be carried out by a person authorized and trained by MANDÍK a.s., who has valid gas and electrical certificates.

WARNING: Under no circumstances should the combustion air, air curtain, or external suction be blocked or clogged, resulting in deterioration of flue gas values (imperfect combustion - lack of air), in case of infrared tube failure / shutdown, failure inoperative.

IX. DISASSEMBLY

Burner box:

The base of the burner box is formed by a shell in which the particular components are mounted. The burner box shell is divided into two parts – burner chamber and control section. The neck with a flange is mounted to the burner chamber enabling the connection to the radiant (combustion) tube.

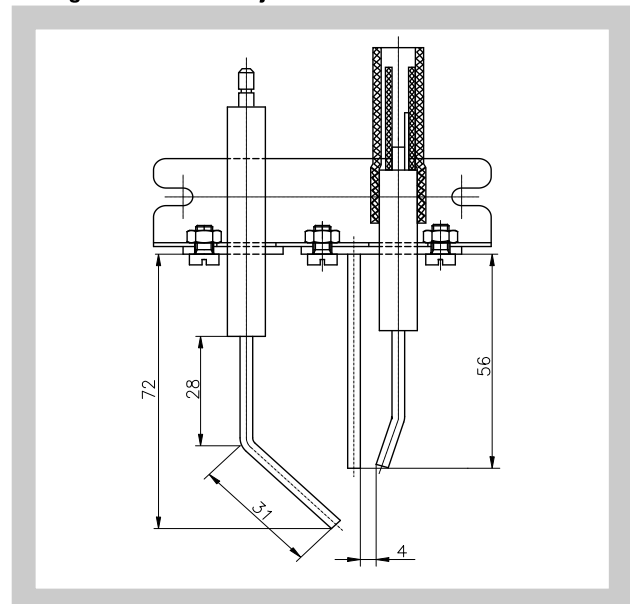
There is the control valve **SIT 843** in the control section (with connection tube, controlling automatics **SIT 579 DBC** (ignition system) and air manostat for the low pressure control*. The connection tube goes from the burner box and serves for the connection to the gas distribution. This section is closed by door.

In the burner chamber, there is the burner with a jet whose opening depends on the burnt gas and the output. The burner is fixed to the gas valve and is directed to the neck. On the shell there is the holder with electrodes (ignition electrode and ionisation sensor) that are inserted into the relevant holes in the neck. On the top of burner chamber there is air intake neck with adjustable aperture used to control the quantity of combustion air. There are three lamps on the shell – green lamp for „POWER SUPPLY“, the red lamp for „ERROR“ and orange lamp „OPERATION“. Also the connectors for burner box and exhaust box and control panel connection are mounted on the shell.

Electrodes disassembly:

1. Disconnect the burner box and the electric supply by removing the large connector X1-X1' and close the gas supply.
2. Disassembly the upper case and the cover (4x stud bolt).
3. Disassembly the electrode holder (2x screw and nut M4).
4. Disconnect the electrodes and the cables.
5. Perform the electrode replacement.
6. Perform the assembly in the reverse order.
7. Check the electrode setting according to Fig. 25.

Fig. 25 Electrode Adjustment



Burner and jet disassembly:

1. Disconnect the burner box and the electric supply by removing both connectors, and close the gas supply and disconnect from the gas distribution.
2. Disconnect the burner box and the radiant tube (remove the clamp and pull).
3. Perform the electrode disassembly (do not disconnect the electrode cables).
4. Dismount the burner and the nozzle in the front section.
5. Perform the assembly in the reverse order. The thread is tightened by teflon band.

Disassembly of the control automatics:

1. Disconnect the burner box and the electric supply by removing the large connector X1-X1' and close the gas supply.
2. Remove the door of the control section (1x stud bolt).
3. Dismount the control automatics (1x screw).
4. Remove the control automatics cover and disconnect the connectors.
5. Perform the control automatics replacement.
6. Perform the assembly in the reverse order.

Disassembly of the gas valve:

1. Disconnect the burner box and the electric supply by removing both connectors, close the gas supply and disconnect from the gas distribution.
2. Disconnect the burner box and the heating tube (remove the clamp and pull).
3. Perform the disassembly of the control automatics (do not disconnect the electric cables from the control automatics).
4. Perform the burner disassembly.
5. Dismount the spacer ring (2x screw M4x8 and nut M4).
6. Dismount the valve and the connection tube (4x screw M4x8) and perform its replacement.
7. Perform the assembly in the reverse order.
8. Perform the gas leakage test (foaming solution, gas detector)
9. Set the gas pressure to the nozzle according to the table 16.1 according to heater model.

Exhaust (ventilator) box

Depending on the type of infrared radiator, the exhaust cabinet consists of a fan "AACO-MANDIK", to which a flange with a flange is screwed and at the outlet a flue gas outlet.

Disassembly of the exhaust box:

1. Disconnect the exhaust box and the electric supply by removing the small connector X2-X2' on the burner box and close the gas supply.
2. Disconnect the ventilator neck and the flue duct
3. Disconnect the exhaust box and the heating tube (remove the clamp and pull).
4. Perform the exhaust box replacement.
5. Perform the assembly in the reverse order.

20. Conversion to another type of fuel

1. Order at MANDIK, a.s. a new burner with jet for new fuel. The Jet is locked in the burner with locking liquid and thus dismantling is difficult. That is why it is advised to exchange the whole burner with jet. Together with new burner, a self-adhesive label Conversion shall be supplied which has to be filled-in and stuck next to the product data label.
2. Disconnect the burner box and the electric supply by removing both connectors, close the gas supply and disconnect from the gas distribution.
3. Disconnect the burner box and the heating tube (remove the clamp and pull).
4. Disassembly the electrodes (do not remove the cables).
5. Disassembly the burner with jet and screw in the new burner with jet for new fuel. The thread is tightened by teflon band.
6. Perform the gas leakage test (foaming solution, gas detector).
7. Put the heater into operation, set the pressure of the jet according tab. 16.1. Only a person who is trained and authorized by MANDIK, a.s.
8. Adjust the combustion air intake by adjustable aperture and flue gas analyser.

Note: When changing the type of natural gas it is necessary to re-adjust the radiator to the combustion values according to tables 16.1. No parts of the radiator change due to a change in the type of natural gas. Only a service technician trained and authorized by MANDIK, a.

21. Components used in infrared heaters HELIOS-S**Gas valves two-stage:**

*SIT 836 TANDEM
SIT 843 SIGMA
HONEYWELL VK 4105Q
WHITE-RODGERS 36E
WHITE-RODGERS 91B*

Control automatics:

*SIT 579 DBC
SIT EFD 503
SIT ABC 537
BRAHMA SE 31F
HONEYWELL S 4565
Bertelli & Partners type FM
INECO typ EPL*

Air manostats 0,4 mbar:

*SIT 380 ARIA
DUNGS LGW 3 A1
HONEYWELL C 6065A*

Flue gas ventilators:

*AIRFLOW 45 BTFR
AACO-MANDIK 133/52*

X. CONTROL

22. Control box

Control by Thermostat

Enables control of single heater based on temperature or temperature programmed by weekly program.

OI control box

OI enables manual control of one (OI 1) to six (OI 6) one-stage or two-stage tube heaters HELIOS-S. The control box has IP 40 rating and it can be equipped with programmable room thermostat TP08 (IP 30). The load selection of two-stage heaters is manual.

OID control box

OID enables automatic and manual control of one (OID 1) to six (OID 6) one-stage or two-stage tube heaters HELIOS-S. The control box has IP 40 rating. The control box is equipped with UC301 (IP 20) regulator with time programme. The load selection of two-stage heaters automatic. The UC301 is a communication two-stage regulator for gas heaters with SSR outputs. It can work autonomously or be connected to a primary regulator (MiniPLC or SoftPLC), visualization (RcWare Vision or other SCADA system) or UCWEB web interface.

Fig. 26 Diagram of controlling the infrared heater HELIOS-S by thermostat

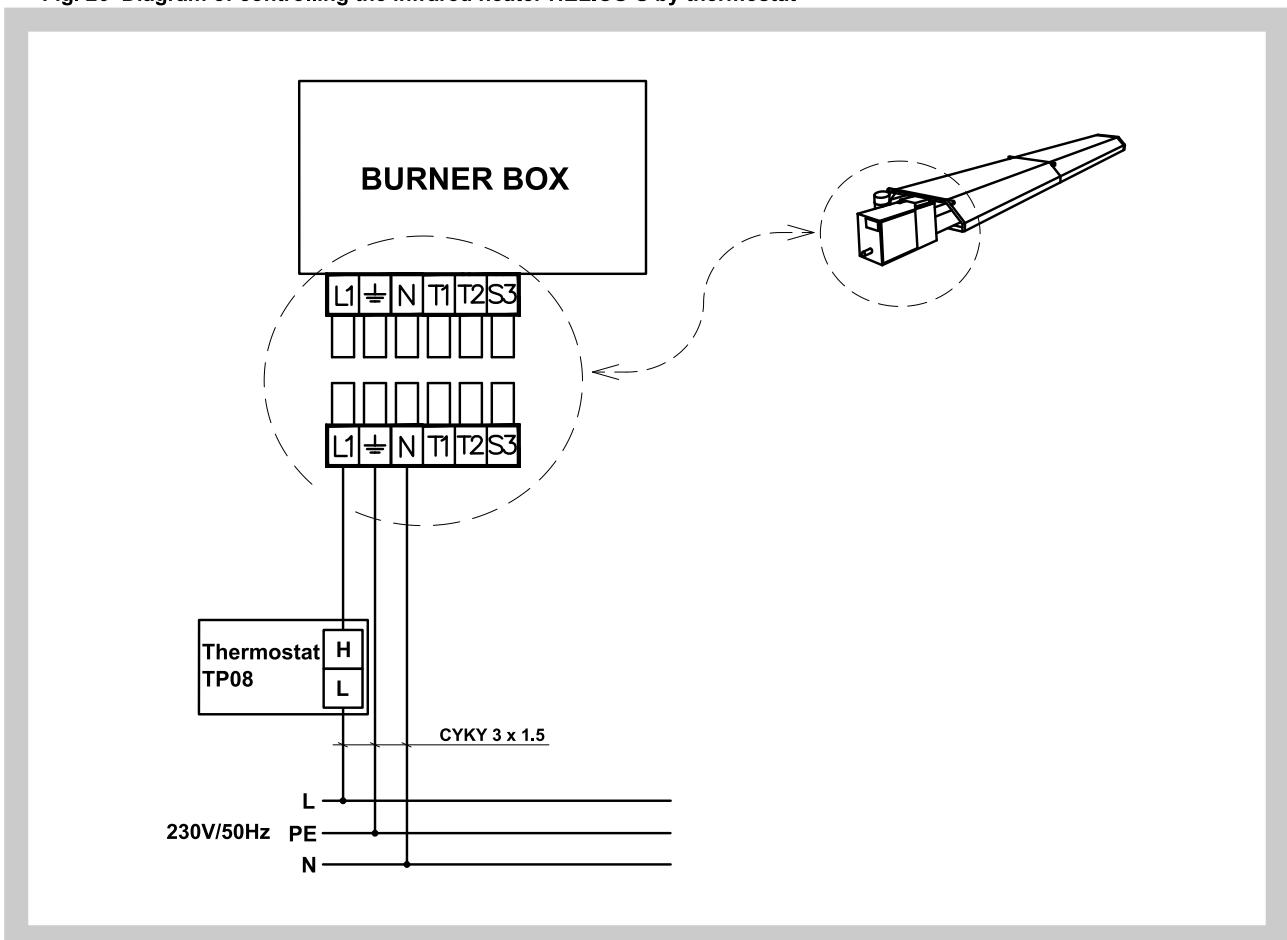


Fig. 27 Diagram of controlling the infrared heater HELIOS-S by control box OI

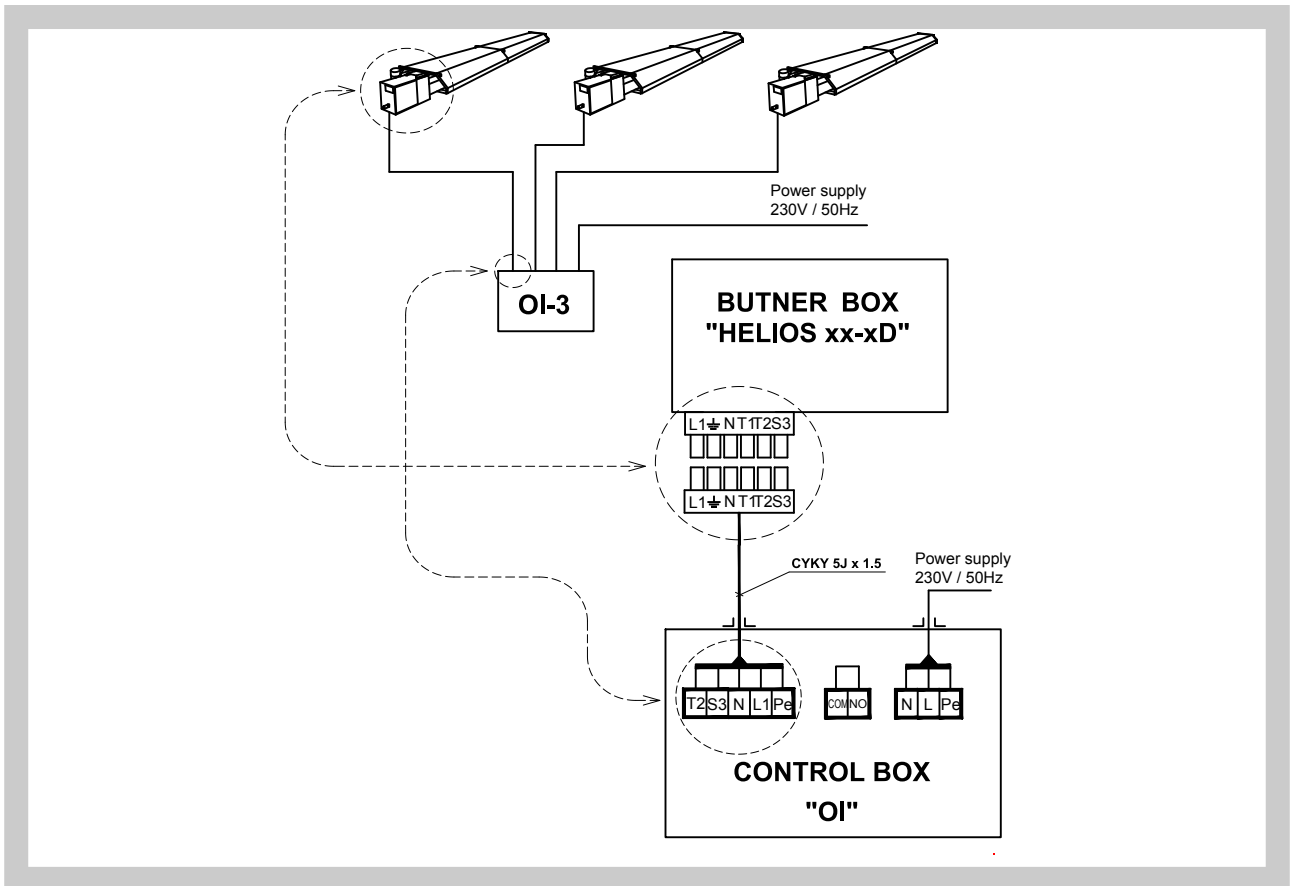
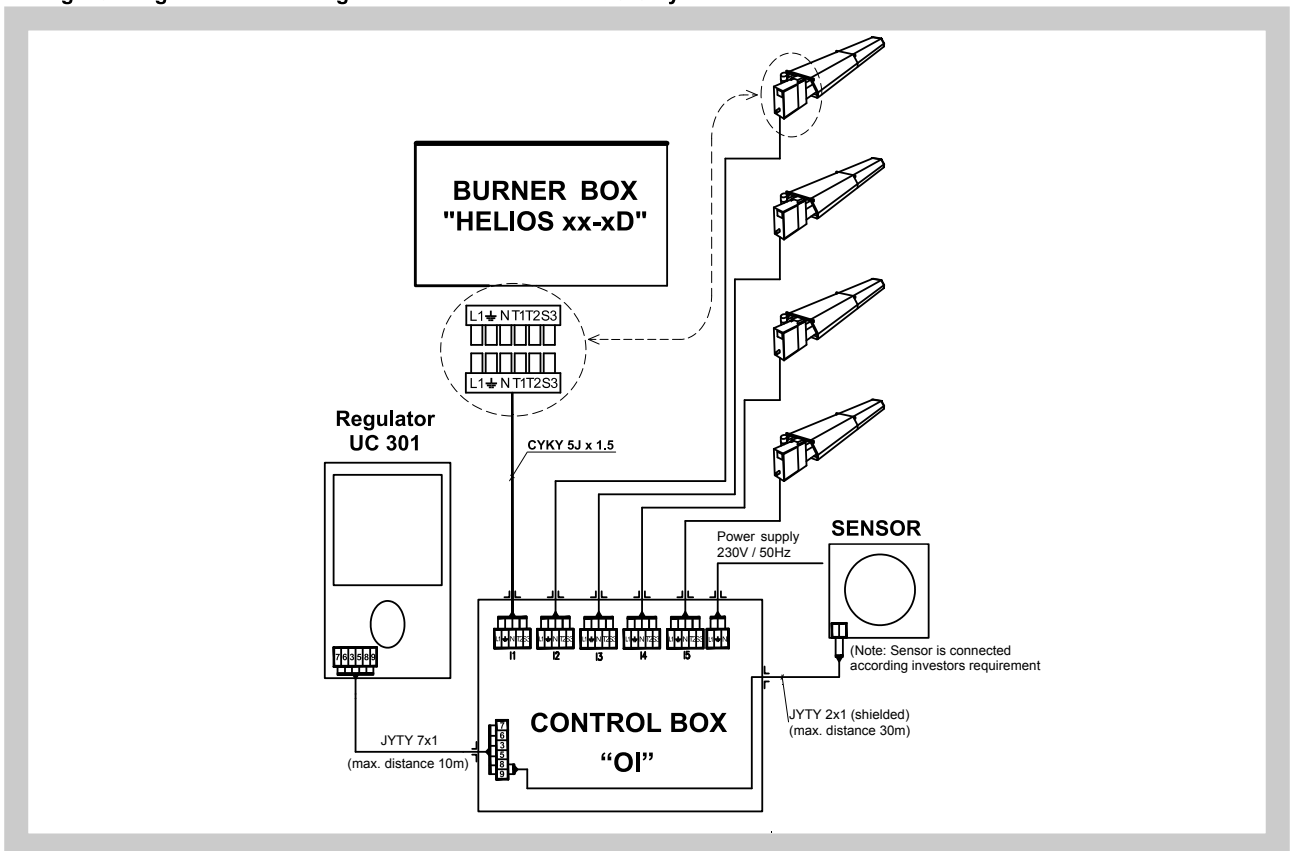


Fig. 28 Diagram of controlling the infrared heater HELIOS-S by control box OI D

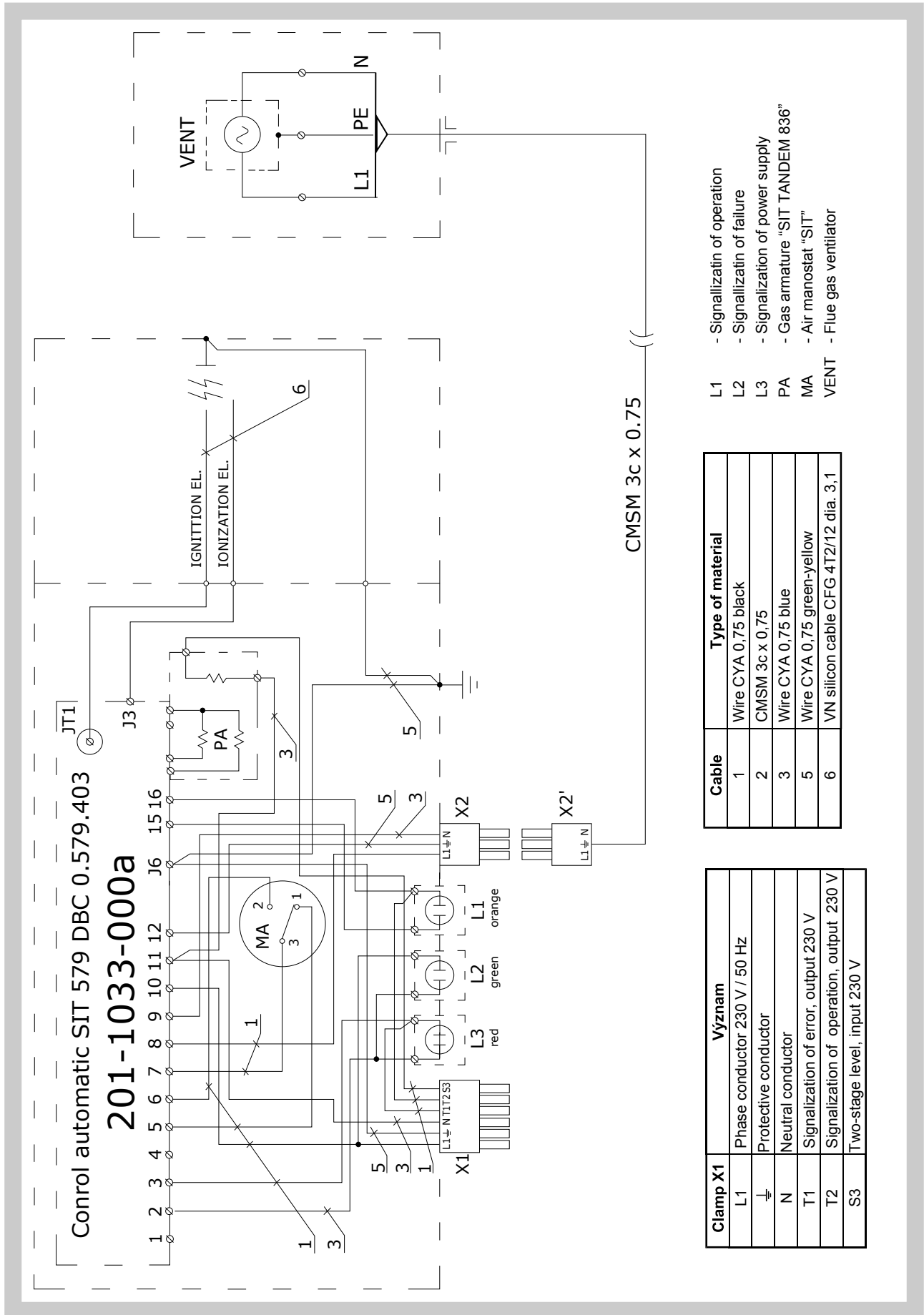


Temperature sensor placement

Temperature sensor or thermostat should be placed into the working zone, 1,5 m above the floor. Preferable placement avoids outer cooled wall of the building. If the above placement is not possible, suitable temperature correction has to be added to the programmed temperatures.

23. Wiring diagram

Fig. 29 Internal wiring diagram for HELIOS-S



Cable	Type of material
1	Wire CYA 0,75 black
2	CMSM 3c x 0,75
3	Wire CYA 0,75 blue
5	Wire CYA 0,75 green-yellow
6	VN silicon cable CFG 4T2/12 dia. 3,1

Clamp X1	Význam
L1	Phase conductor 230 V / 50 Hz
⊥	Protective conductor
N	Neutral conductor
T1	Signalization of error, output 230 V
T2	Signalization of operation, output 230 V
S3	Two-stage level, input 230 V

- L1 - Signallizatin of operation
- L2 - Signallizatin of failure
- L3 - Signalization of power supply
- PA - Gas armature "SIT TANDEM 836"
- MA - Air manostat "SIT"
- VENT - Flue gas ventilator

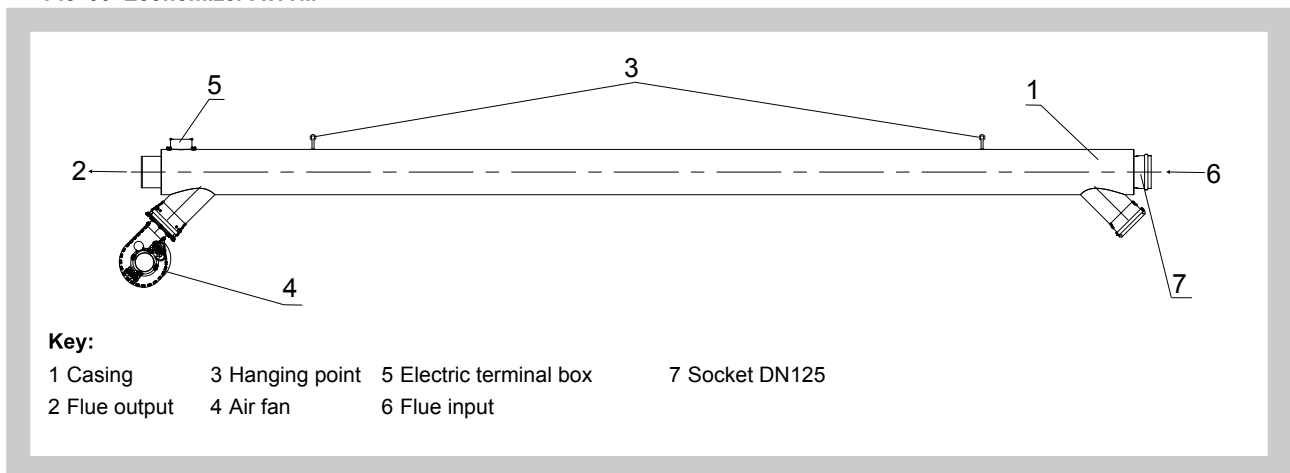
XI. ECONOMIZER AWTM

Economizer is a counterflow heat exchanger which utilizes residual heat of flue gases for air heating. It consists of the heat exchanger itself, air fan and flange on the heated air exit. The internal heat transfer surface of the exchanger is made of aluminium, the external surface is made of galvanized steel plate. To the external surface of heat exchanger, there are connected air fan and air output neck with flange 125 mm. The flange is used for connecting a grille with adjustable blades to blow the heated air into the heated room or for connecting an air-duct transferring the heated air into another room. The internal heat transfer surface has a standard 125 mm socket for connection to flue gases output of HELIOS tube heater and DN 125 mm neck for connection to the socket of condensate trap and further to flue system. Economizer is placed in flue system immediately after the tube heater. Electric supply of the fan can be from connector on the burner box or by cable from mains 230V/50Hz.

24. Economizer functional description

When the heater is started, the flue gases flow inside the internal heat transfer surface and heat it up. As soon as the surface temperature reaches 42°C, the air fan is started and blows the air between the internal heat transfer surface and external casing, the heated air goes out via the neck with connected grille or duct. If the temperature of internal surface decreases below 30°C, the air fan stops.

Pic. 30 Economizer AWTM



25. Pressure loses on flue gas side

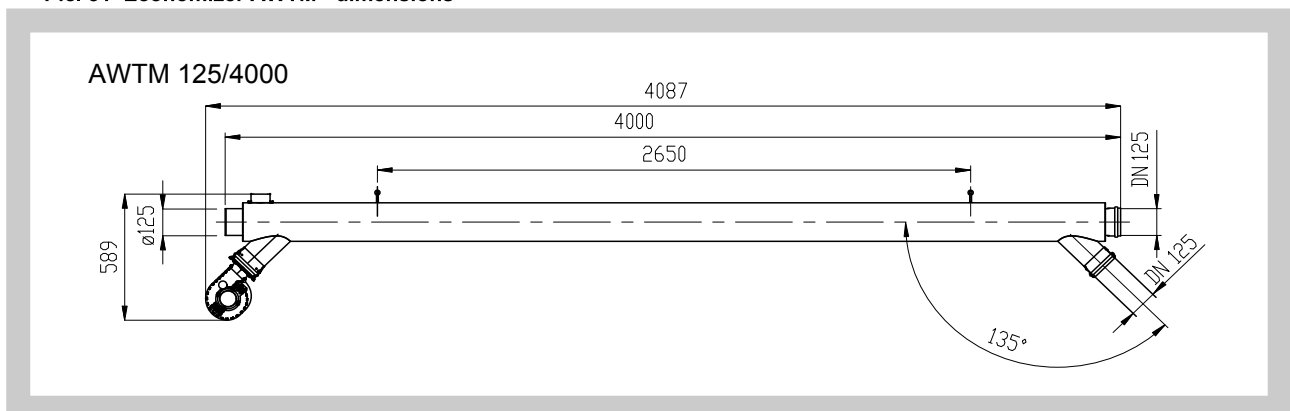
Tab. 25.1 Pressure loss of economizer AWTM on flue gasses side when connected to HELIOS-S heaters

Type	Helios 50 S+	Helios 70 SU+	Helios 70 SI+	Helios 100 S+
AWTM 125/4000	10 Pa	18 Pa	18 Pa	10 Pa

Usable pressure for connection to air duct is 35 Pa.

26. Dimensions of economizer

Pic. 31 Economizer AWTM - dimensions

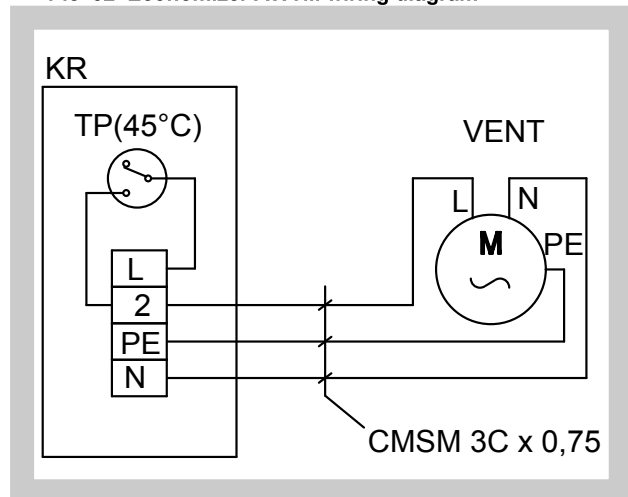


27. Technical data and wiring diagram of economizer

Tab. 27.1 Technical data

Type	AWTM 125/4000
Length [mm]	4087
Weight [kg]	47
Power supply [V/Hz]	230/50
Electric input [W]	75
Air flow [m ³ /h]	750
Thermal output with Helios 50 S+	2300 W
Thermal output with 70 SU+	2600 W
Thermal output with Helios 70 SI+	2700 W
Thermal output with Helios 100 S	2300 W
Available pressure	35 Pa

Pic. 32 Economizer AWTM wiring diagram

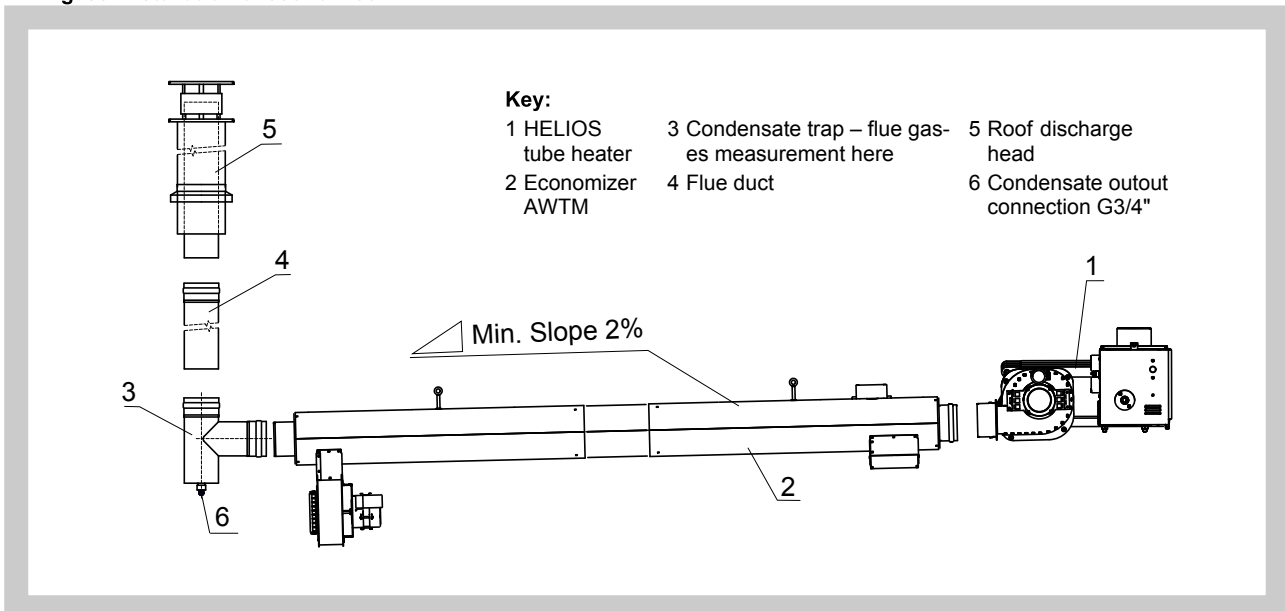


The thermal output of economizer depends on the heater adjustment and air temperature. The above data are for correctly adjusted heaters working on natural gas and air temperature of 20°C.

28. Installation of economizer

Economizer is placed in flue system immediately after the tube heater. The position of economizer is horizontal with slope 2% from the heater. Between heater and economizer, a bend may be inserted if necessary. For hanging, the economiser is equipped with hanging bolts which can be used for fine adjustment if its slope. Immediately after economiser, there must be condensate trap with condensate output and output of flue gases out of the building.

Fig. 33 Installation of economiser AWTM



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