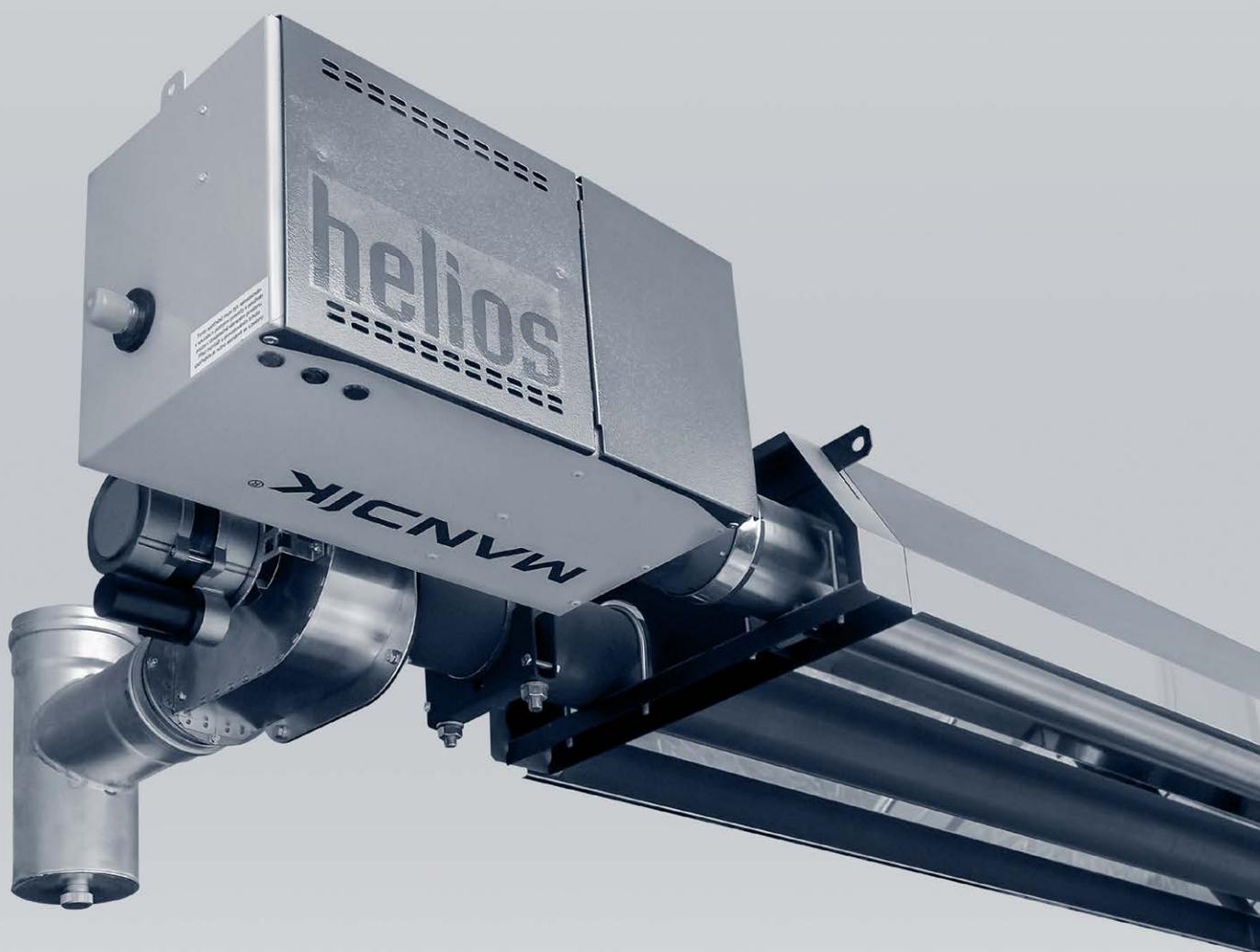


# Dark tube infrared heater HELIOS

Installation,  
operation instructions  
and maintenance manual



# CONTENT

I. GENERAL	4
Infrared heater description	4
Versions	4
Dimensions and weights	5
Description of function	6
Ordering key	6
Material, surface treatment	7
Data label	7
Control	7
Logistic data	7
II. INSTALLATION MANUAL	8
Installation conditions	8
Suspension methods	8
Mounting components of infrared heater HELIOS	9
Instructions for assembling the body of the infrared heater	13
Placement of the burner box	17
Installation of the exhaust box	18
Flue exhaust – connection principles	18
Gas connection installation	20
Electrical installation	20
III. COMMISSIONING AND SERVICE	21
Commissioning conditions	21
Adjustment procedure of single-stage and two-stage heaters	21
Adjustment procedure of modulated heaters	22
Maintenance	29
Failure of infrared heaters HELIOS and their removal	29
Disassembly	30
Conversion to another type of fuel	32
Recycling, dismantling after end of life	32
Components used in infrared heaters HELIOS	32
IV. CONTROL	33
Control of single-stage and two-stage heaters	33
Control of modulated infrared heaters	36
Temperature sensor placement	42

V. OPERATING INSTRUCTIONS .....	43
Instructions for operating single-stage and two-stage infrared heaters .....	43
Instructions for operating modulated infrared heaters .....	44
VI. DESIGN DOCUMENTS .....	45
VII. ECONOMIZER AWTM .....	52
Economiser functional description .....	53
Economiser installation .....	53
Technical data .....	53
Pressure losses .....	54
Economizer accessories .....	55

# I. GENERAL

## Dark tube infrared heater HELIOS (On/Off), HELIOS D (two-stage) and HELIOS M (modulated) in the performance series from 10 to 50 kW is a modern ecological gas heater.

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)**
- **propane – P (G31)**

Product category:

- **II<sub>2E3B/P</sub> II<sub>2ELL3B/P</sub> design A<sub>2</sub>, B<sub>22</sub>, C<sub>12</sub>, C<sub>32</sub>, C<sub>62</sub>, NO<sub>x</sub> class 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.

## Infrared heater description

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) environ-

ment 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.

## Versions

**According to power control of the burner, the infrared heaters are single-stage I, U, LU, two-stage UD, LUD and modulating UM, LUM.**

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.

Modulated heater can vary the output as needed from minimum to full.

The main advantages of the two-stage burner control include reducing burner start-up frequency, better temperature distribution

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

in the heated space and reduced energy consumption. The modulated control of the burner is even more economical thanks to a smooth change in performance.

Infrared heaters HELIOS are divided in terms of installation and used reflector:

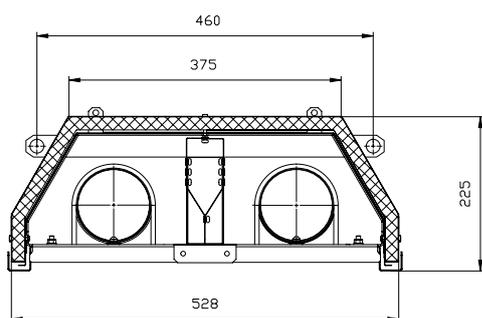
- **Ceiling infrared heaters** with reflectors fitted with hinges in version of hanging under the ceiling
- **Wall infrared heaters** with reflectors fitted with hinges „U(I)/15°, for hanging on the solid walls.

## Dimensions and weights

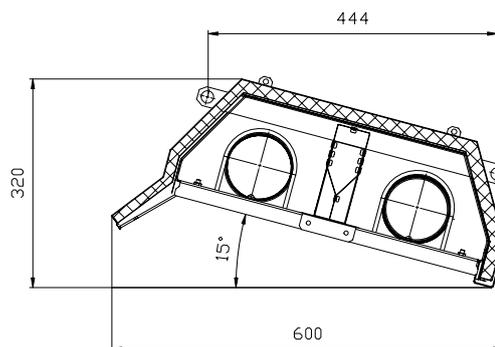
The weights of individual infrared heaters are given in *Table 1*. The weights of two-stage and modulated heaters (UD+, UD/15+, LUD+, LUD/15+, UM+, UM/15+, LUM+, LUM/15+) are the same as the weights of single-stage heaters. The dimensions are visible from *Fig. 1 to 4*.

**Tab. 1: Weights of the infrared heaters Helios**

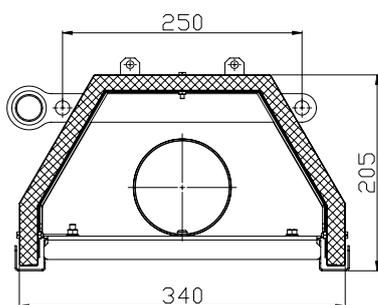
<b>Type</b>	<b>20-I+</b>	<b>30-I+</b>	<b>40-I+</b>	
<b>Weight [kg]</b>	124.1	160.1	196.1	
<b>Type</b>	<b>20-I/15+</b>	<b>30-I/15+</b>	<b>40-I/15+</b>	
<b>Weight [kg]</b>	130.7	168.8	209.6	
<b>Type</b>	<b>10-U+</b>	<b>20-U+</b>	<b>30-U+</b>	<b>40-U+</b>
<b>Weight [kg]</b>	87	120	150.5	179.7
<b>Type</b>	<b>10-U/15+</b>	<b>20-U/15+</b>	<b>30-U/15+</b>	<b>40-U/15+</b>
<b>Weight [kg]</b>	89.8	124.2	156	186.2
<b>Type</b>	<b>20-LU+</b>	<b>30-LU+</b>	<b>40-LU+</b>	<b>50-LU+</b>
<b>Weight [kg]</b>	150.4	179.7	208.2	240.7
<b>Type</b>	<b>20-LU/15+</b>	<b>30-LU/15+</b>	<b>40-LU/15+</b>	<b>50-LU/15+</b>
<b>Weight [kg]</b>	156	186.2	212.8	246.7



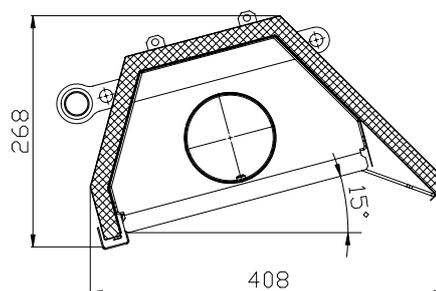
**Fig. 1:** Cross-section of the reflector HELIOS 10 to 50-U, LU(D)+



**Fig. 2:** Průřez reflektorem infrazářiče HELIOS 10 až 50-U, LU(D)/15+



**Fig. 3:** Cross-section of the reflector HELIOS 20 to 40-I(D)+

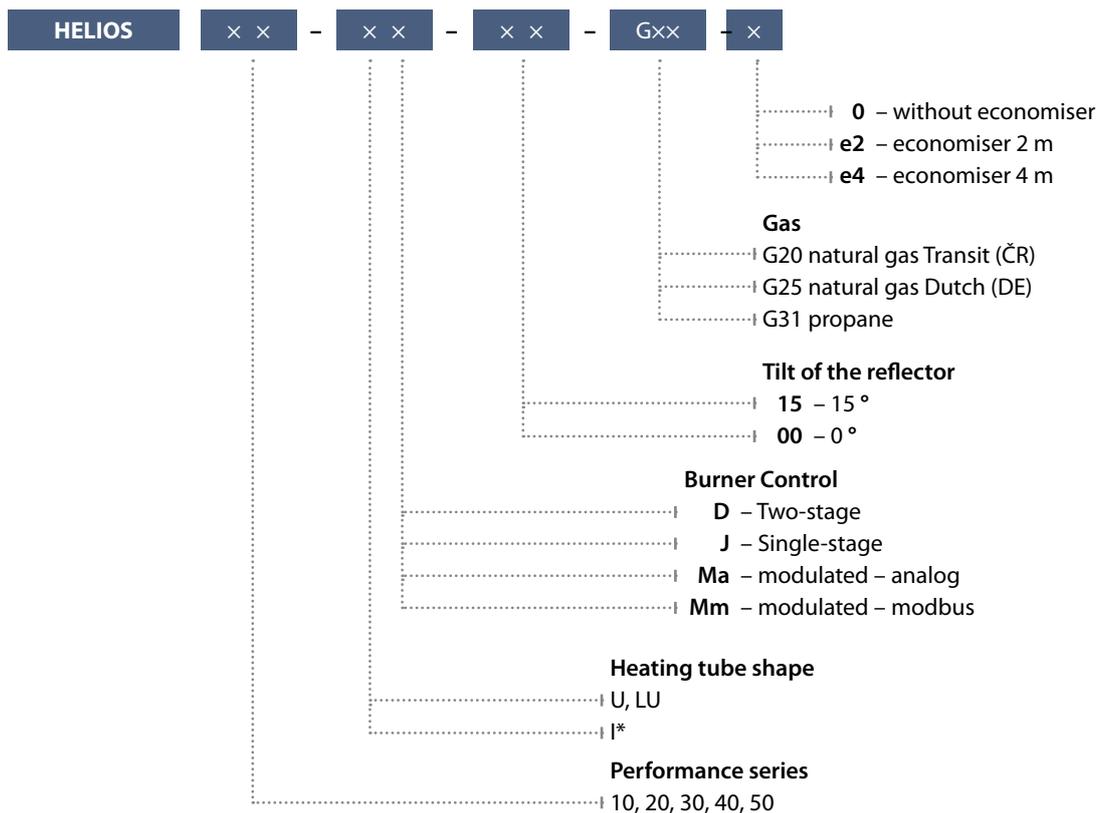


**Fig. 4:** Cross-section of the reflector HELIOS 20 to 40-I(D)/15+

## Description of function

- Infrared heater operation is controlled by the **automatics** located in the burner box, eventually by control board (models M).
- In case of single-stage or two-stage heater, 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. Connecting the heater to the mains is indicated by the green "POWER" light on the burner box.
- The modulated heaters are permanently connected to the grid (the green "POWER" light on the burner box lights all the time) and the radiator is waiting for a command to start. The automatics is connected to the power supply only after receiving this command. Subsequently, the **exhaust fan** is started and the next process is the same for all types of radiant heaters.
- 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** and simultaneously, the orange indicator "FLAME" lights on.
- 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 the heater fails to ignite, the red "BURNER FAILIURE" indicator will light ON.
- Further start is possible after unlocking the fault condition. In case of single-stage and two-stage heaters this is done by disconnecting and reconnecting to the power supply. For modulated heaters, this state can be unblocked by disconnecting the run request and reconnecting it. If this does not happen, the modulated heater tries to unblock this state by itself and re-ignite, but lengthens the intervals between individual attempts.

## Ordering key



\* Performance series only 20, 30, 40

### EXAMPLE:

- HELIOS 20-LUMa-00-G25-0** – 20 kW extended U-shaped analog modulated heater, without tilting, natural gas
- HELIOS 30-UD-15-G31-e4** – 30 kW two-stage U-shaped heater, tilted, with economizer 4m, on propane

## Material, surface treatment

Reflectors of infrared heaters are made of aluminised sheet metal. In insulated version they are equipped with thermal insulation from mineral wool boards, covered with galvanized sheet. The hinges, sockets and couplings are made of steel plates with heat-resist-

ant coating. The casing of the burner casing is made of galvanized sheet steel, powder-coated on the outside. Radiant tubes are steel, dark aluminised.

## Data label

The type data label of the product is shown in Fig. 5.

<b>MANDÍK</b>		MANDÍK, a.s. 267 24 Hostomice		Hostomice 550 Česká republika	
<b>TMAVÝ PLYNOVÝ TRUBKOVÝ INFRAZÁŘIČ</b>					
TYP:	HELIOS 30-UD+	PALIVO:	G20		
PŘÍKON MAX Hi:	33,0 kW	NAPĚTÍ:	230V/50Hz		
PŘÍKON MIN Hi:	29 kW	EL.PŘÍKON:	100W		
SPOTŘEBA MAX:	3,43m <sup>3</sup> /h	KRYTÍ:	IP40		
SPOTŘEBA MIN:	3,01 m <sup>3</sup> /h	HMOTNOST:	137 kg		
PŘETLAK PALIVA:	2 kPa	KATEGORIE:	II2H3B/P		
VÝR:ČÍSLO:	22/308104				
TŘÍDA NOX 3	PROVEDENÍ A2, B22, C12, C32, C62				

Fig. 5: Type data label

## Control

The equipment is checked and pre-set by the manufacturer, its operation depends on correct installation and adjustment.

## Logistic data

Infrared heaters and its accessories are provided with packaging foil and packed in cardboard boxes. They are transported with covered vehicles without the direct influence of the weather. There must be no vibration and the ambient temperature must not exceed +50 °C. When handling during transport and storage, infrared heaters and accessories must be protected against mechanical damage. Infrared heaters must be stored in covered buildings, in

an environment free from aggressive vapours, gases and dust. The delivery includes a complete HELIOS infrared radiator, enclosed quality and completeness certificate with inspection stamp and installation, operation and maintenance instructions.

If the method of acceptance is not specified in the order, handing over the infrared heaters and accessories to the carrier will be considered as acceptance.

## II. INSTALLATION MANUAL

### 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. 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!**

### 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 Fig. 6 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. 7).

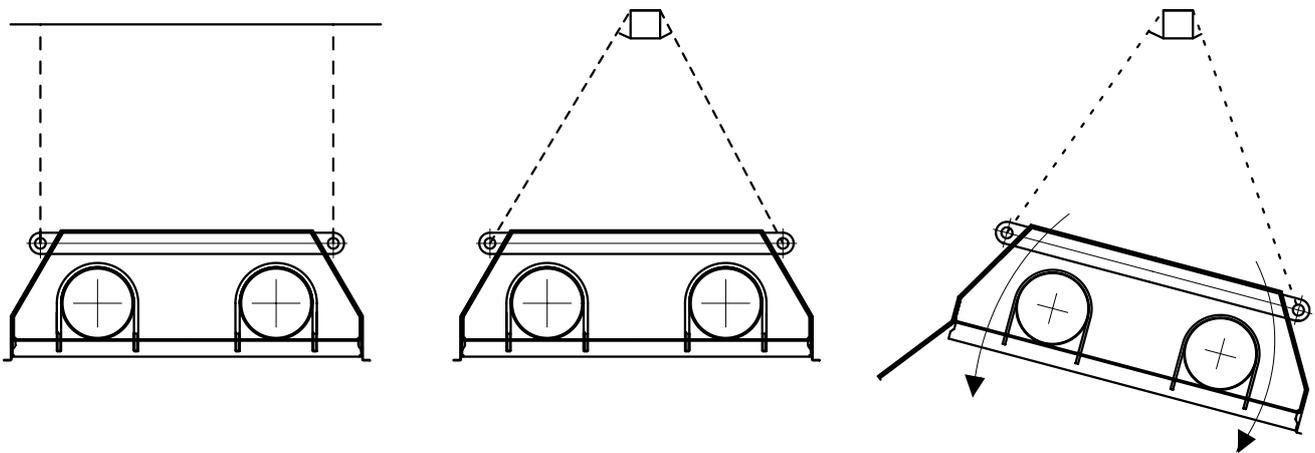


Fig. 6: Suspension of infrared heater Helios

#### **Special cases of installation**

When installing the heater over the runway of portal/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.**

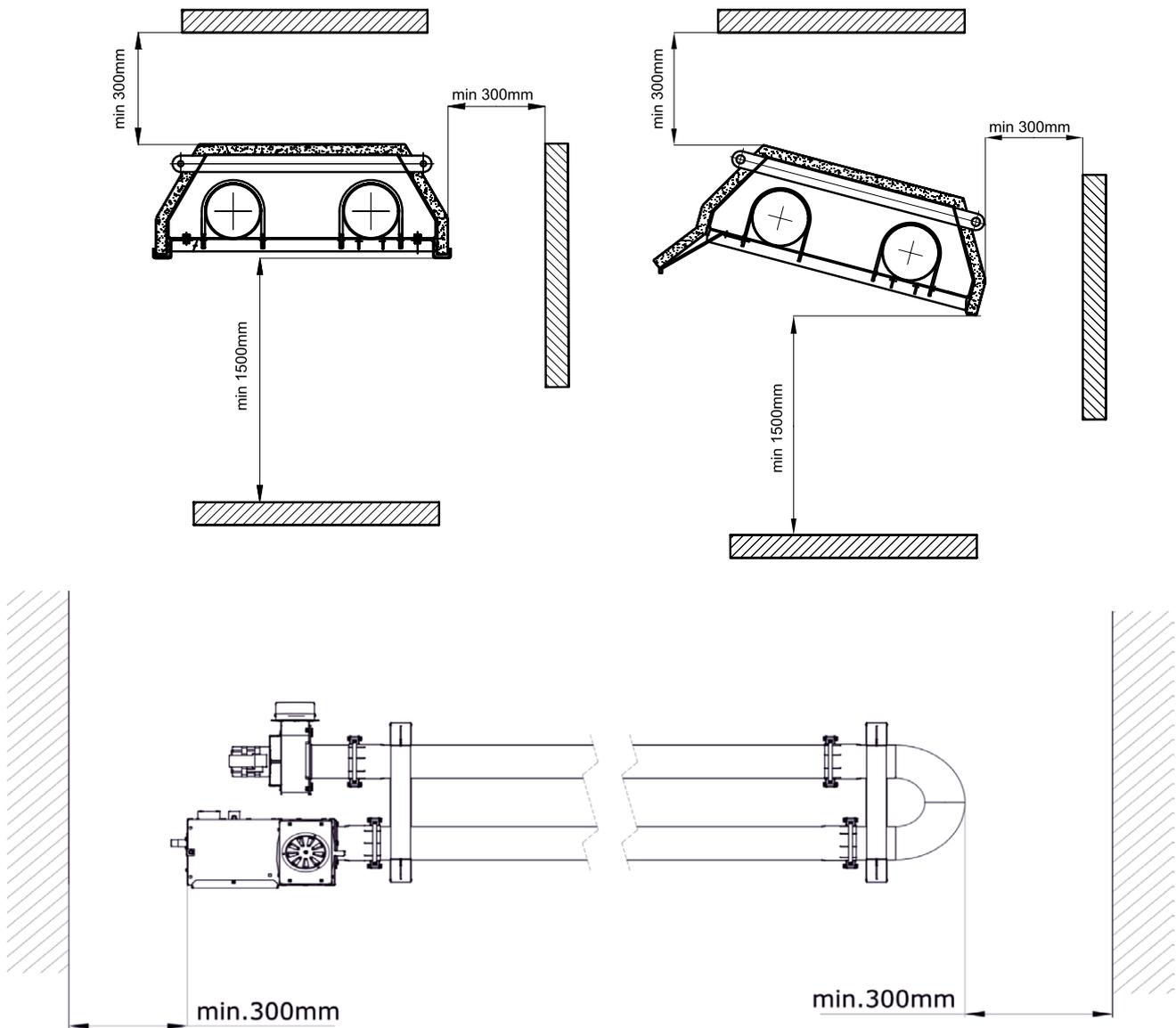


Fig. 7: Minimum safe distance of the infrared heater from walls, ceilings and flammable objects

## Mounting components of infrared heater HELIOS

### Individual assembly components of the infrared heater HELIOS:

- Burner box
- Exhaust (ventilation) box
- Connecting cable with connector
- Radiant tubes
- Tube connections, arch
- Hinges with fixing clamps
- Reflectors
- Arch cover
- Reflector partitions
- Connecting material

### Other components

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

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



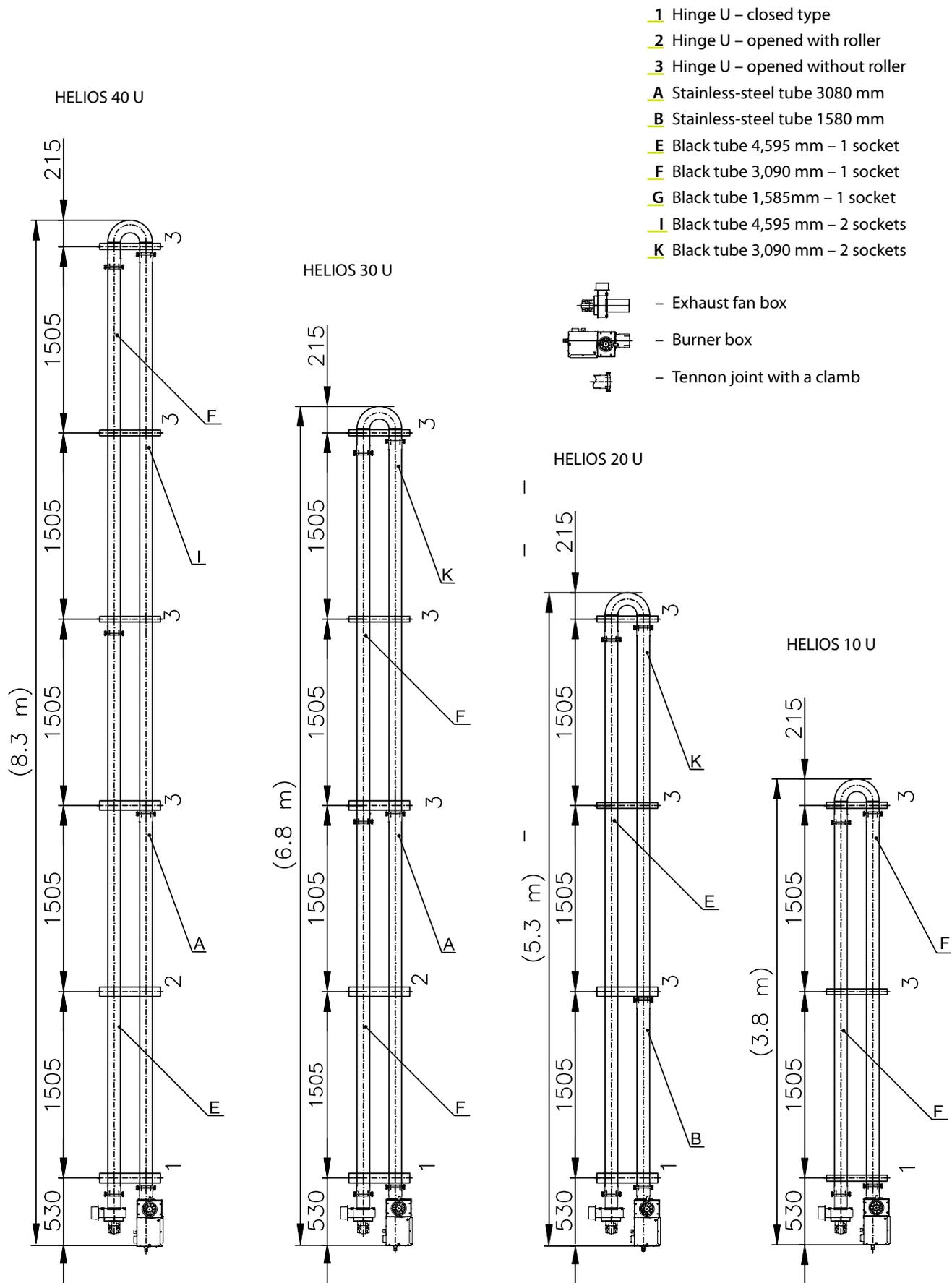


Fig. 9: Scheme of infrared heaters HELIOS UJ, UD, UM (+e)

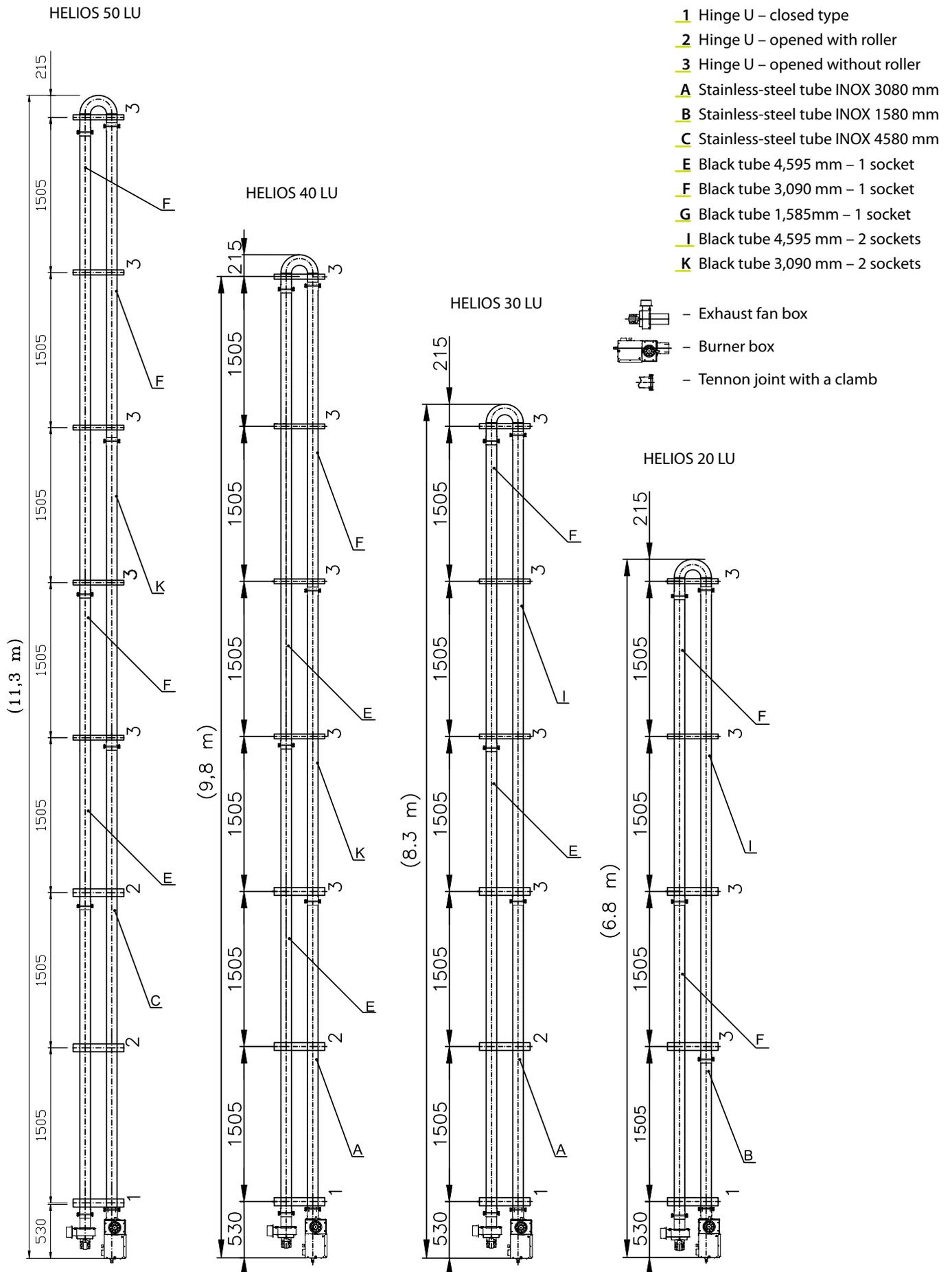


Fig. 10: Scheme of infrared heaters HELIOS LUJ, LUD, LUM (+e)

# Instructions for assembling the body of the infrared heater

## 1. Material preparation

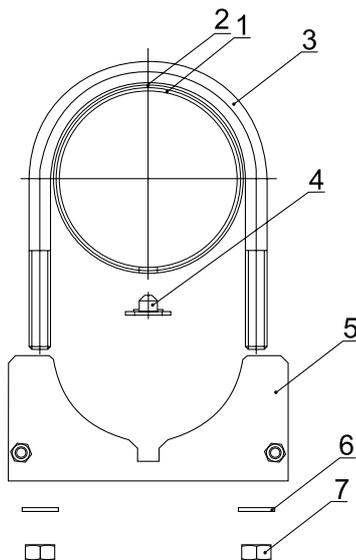
Look for the diagram of the assembled infrared heater in Fig. 8–10, and lay out the necessary material on the floor or sawhorse: Radiant tubes, flue gas swirlers, end arch, hinges with clamps, clips, dividers. Arrange the pipes in the correct order. **For Helios 20, 30, 40 and 50, use a stainless steel (INOX) pipe as the first piece of radiant body (from the burner box), followed by a black pipe**

**with 2 sockets, and further black pipes with 1 socket going along the flue gas flow to the exhaust box.** Pay attention to the different types of hinges - they differ in the closed/opened type and whether or not they have a roller. Place them in the correct positions according to Fig. 8–10.

## 2. Connection of pipes

Thread the hinges onto the radiant tubes (The hinge not go over the tightened tube clamp.) and then connect the tubes by pushing the sockets all the way into each other so that the holes in the tubes overlap. Then insert the tenon into the hole and secure it with the

bowl a tenon (Fig. 11). Tighten the tenon. The recommended tightening torque is 20 Nm. The location of the tenon is determined by the hole in the socket.



### Legenda:

- 1 inner tube (push to the socket)
- 2 outer tube with the socket
- 3 clamp M12
- 4 tenon
- 5 bowl buckle
- 6 washers
- 7 nut M12

Fig. 11: Position of the clamp

## 3. Placing of the flue gas swirlers

Insert flue gas swirlers into the radiant tubes. The swirlers in the HELIOS-I heaters are placed in the last radiant tube 200 mm before the exhaust box. The swirlers in the HELIOS-U heaters are placed immediately behind the arc in the direction of the flue gas flow. If there is more than one swirler in the heater (according to Tab. 2), connect the swirlers before inserting them into the tube with a M4 screw, nut and washers (Fig. 12).

Table 2: Number of swirlers, according the heater type

Heater type	20-I+	30-I+	40-I+	
Number of swirlers	2	2	2	
Heater type	10-U+	20-U+	30-U+	40-U+
Number of swirlers	1	2	2	2
Heater type	20-LU+	30-LU+	40-LU+	50-LU+
Number of swirlers	2	2	2	2

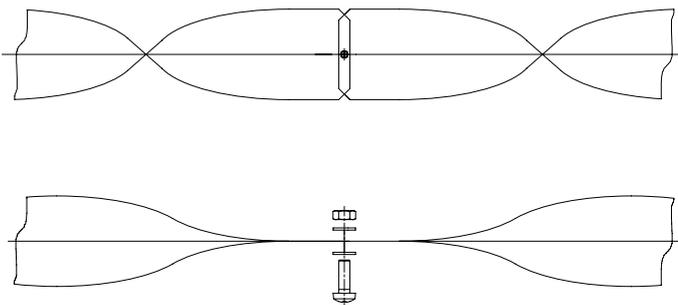


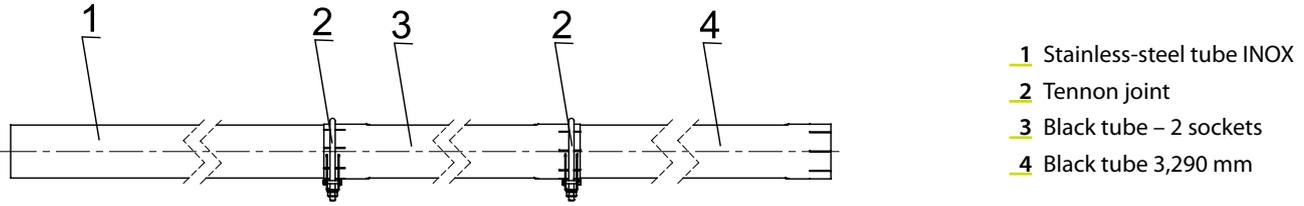
Fig.12: connection of two swirlers

#### 4. Assembly of the arch / last hinge

In the case of a U-shaped heater, connect the end of the radiant tube with an arch. Before connecting the arch to the pipes, first fit the last hinge loosely. Connect the arc to the radiant tubes using the same tenon joint that connects the tubes.

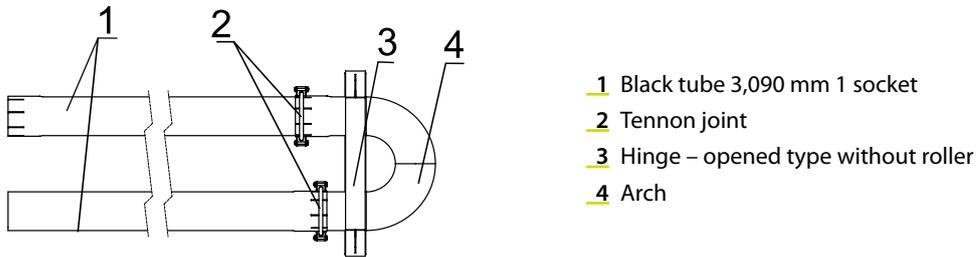
If you are installing an I-shaped heater, put the last hinge with a head on the end of the radiator.

The radiant tubes should now be assembled in accordance with Fig. 13–15.



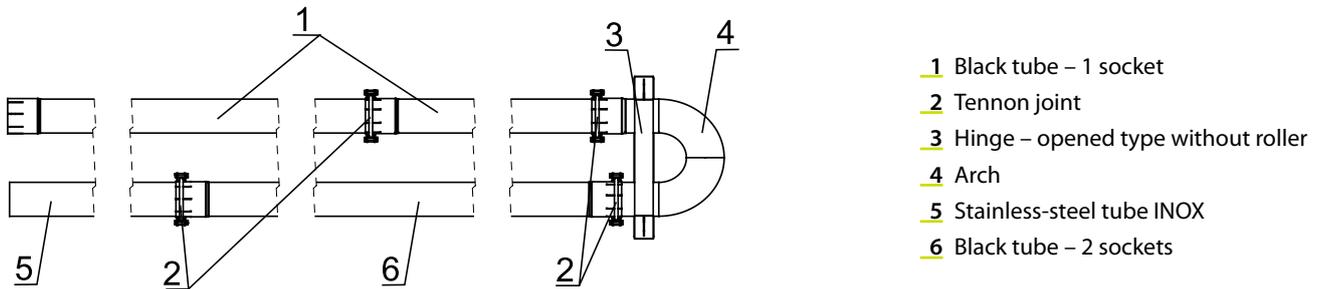
- 1 Stainless-steel tube INOX
- 2 Tenon joint
- 3 Black tube – 2 sockets
- 4 Black tube 3,290 mm

Fig. 13: Scheme of radiant tubes Helios 20-I to Helios 40-I



- 1 Black tube 3,090 mm 1 socket
- 2 Tenon joint
- 3 Hinge – opened type without roller
- 4 Arch

Fig. 14: Scheme of radiant tubes Helios 10-UJ, UD, UM (+e)



- 1 Black tube – 1 socket
- 2 Tenon joint
- 3 Hinge – opened type without roller
- 4 Arch
- 5 Stainless-steel tube INOX
- 6 Black tube – 2 sockets

Fig. 15: Scheme of radiant tubes Helios 20 to Helios 50-UJ, UD, UM, LUJ, LUD, LUM (+e)

#### 5. Fastening the hinges

Place the hinges on the radiant tube at exact intervals of 1505 mm according to Fig. 16–20. For U-shaped heaters, connect the hinges by partitions according to Fig. 21 (start from the arc), which will make it easier to define exact intervals. Fit and tighten the pipe fixing clamps on the hinges. Mount the insulated reflector holders or auxiliary hinges according to Fig. 22–25. Check that you have placed the filled hinges at the beginning (and for I-shaped radiators also at the end) of the radiant tube.

**ATTENTION!** For later installation of the reflector the prescribed spacing of 1,505 mm must be observed.

On hinges with a roller, make sure it rotates freely. Before tightening, the locknuts on the M12 clamps must be set in such a way that the tube is not fixed longitudinally and its free dilatation is allowed.

- 1 U-Hinge with hole for a roller
- 2 M12 clamp with lock nut, serves to guide the stainless steel pipe, must remain free
- 3 nut M12
- 4 clamp M6
- 5 nut M6
- 6 washer 6.4
- 7 roller

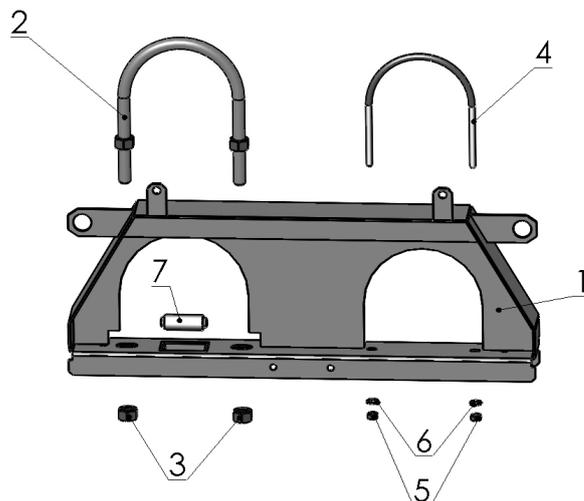
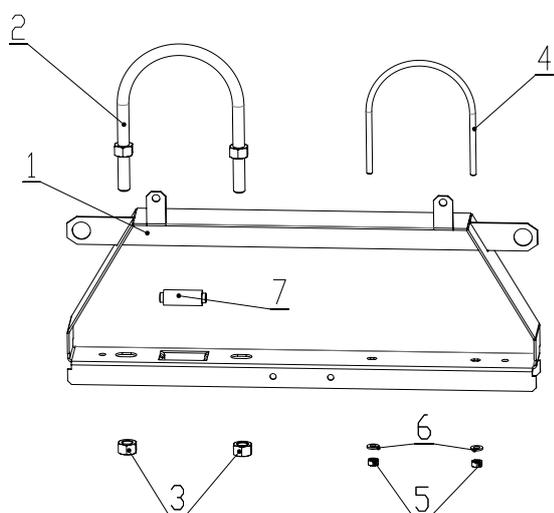


Fig. 16: U hinge with headboard – the first hinge from the burner box



- 1 U-Hinge with hole for a roller
- 2 M12 clamp with lock nut, serves to guide the stainless steel pipe, must remain free
- 3 nut M12
- 4 clamp M6
- 5 nut M6
- 6 washer 6.4
- 7 roller

Fig. 17: U-hinge with roller, not filled – usually the second hinge from the burner box

- 1 U-Hinge
- 2 clamp M6
- 3 washer 6.4
- 4 nut M6

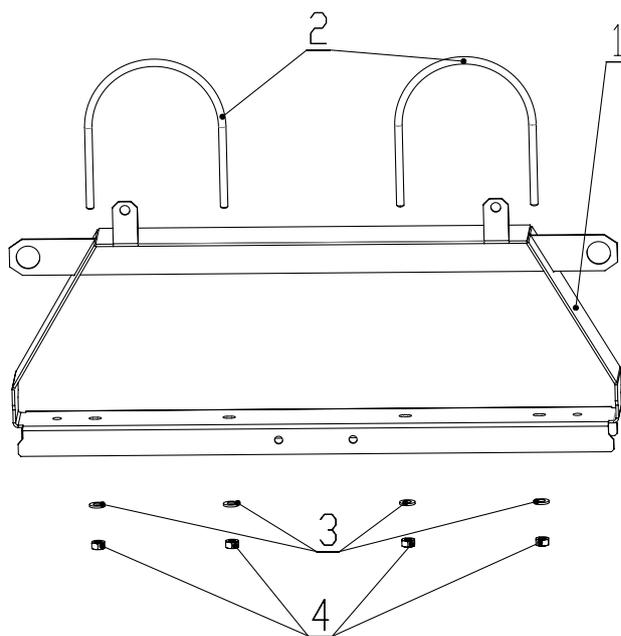


Fig. 18: U-hinge without roller, without head – ordinary hinge

- 1 filled I-Hinge
- 2 clamp M6
- 3 washer 6.4
- 4 nut M6

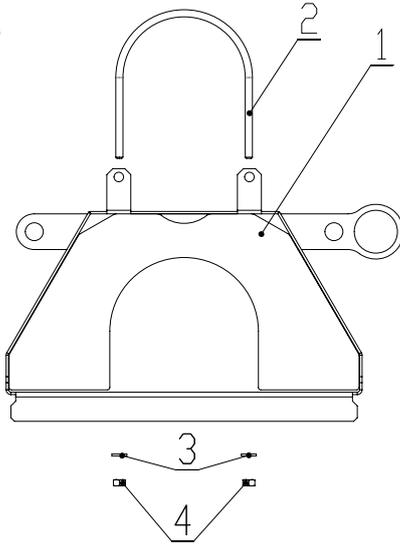
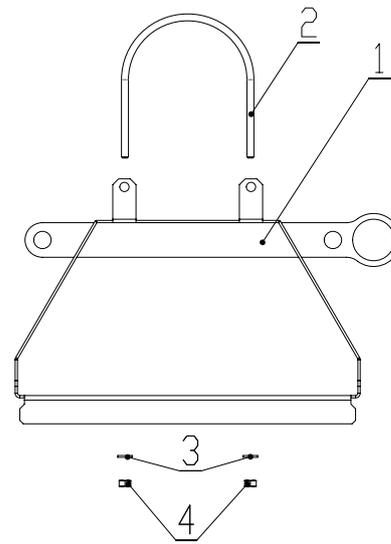
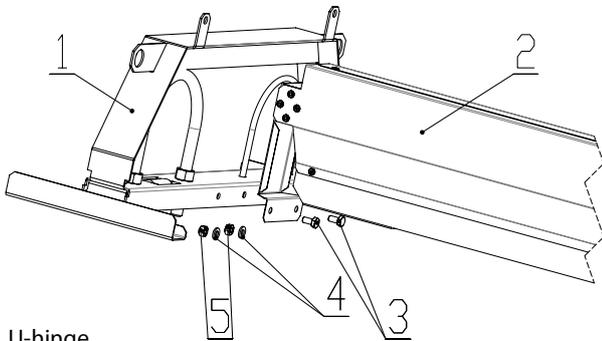


Fig. 19: I-Hinge, filled 2 the first and last hinge



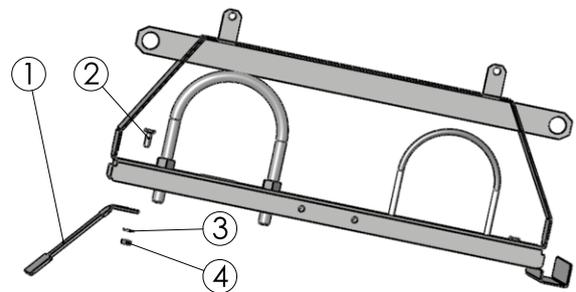
- 1 I-Hinge
- 2 clamp M6
- 3 washer 6.4
- 4 nut M6

Fig. 20: I-Hinge 2 ordinary



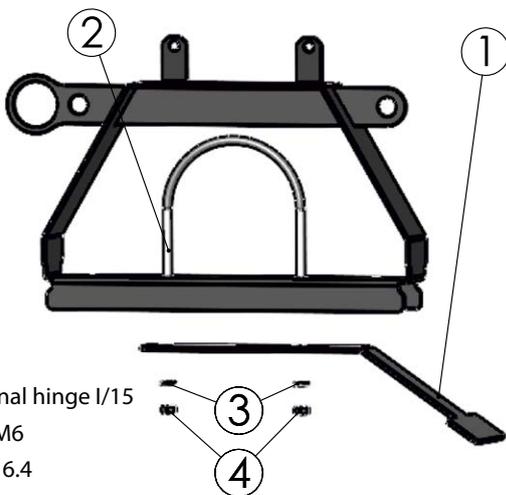
- 1 U-hinge
- 2 partition
- 3 screw M6x12
- 4 washer 6.4
- 5 nut M6

Fig. 21: Installation of the partition



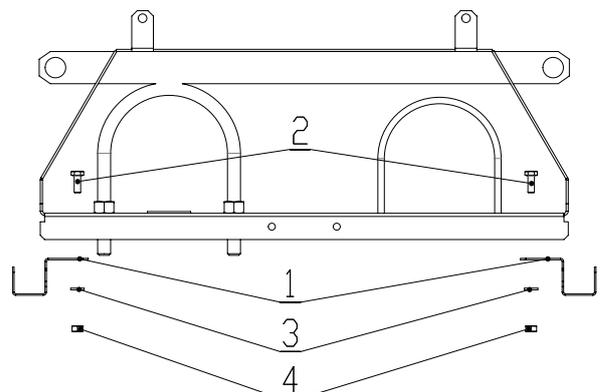
- 1 additional hinge U/15
- 2 screw M6x12
- 3 washer 6.4
- 4 nut M6

Fig. 22: Installation of an additional hinge for the U/15 inclined heater



- 1 additional hinge I/15
- 2 clamp M6
- 3 washer 6.4
- 4 nut M6

Fig. 23: Installation of an additional hinge for the I/15 inclined heater



- 1 insulated reflector holder
- 2 screw M6x12
- 3 washer 6.4
- 4 nut M6

Fig. 24: Diagram of attaching the holders of the insulated reflector to the U-hinge

- 1 insulated reflector holder
- 2 screw M6×12
- 3 washer 6.4
- 4 nut M6

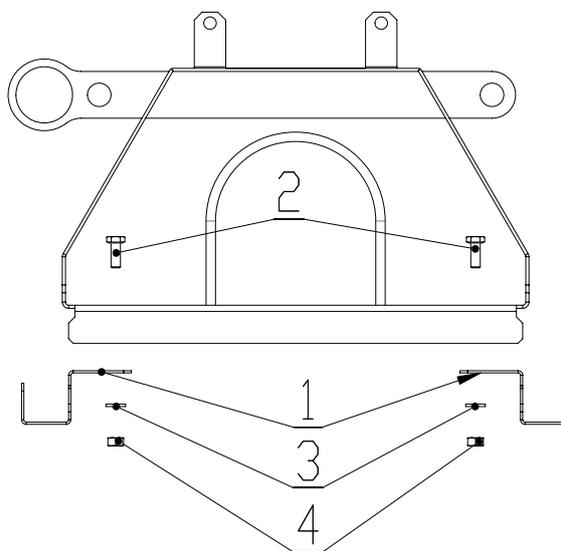


Fig. 25: Diagram of attaching the holders of the insulated reflector to the I-hinge

## 6. Placement of reflectors

Install dilatation inserts on all hinges except the hinge at the arch. Place the arch cover on the arch hinge. Fit the insulated reflectors over the dilatation inserts. For the I+ design, place the armor tube

(BB↔EB connection cable protector) in the hinges. For the wall version, the protector must be placed on the back side (the lower side – Fig. 23).

## 7. Placement in the operating position

Provide all suspension points with fastening elements, e.g. chains, cables, suspension rods, etc. Lift the heater assembled in this way to the operational position with the help of a crane, platform or forklift so that it is suspended in a horizontal position and fasten

the heater to the suspensions according to Fig. 6. Fastening elements must have sufficient load-bearing capacity. After hanging, the fastening elements must always be perpendicular to the axis of the heater. The shortest length of the fastener is 1 m.

## Placement of the burner box

Slide the burner box as far as it will go on the radiant tube. By default, the burner box is mounted on the tube in a vertical position, i.e. with air intake at the top (Fig. 26). If the burner box cannot be in this position and it needs to be rotated, consultation

with MANDÍK, a.s. is necessary. After mounting, secure the burner housing by hanging it by the eye in the rear part of the box so that the housing and the radiant tube are aligned. Tighten the GBS clip, tightening torque 25 Nm.

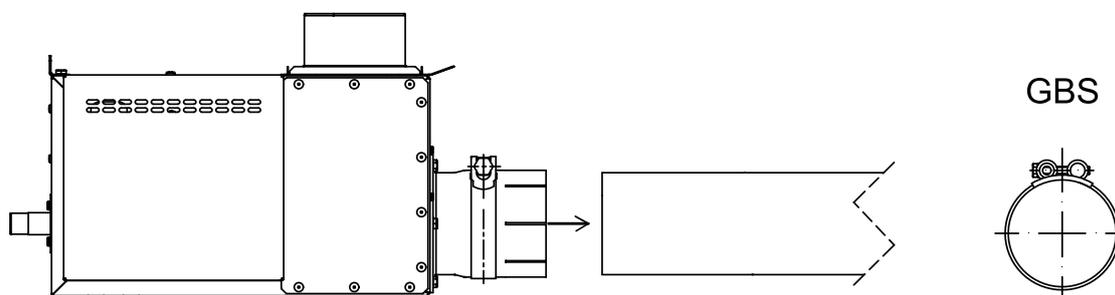


Fig. 26: Placement of the burner box

## Installation of the exhaust box

Insert the exhaust box (EB) into the neck of the last pipe (*Fig. 27*) so that the holes for the tenon are covered. There are 2 holes for the tenon in the EB suction neck, if it is necessary to turn the EB so that neither one overlaps with the hole in the pipe, it is possible to drill

a new hole of  $\phi 10.5$  mm. Insert a tenon into the hole and secure with a clamp as a pipe joint. The EB can be rotated horizontally or upwards as desired. Downward is not allowed.

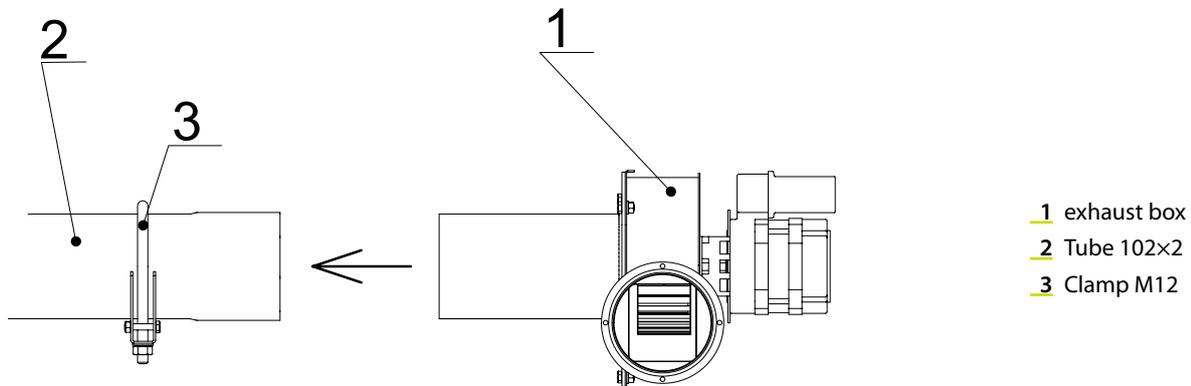


Fig. 27: Installation of the exhaust box

## Flue exhaust – connection principles

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

1. Minimum internal diameter of the pipeline for Helios 10 to Helios 40 is 100 mm, for Helios 50 is internal diameter of the pipeline 125 mm.
  2. Connecting of the combustion gases to the ventilator must be demountable.
  3. It is necessary to connect a condensate collector after the fan (or after the economizer). For variants with an economizer, it is absolutely necessary to drain the condensate from this collector.
  4. The duct system must prevent the condensate from penetration into the exhaust pipeline.
  5. The duct system must be terminated freely in the exposed position so that the flue gases cannot face any resistance, and also that combustion products cannot return back to the building through windows.
  6. The material of flue gases exhaust must be resistant to corrosion and against flue gases temperature according to relevant standards.
  7. **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.
  8. If the heater is installed in version "A2", the minimum separation distances according to *Fig. 28*.
- 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 is higher, it is necessary to use a larger pipe diameter.**

## Pressure losses

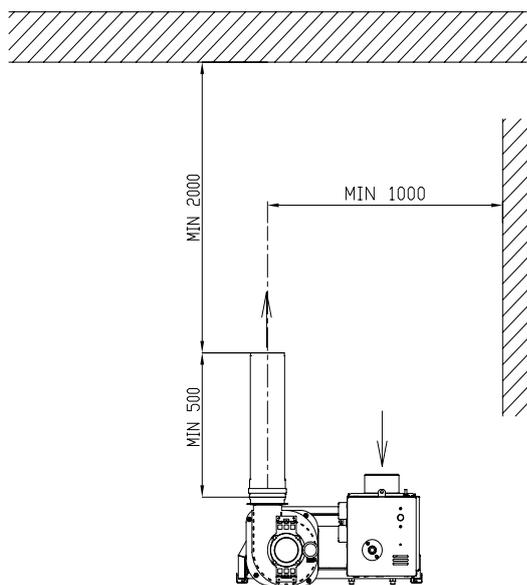
For pressure losses of individual flue system components see *Table 3* and *Table 4*. Total pressure loss of flue system can be calculated as sum of pressure losses of all components used.

**Table 3:** Pressure losses of components for exhausting flue gases and suction of the air – stainless steel system

HELIOS	Nominal dimension	Pressure loss (Pa)										
		Tube 1 m	Bend 45°	Bend 90°	RKN 45°	RKN 90°	Coaxial chimney horizontal	Coaxial chimney vertical	Exhaust head horizontal	Exhaust head vertical	Air intake head	Flexo INOX 1 m
10	DN 100	1,5	1,5	2	2	4	16	23	3	4	5	2
20	DN 100	2	3	4	4,5	7	23	31	5	7	8	4
30	DN100	3	4	6	7	11	29	35	9	11	13	6
	DN130	1	1,5	3	3,5	5,5	16	18	4,5	5,5	6,5	3
40	DN100	3,5	4,5	7	8	14	35	44	11	14	16	7
	DN130	1,5	2	4	4,5	8	19	22	5	6	8	4
50	DN130	2	2,5	4,5	5	10	22	23	6	8	9	5
	DN150	1	2	3,5	5	5	17	19	7	9	12	7

**Table 4:** Pressure losses of components for exhausting flue gases and suction of the air – aluminium system

HELIOS	Nominal dimension	Pressure loss (Pa)										
		Tube 1 m	Bend 45°	Bend 90°	RKN 45°	RKN 90°	Coaxial chimney horizontal	Coaxial chimney vertical	Exhaust head horizontal	Exhaust head vertical	Air intake head	
10	DN 100	2	2,5	5	3,5	7	18	20	4	5	3	
20	DN 100	3	4	6	6	11	26	29	6	8	5	
30	DN 100	3,5	5	7	9	14	31	33	11	13	7	
	DN 125	2	3,5	5	6	10	20	20	8	9	5	
40	DN 100	4	6	8	11	16	37	39	14	16	8	
	DN125	3	4	6	6	11	35	35	10	11	6	
50	DN125	4	6	9	10	16	–	–	15	16	9	



**Fig. 28:** Distances from the flue outlet of the infrared heater in 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 the correct standard.

When installing the heater in design A2 in enclosed space, it is necessary to ensure forced ventilation with min. 10 m<sup>3</sup>/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 box so that the flue gas is directed vertically upwards.

## Gas connection installation

Installation of gas connection must be carried out according to applicable standards and regulations (see *Chap. III*). Pipeline must be ended by a gas ball valve near the joining point of the infrared heater – max. 1.5 m (Fig. 29). When the infrared heater is in operation, there must be stable and unwavering gas pressure guaranteed in the pipeline – NG, P, see *tab. 4.2 to 4.4*. 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. Dimension G\* is G1/2" for Helios 10 to 40; G3/4" for Helios 50.

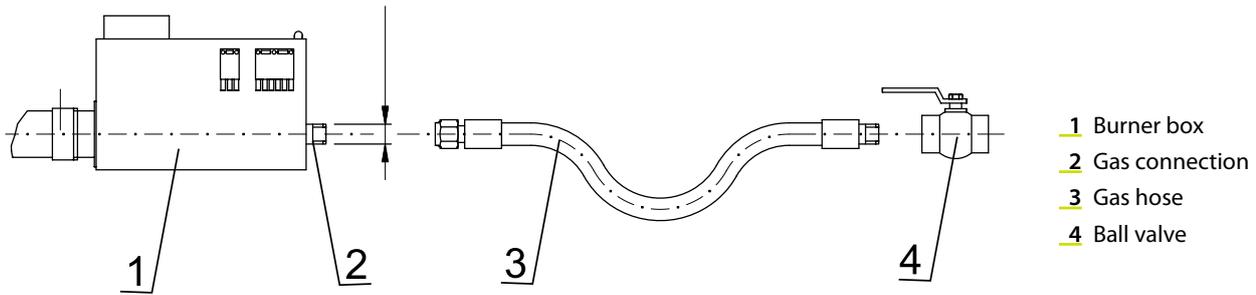


Fig. 29: Gas connection

## Electrical installation

The installation of the electrical connection must be carried out by a worker with the appropriate authorization. The installation of the electrical connection must include a functional test and initial revision. The infrared heater is connected to the power distribution 230 V / 50 Hz, and to the control, depending on the type, according to the diagram in *Fig. 36, 41, 42*. A more detailed description is contained in Chapter IV Regulation.

### III. COMMISSIONING AND SERVICE

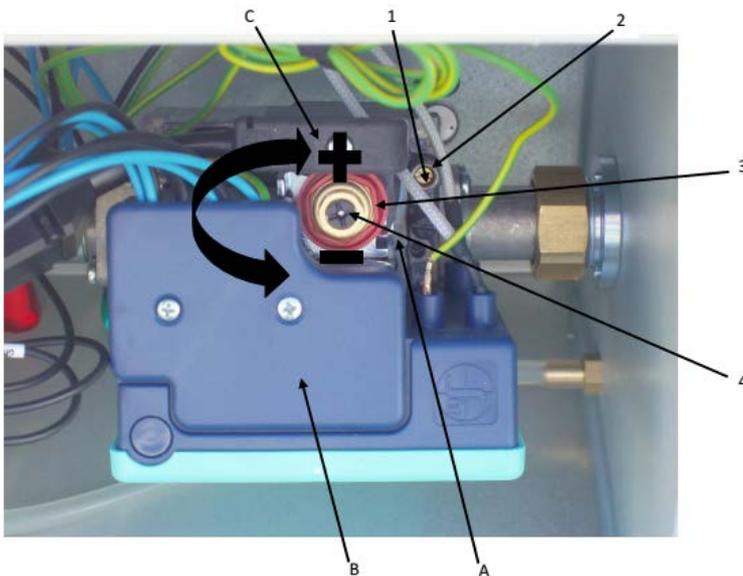


#### Commissioning conditions

- Infrared heaters HELIOS 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 230 V /50 Hz.
  - 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.

#### Adjustment procedure of single-stage and two-stage heaters

- a) Check the conformity of assembly of heater, flue gases exhaust and Air-intake duct visually with this manual
- b) Switch the heater on at nominal power (see chapter V) and after it starts to work, let it warm-up for several minutes.



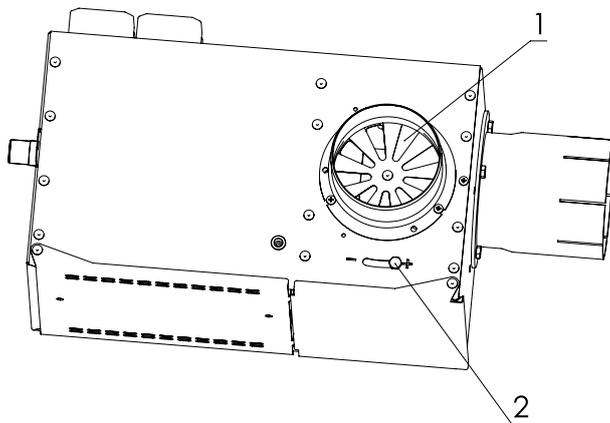
#### Description:

- A** Gas valve
- B** Control automatics
- C** Dual/modulating cable – two stage / modulated heaters only
- 1** Conical neck for fitting the manometer hose
- 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

Fig. 30: Gas valve

- c) Check the nozzle pressure according to Fig. 30. First loosen the closing screw (2) by two turns. Then put the pressure gauge tube (approx. 9 mm) on the conical neck (1) and read the gas pressure at nominal power.
- d) Compare the nozzle pressure with the desired pressure according to the adjustment Table 5–10. If the pressures differ, use a 10 mm hex key and turn the adjusting screw (3) to the correct pressure.

- e) In two-stage models, the minimum pressure is also adjusted. Disconnect the dual cable (C) and compare the nozzle pressure to the desired pressure. The pressure on the nozzle at minimum power is adjusted with the screw (4) using a cross-head screwdriver, while holding the brass screw (3) with a 10 mm key so that it does not move.
- f) Switch the heater back to nominal power by plugging in the dual cable and recheck the nozzle pressure at nominal power as per the procedure above. Disconnect the pressure measurement and tighten the closing screw (2) again. After setting the pressures, let the heater burn at maximum output for another 30 minutes.
- g) When the heater is warmed-up, adjust the air intake. Connect the flue gas analyser to the heater and by opening/closing the adjustment rosette (Fig. 31) in the air intake, adjust the combustion so that the amount of oxygen in the flue gas matches the prescribed amount in the adjustment Table 5-10 for the given heater. After setting the adjustment rosette to the correct position, tighten the locking screw.
- h) In the case of two-stage infrared heaters, the air intake is also adjusted to minimum power. Switch the infrared heater to minimum power and wait 15 minutes. Then connect the flue gas analyser and compare amount of the oxygen in the flue gas with the reading in the reduced power adjustment table. Adjust the fan power to achieve the desired oxygen amount in the flue gas. The minimum speed of the fan is adjusted by carefully turning the "minimum speed" adjusting screw on the speed controller (Fig. 33 b). If it is difficult to adjust the fan, connect a voltmeter to the fan power supply and look for minimum speed in the supply voltage range of 67-73 V. The adjustment screw is sensitive.
- i) Disconnect the flue gas analyser and close the flue gas measurement opening. The heater is adjusted.



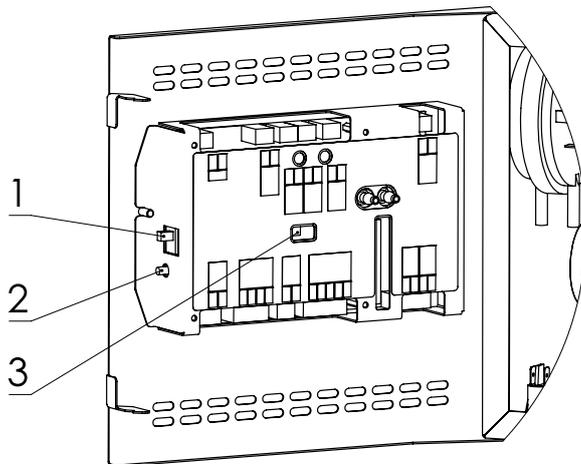
- 1 Adjustment rosette
- 2 Locking screw

Fig. 31: Adjustment rosette and locking screw

## Adjustment procedure of modulated heaters

Only a technician authorized by Mandík a. s. may put the modulated heaters into operation. The heaters are put into operation with the help of the service button on the control board (Fig. 32). The

button puts the heater into service mode, in which the heater does not respond to control by standard signals, but only sets the maximum or minimum power.



- 1 service switch max. and min. performance
- 2 service button to turn on/off the service mode
- 3 LEDs for service mode indication and for Modbus communication indication

Fig. 32: Control board on the inside of the door

- a) Check the conformity of assembly of heater, flue gases exhaust and Air-intake duct visually with this manual.
- b) Open the burner box and locate the service button and switch (Fig. 32).
- c) Set the switch to maximum power and activate the service mode. The mode is activated by one long press of the button (3 s) and one short press. The heater starts up, the trio of LEDs on the control board light up – green, red and green together indicates operation in service mode. Wait a few minutes.
- d) Check the nozzle pressure according to Fig. 30. First loosen the closing screw (2) by two turns. Then put the pressure gauge tube (approx. 9 mm) on the conical neck (1) and read the gas pressure at nominal power.
- e) Compare the nozzle pressure with the desired pressure according to the adjustment Table 11–13. If the pressures differ, use a 10 mm hex key and turn the adjusting screw (3) to the correct pressure.
- f) Check/adjust also the minimum pressure. Disconnect the dual cable (C) and compare the nozzle pressure to the desired pressure. The pressure on the nozzle at minimum power is adjusted with the screw (4) using a cross-head screwdriver, while holding the brass screw (3) with a 10 mm key so that it does not move.
- g) Switch the heater back to nominal power by plugging in the dual cable and recheck the nozzle pressure at nominal power as per the procedure above. Disconnect the pressure measurement and tighten the closing screw (2) again. After setting the pressures, let the heater burn at maximum output for another 30 minutes.
- h) When the heater is warmed-up, adjust the air intake. Connect the flue gas analyser to the heater and by opening/closing the adjustment rosette (Fig. 31) in the air intake, adjust the combustion so that the amount of oxygen in the flue gas matches the prescribed amount in the adjustment Table 11–13 for the given heater. After setting the adjustment rosette to the correct position, tighten the locking screw. Before the next step, the heater must burn for at least two minutes, with the setting of the suction rose unchanged, so that the required max. under-pressure in the burner box is correctly saved.
- i) Toggle the service switch (Fig. 32). The heater switches to service mode for minimum power. Wait 15 minutes.
- j) Connect the flue gas analyser and compare amount of the oxygen in the flue gas with the reading in the reduced power adjustment table. Adjust the fan power to achieve the desired oxygen amount in the flue gas. The minimum speed of the fan is adjusted by carefully turning the “minimum speed” adjusting screw on the speed controller (Fig. 33 b). If it is difficult to adjust the fan, connect a voltmeter to the fan power supply and look for minimum speed in the supply voltage range of 67–73 V. The adjustment screw is sensitive. Before the next step, the heater must burn for at least two minutes, with the setting of the suction rose unchanged, so that the required min. under-pressure in the burner box is correctly saved.
- k) Disconnect the flue gas analyser and close the flue gas measurement opening. Press the service button to exit service mode.  
**The heater is adjusted.**

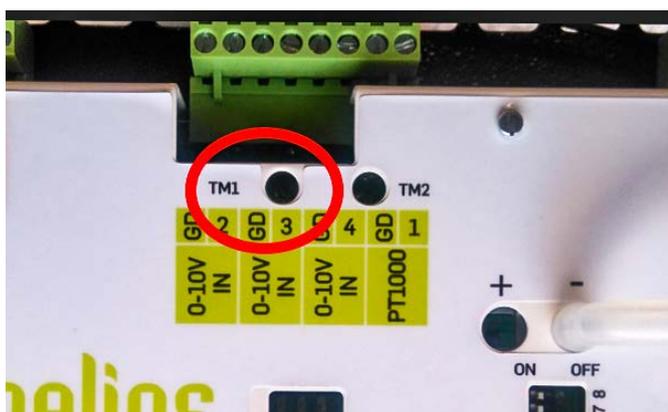


Fig. 33: a) flue fan setting: EC variant



b) flue fan setting: AC variant

**Note:** If the service mode is not terminated with the button, the heater will leave the service mode after three hours by itself and start following external signals.

**Table 5:** Setting values of the infrared heater HELIOS IJ+

Heater type		20-IJ+	30-IJ+	40-IJ+
Nozzle diameter [mm]	NG G20/G25	3.8 / 4	4.6 / 5	5.3 / 6.2
	P G31	2.6	3.3	3.8
Nozzle pressure [mbar]	NG G20/G25	12	12	12
	P G31	25	27	21
Flue gas temperature [°C]	NG G20/G25	180–190	190–200	200–210
	P G31	175–190	185–195	195–205
O <sub>2</sub> -fraction [%]	NG G20/G25	8.2–9.0	6–6.5	6.8–7.5
	P G31	8.9–9.2	8.8–9.1	7.8–8.5
CO-fraction [ppm]	NG G20/G25	0–20	0–10	0–10
	P G31	0–20	0–20	0–20
NO-fraction [mg/kWh]	NG G20/G25	100–150	100–150	100–170
	P G31	130–180	130–190	130–190
CO <sub>2</sub> -fraction [%]	NG G20/G25	6.0–6.5	8.0–8.5	7.5–7.9
	P G31	7.5–7.9	7.8–8.0	7.8–8.1
Efficiency [%]	NG G20/G25	90.0–90.5	91.0–91.3	91.0–91.4
	P G31	90.5–90.5	91.0–91.5	91.0–91.4

Note: NG – Natural gas, P – Propane

**Table 6:** Setting values of the infrared heater HELIOS IJ+ with Economiser AWTM 100/2000

Heater type		20-IJ+e2	30-IJ+e2	40-IJ+e2
Nozzle diameter [mm]	NG G20/G25	3.8 / 4.2	4.6 / 5	5.3 / 6.2
	P G31	2.6	3.3	3.8
Nozzle pressure [mbar]	NG G20/G25	12	12	12
	P G31	25	27	21
Flue gas temperature [°C]	NG G20/G25	143–148	145–155	158–168
	P G31	145–150	145–155	160–170
O <sub>2</sub> -fraction [%]	NG G20/G25	8.2–9.0	6–6.5	7.8–7.5
	P G31	8.9–9.2	8.8–9.1	7.8–8.5
CO-fraction [ppm]	NG G20/G25	0–20	0–10	0–10
	P G31	0–20	0–20	0–20
NO-fraction [mg/kWh]	NG G20/G25	100–150	100–150	100–170
	P G31	130–180	130–190	130–190
CO <sub>2</sub> -fraction [%]	NG G20/G25	6.0–6.5	8.0–8.5	7.5–7.9
	P G31	7.5–7.9	7.8–8.0	7.8–8.1
Efficiency [%]	NG G20/G25	93.0–94.0	93.2–94.0	92.0–93.0
	P G31	92.5–93.2	93.0–94.0	91.7–92.5

Note: NG – Natural gas, P – Propane

Table 7: Setting values of the infrared heater HELIOS IJ+ with economiser AWTM 100/4000

Heater type		20-IJ+e4	30-IJ+e4	40-IJ+e4
<b>Nozzle diameter</b> [mm]	NG G20/G25	3.8 / 4.2	4.6 / 5	5.3 / 6.2
	P G31	2.6	3.3	3.8
<b>Nozzle pressure</b> [mbar]	NG G20/G25	12	12	12
	P G31	25	27	21
<b>Flue gas temperature</b> [°C]	NG G20/G25	100–105	126–131	130–138
	P G31	105–112	143–150	143–150
<b>O<sub>2</sub>-fraction</b> [%]	NG G20/G25	8.2–9.0	6–6.5	6.8–7.5
	P G31	8.9–9.2	8.8–9.1	7.8–8.5
<b>CO-fraction</b> [ppm]	NG G20/G25	0–20	0–10	0–10
	P G31	0–20	0–20	0–20
<b>NO-fraction</b> [mg/kWh]	NG G20/G25	100–150	100–150	100–170
	P G31	130–180	130–190	130–190
<b>CO<sub>2</sub>-fraction</b> [%]	NG G20/G25	6.0–6.5	8.0–8.5	7.5–7.9
	P G31	7.5–7.9	7.8–8.0	7.8–8.1
<b>Efficiency</b> [%]	NG G20/G25	95.1–96.2	93.5–94.5	93.0–94.0
	P G31	95.0–96.0	93.5–94.0	92.6–93.5

Note: NG – Natural gas, P – Propane

Table 8: Setting values of the infrared heater HELIOS (L)UJ(D)(M)+

Heater type		10-U+	20-U+	20-LU+	30-U+	30-LU+	40-U+	40-LU+	50-LU+
<b>Nozzle diameter</b> [mm]	NG G20/G25	2.6 / 3	3.8 / 4		4.6 / 5		5.3 / 6.2		6.2 / 6.6
	P G31	1.9	2.6		3.3		3.8		4.2
<b>Nozzle pressure</b> [mbar]	NG G20/G25	12	12		12		12		12
	P G31	24	25		27		21		25
<b>Flue gas temperature</b> [°C]	NG G20/G25	140–150	160–175	150–165	195–215	170–185	210–225	185–200	190–205
	P G31	140–150	165–185	155–170	215–230	190–205	220–235	195–210	190–205
<b>O<sub>2</sub>-fraction</b> [%]	NG G20/G25	8.5–9.5	6.5–7.5	6.5–7.5	6–6.5	6–6.5	5.0–6.0	5.0–6.0	5.6–6.0
	P G31	9.0–10.0	7.0–8.0	7.0–8.0	6.5–7.2	6.5–7.2	5.8–6.8	5.8–6.8	7.2–8.5
<b>CO-fraction</b> [ppm]	NG G20/G25	0–5	0–5	0–5	0–5	0–5	0–5	0–5	0–5
	P G31	0–10	0–10	0–10	0–10	0–10	0–10	0–10	0–10
<b>NO-fraction</b> [mg/kWh]	NG G20/G25	90–130	100–140	100–140	100–150	100–150	90–130	90–130	90–130
	P G31	90–140	100–140	100–140	130–190	130–190	90–130	90–130	90–130
<b>CO<sub>2</sub>-fraction</b> [%]	NG G20/G25	6.6–7.6	7.6–8.7	7.6–8.7	8.1–8.8	8.1–8.8	8.5–9.5	8.5–9.5	7.6–8.3
	P G31	6.9–7.9	8.1–9.1	8.1–9.1	8.5–9.5	8.5–9.5	9.5–10.5	9.5–10.5	8.0–9.0
<b>Efficiency</b> [%]	NG G20/G25	92.0–92.5	91.5–92.5	92.0–93.0	89.5–90.5	91.0–92.0	90.0–91.0	91.5–92.5	90.5–91.5
	P G31	92.0–92.5	91.5–92.5	92.0–93.0	89.5–90.5	91.0–92.0	89.5–90.5	91.0–92.0	90.0–91.0
<b>Nozzle pressure</b> [mbar]	NG G20/G25	5.5	4		4		4		4
	P G31	9	10		10		7		9
<b>Flue gas temperature</b> [°C]	NG G20/G25	120–130	140–150	115–125	150–160	120–140	165–185	145–165	135–155
	P G31	120–130	150–165	130–140	150–160	120–140	165–185	145–165	140–160
<b>O<sub>2</sub>-fraction</b> [%]	NG G20/G25	11.5–12.5	10.5–11.5	10.0–11.0	10.0–11.0	8.5–9.5	9.0–10.0	9.0–10.0	6–7.5
	P G31	12.0–13.0	11.5–12.5	11.0–12.0	9.5–10.5	9.5–10.5	10.0–11.0	10.0–11.0	8.0–9.2
<b>CO-fraction</b> [ppm]	NG G20/G25	0–10	0–10	0–10	0–10	0–10	0–10	0–10	0–10
	P G31	5–25	5–25	5–25	0–20	0–20	0–20	0–20	0–20
<b>NO-fraction</b> [mg/kWh]	NG G20/G25	50–100	50–100	50–100	70–120	70–120	70–120	70–120	70–120
	P G31	70–120	70–120	70–120	70–120	70–120	70–120	70–120	70–120
<b>CO<sub>2</sub>-fraction</b> [%]	NG G20/G25	4.5–5.5	5.5–6.5	5.5–6.5	5.0–6.5	5.0–6.5	6.0–7.0	6.0–7.0	7.0–7.8
	P G31	4.5–5.5	5.5–6.5	5.5–6.5	6.0–7.5	6.0–7.5	6.5–7.5	6.5–7.5	8.0–8.8
<b>Efficiency</b> [%]	NG G20/G25	91.0–91.5	90.5–91.5	92.5–93.5	90.0–91.0	92.5–93.5	89.5–90.5	92.0–93.0	92.5–93.5
	P G31	91.0–91.5	90.5–91.5	92.5–93.5	90.0–91.0	92.5–93.5	89.0–90.0	91.5–92.5	92.0–93.0

Note: NG – Natural gas, P – Propane

\* only applies to the two-stage and modulated heater

Table 9: Setting values of the infrared heater HELIOS (L)UJ(D)(M)+ with economiser AWTM 100/2000

Heater type		10-U+e2	20-U+e2	20-LU+e2	30-U+e2	30-LU+e2	40-U+e2	40-LU+e2
<b>Nozzle diameter</b> [mm]	NG G20/G25	2.6 / 3	3.8 / 4.2		4.6 / 5		5.3 / 6.2	
	P G31	1.9	2.6		3.3		3.8	
<b>Nozzle pressure</b> [mbar]	NG G20/G25	12	12		12		12	
	P G31	24	25		27		21	
<b>Flue gas temperature</b> [°C]	NG G20/G25	100–110	115–130	105–120	155–165	130–140	160–180	140–160
	P G31	100–110	120–135	110–125	165–180	145–160	170–190	150–170
<b>O<sub>2</sub>-fraction</b> [%]	NG G20/G25	8.5–9.5	6.5–7.5	6.5–7.5	6–6.5	6–6.5	5.0–6.0	5.0–6.0
	P G31	9.0–10.0	7.0–8.0	7.0–8.0	6.5–7.2	6.5–7.2	5.8–6.8	5.8–6.8
<b>CO-fraction</b> [ppm]	NG G20/G25	0–5	0–5	0–5	0–5	0–5	0–5	0–5
	P G31	0–10	0–10	0–10	0–10	0–10	0–10	0–10
<b>NO-fraction</b> [mg/kWh]	NG G20/G25	90–130	100–140	100–140	100–150	100–150	90–130	90–130
	P G31	90–140	100–140	100–140	130–190	130–190	90–130	90–130
<b>CO<sub>2</sub>-fraction</b> [%]	NG G20/G25	6.6–7.6	7.6–8.7	7.6–8.7	8.1–8.8	8.1–8.8	8.5–9.5	8.5–9.5
	P G31	6.9–7.9	8.1–9.1	8.1–9.1	8.5–9.5	8.5–9.5	9.5–10.5	9.5–10.5
<b>Efficiency</b> [%]	NG G20/G25	94.5–95.0	94.0–95.0	94.0–95.0	92.5–93.5	93.5–94.5	92.0–93.0	93.0–94.0
	P G31	94.5–95.0	94.0–95.0	94.0–95.0	92.0–93.0	92.5–93.5	91.5–92.5	92.5–93.5
<b>Nozzle pressure</b> [mbar]	NG G20/G25	5.5	4		4		4	
	P G31	9	10		10		7	
<b>Flue gas temperature</b> [°C]	NG G20/G25	80–95	95–105	80–90	110–125	85–100	125–145	105–125
	P G31	80–95	100–115	90–105	120–135	90–105	125–145	100–120
<b>O<sub>2</sub>-fraction</b> [%]	NG G20/G25	11.5–12.5	10.5–11.5	10.0–11.0	10.0–11.0	8.5–9.5	9.0–10.0	9.0–10.0
	P G31	12.0–13.0	11.5–12.5	11.0–12.0	9.5–10.5	9.5–10.5	10.0–11.0	10.0–11.0
<b>CO-fraction</b> [ppm]	NG G20/G25	0–10	0–10	0–10	0–10	0–10	0–10	0–10
	P G31	5–25	5–25	5–25	0–20	0–20	0–20	0–20
<b>NO-fraction</b> [mg/kWh]	NG G20/G25	50–100	50–100	50–100	70–120	70–120	70–120	70–120
	P G31	70–120	70–120	70–120	70–120	70–120	70–120	70–120
<b>CO<sub>2</sub>-fraction</b> [%]	NG G20/G25	4.5–5.5	5.5–6.5	5.5–6.5	5.0–6.5	5.0–6.5	6.0–7.0	6.0–7.0
	P G31	4.5–5.5	5.5–6.5	5.5–6.5	6.0–7.5	6.0–7.5	6.5–7.5	6.5–7.5
<b>Efficiency</b> [%]	NG G20/G25	94.5–95.0	94.0–95.0	95.0–96.0	92.5–93.5	95.0–96.0	93.5–94.5	94.0–95.0
	P G31	94.0–94.5	93.5–94.5	95.0–96.0	91.5–92.5	94.0–95.0	93.0–94.0	93.5–94.5

Note: NG – Natural gas, P – Propane

\* only applies to the two-stage and modulated heater

Table 10: Setting values of the infrared heater HELIOS (L)UJ(D)(M)+ with economiser AWTM 100/4000

Heater type		20-U+e4	20-LU+e4	30-U+e4	30-LU+e4	40-U+e4	40-LU+e4	50-LU+e4**
<b>Nozzle diameter</b> [mm]	NG G20/G25	3.8 / 4.2		4.6 / 5		5.3 / 6.2		6.2 / 6.6
	P G31	2.6		3.3		3.8		4.2
<b>Nozzle pressure</b> [mbar]	NG G20/G25	12		12		12		12
	P G31	25		27		21		25
<b>Flue gas temperature</b> [°C]	NG G20/G25	95–105	90–100	125–140	105–120	140–155	120–135	130–145
	P G31	95–105	90–100	140–155	120–135	145–160	125–140	130–145
<b>O<sub>2</sub>-fraction</b> [%]	NG G20/G25	6.5–7.5	6.5–7.5	6–6.5	6–6.5	5.0–6.0	5.0–6.0	5.6–6.0
	P G31	7.0–8.0	7.0–8.0	6.5–7.2	6.5–7.2	5.8–6.8	5.8–6.8	7.2–8.5
<b>CO-fraction</b> [ppm]	NG G20/G25	0–5	0–5	0–5	0–5	0–5	0–5	0–5
	P G31	0–10	0–10	0–10	0–10	0–10	0–10	0–10
<b>NO-fraction</b> [mg/kWh]	NG G20/G25	100–140	100–140	100–150	100–150	90–130	90–130	90–130
	P G31	100–140	100–140	130–190	130–190	90–130	90–130	90–130
<b>CO<sub>2</sub>-fraction</b> [%]	NG G20/G25	7.6–8.7	7.6–8.7	8.1–8.8	8.1–8.8	8.5–9.5	8.5–9.5	7.6–8.3
	P G31	8.1–9.1	8.1–9.1	8.5–9.5	8.5–9.5	9.5–10.5	9.5–10.5	8.0–9.0
<b>Efficiency</b> [%]	NG G20/G25	95.5–96.5	95.5–96.5	94.0–95.0	94.5–95.5	93.5–94.5	94.0–95.0	94.0–95.0
	P G31	95.0–96.0	95.5–96.5	93.0–94.0	93.5–94.5	93.0–94.0	93.5–94.0	94.0–95.0
<b>Nozzle pressure</b> [mbar]	NG G20/G25	4		4		4		4
	P G31	10		10		7		9
<b>Flue gas temperature</b> [°C]	NG G20/G25	75–85	65–75	90–105	70–80	105–125	85–105	90–100
	P G31	85–95	75–85	105–120	80–90	110–130	80–100	90–100
<b>O<sub>2</sub>-fraction</b> [%]	NG G20/G25	10.5–11.5	10.0–11.0	10.0–11.0	8.5–9.5	9.0–10.0	9.0–10.0	6–7.5
	P G31	11.5–12.5	11.0–12.0	9.5–10.5	9.5–10.5	10.0–11.0	10.0–11.0	8.0–9.2
<b>CO-fraction</b> [ppm]	NG G20/G25	0–10	0–10	0–10	0–10	0–10	0–10	0–10
	P G31	5–25	5–25	0–20	0–20	0–20	0–20	0–20
<b>NO-fraction</b> [mg/kWh]	NG G20/G25	50–100	50–100	70–120	70–120	70–120	70–120	70–120
	P G31	70–120	70–120	70–120	70–120	70–120	70–120	70–120
<b>CO<sub>2</sub>-fraction</b> [%]	NG G20/G25	5.5–6.5	5.5–6.5	5.0–6.5	5.0–6.5	6.0–7.0	6.0–7.0	7.0–7.8
	P G31	5.5–6.5	5.5–6.5	6.0–7.5	6.0–7.5	6.5–7.5	6.5–7.5	8.0–8.8
<b>Efficiency</b> [%]	NG G20/G25	95.5–96.5	96.0–97.0	94.5–95.5	96.0–97.0	94.0–95.0	95.5–96.5	95.0–96.0
	P G31	95.0–96.0	95.5–96.5	93.5–94.5	95.0–96.0	93.5–94.5	95.0–96.0	95.0–96.0

Note: NG – Natural gas, P – Propane

\* – only applies to the two-stage and modulated heater

\*\* 2 economiser AWTM 125/4000

# Maintenance

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

No special tools are required for product maintenance and service. During the lifetime of the appliance, regular replacement of components is not prescribed by the manufacturer.

The annual inspection includes a professional service inspection at least to the extent of the following description:

### 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
- Flue gases measurement, eventually adjustment of parameters
- Measurement of jet pressures, eventually adjustment
- Inspection of ionisation and ignition electrodes, cleaning, and adjustment if necessary
- Performance check of the heater, testing of safety elements of the appliance

### c) Part 3 – Electric Inspection

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

## Failure of infrared heaters HELIOS and their removal:

Table 11: Known failures of infrared heaters Helios

Failure – all heater types	Cause	Remedy
<b>It is not functional</b> – flue fan does not work (no reaction to the release)	Defective fan	Replace the fan
	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
<b>It is not functional</b> – flue fan 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 in the burner box electric connection	Check the connection (cables)
<b>It is not possible to start it</b> – fan works during the aeration and starting, but the heater do not ignite nor light the orange "Flame" indicator	Defective electrodes or their setting or defective electrode cables	Check, replace
	Wrong setting of air intake rosette	Check, set
	Defective jet pressure setting	Set
	Defective gas armature regulator	Replace the armature
	Defective automatics	Replace the automatics
	Low gas pipeline pressure	Increase the pressure

Failure – modulated heaters	Cause	Remedy
The green power light is off	no power supply	check and repair the connection of the power cord and connector
	defective warning light	replace the defective warning light
The green power light is on, the heater does not start	there is no command to run	check and repair the connection of the power cord and connector
	defective control board	replace the board
Heater for min. power extinguishes	too low min. fan speed	increase speed
The heater at maximum power goes off	Change in pressure ratios compared to the state during adjustment	Check and clean the air intake, flue gas exhaust and the body of the heater
	Bad initial pressure setting	Go through service mode again

## 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/SIT 845** in the control section (with connection tube), controlling automatics **SIT 539 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 nozzle whose diameter depends on the burnt gas and the output. The burner is fixed to the gas valve. 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 with adjustable aperture used to control the quantity of combustion air. There are three indicators on the shell – green indicator for "POWER SUPPLY", the red indicator for "ERROR" and orange indicator "OPERATION". Also the connectors for burner box and exhaust box and control panel connection are mounted on the shell. The individual components in the burner box are connected by wiring according to *Fig. 36, 37, 42, 43*.

### Electrodes disassembly:

1. Disconnect the burner box and the electric supply by removing both connectors and close the gas supply.
2. First open the large rear door covering the control section and then the small front service door.
3. Disassembly the electrode holder (2× 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. 34.

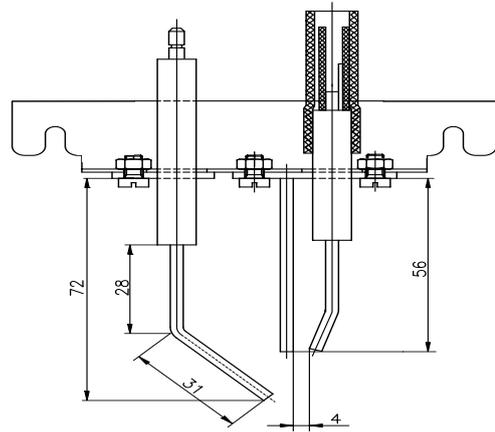


Fig. 34: Electrode adjustment

### Burner and nozzle disassembly:

1. Disconnect the burner box and the electric supply by removing both connectors and close the gas supply.
2. Do the electrodes disassembly – (do not disconnect the cables from the electrodes).
3. Unscrew the burner with a special burner key and pull it out through the service door. The burner can also be unscrewed with water pump pliers.
4. Install in reverse order. The burner is sealed in the gas valve with Teflon tape.

### Disassembly of control automatics:

1. Disconnect the burner box and the electric supply by removing both connectors and close the gas supply.
2. Open the door of the control section.
3. Dismount the control automatics (1× 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 the gas intake.
2. Perform the disassembly of the control automatics (do not disconnect the electric cables from the control automatics).
3. Perform the disassembly of the burner.
4. Dismount the spacer ring (2× screw M4×8 and nut M4).
5. Dismount the valve and the connection tube (4× screw M4×8) and perform its replacement.
6. Perform the assembly in the reverse order.
7. Perform the gas leakage test (foaming solution, gas detector).
8. Set the gas pressure to the nozzle according to the table 6 to 10 according to heater model.

### Exhaust (flue fan) box

Depending on the type of infrared heater, the exhaust box consists of a fan "AACO-MANDIK" or EC fan TORIN-SIFAN, 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 X1 on the burner box and close the gas supply.
2. Disconnect the fan 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.

Before replacing parts other than those listed in this chapter, it is necessary to consult the procedure with the company MANDÍK a. s.

## Conversion to another type of fuel

1. Order at MANDIK, a. s. a new burner with nozzle for new fuel.  
The nozzle 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 nozzle. 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.
3. Disassembly the electrodes (do not remove the cables).
4. Perform the disassembly of the burner. Perform the assembly of the new burner in reverse order. The burner is sealed in the gas valve with Teflon tape.
5. Perform the gas leakage test (foaming solution, gas detector).
6. Put the heater into operation, according to *Chapter III*. Set the pressure of the nozzle according *tab. 5–10*. Only a person who is trained and authorized by MANDÍK, a. s.
7. Adjust the air intake with an adjustable rosette using a flue gas analyser.



When changing the type of fuel it is necessary to re-adjust the heater to the combustion values. Only a service technician trained and authorized by MANDÍK, a. s.

## Recycling, dismantling after end of life

After the end of its useful life, the old device can be disposed of in the following ways:

1. When purchasing a new device, the supplier will take back the old heater and arrange for its disposal.
2. Hand over the old heater to the manufacturer for disposal
3. Disassemble the heater and hand it in as scrap.

It must be broken down into at least the following parts:

- Fans, gas valve and heater wiring as electrical waste
- Heater envelope and radiant tube as grade 27 mild steel scrap
- Burner and stainless steel. pipe as alloy steel waste, grade 025
- Mineral insulation as mixed waste

## Components used in infrared heaters HELIOS

### Gas valve two-stage:

SIT 836 TANDEM  
SIT 843 SIGMA  
HONEYWELL VK 4105Q

### Gas valve modulated:

SIT 845 SIGMA

### Control automatics:

SIT 579 DBC

### Air manostats 0,4 mbar:

SIT 380 ARIA  
DUNGS LGW 3 A1

### Flue gas fans:

AIRFLOW 45 BTFR  
AACO-MANDIK 133/52  
Torin-Sifan DSFL120062 EC3BA090  
ebm-papst R3G180AJ1101

### Control board of modulated heater:

Mandík H-Board 1.2

# IV. CONTROL

The Helios infrared heater can be controlled in different ways. Single-stage and two-stage heaters are controlled by 230 V power signals from OI/OID control boxes. Modulated heaters can be controlled by a 0–10 V signal, but they also support bus communication via the Modbus interface.

## Control of single-stage and two-stage heaters

Single-stage and two-stage infrared heaters are connected to the control with connector X1, according to Fig. 35. Connector X2 is used to connect the exhaust box. The internal arrangement and marking of the wires in the connectors can be seen from the internal wiring diagram in Fig. 36 and Fig. 37.

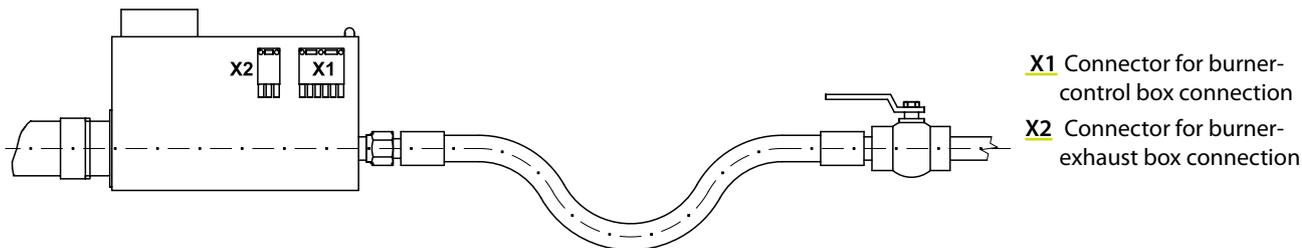


Fig. 35: Wiring connection points – one/two-stage heater

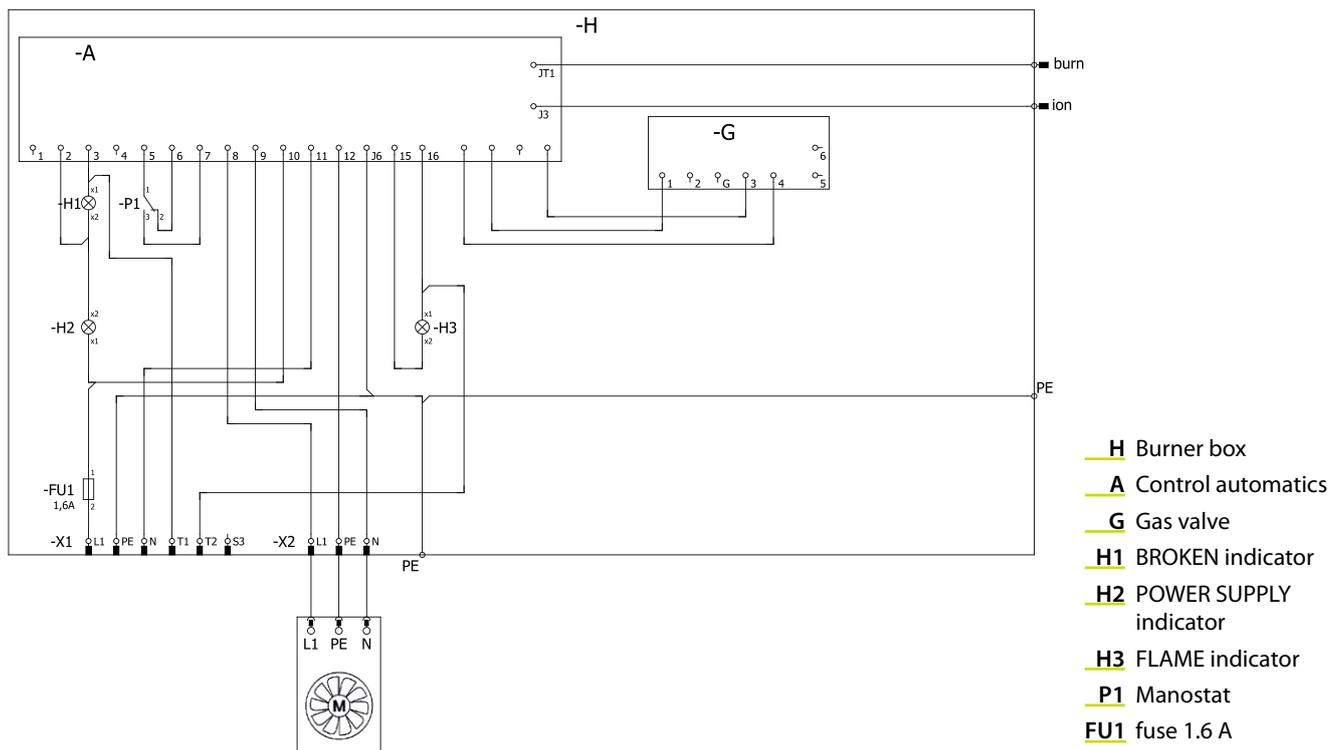


Fig. 36: Internal electrical wiring for HELIOS 10 to 50, variant J (single-stage)

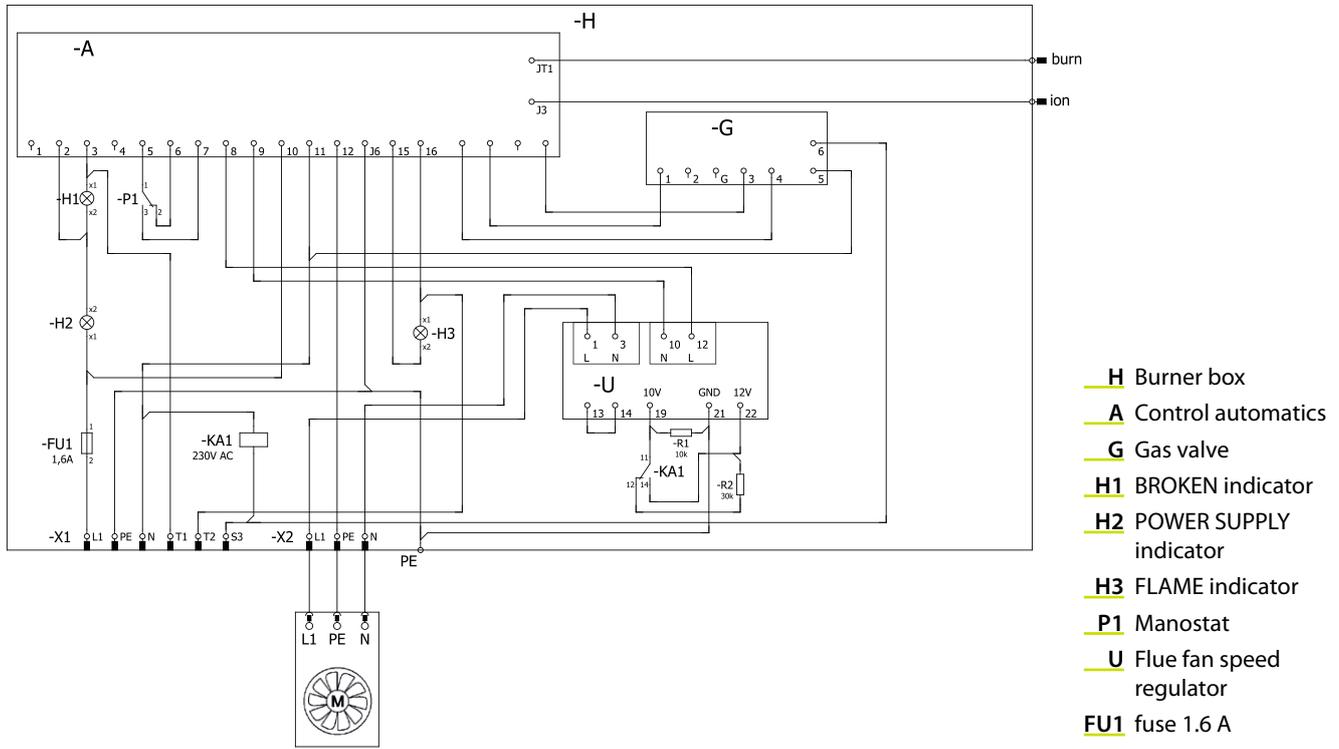


Fig. 37: Internal electrical wiring for HELIOS 10 to 50, variant D (two-stage)

### Control via room thermostat

Enables control of single heater based on temperature or temperature programmed by weekly program. It can be implemented with the help of a thermostat, according to Fig. 38.

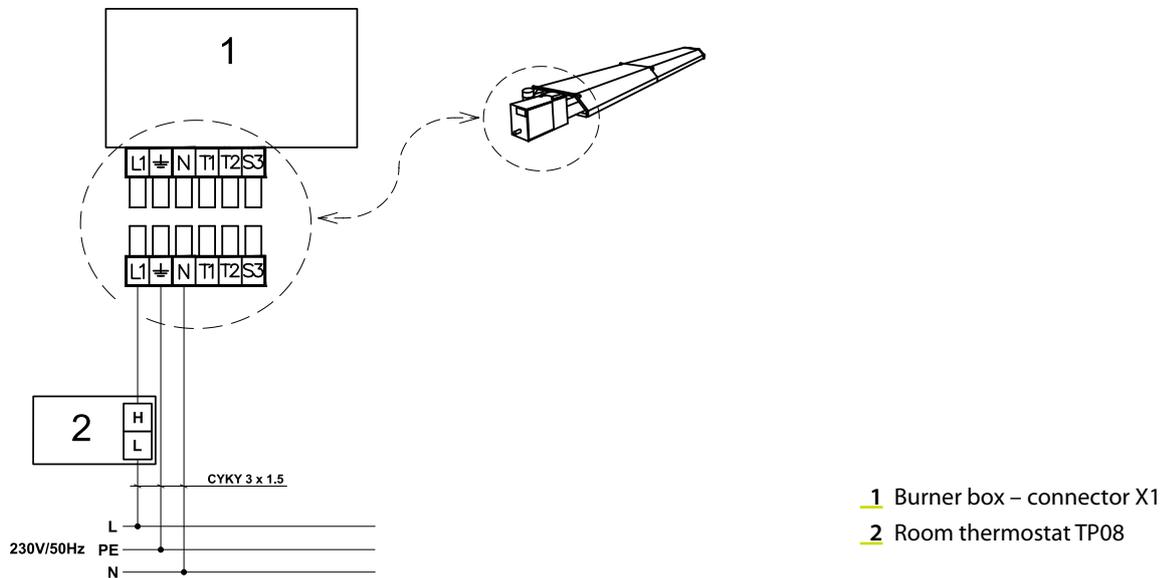


Fig. 38: Schematic of controlling the HELIOS infrared radiator with a thermostat

## OHDR Control box

OHDR enables manual control of one to three (OHDR 3) or to six (OHDR 6) one-stage or two-stage tube heaters HELIOS (Fig. 39). The control box has IP 30 rating and it can be supplemented with programmable room thermostat. The load selection of two-stage heaters is manual.

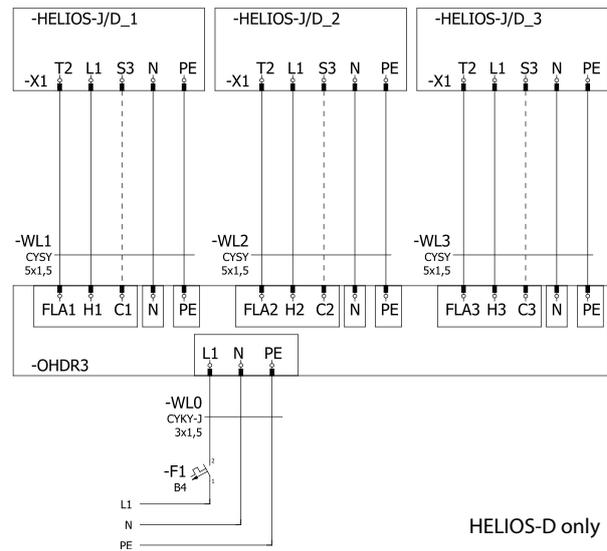


Fig. 39: Connection of HELIOS infrared heaters with the OHDR control box

## DHS Control box

DHS enables automatic and manual control of one (DHS) to three (DHS+ODH 3) or six (DHS+ODH 6) one-stage or two-stage tube heaters HELIOS (Fig. 40). The control box has IP 30 rating. The control box is equipped with SIEMNS RDG 160T regulator with time programme. The load selection of two-stage heaters is automatic. Even when RDG 160T includes an internal temperature sensor, the use of QAA32 external temperature sensor is highly recommended.

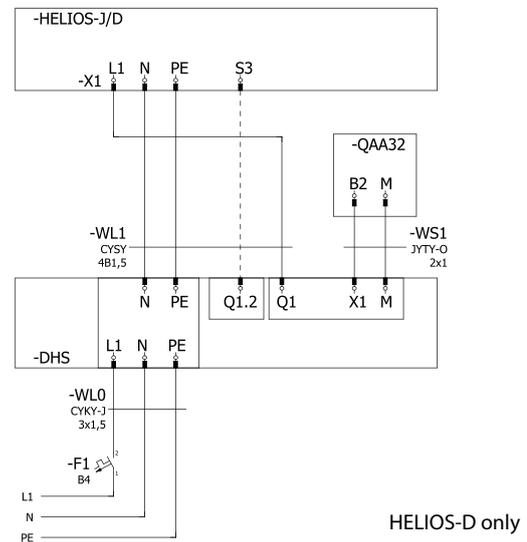


Fig. 40: Connection of HELIOS infrared heater with the DHS control box

Install the remote-control box according to the project so that it is freely accessible for operation. Connect the remote-control box to the 230 V / 50 Hz mains using a CYKY 3Jx1.5 cable. Connect the remote-control box to the heater permanently with a CYSY 5Jx1.5 cable and connect the cable to the terminal block according to the relevant wiring diagram.

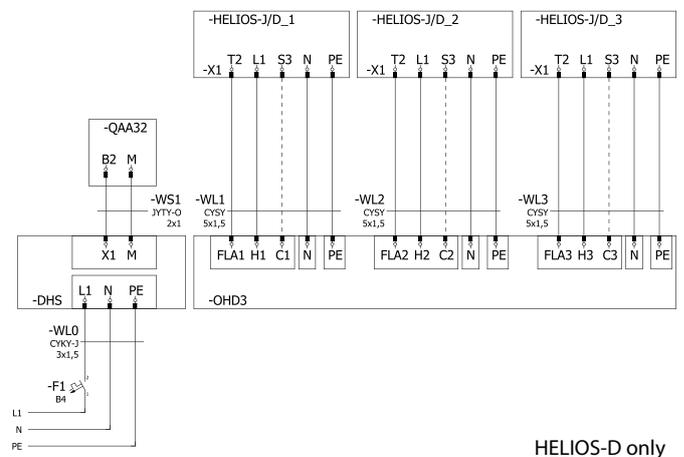


Fig. 41: Connection of HELIOS infrared heaters with the DHS+OHD control box

# Control of modulated infrared heaters

Unlike single-stage and two-stage heaters, modulated ones are permanently energized, even in the off state. The operation of the heater is controlled by the operation permission (logical signal) and the required power (continuous signal). If the heater does not receive permission to run, it will not heat regardless of the required power.

Modulated infrared heaters are equipped with a control board located on the door of the control part, which processes input signals and controls the operation of the infrared heater. The control board is equipped with a microcomputer, control and diagnostic circuits and default setting switches.

Default setting switches are mounted on the control board. These switches are used to set:

- 1) Regulation mode – whether it is analog or digital (via Modbus). Attention, this switch is factory set. When changing from analog to digital control, it is necessary to adjust the wiring inside the cabinet.
- 2) Continuous or logical control - the switch is only intended for service, in normal operation it is always set to “Continuous”.
- 3) Modbus address – only used in the case of digital control. On a given bus, each infrared heater must have its own unique address and a correctly set transmission speed.

## Electrical connection

The infrared heaters are connected to the electrical grid with appropriate protection, three-core to connector X1 (Fig. 42), which is also used for powering the exhaust box (Fig. 41 and 42). Connector

X3 is for communication and is used for connection with the control system.

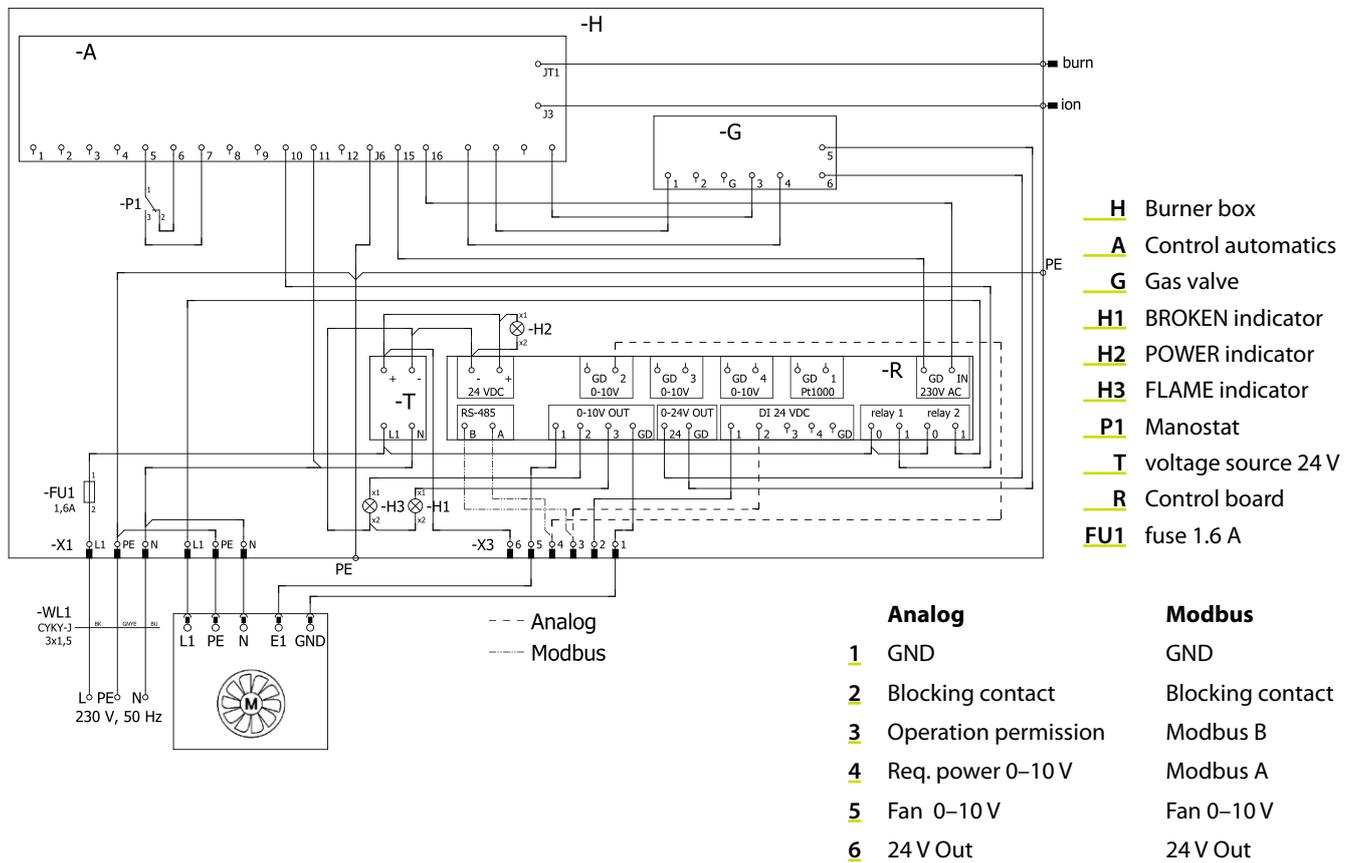


Fig. 42: Internal electrical wiring for HELIOS 10 to 50, variant M with EC motor

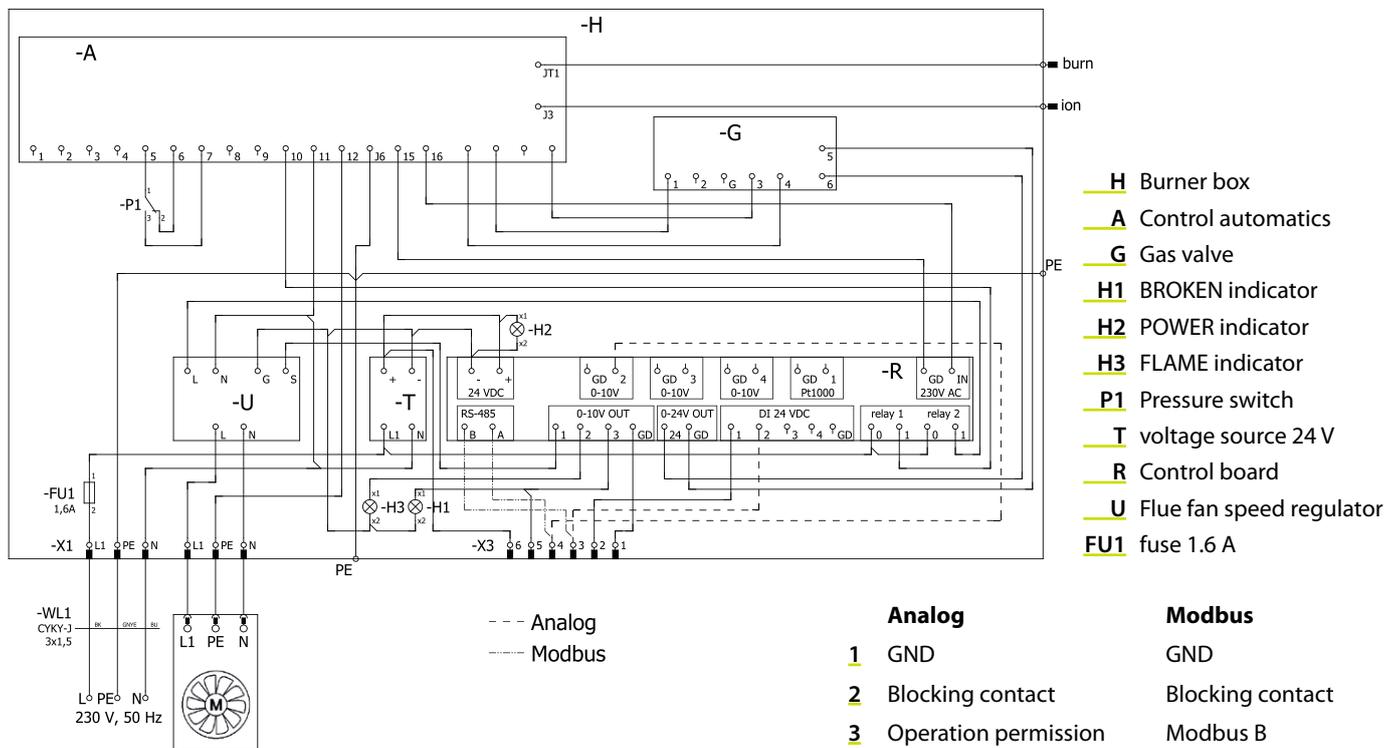


Fig. 43: Internal electrical wiring for HELIOS 10 to 50, variant M with AC motor

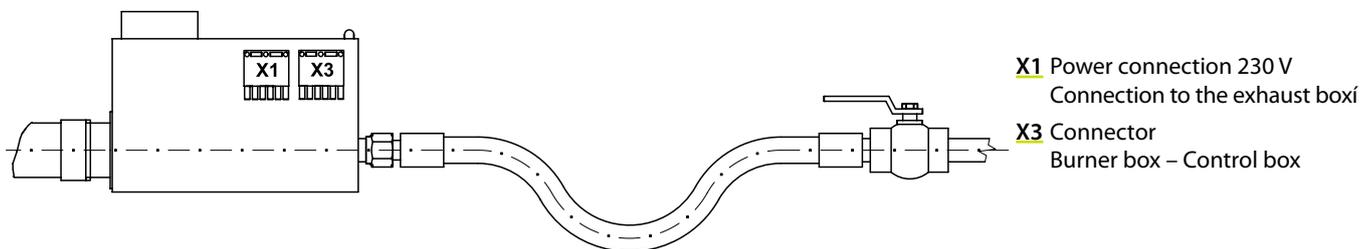


Fig. 44: Connectors of modulated heaters

### Analog operation

The Helios heater can be controlled analogically from the BMS central switchboard, individually or zone-wise. The control board receives analog commands when DIP 2 in socket S2 is ON. From the point of view of control, it is recommended to group the heaters

into control zones according to temperature sensors and to control one group of heaters with one pair of "operation request + required power" signals according to Fig. 44.

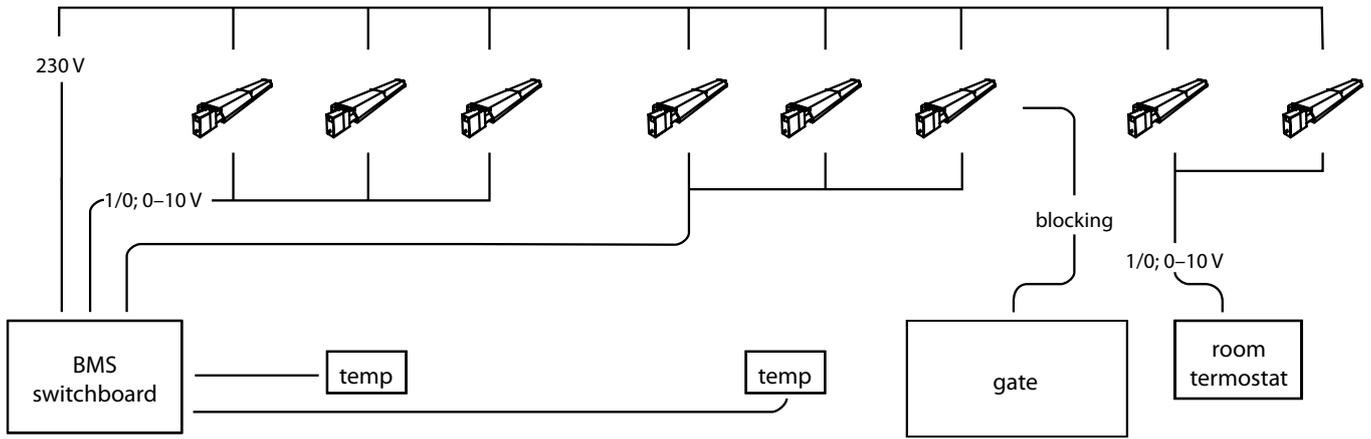


Fig. 45: Diagram of control by analog signals

The "operation permission" signal can be supplied as (Fig. 45):

a) 10–30 V signal on terminal (3), against GND on terminal (1) in connector X3, or

b) potential-free contact between terminals (3) and (6) in connector X3

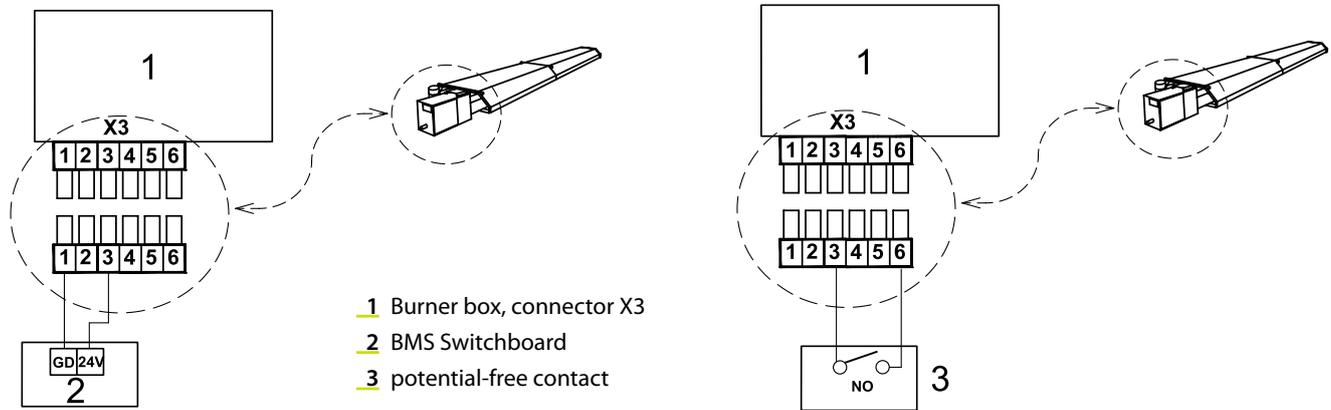


Fig. 46: Possibilities to connect the operation permission

The "requested power" signal can be fed as (Fig. 46) a 0–10 V signal on terminal (4) against GND on terminal (1) of connector X3

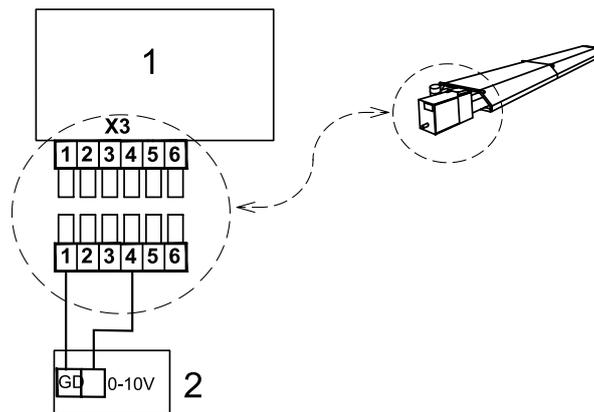


Fig. 47: The possibility of connecting the required power

### Control via thermostat MHS

In cases where control via the building management system (BMS) is not available, it is possible to control one zone with one MHS thermostat. The thermostat is connected to connector X3 according to Fig. 47. The thermostat is powered by a source in the heater and it is not necessary to power the thermostat separately. The MHS thermostat is factory pre-set for operation with HELIOS infrared heaters.

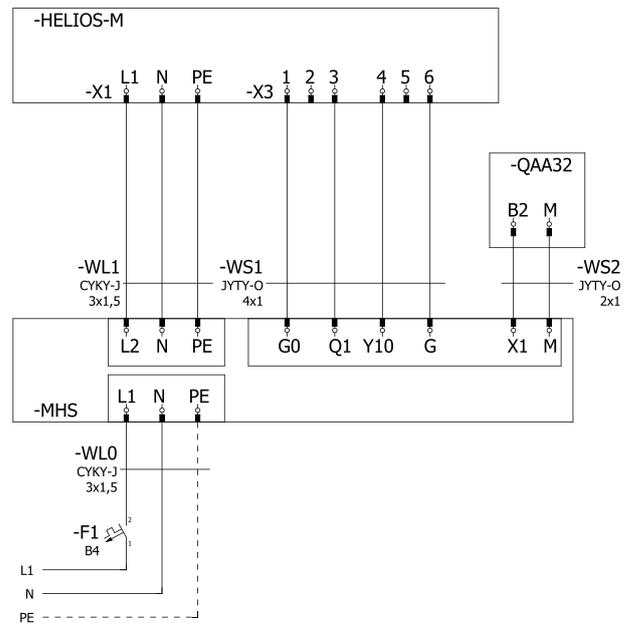


Fig. 48: Connection of HELIOS-M infrared heater with the MHS thermostat

MHS thermostat with extension box MHS-OHM 3 (OHM6) can control up to three (six) infrared heaters in one zone. The OHM extension box enables each heater individually switch off manually or switch it into automated control or switch it on manually. If

the heater is in automated control mode, it is controlled by MHS thermostat. In manual mode the heaters are on or off until they are switched other way.

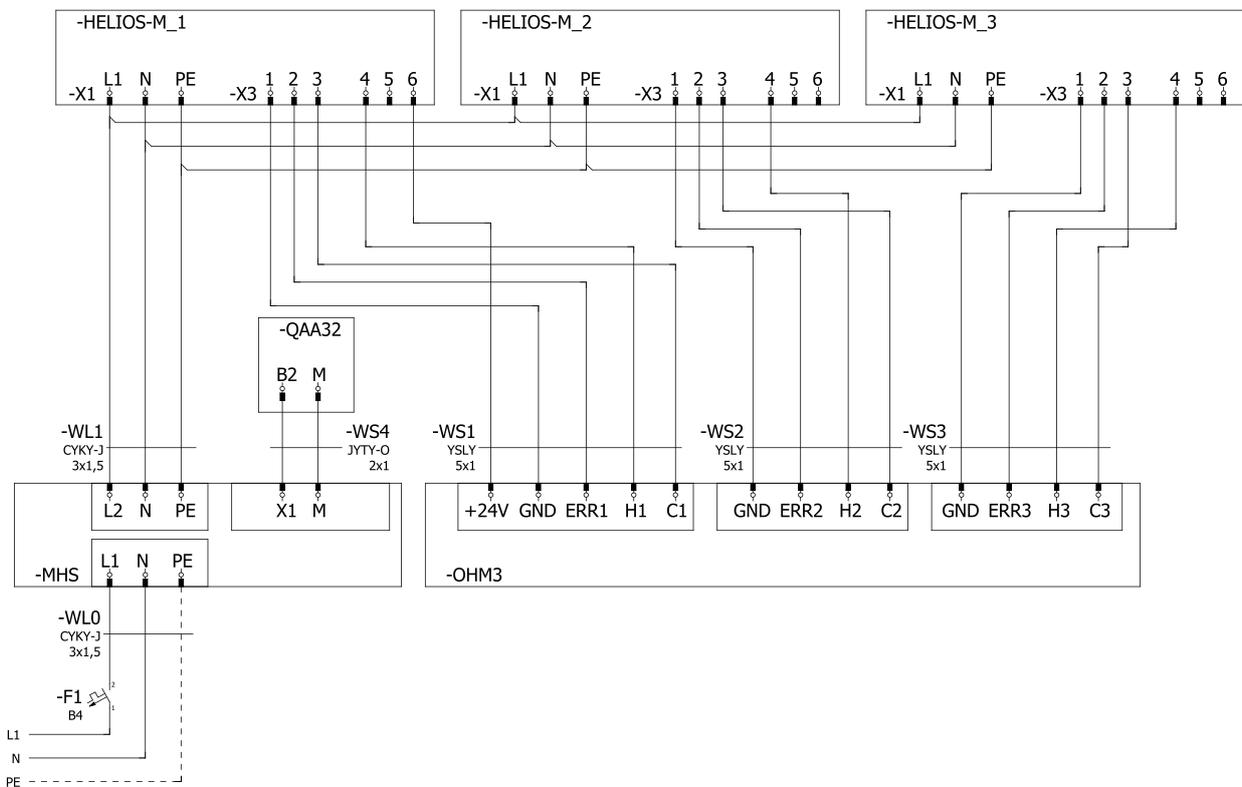


Fig. 49: Connection of HELIOS-M infrared heaters with the MHS thermostat and OHM extension

**Control via the Modbus**

Helios infrared heaters can be controlled by bus. This option is beneficial for saving cabling, as the bus communication cable can connect up to 32 heaters per branch. The heaters are then controlled

and monitored individually, their assignment to zones is done at the controller level (Fig. 48).

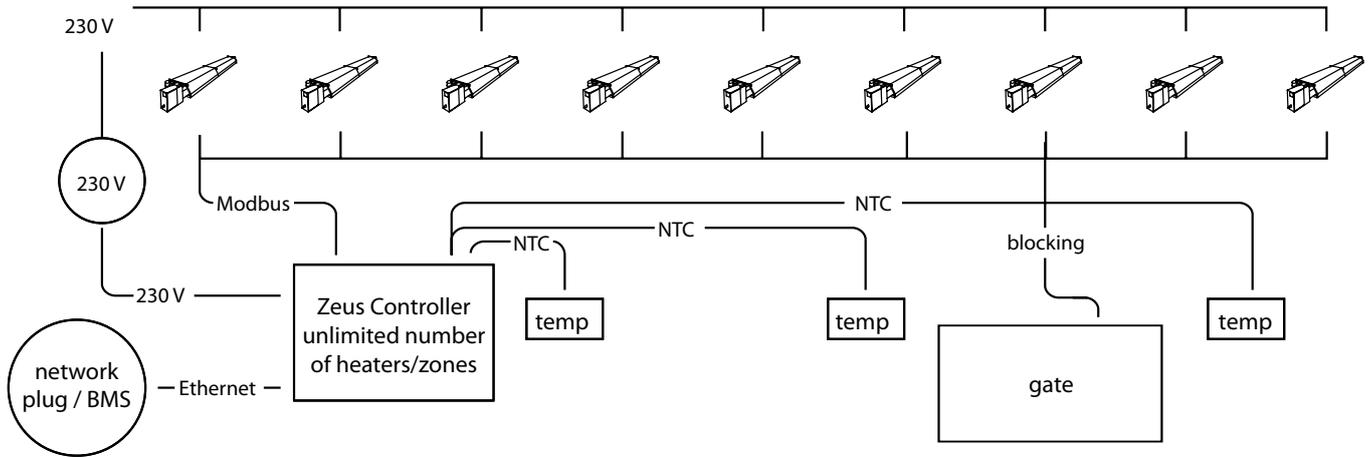


Fig. 50: Bus control scheme

For proper function, it is necessary that each heater has its own address, which is unique on the given branch. The address in the range 1–32 is set using switches 428 in socket S2 on the control board (Fig. 49) according to Table 12. The control board receives

commands via the bus when DIP 2 in socket S2 is turned OFF. DIP 1 must also be off. The last heater on the line is marked with a 120 Ω end resistor by jumper JP4.

The bus communication is indicated by blue LED in the same window where other indicating LEDs are placed.

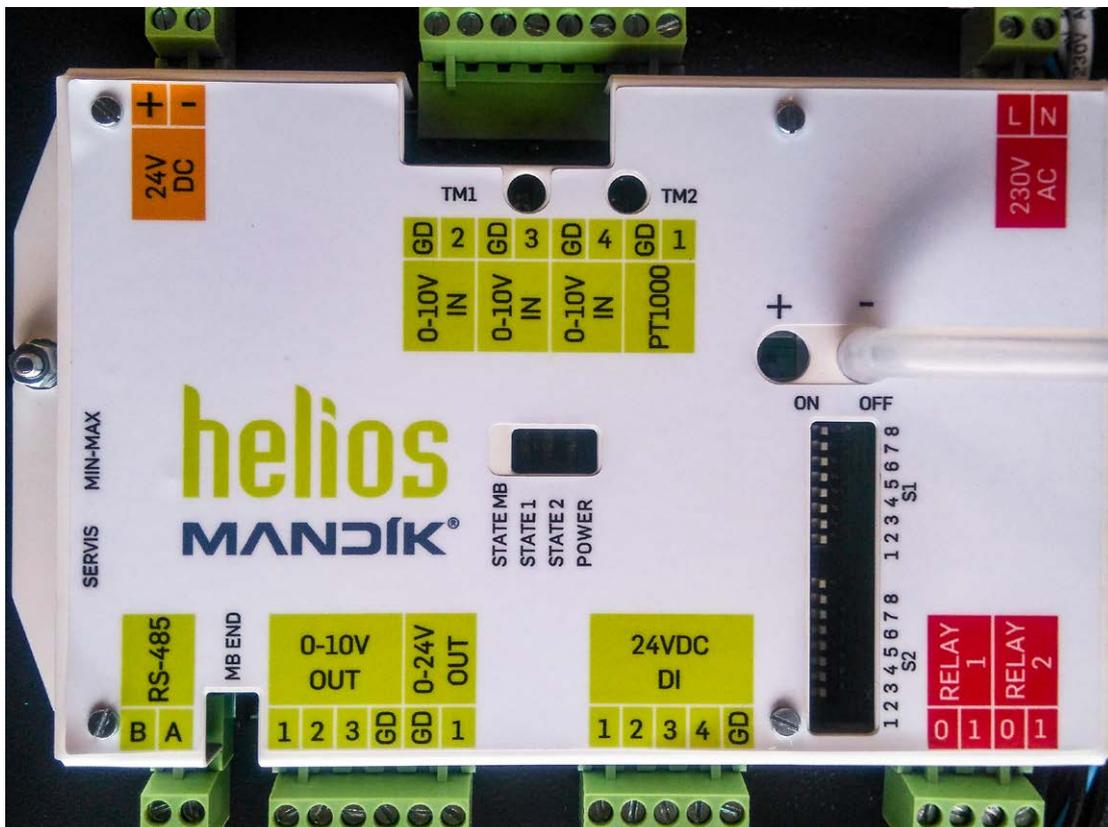


Fig. 51: DIP switches for setting the heater

Table 12: Heater address setting using DIP switches (white = OFF; black = ON)

S2	Modbus address																																				
Sw	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32					
8	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White			
7	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White		
6	White	White	Black	White																																	
5	White	White	White	White	Black	White																															
4	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	Black	White																				

Commands can be sent to individual heaters and their status can be checked via the bus. Bus communication is therefore suitable for radiator monitoring, fault reporting and remote diagnostics. Table 13 is used for communication settings. As a central controller, it is possible to choose the Zeus controller, which has a ready interface for assigning heaters to zones, time programs for individual zones, displaying the current status, etc. The Zeus controller is already equipped with a library of commands for communicating

with the infrared heater HELIOS. However, it is also possible to control the heaters via another measurement and regulation system (BMS). When using your own solution, remember that the permission to run needs to be renewed every 60 seconds. If the heater does not receive permission to run within this interval, it will automatically shut down. For communication with the heater, Table 14a: Modbus commands for the infrared heater is used. Even parity, 8 data bits, one STOP bit.

Table 13: Modbus communication settings (white = OFF; black = ON)

S1	Switch	
	1	2
Baud rate		
4800	White	White
9600	White	Black
19200	Black	White
38400	Black	Black

Table 14a: Modbus commands for the infrared heater

Register address	Read/Write	Command	Description	Size	Note	
0	R/W	0x03	Operation allowance	1	0	
		0x06			>0	
		0x10			Off On	
1	R/W	0x03	Power target	1	U16	
		0x06			0–1,000	
		0x10				
2	R/–	0x03	Operational flags	1	bit 15	
					bit 14	Flame
					bit 13	Blocking contact
					bit 12	Operation allowance
					bit 11	Relay: Control automatics
bits 0–2	Relay: Flue fan Status (tab. 17b)					
3	R/–	0x03	Gas valve control – Current value	1	U16 U = value/1,000 [V]	
4	R/–	0x03	Flue fan control – Current value	1	U16 U = value/1,000 [V]	
5	R/–	0x03	Gas valve control – Target	1	U16 U = value/1,000 [V]	
6	R/–	0x03	Flue fan control – Target	1	U16 U = value/1,000 [V]	
7	R/–	0x03	Burner under-pressure	1	S16 p = value/60 [Pa]	
8	R/–	0x03	Temperature (Pt1000) – Inp.1	1	S16 t = value [°C]	
9	R/–	0x03	Temperature(NTC) – Inp.2	1	S16 t = value/10 [°C]	

Table 14b: Heater status coding

Bit 2	Bit 1	Bit 0	Status
0	0	0	Stopped
0	0	1	Ignition
0	1	0	Running
0	1	1	Blocked
1	0	0	Shutdown
1	0	1	No Flame
1	1	0	Actualization
1	1	1	Setup

### Blocking contact

Modulated heaters are equipped with a blocking contact, which can be used to immediately switch off the heater regardless of the “request to run” signal. In this way, it is possible, for example, to block heaters at an open gate, a heater under which a crane is located, etc. The “blocking” signal can be provided as (Fig. 50):

- a) 10–30 V signal on terminal (2), against GND on terminal (1) in connector X3, or
- b) potential-free contact between terminals (2) and (6) in connector X3
  - 1. burner box, connector X3
  - 2. BMS
  - 3. potential-free contact

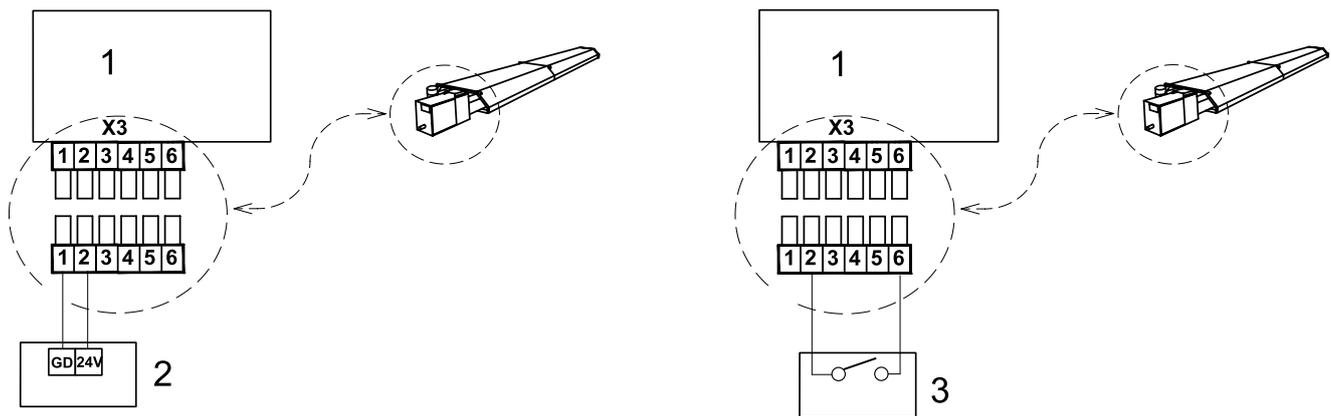


Fig. 52: Blocking contact connection options

## 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.

## V. OPERATING INSTRUCTIONS



The infrared heater itself is not operated; it is controlled via the supplied regulation. It may only be operated by a person trained and authorized for this activity. Installation, repairs and possible conversions of the appliance may only be carried out by a qualified assembly worker.

- a) Gas tube infrared heaters HELIOS 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.



**ATTENTION: Under no circumstances must the combustion air intake or external suction be blocked, which would result in a deterioration of the flue gas values (incomplete combustion – lack of air), in case of untimely removal of blockage (clogging) of the infrared heater tubes => failure, shutdown inoperative.**

### Instructions for operating single-stage and two-stage infrared heaters

#### Start with DHS control box

Switch the main switch of the DHS on. By repeated pushing of the left button choose the heating regime  and comfort . When the actual measured temperature is lower than the set comfort temperature, the radiant heater shall start. If the actual measured temperature is higher than the set temperature, increase the set

temperature by turning the button clockwise. The set temperature is blinking and the thermometer symbol is not visible. The burner load of two-step heaters is controlled according to the difference between setpoint temperature and actual measured temperature.

#### Decommissioning with DHS

Using the left button of DHS switch to a regime with set temperature lower than the actual measured one (Economy  or Frost protection ) or lower the required comfort temperature by turning

the button anticlockwise. The heater shall stop, after that switch off the main switch of DHS.

#### Start with OHDR control box

Switch the main switch of the OHDR on. Use the corresponding switch to switch on the radiant heater to first or second step of load.

#### Decommissioning with OHDR

Put the switch of the heater to off (mid) position. When all heaters controlled by the OHDR box are off, switch off the main switch of the OHDR control box.

In case of long-term shutdown, it is advisable to close the gas valve before the heater.

## Instructions for operating modulated infrared heaters

When power is applied to the burner, the green "POWER" indicator on the burner box lights on. The heater remains off and waits for permission to run.

When the heater is cleared to run, a venting, ignition cycle is performed, and the orange "flame" indicator on the burner box lights on after the gas in the radiant tube is ignited.

If the heater is bus-controlled (via modbus), it is possible to read the status variables and values from it at any time, both during and after operation.

After commissioning, the heater burns at rated output for approximately 5 minutes to warm up the entire tube and reflectors. After that, the heater starts to respond to the signal about the required power and adjusts the power to the required value.

At rated power, the heater works at an input signal value of 100 %. At minimum power (approx. 60 % of nominal) the heater works at zero value of the input signal.

After disconnecting the request for operation, the infrared heater will be turned off, the orange "FLAME" light will go out. The heater ventilates residual fumes from the radiant tube for a few seconds, and then turns off the fan as well.

## VI. DESIGN DOCUMENTS

The design of radiant heating with dark gas infrared heaters Helios can be done using the design software Hefaistos of the company MANDÍK, a. s.

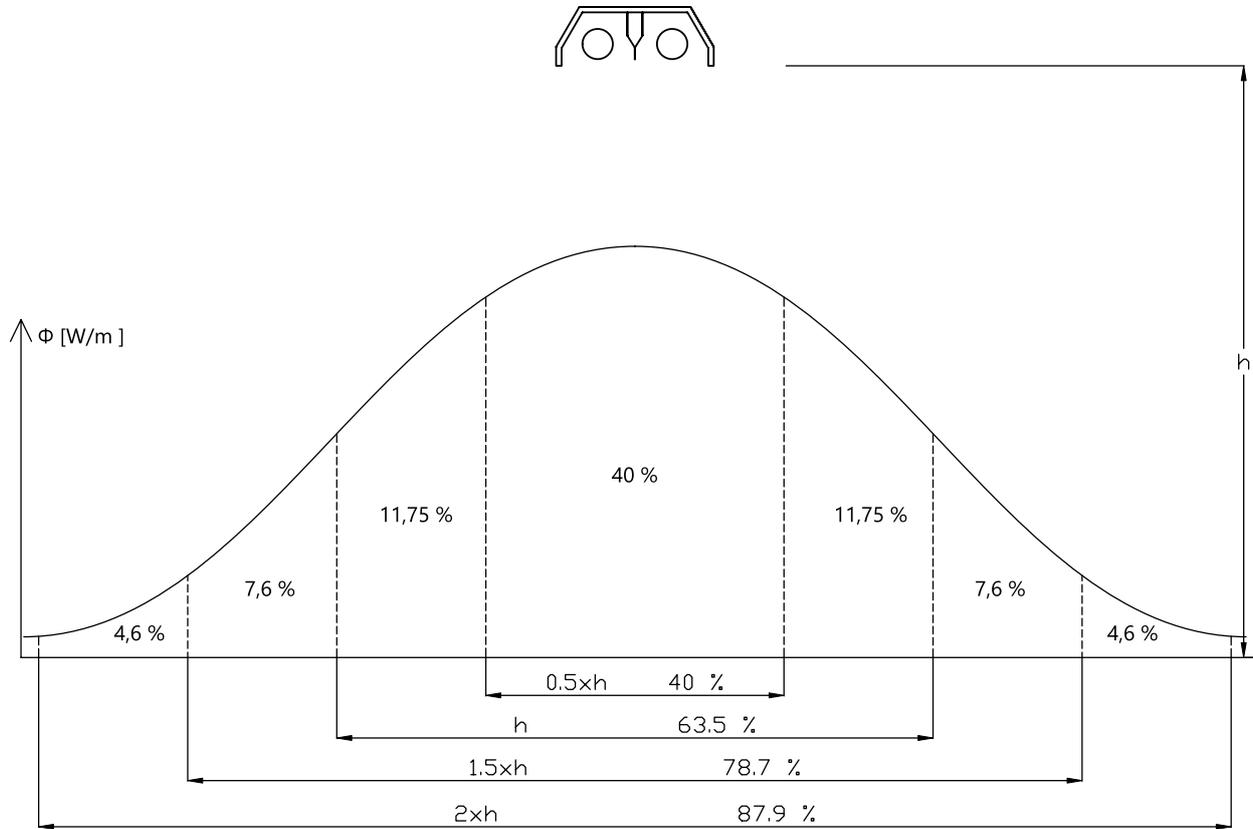


Fig. 53: Distribution of infrared radiation under infrared heater

The technical parameters of Helios infrared heaters are listed in Tables 15 to 20. The electrical protection of the product is IP 40.

Table 15: Technical parameters of the infrared heater HELIOS IJ+

Heater type		20-IJ+	30-IJ+	40-IJ+
Nominal input power NG G20/G25 / P G31 [kW]		21.1 / 18.4 / 20.1 / 20.41	29.8 / 28.9 / 29.9 / 29.9	38.8 / 41.0 / 40.3 / 40.3
Minimal input power NG G20/G25 / P G31 [kW]*		not applied		
Nominal output power NG G20/G25 / P G31 [kW]		19.4 / 16.9 / 18.5 / 18.5	26.6 / 26.0 / 26.9 / 26.9	35.0 / 37.0 / 36.1 / 36.1
Minimal output power NG G20/G25 / P G31 [kW]*		not applied		
El. connection [V/Hz]		230 / 50		
El. power input [W]		100		
Protection [A]		4		
Operating pressure	NG G20/G25 [mbar]	17–26		
	P G31 [mbar]	28–50		
Gas consumption at nominal output power	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	2.19 / 2.41	3.08 / 3.43	4.10 / 5.05
	P G31 [kg.h <sup>-1</sup> ]	1.15 / 1.53	1.84 / 2.44	2.58 / 3.43
Gas consumption at minimal output power*	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	not applied		
	P G31 [kg.h <sup>-1</sup> ]	not applied		
Length of heater [m]		10	13	16
Max. amount of flue gas [kg.s <sup>-1</sup> ]		0.015	0.025	0.03
Flue gas fan	Max. vol. flowrate [m <sup>3</sup> .h <sup>-1</sup> ]	350		
	Max. pressure [Pa]	360		
Emissions during space heating No <sub>x</sub> [Mg/kWh <sub>INPUT</sub> (GCV)]		150	150	150
Radiation coefficient at nominal heating power R <sub>Fnom</sub> [-]		0.57	0.61	0.63
Radiation coefficient at minimal heating power R <sub>Fmin</sub> [-]*		not applied		
Consumption of additional el. energu during nominal heating power el <sub>max</sub> [kW]		0.08		
Consumption of additional el. energy during minimal heating power el <sub>min</sub> [kW]*		not applied		
In standby mode el <sub>SB</sub> [kW]		0.01		
Power input of permanently burning ignition burner [kW]		not applied		
Useful capacity with nominal power (GCV) η <sub>th, nom</sub> [%]		81.5	81.5	81.9
Useful capacity with minimal power (GCV) η <sub>th, min</sub> [%]*		not applied		
Heat emission control type [-]		one stage		
Total season energetic efficiency [%]		77.1	79.5	81.1

Note: NG – Natural gas, P – Propane

\* only valid for two-stage and modulated heaters

Table 16: Technical parameters of the infrared heater HELIOS IJ+ with economiser AWTM 100/2000

Heater type		20-IJ+e2	30-IJ+e2	40-IJ+e2
Nominal input power NG G20/G25 / P G31 [kW]		21.1 / 18.4 / 20.1 / 20.41	29.8 / 28.9 / 29.9 / 29.9	38.8 / 41.0 / 40.3 / 40.3
Minimal input power NG G20/G25 / P G31 [kW]*		not applied		
Nominal output power NG G20/G25 / P G31 [kW]		20.1 / 17.5 / 19.0 / 19.0	27.5 / 26.6 / 27.9 / 27.9	36.0 / 38.1 / 37.2 / 37.2
Minimal output power NG G20/G25 / P G31 [kW]*		not applied		
El. connection [V/Hz]		230 / 50		
El. power input [W]		100		
Protection [A]		4		
Operating pressure	NG G20/G25 [mbar]	17–26		
	P G31 [mbar]	28–50		
Gas consumption at nominal output power	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	2.19 / 2.41	3.08 / 3.43	4.10 / 5.05
	P G31 [kg.h <sup>-1</sup> ]	1.15 / 1.53	1.84 / 2.44	2.58 / 3.43
Gas consumption at minimal output power*	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	not applied		
	P G31 [kg.h <sup>-1</sup> ]	not applied		
Length of heater [m]		10	13	16
Max. amount of flue gas [kg.s <sup>-1</sup> ]		0.015	0.025	0.03
Flue gas fan	Max. vol. flowrate [m <sup>3</sup> .h <sup>-1</sup> ]	350		
	Max. pressure [Pa]	360		
Emissions during space heating No <sub>x</sub> [Mg/kWh <sub>INPUT</sub> (GCV)]		150	150	150
Radiation coefficient at nominal heating power R <sub>Fnom</sub> [-]		0.57	0.61	0.63
Radiation coefficient at minimal heating power R <sub>Fmin</sub> [-]*		not applied		
Consumption of additional el. energu during nominal heating power el <sub>max</sub> [kW]		0.14		
Consumption of additional el. energy during minimal heating power el <sub>min</sub> [kW]*		not applied		
In standby mode el <sub>sb</sub> [kW]		0.01		
Power input of permanently burning ignition burner [kW]		not applied		
Useful capacity with nominal power (GCV) η <sub>th, nom</sub> [%]		83.7	83.3	83
Useful capacity with minimal power (GCV) η <sub>th, min</sub> [%]*		not applied		
Heat emission control type [-]		one stage		
Total season energetic efficiency [%]		78.6	80.8	81.9

Note: NG – Natural gas, P – Propane

\* only valid for two-stage and modulated heaters

Table 17: Technical parameters of the infrared heater HELIOS IJ+ with economiser AWTM 100/4000

Heater type		20-IJ+e4	30-IJ+e4	40-IJ+e4
Nominal input power NG G20/G25 / P G31 [kW]		21.1 / 18.4 / 20.1 / 20.41	29.8 / 28.9 / 29.9 / 29.9	38.8 / 41.0 / 40.3 / 40.3
Minimal input power NG G20/G25 / P G31 [kW]*		not applied		
Nominal output power NG G20/G25 / P G31 [kW]		20.4 / 17.8 / 19.3 / 19.3	28.0 / 27.4 / 28.3 / 28.3	36.5 / 38.6 / 37.8 / 37.8
Minimal output power NG G20/G25 / P G31 [kW]*		not applied		
El. connection [V/Hz]		230 / 50		
El. power input [W]		100		
Protection [A]		4		
Operating pressure	NG G20/G25 [mbar]	17–26		
	P G31 [mbar]	28–50		
Gas consumption at nominal output power	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	2.19 / 2.41	3.08 / 3.43	4.10 / 5.05
	P G31 [kg.h <sup>-1</sup> ]	1.15 / 1.53	1.84 / 2.44	2.58 / 3.43
Gas consumption at minimal output power*	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	not applied		
	P G31 [kg.h <sup>-1</sup> ]	not applied		
Length of heater [m]		10	13	16
Max. amount of flue gas [kg.s <sup>-1</sup> ]		0.015	0.025	0.03
Flue gas fan	Max. vol. flowrate [m <sup>3</sup> .h <sup>-1</sup> ]	350		
	Max. pressure [Pa]	360		
Emissions during space heating No <sub>x</sub> [Mg/kWh <sub>INPUT</sub> (GCV)]		150	150	150
Radiation coefficient at nominal heating power R <sub>Fnom</sub> [-]		0.57	0.61	0.63
Radiation coefficient at minimal heating power R <sub>Fmin</sub> [-]*		not applied		
Consumption of additional el. energu during nominal heating power el <sub>max</sub> [kW]		0.14		
Consumption of additional el. energy during minimal heating power el <sub>min</sub> [kW]*		not applied		
In standby mode el <sub>sb</sub> [kW]		0.01		
Power input of permanently burning ignition burner [kW]		not applied		
Useful capacity with nominal power (GCV) η <sub>th, nom</sub> [%]		85.5	84.6	84.0
Useful capacity with minimal power (GCV) η <sub>th, min</sub> [%]*		not applied		
Heat emission control type [-]		one stage		
Total season energetic efficiency [%]		80.5	82.2	82.9

Note: NG – Natural gas, P – Propane

\* only valid for two-stage and modulated heaters

Table 18: Technical parameters of the infrared heater HELIOS (L)UJ(D)(M)+

Heater type	10-UJ (D) [M]+	20-UJ(D) [M]+	20-LU- J(D) [M]+	30-UJ(D) [M]+	30-LU- J(D) [M]+	40-UJ(D) [M]+	40-LU- J(D) [M]+	50-LU- J(D) [M]+	
Nominal input power NG G20/G25 [kW]	9.5 / 10.1	21.1 / 18.4		29.8 / 28.9		38.8 / 41.0		49.0 / 48.2	
Nominal input power P G31 [kW]	10.5	20.1		29.9		40.3		50.9	
Min. input power NG G20/G25 [kW]*	6.6 / 7.2	14.0 / 11.6		18.4 / 16.5		23.8 / 24.8		29.7 / 28.2	
Min. input power P G31 [kW]*	6.8	13.4		19.3		26.5		29.8	
Nominal output power NG G20/G25 [kW]	8.9/9.5	19.4 / 16.9	19.5 / 17.0	26.8 / 26.0	27.2 / 26.4	35.0 / 37.0	35.4 / 37.4	44.4 / 43.7	
Nominal output power P G31 [kW]	9.9	18.5	18.6	26.9	27.3	36.1	36.5	46.1	
Min. output power NG G20/G25 [kW]*	6.1 / 6.6	12.8 / 10.6	13.0 / 10.7	16.6 / 14.9	17.1 / 15.2	21.7 / 22.6	22.3 / 23.2	27.5 / 26.1	
Min. output power P G31 [kW]*	6.4	12.2	12.4	17.4	17.9	23.7	24.3	27.6	
El. connection [V/Hz]	230/50								
El. power input [W]	100								
Protection [A]	4								
Operating pressure	NG G20/G25 [mbar]	17–26							
	P G31 [mbar]	28–50							
Gas consumption at nominal output power	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	28 - 50	2.19 / 2.41		3.08 / 3.43		4.10 / 5.05	5.18 / 5.52	
	P G31 [kg.h <sup>-1</sup> ]	0.75	1.51		2.44		3.43	3.84	
Gas consumption at minimal output power*	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	0.69 / 0.85	1.48 / 1.51		1.94 / 2.17		2.51 / 2.95	3.14 / 3.34	
	P G31 [kg.h <sup>-1</sup> ]	0.49	1.0		1.48		1.87	2.25	
Length of heater [m]	3.8	5.3	6.8	6.8	8.3	8.3	9.8	11.3	
Max. amount of flue gas [kg.s <sup>-1</sup> ]	0.009	0.015		0.025		0.03		0.035	
Flue gas fan	Max. volumetric flowrate [m <sup>3</sup> .h <sup>-1</sup> ]	216			350				
	Max. static pressure [Pa]	280			360				
Emissions during space heating No <sub>x</sub> [Mg/kWh <sub>INPUT</sub> (GCV)]	130	130	130	140	140	160	160	170	
Radiation coefficient at nominal heating power R <sub>Fnom</sub> [-]	0.661	0.682	0.678	0.722	0.71	0.72	0.709	0.72	
Radiation coefficient at minimal heating power R <sub>Fmin</sub> [-]*	0.661	0.682	0.678	0.722	0.71	0.72	0.709	0.72	
Consumption of additional el. energu during nominal heating power el <sub>max</sub> [kW]				0.05					0.11
Consumption of additional el. energu during minimal heating power el <sub>min</sub> [kW]*				0.025					0.05
In standby mode el <sub>SB</sub> [kW] Single-stage and two -stage heaters	0								
In standby mode el <sub>SB</sub> [kW] modulated heater	0.005								
Power input of permanently burning ignition burner [kW]	not applied								
Useful capacity with nominal heating power (GCV) η <sub>th,nom</sub> [%]	84.3	82.7	83.4	81.1	82.3	81.0	82.2	81.6	
Useful capacity with minimal heating power (GCV) η <sub>th,min</sub> [%]*	83	81.7	83.4	81.2	83.7	81.4	83.9	83.4	
Heat emission control type [-]	One-stage (Two-stage)[Modulated]								
Total season energetic efficiency – one-stage heater [%]	83.2	83.5	85	84.8	86.8	84.9	87	87	
Total season energetic efficiency – two-stage heater [%]	86.3	86.5	88	88.1	90.1	88.3	90.3	90.4	
Total season energetic efficiency – modulated heater [%]	87.4	87.9	89.4	89.7	91.7	89.9	91.9	92.0	

Note: NG – Natural gas, P – Propane

\* only valid for two-stage and modulated heaters

Table 19: Technical parameters of the infrared heater HELIOS (L)UJ(D)(M)+ with economiser AWTM 100/2000

Heater type	10-UJ(D) +e2	20-UJ(D) +e2	20-LUJ(D) +e2	30-UJ(D) +e2	30-LUJ(D) +e2	40-UJ(D) +e2	40-LUJ(D) +e2
Nominal input power NG G20/G25 [kW]	9.5/10.1	21.1 / 18.4		29.8 / 28.9		38.8 / 41.0	
Nominal input power P G31 [kW]	10.5	20.1		29.9		40.3	
Min. input power NG G20/G25 [kW]*	6.6/7.2	14.0 / 11.6		18.4 / 16.5		23.8 / 24.8	
Min. input power P G31 [kW]*	6.8	13.4		19.3		26.5	
Nominal output power NG G20/G25 [kW]	9.4/10.0	20.1 / 17.5	20.1 / 17.5	27.7 / 26.9	28.0 / 27.2	36.0 / 38.1	36.4 / 38.5
Nominal output power P G31 [kW]	10.4	19.0	19.2	27.9	28.2	37.2	37.6
Min. output power NG G20/G25 [kW]*	6.5 / 7.1	13.3 / 11.0	13.6 / 11.3	17.2 / 15.2	17.7 / 15.8	22.2 / 23.1	22.8 / 23.9
Min. output power P G31 [kW]*	6.7	11.0	13.0	18.1	18.6	24.5	25.1
El. connection [V/Hz]	230/50						
El. power input [W]	220						
Protection [A]	4						
Operating pressure	NG G20/G25 [mbar]	17–26					
	P G31 [mbar]	28–50					
Gas consumption at nominal output power	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	1.0 / 1.20	2.19 / 2.41		3.08 / 3.43		4.10 / 5.05
	P G31 [kg.h <sup>-1</sup> ]	0.75	1.51		2.44		3.43
Gas consumption at minimal output power*	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	0.69/0.85	1.48 / 1.51		1.94 / 2.17		2.51 / 2.95
	P G31 [kg.h <sup>-1</sup> ]	0.49	1.0		1.48		1.87
Length of heater [m]	3.8	5.3	6.8	6.8	8.3	8.3	9.8
Max. amount of flue gas [kg.s <sup>-1</sup> ]	0.009	0.015		0.025		0.03	
Flue gas fan	Max. volumetric flowrate [m <sup>3</sup> .h <sup>-1</sup> ]	216	350				
	Max. static pressure [Pa]	280	360				
Emissions during space heating No <sub>x</sub> [Mg/kWh <sub>INPUT</sub> (GCV)]	130	130	130	140	140	160	160
Radiation coefficient at nominal heating power R <sub>Fnom</sub> [-]	0.661	0.682	0.678	0.722	0.71	0.72	0.709
Radiation coefficient at minimal heating power R <sub>Fmin</sub> [-]*	0.661	0.682	0.678	0.722	0.71	0.72	0.709
Consumption of additional el. energy during nominal heating power el <sub>max</sub> [kW]				0.14			
Consumption of additional el. energy during minimal heating power el <sub>min</sub> [kW]*				0.12			
In standby mode el <sub>SB</sub> [kW] Single-stage and two-stage heaters				0			
In standby mode el <sub>SB</sub> [kW] modulated heater				0.005			
Power input of permanently burning ignition burner [kW]	not applied						
Useful capacity with nominal heating power (GCV) η <sub>th,nom</sub> [%]	89.0	85.3	85.8	83.9	84.9	83.4	84.4
Useful capacity with minimal heating power (GCV) η <sub>th,min</sub> [%]*	88.2	84.9	87.5	84.3	86.8	83.6	86.1
Heat emission control type [-]	One-stage (Two-stage)[Modulated]						
Total season energetic efficiency – one-stage heater [%]	88.7	86.9	89.1	88.1	90.1	87.4	89.4
Total season energetic efficiency – two-stage heater [%]	89.3	88.8	91.1	90.7	92.7	90.2	92.2
Total season energetic efficiency – modulated heater [%]	90.4	90.1	92.4	92.3	94.2	91.7	93.7

Note: NG – Natural gas, P – Propane

\* only valid for two-stage and modulated heaters

Table 20: Technical parameters of the infrared heater HELIOS (L)UJ(D)(M)+ with economiser AWTM 100/4000

Heater type	20-UJ(D) +e4	20-LUJ(D) +e4	30-UJ(D) +e4	30-LUJ(D) +e4	40-UJ(D) +e4	40-LUJ(D) +e4	50-LUJ(D) +e4**
Nominal input power NG G20/G25 [kW]	21.1 / 18.4		29.8 / 28.9		38.8 / 41.0		49.0 / 48.2
Nominal input power P G31 [kW]	20.1		29.9		40.3		50.9
Min. input power NG G20/G25 [kW]*	14.0 / 11.6		18.4 / 16.5		23.8 / 24.8		29.7 / 28.2
Min. input power P G31 [kW]*	13.4		19.3		26.5		29.8
Nominal output power NG G20/G25 [kW]	20.4 / 17.8	20.5 / 17.9	28.3 / 27.4	28.4 / 27.7	36.5 / 38.6	36.9 / 39.1	46.4 / 45.6
Nominal output power P G31 [kW]	19.3	19.4	28.3	28.6	37.8	38.3	48.2
Min. output power NG G20/G25 [kW]*	13.6 / 11.2	13.9 / 11.5	17.5 / 15.8	18.0 / 16.0	22.4 / 23.4	23.0 / 24.0	28.6 / 27.2
Min. output power P G31 [kW]*	10.4	10.7	18.4	18.9	24.9	25.5	28.7
El. connection [V/Hz]	230 / 50						
El. power input [W]	220						
Protection [A]	4						
Operating pressure	NG G20/G25 [mbar]	17–26					
	P G31 [mbar]	28–50					
Gas consumption at nominal output power	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	2.19 / 2.41		3.08 / 3.43		4.10 / 5.05	
	P G31 [kg.h <sup>-1</sup> ]	1.51		2.44		3.43	
Gas consumption at minimal output power*	NG G20/G25 [m <sup>3</sup> .h <sup>-1</sup> ]	1.48 / 1.51		1.94 / 2.17		2.51 / 2.95	
	P G31 [kg.h <sup>-1</sup> ]	1.0		1.48		1.87	
Length of heater [m]	5.3	6.8	6.8	8.3	8.3	9.8	11.3
Max. amount of flue gas [kg.s <sup>-1</sup> ]	0.015		0.025		0.03		0.035
Flue gas fan	Max. volumetric flowrate [m <sup>3</sup> .h <sup>-1</sup> ]	350					
	Max. static pressure [Pa]	360					
Emissions during space heating No <sub>x</sub> [Mg/kWh <sub>INPUT</sub> (GCV)]	130	130	140	140	160	160	170
Radiation coefficient at nominal heating power R <sub>Fnom</sub> [-]	0.682	0.678	0.722	0.71	0.72	0.709	0.72
Radiation coefficient at minimal heating power R <sub>Fmin</sub> [-]*	0.682	0.678	0.722	0.71	0.72	0.709	0.72
Consumption of additional el. energu during nominal heating power el <sub>max</sub> [kW]	0.14						
Consumption of additional el. energu during minimal heating power el <sub>min</sub> [kW]*	0.12						
In standby mode el <sub>SB</sub> [kW] Single-stage and two-stage heaters	0						
In standby mode el <sub>SB</sub> [kW] modulated heater	0.005						
Power input of permanently burning ignition burner [kW]	not applied						
Useful capacity with nominal heating power (GCV) η <sub>th, nom</sub> [%]	86.6	87.3	85.3	86.2	84.6	85.5	85.2
Useful capacity with minimal heating power (GCV) η <sub>th, min</sub> [%]*	86.2	88.5	85.8	88.2	84.7	87.1	86.7
Heat emission control type [-]	One-stage (Two-stage)[Modulated]						
Total season energetic efficiency – one-stage heater [%]	87.6	90.3	89.6	91.6	88.5	90.5	90.6
Total season energetic efficiency – two-stage heater [%]	88.2	92.3	91.6	94.2	91.1	93.2	93.4
Total season energetic efficiency – modulated heater [%]	91.6	93.6	93.9	95.7	93.0	94.8	95.2

Note: NG – Natural gas, P – Propane

\* only valid for two-stage and modulated heaters

\*\* – economiser AWTM 125/4000

# VII. 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 130 by 130 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 DN100 (125) mm socket for

connection to flue gases output of HELIOS tube heater and DN 100 (125) mm neck for connection to the socket of condensate trap and further to flue system.

The economizer is produced with an exchanger length of 2 m or 4 m (Fig. 55). It is inserted into the flue gas path immediately behind the heater. The electric power supply of the fan is supplied to the terminal box of the economizer by a cable from the 230 V / 50 Hz network (Fig. 56).

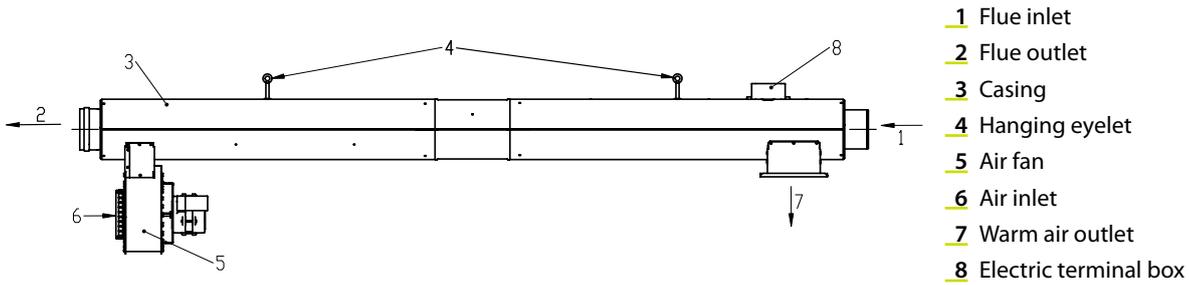


Fig. 54: Economizer AWTM – description

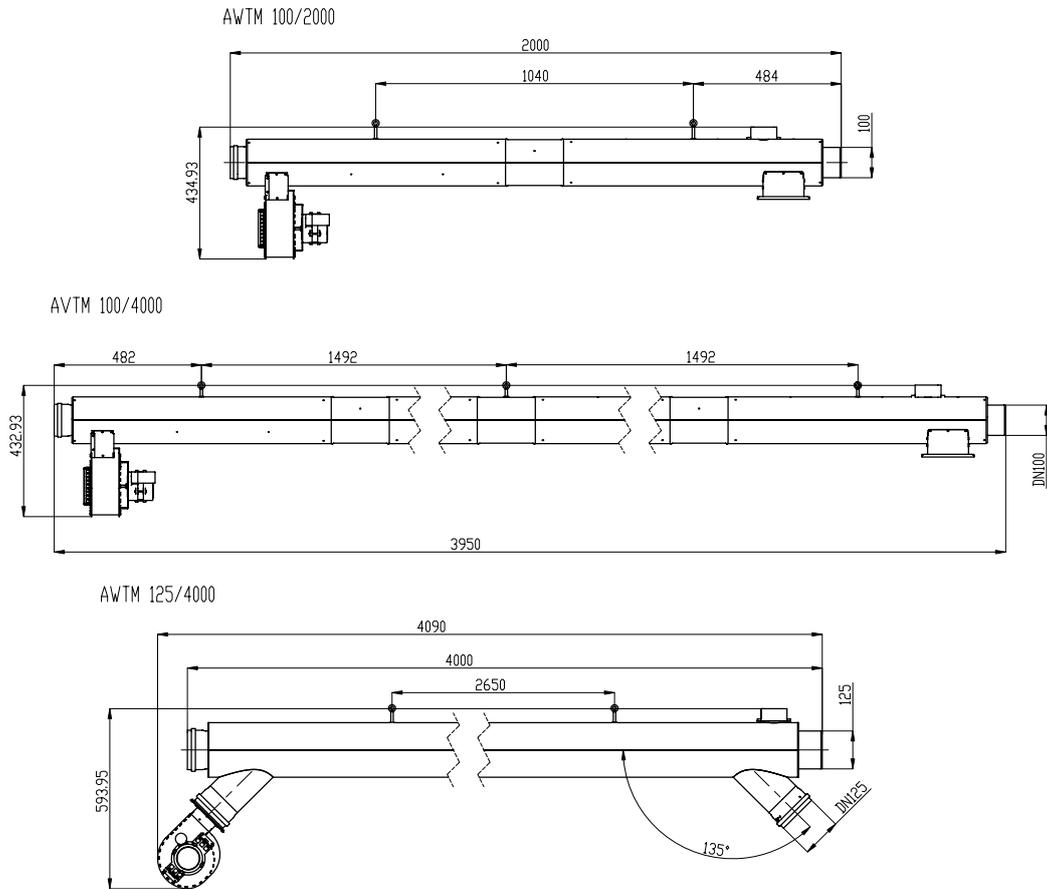


Fig. 55: Economizer AWTM – Dimensions

## Economiser 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.

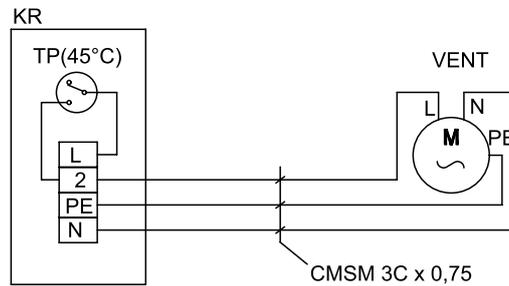
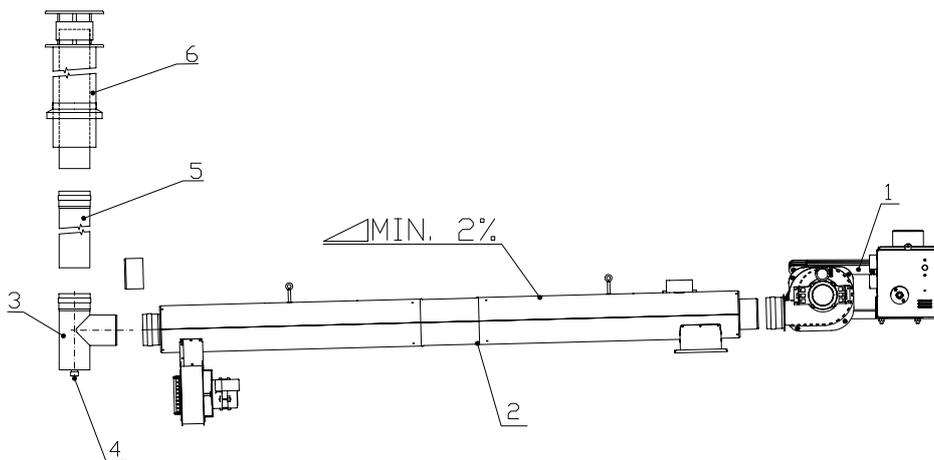


Fig. 56: Economizer AWTM – wiring diagram

## Economiser installation

Economizer is placed in flue system immediately after the tube heater (Fig. 57). 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 economizer is equipped

with hanging bolts which can be used for fine adjustment if its slope. Immediately after economizer, there must be condensate trap with condensate output and output of flue gases out of the building.



### Legenda:

- 1 Infrared heater Helios
- 2 Economizer AWTM
- 3 Condensate trap – Flue gas measurement here
- 4 Condensate output connection 3/4"
- 5 Flue duct
- 6 Roof discharge head

Fig. 57: Economizer AWTM installation diagram

## Technical data

Economizer performance depends on heater adjustment and intake air temperature.

The values given in Table 21 apply to well-adjusted natural gas heater at rated power and air temperature of 20 °C.

Table 21: Technical parameters of AWTM economizers

Type	AWTM 100/2000	AWTM 100/4000	AWTM 125/4000
length [mm]	2,000	3,950	4,040
Weight [kg]	14.5	26	47
El. connection [V/Hz]	230/50		
Electric input[W]	50		75
Air flowrate[m3/h]	600		750
Output with Helios 10	420 W	950 W	–
Output with Helios 20	690 W	1,200 W	–
Output with Helios 30	1,400 W	1,720 W	–
Output with Helios 40	1,900 W	2,350 W	–
Output with Helios 50	–	–	2,300 W
Residual static pressure	45 Pa	35 Pa	35 Pa

## Pressure losses

The economizer increases the pressure loss on the flue gas side, so it must be included in the design of the flue gas path. Pressure losses on the flue gas side are given in *Table 22*. On the secondary air side, which removes heat from the flue gas, the economizer is

equipped with a fan that ensures the flow of secondary air. This fan has a pressure reserve for the connection of another ventilation pipe for the removal of heated air, or for a distribution element. This pressure reserve is shown in *Table 21*.

Table 22: Economizer pressure loss with individual types of heaters

Type	Helios 10	Helios 20	Helios 30	Helios 40	Helios 50
AWTM 100/2000	5 Pa	7 Pa	8 Pa	9 Pa	–
AWTM 100/4000	9 Pa	13 Pa	15 Pa	18 Pa	–
AWTM 125/4000	–	–	–	–	18 Pa

Table 23: Disposable static pressure on air side

Economizer type	Disposable pressure [Pa]
AWTM 100/2000	45 Pa
AWTM 100/4000	35 Pa
AWTM 125/4000	35 Pa

## Economizer accessories

For the distribution of warm air in the working area, it is possible to install an outlet with adjustable slats (Fig. 58) directly on the flange of the economizer. If the economizer is connected to the ventila-

tion duct, it is advisable to use one of the front plates listed in Tab. 24.

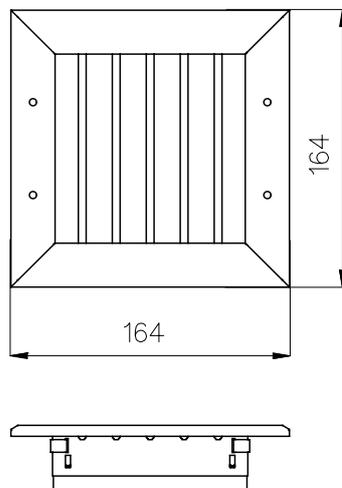


Fig. 58: Outlet with adjustable lamellas for attachment to the economizer flange

Table 24: Front plates for air ducts

Type	Front plate with EKOBOX	
	Pressure loss [Pa]	Acoustic power level [dB]
VVM 600/24 (625/24) 28 37	28	37
VVM 600/48 (625/48) 20,00 30	20	30
VVPM 600(625) 28 41	28	41
VVDM 600(625) 12 33	12	33
ALCM 600 6 22	6	22
ALCM 625 5 21	5	21
ALKM 500 14 27	14	27
VASM 400 18 34	18	34
VAPM 400/D 20 30	20	30

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