GB

Use, Installation and Maintenance Manual
LKH HYBRID CONDENSING WARM AIR HEATER

H2 Ready
Ready Hydrogen 20%

CE

TRANSLATION OF ORIGINAL Manual

VER. 01.2024

Dichiarazione di Conformità
Statement of Compliance

CE

APEN GROUP S.p.A.
20042 Pessano con Bornago (MI)
Via Isonzo, 1
Tel +39.02.9596931 r.a.
Fax +39.02.95742758
Internet: http://www.apengroup.com

Il presente documento dichiara che la macchina:
With this document we declare that the unit:

Modello:	**Generatore d'aria calda ibrido a condensazione LKH**
Model:	***hybrid condensing warm air heater LKH***

è stata progettata e costruita in conformità con le disposizioni delle Direttive Comunitarie:
has been designed and manufactured in compliance with the prescriptions of the following EC Directives:

- **Regolamento Apparecchi a Gas 2016/426/UE**
  Gas Appliance Regulation 2016/426/UE
- **Direttiva compatibilità elettromagnetica 2014/30/UE**
  Electromagnetic Compatibility Directive 2014/30/UE
- **Direttiva Bassa Tensione 2014/35/UE**
  Low Voltage Directive 2014/35/UE
- **Regolamento ErP 2281/2016/CE**
  ErP Regulation 2281/2016/CE
- **Direttiva ROHS II 2011/65/UE e ROHS III 2015/863/UE**
  ROHS II 2011/65/UE and ROHS III 2015/863/UE Directives

è stata progettata e costruita in conformità con le norme:
has been designed and manufactured in compliance with the standards:

- **EN17082:2019**
- **EN60335-1**
- **EN60335-2-102**
- **EN60068-2-78**
- **EN 60068-2-1**
- **EN 60068-2-2**
- **EN55014-1**
- **EN55014-2**

Organismo Notificato:
Notified body:

Kiwa Cermet Italia S.p.A
0476
PIN 0476DN1714

La presente dichiarazione di conformità è rilasciata sotto la responsabilità esclusiva del fabbricante
This declaration of conformity is issued under the sole responsibility of the manufacturer

Pessano con Bornago
05/06/2024

Apen Group S.p.A.
Un Amministratore
Mariagiovanna Rigamonti

CODE

SERIAL NUMBER

VER. 01.2024

UK Declaration of Conformity

APEN GROUP S.p.A.
20042 Pessano con Bornago (MI)
Via Isonzo, 1 - ITALY
Tel +39.02.9596931 r.a.
Fax +39.02.95742758
Internet: http://www.apengroup.com

With this document we declare that the unit:

Model:	***Hybrid Condensing Warm Air Heater* LKH**

has been designed and manufactured in compliance with the prescriptions of the following Regulations:

- **Regulation 2016/426 on gas appliances as brought into UK law and amended**
- **Electrical Equipment (Safety) Regulations 2016**
- **Electromagnetic Compatibility Regulations 2016**
- **The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012**
- **ErP Regulation 2016/2281/UE**

has been designed and manufactured in compliance with the standards:

- **EN17082:2019**
- **EN60335-1**
- **EN60335-2-102**
- **EN55014-1**
- **EN55014-2**
- **EN 60068-2-1**
- **EN 60068-2-2**
- **EN 60068-2-78**

Notified body:
Kiwa UK
0558
PIN 0476DN1714

This declaration of conformity is issued under the sole responsibility of the manufacturer

Pessano con Bornago
05/06/2024

Apen Group S.p.A.
Un Amministratore
Mariagiovanna Rigamonti

CODE

SERIAL NUMBER

TABLE OF CONTENTS

1. GENERAL CAUTIONS

This manual is an integral part of the product and must always accompany it.
Should the equipment be sold or passed on to someone else, always make sure that this manual is supplied with the equipment for future reference by the new owner and/or installer.

The manufacturer shall not be held civilly or criminally responsible for injuries to people or animals or damages to things caused by incorrect installation, calibration and maintenance or by failure to follow the instructions contained in this manual or by operations carried out by unqualified staff.

This product must be used only for the applications for which it was designed or approved. Any other use must be regarded as hazardous. Improper use may impair the operation, service life and safety of the unit.

During the installation, operation and maintenance of the equipment described in this manual, the user must always strictly follow the instructions given in all the chapters of this use and instruction manual.

ATTENTION: The warm air heater must be installed in compliance with current regulations, according to the manufacturer's instructions and by qualified staff, technically specialised in the heating and gas system field.

First start-up, conversion between different types of gas and maintenance operations must be carried out only by suitably qualified staff of Technical Service Centres complying with the requisites required by the regulations in force in their country. Maintenance must be carried out with methods and timescales in compliance with the regulations in force in the country where the appliance is installed.

For Italy, the “technical service” tab of Apen Group website www.apengroup.com indicates several Technical Service Centres that the user can contact to have the first start-up, adjustment and maintenance of the product carried out according to law 37/2007 (ex 46/90)

For more information, visit our website www.apengroup.com or contact Apen Group directly.

The warranty conditions are specified on the warranty certificate supplied with this equipment.

2. SAFETY-RELATED WARNINGS

This chapter describes the safety instructions to be followed by machine operators.

2.1. Fuel

Before starting up the heater, make sure that:
- the gas mains supply data are compatible with the data stated on the nameplate;
- the combustion air intake ducts (when fitted) and the flue gas pipes are only those specified by the manufacturer;
- the combustion air is supplied in such a way as to avoid even partial obstructions of the intake grille (caused by leaves etc.);
- the gas seal of the feeding system has been tested and approved in compliance with the applicable standards;
- the heater is supplied with the same type of fuel it has been designed for;
- the system is correctly sized for such flow rate and is fitted with all safety and monitoring devices required by applicable standards;
- the inside of the gas pipes and air distribution ducts for ducted heaters have been thoroughly cleaned;
- the fuel flow rate is suitable for the power required by the heater;
- the fuel supply pressure is between the range specified on the nameplate.

ATTENTION: When connecting gas supply pipe to gas valve, do not tighten excessively in order to avoid damaging sealing gaskets. (See paragraph 5.9 "GAS Connection")

2.2. Gas Leaks

If you smell gas:
- do not operate electrical switches, the telephone or any other object or device that can cause sparks or naked flames;
- immediately open doors and windows to create an air flow to vent the gas out of the room;
- close the gas valves;
- switch off the power supply via a disconnector outside the unit;
- move away from the unit
- call for **qualified staff.**
- call the **Fire Brigade.**

NOTE: IT is strictly prohibited to supply gas to the circuit with pressures higher than 60 mbar. Such pressures could cause the valve to break.

2.3. Power supply

The heater must be correctly connected to an effective earthing system, made in compliance with current regulations (IEC 64-8, applies to Italy only).

Cautions

- Check the efficiency of the earthing system and, if required, call out a qualified engineer.
- Check that the mains power supply is the same as the power input stated on the equipment nameplate and in this manual.
- Do not mistake the neutral for the live wire.
- The heater can be connected to the mains power supply with a plug-socket only if the latter does not allow live and neutral to be swapped.
- The electrical system and, more specifically, the cable section, must be suitable for the equipment maximum power input, shown on the nameplate and in this manual.
- Do not pull electric cables and keep them away from heat sources.

NOTE: upstream of the power supply cable, the installation of a fused multipole circuit breaker, overvoltage category III, is mandatory. The switch must be visible, accessible and less than 3m away from the control board. All electrical operations (installation and maintenance) must be carried out by qualified staff.

2.4. Use

“The appliance may be used by children of at least 8 years of age and by persons with reduced physical, sensory or mental capabilities, or lack of experience or the necessary knowledge, provided that they are supervised or have been instructed in the safe use of the appliance and understand the dangers involved. Children must not play with the device. Cleaning and maintenance intended to be carried out by the user must not be done by unsupervised children.”

The following instructions must be followed:

- do not touch the equipment with wet or damp parts of your body and/or with bare feet;
- do not leave the equipment exposed to the elements (rain, sun etc...) unless it is adequately protected;
- do not use the gas pipes to earth electrical equipment;
- do not touch the hot parts of the heater, such as the flue gas duct;
- do not wet the heater with water or other fluids;
- do not place any object over the equipment;
- do not touch the moving parts of the heater.

2.5. Maintenance

NOTE: Maintenance operations and combustion inspections must be carried out in compliance with current standards.

Before carrying out any cleaning and maintenance operations, isolate the boiler from the mains power supply using the switch located on the electrical system and/or on the shut-out devices.

If the heater is faulty and/or incorrectly operating, switch it off and do not attempt to repair it yourself, but contact our local Technical Service Centre.
All repairs must be carried out by using genuine spare parts. Failure to comply with the above instructions could compromise the safety of the equipment and invalidate the warranty.
If the equipment is not used for long periods, shut the gas supply off through the gas stopcock and disconnect it from the power supply.
If the heater is to be put out of service, in addition to the above operations, potential sources of hazard on the unit must be disabled.
It is strictly forbidden to obstruct the Venturi pipe inlet, located on the burner-fan unit, with your hands or with any other objects. Any obstruction could cause a backfire from the premixed burner.

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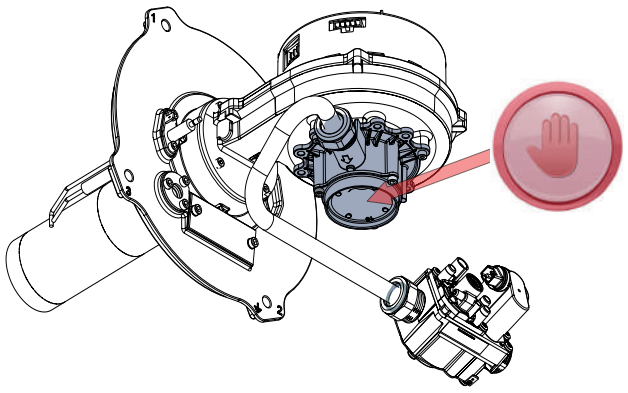

DO NOT COVER IT WITH YOUR HAND OR OTHER OBJECTS!

2.6. Transport and Handling

The heater is delivered fastened to a pallet and covered with a suitably secured cardboard box.
Unload the heater from the truck and move it to the site of installation by using means of transport suitable for the shape of the load and for the weight.
If the unit is stored at the customer's premises, make sure a suitable place is selected, sheltered from rain and from excessive humidity, for the shortest possible time.
Any lifting and transport operations must be carried out by skilled staff, adequately trained and informed on the working procedures and safety regulations.
Once the equipment is moved to the correct position, the unpacking operation can be started.

2.7. Unpacking

The unpacking operation must be carried out by using suitable tools or safety devices where required. Recovered packaging materials must be separated and disposed of according to applicable regulations in the country of use. While unpacking the unit, check that the unit and all its parts have not been damaged during transport and match the order. If damages have occurred or parts are found to be missing, immediately contact the supplier. The manufacturer is not liable for any damages occurred during transport, handling and unloading.

Packing material disposal
The packing safeguards the product from transport damages. All the materials used are environmentally friendly and recyclable. Please contact a specialised distributor or your local administration for more information on waste disposal.

2.8. Disposal and Demolition

Should the machine be dismantled or demolished, the person in charge with the operation shall proceed as follows:
Disposal of end-of-life products

This equipment is marked in compliance with European Directive 2012/19/EU on waste electrical and electronic equipment (WEEE). This Directive defines the rules for collecting and recycling waste equipments throughout the entire territory of the European Union.
WEEE contains both pollutants (that can negatively affect the environment) and raw materials (that can be reused). IT is therefore necessary to subject WEEE to appropriate treatments, in order to remove and safely dispose of pollutants and to extract and recycle raw materials. IT is forbidden to dispose of WEEE as unsorted waste. These operations facilitate recovery and recycling of the materials, thus reducing the environmental impact.

NOTE: All materials recovered will be processed and disposed of according to what provided for by the laws in force in the country of use and/or according to the standards indicated in the safety sheets of the chemicals.

INFORMATION FOR DISPOSAL valid in ITALY (Legislative Decree 49/2014)
The heaters and relating accessories are considered "professional WEEE - waste electrical and electronic equipment". According to the legislation in force in Italy, professional WEEE must be sent to treatment plants suitable for these types of waste. Please contact the Apen Group for end-of-life products so as to obtain all the information necessary for their correct waste disposal, which is possible thanks to the Collective System (Union) to which the company is associated. Please remember that product disposal without complying with the mode described above is a violation liable to administrative and penal sanctions.

INFORMATION FOR DISPOSAL valid abroad (EU COUNTRIES except Italy).
The European Directive 2012/19/EC shall be implemented in every EU member state. There may be different application modalities for the various member states, even in terms of modality for waste disposal depending on its type (House-hold or Professional WEEE). To this regard at the end of the life of the product, we highly recommend you call the distributor or installer so as to obtain information on the correct disposal, in compliance with the existing laws of the installation country.

2.9. Installation

The LKH heat exchanger must be used in the following conditions:
- The fuel used must have a sulphur content according to the European standard, namely: maximum peak, for short periods, 150 mg/m3, annual average lower than 30 mg/m3;
- Combustion air must not contain chlorine, ammonia, alkalis, sulphides or sulphur derivatives; for example, installation near swimming pools or laundries exposes the unit to the effects of such agents; if this is the case it is necessary to take air from the outside.
- If air is taken from the outside, position the relevant terminals away from air renewal systems or extractors.

ATTENTION: Do not install where leakages of oils in the atmosphere (e.g. dietary fats) are present.

ATTENTION: Do not use in particularly aggressive environments or with potentially corrosive atmospheres (e.g. in animal or livestock breeding environments) that can generate corrosion or rust on the metal parts of the generator components.

ATTENTION: Do not use in extreme operating conditions or in any case outside the operating ranges provided for by the manufacturer.

3. TECHNICAL FEATURES

The LKH-KONDENSA HYBRID series modulating warm air heaters have been designed for heating and conditioning of industrial and commercial environments.
The heater consists of a gas condensing heat exchanger combined with a water finned coil. The coil can be supplied by an external heat pump or other source of hot\cold water. The system thus composed is capable of providing a combined heat output of 44 kW in heating mode and 11.5 kW in conditioning mode.

Based on the external conditions and the user's needs, the Smart X programmable thermostat is able to run the heater in the best conditions, activating only one or both heat generation systems: gas heat exchanger and water coil.
The water coil ensures maximum energy savings with the use of renewable energy, while the gas heat exchanger allows the demand to be met in all external conditions.

The heater PCB continually modulates the heat output between the minimum and maximum power, according to heating requirements.
The control located on the front panel allows the service centre to check and view the working phases and identify any faults that may have occurred.

The units can be controlled in three ways:
- externally via modbus (through Smart X)
- with NTC1 temperature probe

Gas heat exchanger
The heat exchanger complies with the manufacturing requirements for condensing warm air heaters, according to prevailing standards (EN17082:2019).

The entire gas heat exchanger is made of AISI 441 sheet metal to offer high resistance to condensation and high temperature. The following table shows the conversion of stainless steels used:

USA-AIS	EN-No.	COMPOSITION
AISI 441	1.4509	X2 CrTiNb 18

The innovative design and large heat exchanging surface of the combustion chamber and of the pipes ensure optimum efficiency and durability.
The burner is made entirely of stainless steel with special mechanical solutions to ensure optimal reliability and performance levels, as well as high thermal and mechanical resistance.

Inherent Safety
The efficiency increase at minimum power is achieved by using a sophisticated air/gas mixing technique and by regulating at the same time the combustion air flow and the fuel gas flow.
This technology increases the heater safety as the gas valve supplies the fuel according to the air flow. Unlike atmospheric burners, the CO_2 content remains constant throughout the heater operating range, allowing the heater to increase its efficiency when the heat output reduces.

If there is no combustion air, the valve will not supply gas; if the combustion air flow reduces, the valve will automatically reduce the gas flow yet will keep its combustion parameters at optimal levels.

Low emissions
The premixed burner, in combination with the air/gas valve, ensures "clean" efficient combustion having very low emissions.

Water coil
The water coil integrated in the LKH heater is made of copper tubes and shaped aluminium fins to increase heat exchange efficiency.
The coil is already equipped with a vent valve.
Below it there is the condensate collection tray for summer use.

Heat pump HP
An ApenGroup or other supplier's HP or other hot\cold water source must be connected to supply the water coil on board the LKH heater. In the first case, it will be possible to control all the parameters of the HP, having a complete and integrated management of the system, by using the Smart X programmable thermostat; in the last two cases, on the other hand, it will only be possible to manage the ON/OFF command, season change and the signalling of any HP alarms.

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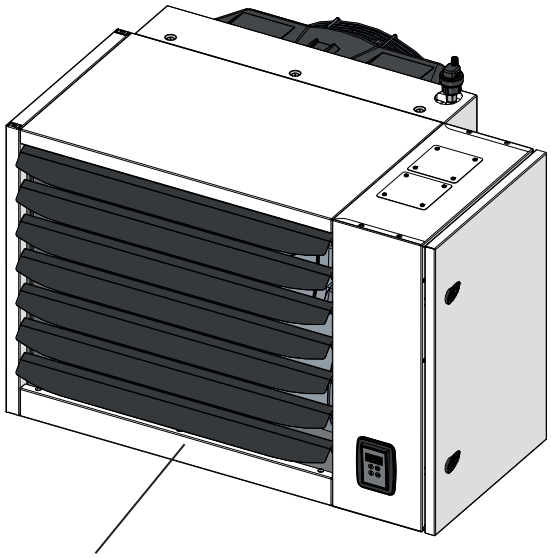

ATTENTION: Before switching the heater on, open the louvers by at least 45°.

3.1. Technical Data

General data		LKH044	
EC approval	PIN.	0476DN1714	
		Heating performance	
Rated power	kW	15.2 (Coil) +28.8 (GAS Heat exchanger)	
		Conditioning performance	
Rated power	kW	11.5 (Coil)	
		Electrical Characteristics	
Supply voltage	V	230 Vac - 50 Hz single-phase	
Rated power	kW	0.1	0.3
Protection Rating	IP	IP 20	
Operating Temperatures	°C	0°C to +40°C	
Storage Temperatures	°C	-25°C to +60°C	
		Air flow rate	
Air flow rate (15°C)(7)	m^3/h	1920-3820	
Number and diameter of fans		1 X Ø450 (EC)	
Fans speed	rpm	1280	
Sound pressure (Lp) (8)	dB(A)	49	
		Weight	
Net Weight	kg	81	
Weight with packaging	kg	101	

Finned coil data		LKH044
Max. operating pressure	bar	16
Water content	l	3.2
Water connection Ø	GAS	UNI/ISO 228/1- G 1"
MAX water temperature	°C	85

Finned coil performance

Heating							
IN air T	Volt	Air flow rate	Heat output	Sensitive heat output	IN H_2O T	Water flow rate	Water heat loss
°C	V	m^3/h	kW	kW	°C	m^3/h	kPa
15	5.4	2060	12.85	-	45	2.34	19
15	6.6	2590	14.93	-	45	2.34	19
15	9.4	3820	18.94	-	45	2.34	19
Conditioning							
30 (50% r.h.)	5.0	1920	11.5	6.8	7	1.98	18

NOTES:
* Symbol in compliance with Reg.EU/2281/2016.
(1) With natural gas mixture with 20% hydrogen rated heat input decreased by 5%.
(2) Max. condensation produced acquired from testing at Qmin.
(3) Value referred to cat. H (G20)
(4) Weighted value to EN17082 ref. to cat. H (G20), referred to net calorific value (Hi, N.C.V).
(5) Weighted value to EN17082 ref. to cat. H (G20), referred to gross calorific value (Hs, G.C.V).
(6) The gas line must be dimensioned according to the length of the routing and not to the heater input diameter.
For countries requiring an ISO connection different from the one shown, an adaptor will be supplied.
(7) Calculated according to ISO 5801- 2007
(8) Measured at a distance of 6 m from the machine.

GAS heat exchanger data		LKH044	
Type of equipment		B23 - B23P - C13 - C33 - C53 - C63	
EC approval	PIN.	0476DN1714	
NOx class [EN17082:2019]	Val	5	
Type of fuel		Gaseous	
		Heater Performance	
		min	max
Burner heat output (Hi) (1)	kW	7.5	30.0
Useful heat output [P_{min}, P_{rated}]*	kW	8.1	28.8
Hi Efficiency (N.C.V.) [η_{pl}, η_{nom}]*	%	108.0	96.0
Hs efficiency (G.C.V.) [η_{pl}, η_{nom}]*	%	97.2	86.5
Flue losses with burner on (Hi)	%	0.5	4.0
Flue losses with burner off (Hi)	%	<0,1	
Max. flue gas condensation quantity (2)	l/h	0.9	
		Flue gas emissions	
Carbon monoxide - CO - (0% of O_2) (3)	ppm	< 5	
Emissions of nitrogen oxides - *NOx*** (0% of O_2) (Hi) (4)		58 mg/kWh - 32.8 ppm	
Emissions of nitrogen oxides - *NOx*** (0% of O_2) (Hs) (5)		52 mg/kWh - 30 ppm	
Pressure available at the flue	Pa	100	
		Flue gas temperature, CO_2 content and flue gas mass flow rate: see "Gas settings tables"	
		Connections	
Ø gas connection (6)	GAS	UNI/ISO 228/1- G 3/4"	
Intake/exhaust pipes Ø	mm	80/80	
		Air flow rate	
Air flow rate (15°C)(7)	m^3/h	2060	3820
Air temperature increase	°C	11.3	21.6

NOTES:
* Symbol in compliance with Reg.EU/2281/2016.
(1) With natural gas mixture with 20% hydrogen rated heat input decreased by 5%.
(2) Max. condensation produced acquired from testing at Qmin.
(3) Value referred to cat. H (G20)
(4) Weighted value to EN17082 ref. to cat. H (G20), referred to net calorific value (Hi, N.C.V).
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(8) Measured at a distance of 6 m from the machine.

3.2. REGULATION (EU) 2016/2281

Product Information in accordance with Annex 2 point 5 a)

Model:	See table
Warm air heaters B1 [yes/no]:	No
Warm air heaters C2 [yes/no]:	No
Warm air heaters C4 [yes/no]:	No
Type of fuel [gaseous/liquid/electricity]:	Gaseous

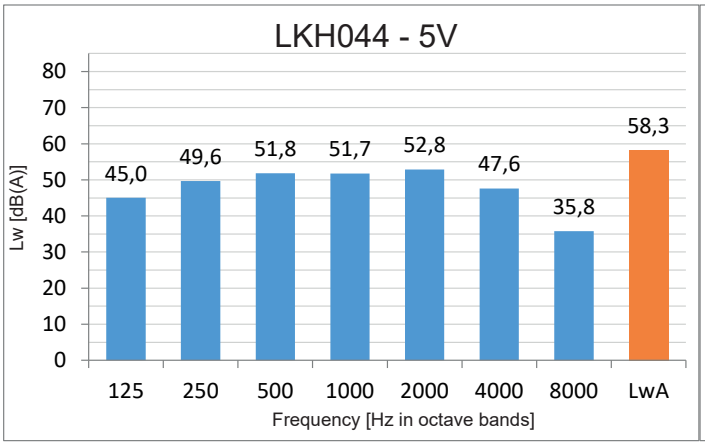
Model	Capacity		Useful efficiency		Other elements					Power consumption		
	Rated heating capacity	Minimum capacity	Useful efficiency at rated heating capacity	Useful efficiency at minimum capacity	Casing loss factor	Ignition burner consumption	Emissions of nitrogen oxides	Output efficiency	Seasonal space heating energy efficiency	At rated heating capacity	At minimum capacity	In stand-by mode
	$P_{rated,h}$	P_{min}	η_{nom}	η_{pl}	F_{env}	P_{ign}	NO_x	$\eta_{s,flow}$	$\eta_{s,h}$	el_{max}	el_{min}	el_{sb}
	kW	kW	%	%	%	kW	mg/Wh ref.CV	%	%	kW	kW	kW
LKH044	28.8	8.1	86.5	97.2	0.0	0.0	52.3	95.64	91.27	0.055	0.010	0.005

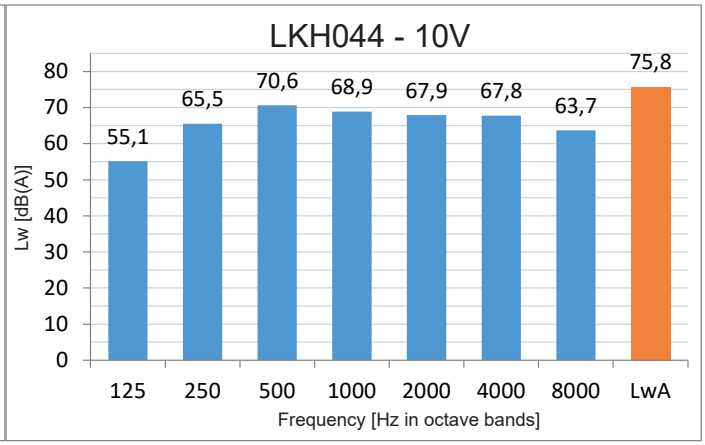
3.3. Noise

Sound power

The sound power of a source (energy emitted per unit time) is a characteristic of the same source and does not depend on the environment in which the sound is emitted: this measurement allows comparing the noise of different machines.
The sound power of the LKH warm air heaters has been measured in a reverberation room according to the following standard:

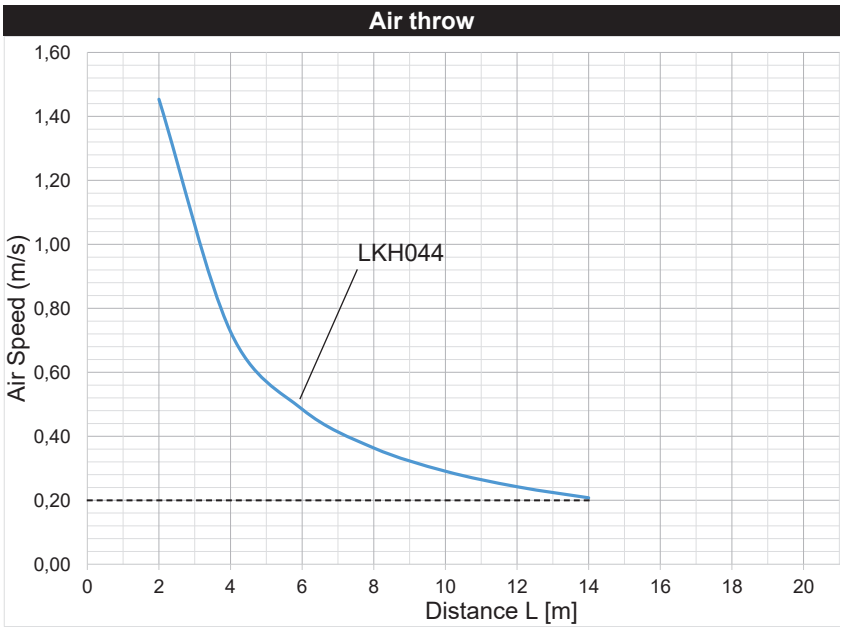
ISO 3741 Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for reverberation test rooms



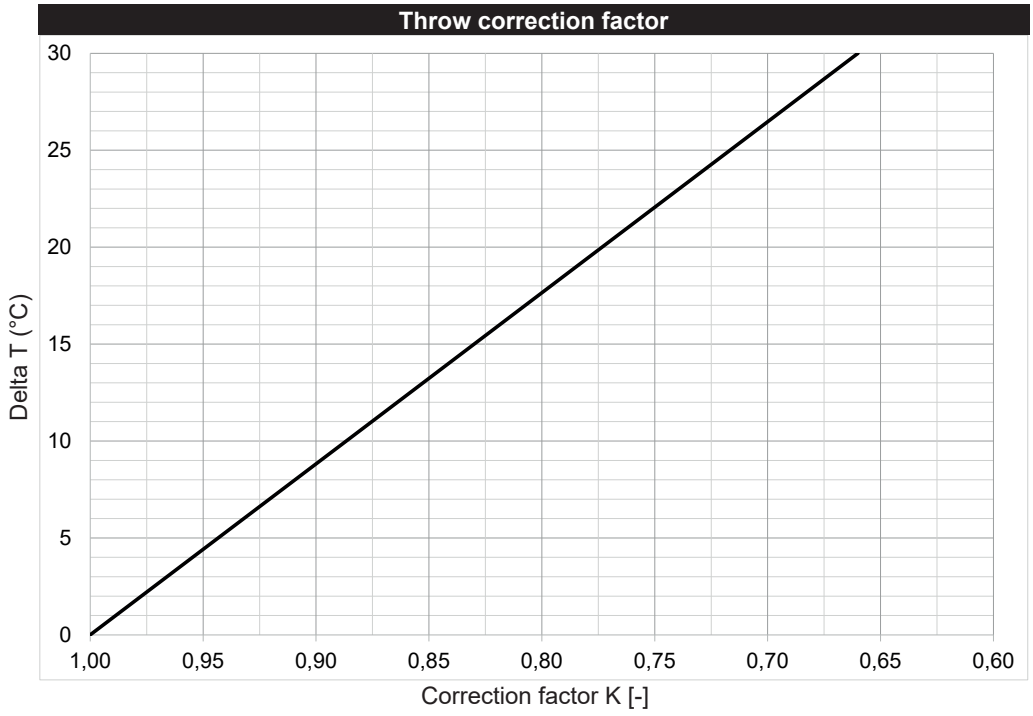


3.4. Air flow performance

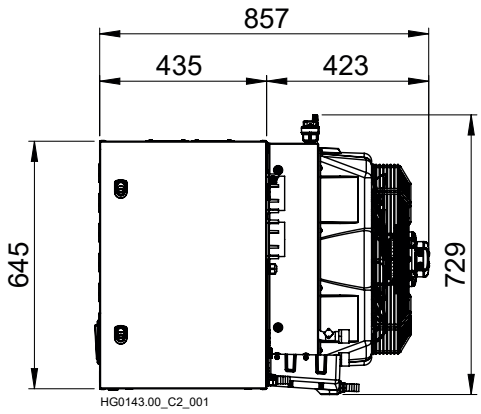
The air flow range, or air throw, is the distance reached by the air jet before its speed decreases and equals the reference speed, assumed to be 0.2 m/s.
The throw depends on the speed of the air leaving the heater, which in turn depends on the air flow rate and on the section of the heater air passage.
Below is a graph showing the air speed as a function of the distance from the heater outlet. The curves shown in the graph refer to isothermal air throw conditions (i.e. with the warm air heater switched off and therefore at constant air temperature over the entire supply surface), at maximum fan speed and with horizontal and parallel supply fins.
In non-isothermal conditions (warm air heater in heating mode), the air throw is reduced proportionally to the temperature difference

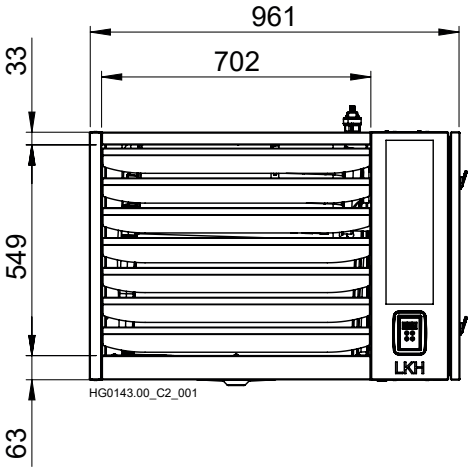


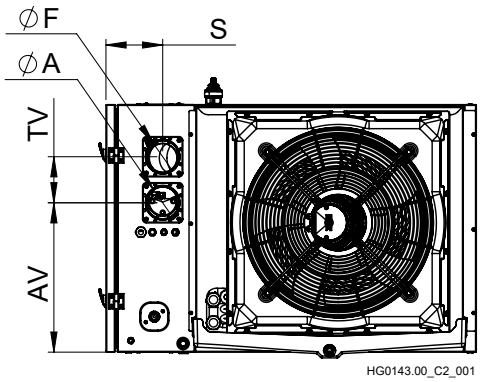
between the warm supply air and the room air ("air temperature increase" ΔT values - see table in paragraph 3.1 "Technical Data").
For example, with a ΔT of 15K, the throw is about 83% of the isothermal throw.
The corrected throw value (Lc) on the basis of the ΔT is as follows: **Lc = L * K**

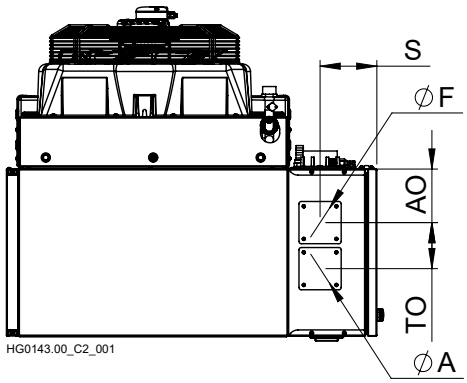


3.5. Dimensions



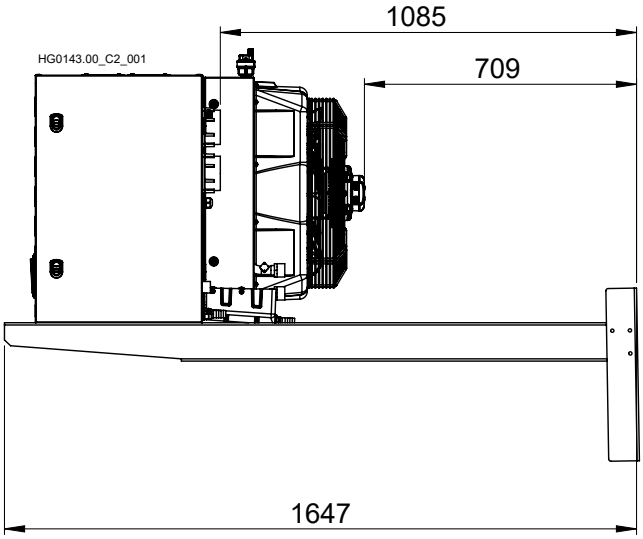


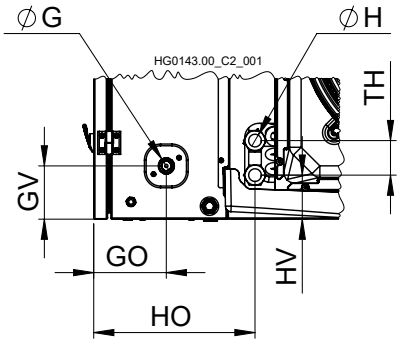




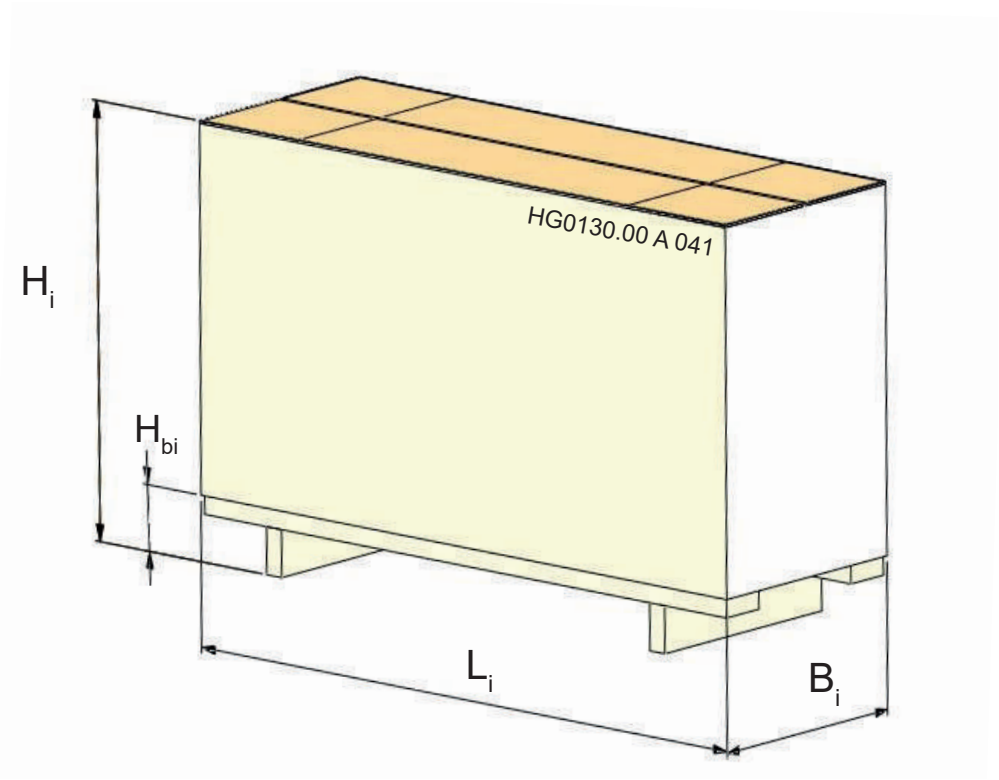
Mod. [mm]	Horizontal exhausts (STD)				
	A	F	AV	TV	S
LKH044	80	80	390	120	145

Mod. [mm]	Vertical drains (OPT.)				
	A	F	AO	TO	S
LKH044	80	80	140	120	145





Mod. [mm]	GAS connection			WATER connection			
	ØG	GO	GV	ØH	HO	HV	TH
LKH044	3/4"	125	93	1"	280	77	60



Mod. LKH [mm]	Packaging			
	Bi	Li	Hi	Hbi
LKH044	885	1030	800	112

4. USER'S INSTRUCTIONS

4.1. Operating Cycle

LKH suspended heaters can operate only if combined with the SMART X WEB or SMART X EASY touchscreen remote control, which manages the combined operation of the two technologies that compose the hybrid system. The management will be complete if an ApenGroup's HP is present, controlling all its parameters; otherwise it will be partial, managing only the ON/OFF command, season change and any alarms of the other supplier's HP.
The operation of LKH heaters is fully automatic; they are fitted with an electronic device with self-check functions that manages all the burner control and monitoring operations and with a microprocessor based electronic PCB that controls the heat output regulation.

The boiler is switched on when the following three conditions are met:
- heater powered on and not locked out
- contact closed on ID0-GND terminals of the heater PCB (already closed by default)
- heat demand met

In these conditions the burner fan will be immediately started; after pre-cleaning time has elapsed, the flame will light up with an ignition power equal to approximately 30% of its maximum output. Once the flame stabilising time has expired, the burner will start to modulate its heat output according to the temperature measured by the NTC1 probe and by the Smart X probe.
If there is no flame during the ignition phase, the heater will make other 4 ignition attempts, if the last attempt is also not successful, the heater will be locked out.
The heater is switched off following the termination of the Smart X heat demand or the opening of the ID0-GND contact.
Disconnecting the power supply is prohibited, except for emergencies because, when the heater is switched off, the burner fan will continue to work for approximately 90 seconds to clean up the combustion chamber (combustion chamber post-cleaning phase) and the external fan for approximately 150 seconds.
Failure to perform the post-cooling operations on the exchanger will cause:
- a shorter lifetime of the exchanger and the guarantee will be null and void;
- the safety thermostat to operate and the associated requirement to manually reset the heater.

If, during the cooling cycle, there is a new demand for heat, the modulation PCB will wait for the cooling fans to shut down and then reset the counters and start a new cycle.

IMPORTANT: Powering off the machine before completing the cooling cycle and/or with machine set to ON is strictly prohibited. Failure to follow these instructions shall invalidate the warranty and cause early deterioration of the heat exchanger.

4.2. Interface Panel

The LKH heaters are fitted as standard with a multifunction LCD panel located on the front side of the suspended heater, which is used to control, configure and diagnose all operating parameters of the equipment.
To ensure operation, do not move the panel away from the heater.
The panel is fitted with a red 3-digit LCD display and with four function keys: ↑ , ↓ , ESC and ENTER; the display allows the user to display the heater operating mode and its Faults. It also allows the service centre to change the main operating parameters.
Changing parameters requires a password.

Viewing the machine status
The machine status is shown on the display by the following wordings:

rdy	OFF FROM SUPERVISOR Unit off and waiting for ON command from the supervisor (Smart X or another Modbus system).
Sty	REMOTE OFF Unit turned off by ID0/GND remote digital input not provided for this product
rOF	Temperature control OFF condition (REG_0X condition met)
OFF	OFF FROM LCD PANEL Unit turned off from LCD control on board of the machine
Exx	OFF FROM ALARM Unit turned off from Exx alarm. (e.g. "E10") **Any heat demands will be ignored**
HEA	UNIT RUNNING (Heating)
Air	UNIT RUNNING (Ventilation)
COO	UNIT RUNNING (Conditioning)
SAn	UNIT RUNNING (Domestic) not provided for this product
Axx	Unit address; The display will show the address assigned to the module alternating it with the operation in progress. (e.g. "A01")

NOTE: During normal operation, the display will show "HEA" if the burner is on; "rdy" or "Sty" when the boiler is being switched off; "rOF" if the room control has been met.

If there are communication problems between CPU PCB and LCD panel, the display will show flashing:
"**CPU**" if the problem lies with the CPU;
"**...**" if the problem lies in the display board.
If needs be, check that the display and the PCB are correctly connected and that the small cable RJ11 is securely held in the connector.

Navigating the menu
The menu has three levels. The first and the second are accessible without entering a password, the third requires entering writing-level passwords to change the parameters.
Also with modbus address other than Ø, all parameters can be viewed and/or edited through the LCD panel.
Use the ↑ (up arrow) and ↓ (down arrow) buttons to scroll through

the menus. To select the menu, or select the parameter, press ENTER. The parameter can be changed using the arrows: pressing ↑ (up arrow) increases the parameter by 1, pressing ↓ (down arrow) reduces it by 1. When the arrow keys are pressed for at least three seconds, the parameter scrolling speed is increased. To confirm a change in parameters, press ENTER. A change in the parameter is indicate by the display flashing.
To exit the parameter or menu, press ESC. If you exit the programming function, after about 10 minutes the program will exit the menu and go back to the "machine status" display. All submenus can be scrolled from the bottom to the top, and they start over when the end of the menu is reached.

First level menus
The following information is available on the first level:

Machine status	Provides information on unit operation (rdy/Sty/ rOF/OFF/HEA/Air/COO/SAn)
Axx	Shows the address assigned to the CPU OCB of the unit (0 to 15); it is displayed alternating with "Machine Status" (e.g., "A01" = address1)
Exx	In case of an alarm in progress, shows the error code (e.g. "E10")

Second level menu
The following menus are available on the second level:

Fun	Allows to choose the type of operation: Aut or OFF
rEg	Allows to force the burner at minimum or maximum output in order to perform combustion tests;
dEG	not provided for this product
inP	Allows to display the status of inputs
Out	Allows to display the status of outputs
PAr	Allows to display and edit (after entering the password) parameters of adjustments, functions and controls

Operation - Fun Menu
Allows to select the type of operation of the CPU PCB, between AUT (automatic) and OFF (off).

OFF	Has priority also over external controls (Smart X type)
Aut	Corresponds to ON, the system sets itself up to receive inputs from the remote control (Smart X), adjustments, or external controls

Adjustment - rEg Menu
Allows forcing the burner to operate at maximum (Hi) or minimum (Lo) power, in order to check combustion or for the “chimney sweep” function (the ID0\GND contact must be closed and the burner must be on). The burner returns to the initial state automatically at the end of the set time (about 10 minutes)

Hi	Burner set to maximum output
Lo	Burner set to minimum output

Input - InP Menu
Allows to display the value and/or status of analogue and digital inputs. For the meaning and the default values, please refer to the table CPU PCB Parameters in paragraph 5.7 "Modulation PCB parameters".

nt1	“Value” for NTC1 probe temperature (modulation)
nt2	“Value” for NTC2 probe temperature (not used)
nt3	“Value” for NTC3 probe temperature (not used)
An0	“Value” for Number of flue gas fan revolutions (Premix)
An1	“Value" for Analogue input voltage B1 (0-10V)
An2	“Value" for Analogue input voltage B2 (0-10V)
An3	"Value" for Analogue input B3 (not used)
id0	Open/closed status of "OPn/CLS" Id0 digital input (remove ON/OFF)
id1	Open/closed status of "OPn/CLS" Id1 digital input (Remote Reset)
id2	Open/closed status of "OPn/CLS" Id2 digital input (*EXTERNAL heat pump alarm (Fault E50)*)
id3	Open/closed status of "OPn/CLS" Id3 digital input
id4	Open/closed status of "OPn/CLS" 230 Vac Id4 input (1=contact closed; 0=alarm E24 in progress)
id5	Open/closed status of "OPn/CLS" 230 Vac Id5 input (1=contact closed; 0=alarm E25 in progress)

Output - Out Menu
Allows to display the value and/or status of analogue and digital outputs. For the meaning and the default values, please refer to the table CPU PCB Parameters in paragraph 5.7 "Modulation PCB parameters".

y0	"Value" of PWM (%) for flue gas fan (premix)
y1	"Value" for Y1 output (PWM %)
y2	“Value” for Y2 output (0-10 Vdc) - EC fan(s)
y3	“Value” for Y3 output (0-10 Vdc)
ion	"Value" (%) of flame detection signal (100: value >2mA)
U1	Open/closed status of "OPn/CLS" Q1 output (CPU Lockout signal)
U2	Open/closed status of "OPn/CLS" Q2 output (EXTERNAL Heat pump ON/OFF signal)
U3	Open/closed status of "OPn/CLS" Q3 output (EXTERNAL Heat pump Conditioning ON signal)
rL1	Open/closed status of "OPn/CLS" RL1 relay (0=circulator/fan OFF; 1=circulator/fan ON)

Parameters - PAr Menu
Allows to display, and edit, the value of the main parameters of the CPU PCB. For the meaning and the default values, please refer to the table CPU PCB Parameters in paragraph 5.7 "Modulation PCB parameters".
By entering the menu, it is possible to display parameter values inside the relevant submenus

rGL	(adjustments parameters)
CrL	(controls parameters)
Fnu	(functions parameters)
rtU	(modbus serial parameters)

In order to change the value of the parameters, the password must be entered in the **Abi** submenu.

Entering the password

- From the home screen (rdy/Sty/rOF/OFF/HEA/Air/COO/SAn/EXX) press ENTER then use the ↑ (up arrow) and ↓ (down arrow) arrows to go to the PAR item; use the ↑ (up arrow) and ↓ (down arrow) arrows to go to the ABI item and press ENTER;
- Set the password inside the ABI menu and confirm it with ENTER (the flashing display will confirm that the parameter has been stored);
- Press ESC to return to the PAR menu
- Move with the ↑ and ↓ arrows to scroll within the PAR menu to the desired submenu item (rGL, CrL, Fnu, rtU);
- Press ENTER to access the submenu;
- Use the ↑ and ↓ arrow keys to select the parameters to be displayed and edited;
- Press ENTER to display the parameter value;
- Use the ↑ and ↓ arrows to edit the value;
- Press ENTER to confirm the change made;
- To exit the parameter and the menu, press ESC until the home screen is displayed.

4.3. Reset

The modulation PCB allows the operator to identify more than 30 different causes of lockouts. This allows a precise diagnostics managing each event very accurately.
To reset a lockout, press both ↑ and ↓ arrows simultaneously for a few seconds.
It is possible to reset the lockouts remotely using one of the following solutions:

- the digital input ID1-GND - button N.O.;
- the Smart X Web/Easy control
- the ModBus protocol, if implemented by the customer.

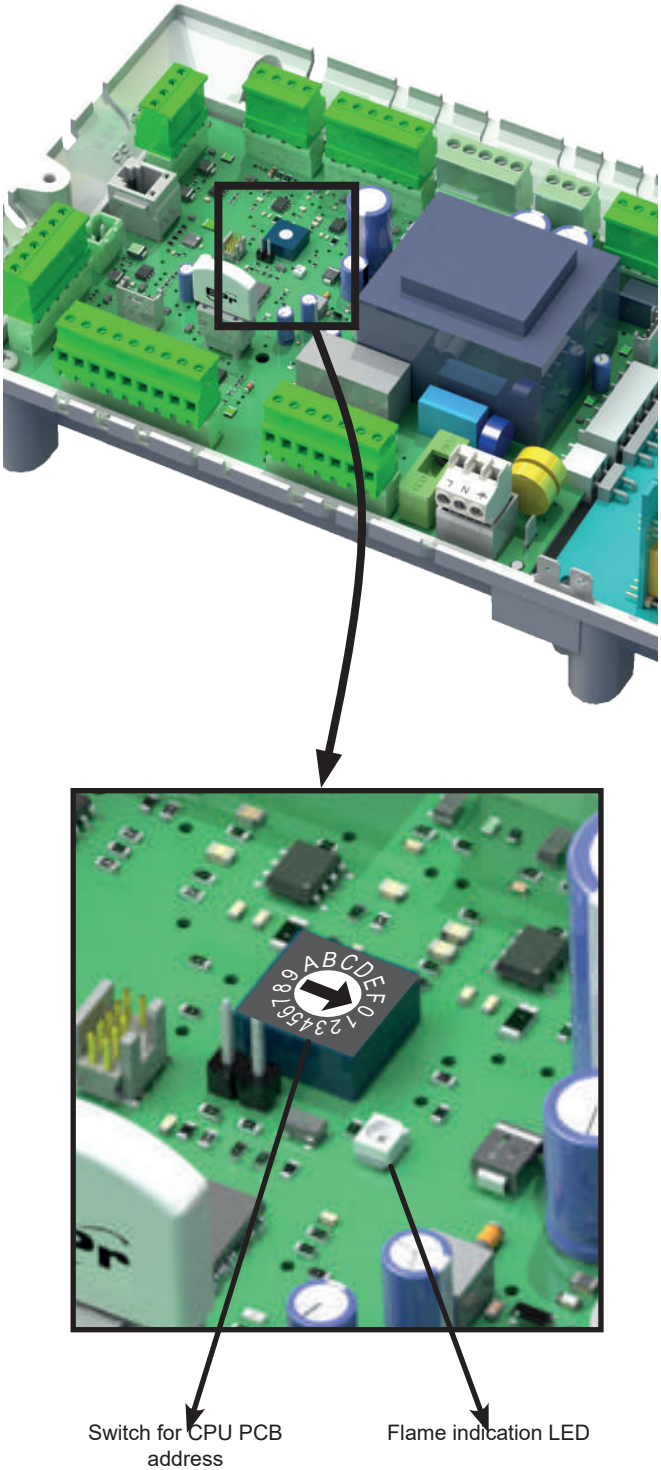
If ignition fails, the flame monitoring PCB reattempts ignition four times. After four failed attempts, it will lock out and will display the code E10.
The code of lockouts and their cause are shown in the ERRORS table in paragraph 5.8 "Analysis of lockouts- faults".
If the flame monitoring equipment has locked out (errors from E10 to E22), it can be reset by using the dedicated button on the equipment itself. This type of lockout is also shown by a warning LED that lights up.

ATTENTION: The flame monitoring equipment stores the number of manual resets that are performed remotely over time. If ignition fails with more than 5 resets performed in 15 minutes it switches to "timed" lockout (E13). In this case, it is required to wait another 15 minutes before remotely resetting it again. The reset button on the equipment allows to reset lockout E13 immediately.

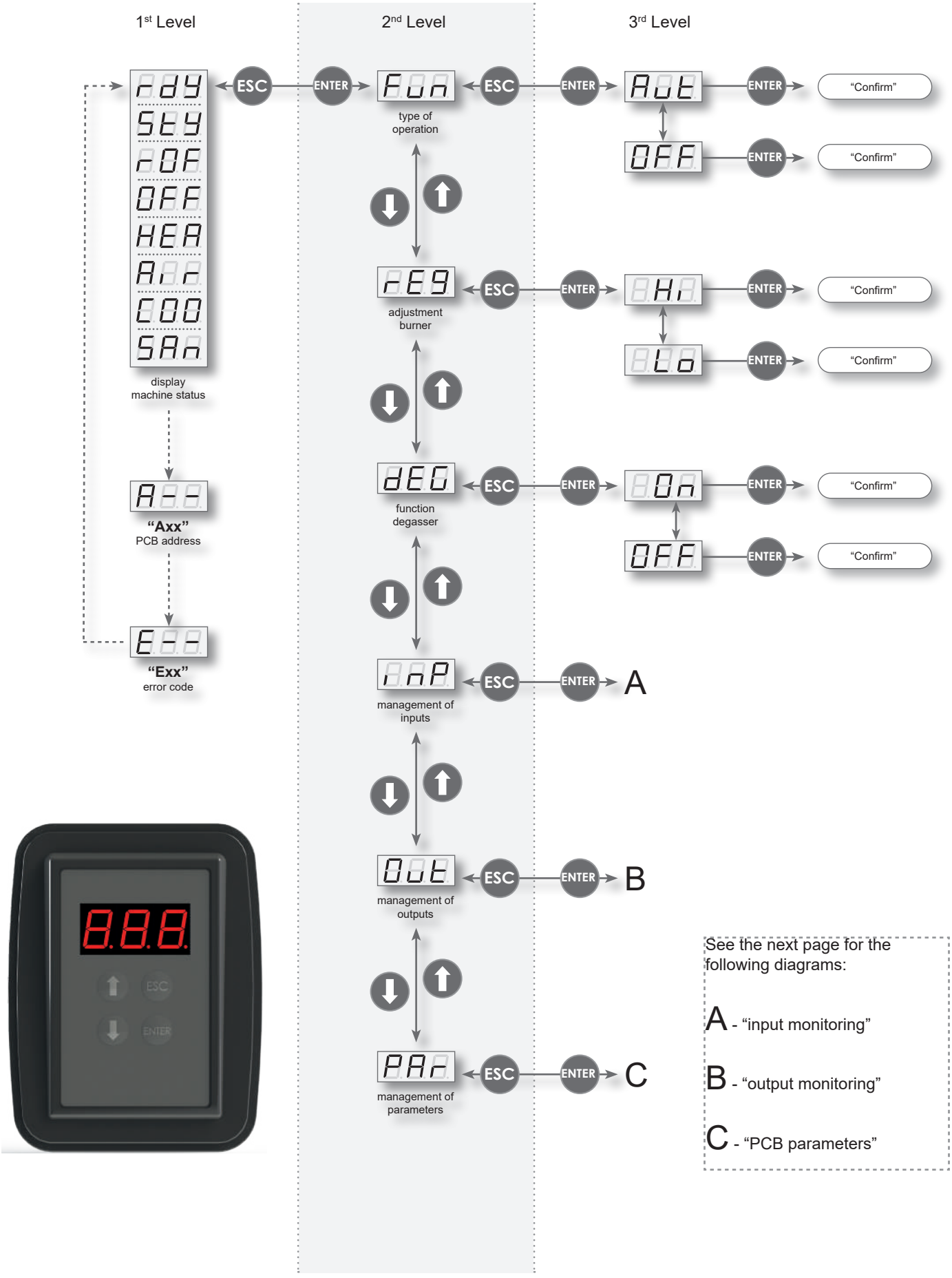
NOTE: Should the safety thermostat (STB) be open before starting the start-up cycle (this could be caused, for example, by low temperatures), the flame monitoring equipment will be kept in "stand-by" indicating lockout E22.

4.4. Flame indication LED

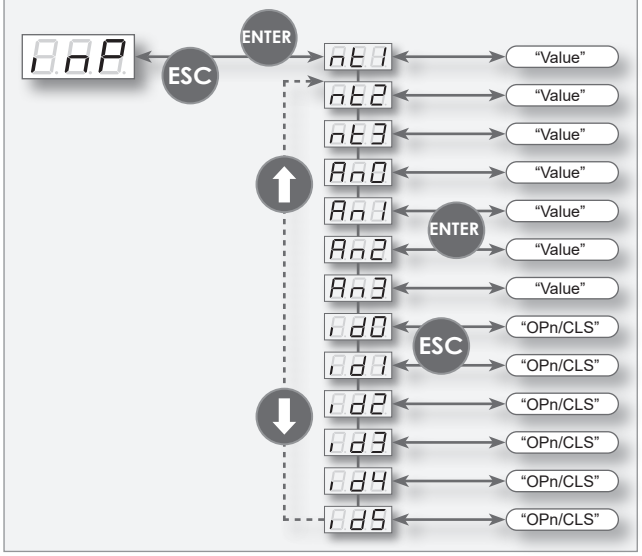
An orange LED is present on board the CPU PCB, indicating the opening of the gas valve and/or the presence of flame.



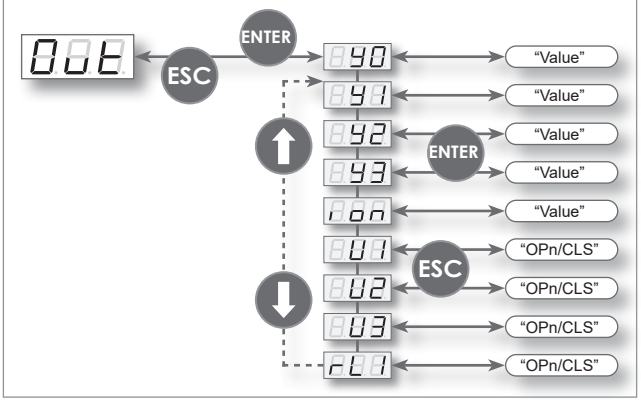
4.5. Navigation map of LCD display menu CPUE G26800



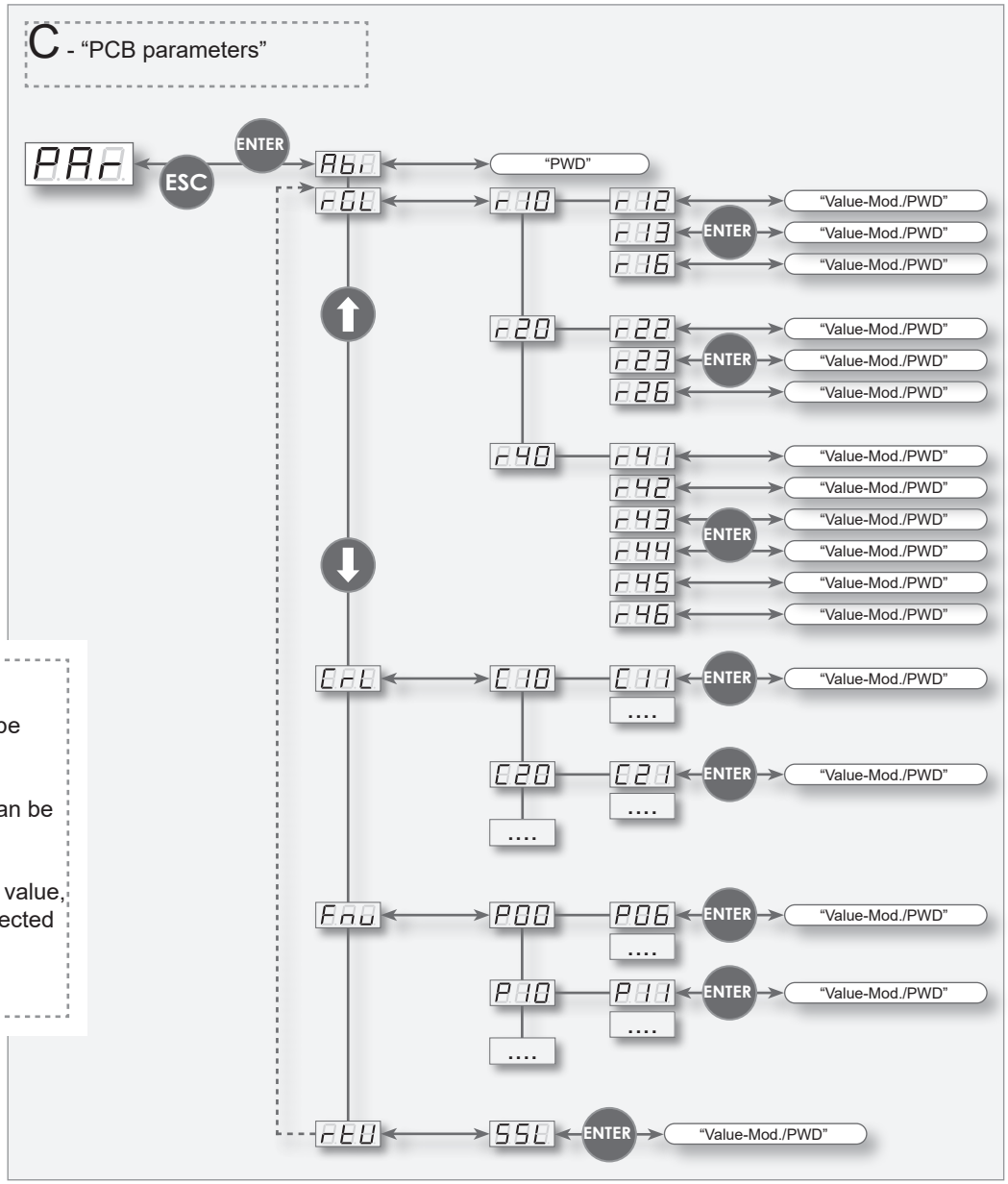
A - "input management"



B - "output management"



C - "PCB parameters"



Key:

"Value" = value which cannot be modified, read-only value

"Value-Mod." = Value which can be modified, write value

"Value-Mod./PWD" = Editable value, value in writing. Password-protected

"PWD" = Password entry

4.6. Adjustment

The LKH heaters have three heat output regulation modes:
- ModBus;
- NTC1 temperature probe.

NOTE: The NTC1 probe is always active as a limit, even with 0-10V and ModBus regulation modes.

The adjustment mode associated with the heater is defined by the SMART parameter, which identifies its type. This parameter varies automatically according to the position of the address selector (switch) on the CPU board, after power supply ON/OFF.

Function	CPU Switch	SMART parameter	Regulation mode
Flame modulation	≠ 0	SMART=1	Modbus (PID modulation and ON/OFF of the SMART)

Safety thermostat
A safety thermostat with automatic reset and positive safety setting is installed on the LKH heaters; the breakage of the sensitive element corresponds to a safety intervention.
The triggering of the thermostat, through the flame monitoring equipment, causes the burner stop and the flame equipment lockout.
The lockout of the unit, caused by the safety thermostat triggering, is indicated on the LCD display of the CPU PCB on board the machine with E20/E22.
The lockout E20 is classified as "non-volatile" and requires a manual reset.

NTC1 temperature probe
On the delivery line of the heater, there is an NTC1 temperature probe set to the value of the ST1 parameter (R12), which modulates the burner heat input when the setpoint is reached, regardless of the Smart X.
The probe measures the temperature of the air leaving the heater.
It is not advisable to change the ST1 value (R12) without consulting the APEN GROUP Service Centre.

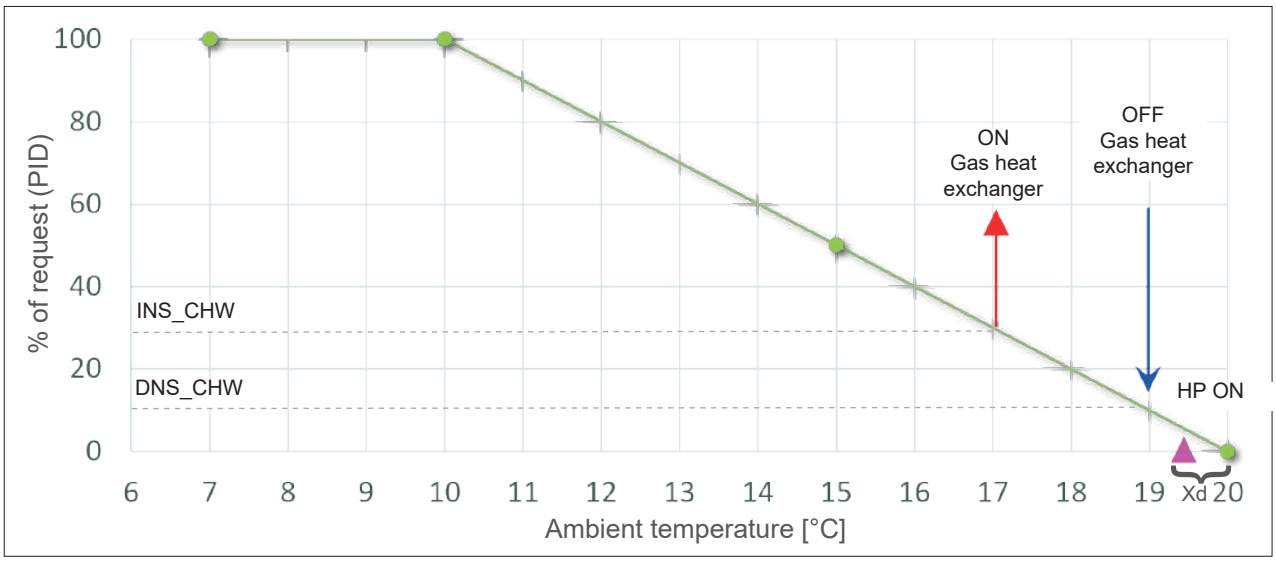
Hybrid system operation logic
The LKH heater allows operation with the following conditions:
- chiller/heat pump only
- heat pump + gas heat exchanger
- gas heat exchanger only

The modulation of the operating power of both technologies is regulated so that the delivery temperature of both systems remains fixed.

Winter setup
The Smart X parameters for operation are:
- TEMP_EXT external temperature
- T_RIF setpoint, room temperature
- Xd ON/OFF differential
- SET_PDC_HEAT heat pump setpoint in heat
- INS_CHW percentage PID of gas heat exchanger activation on T_RIF
- DNS_CHW percentage PID of gas heat exchanger switch-off on T_RIF
- SET_CUT_OFF heat pump exclusion setpoint

The operation of the device during the heating phase provides that under normal operating conditions the heat pump switches on when the temperature of the room to be heated is lower than T_RIF-Xd. The heat pump switches off when the temperature of the room to be heated is higher than or equal to T_RIF.
The heat pump starts if TEMP_EXT ≥ SET_CUT_OFF, otherwise the gas heat exchanger starts immediately regardless of the PID value calculated by Smart X.
The gas heat exchanger is switched on when the PID calculated by Smart X is higher than INS_CHW and switched off when the PID is lower than DNS_CHW. However, if the HP is in alarm or defrost phase (ApenGroup's HP only) and the PID is less than DNS_CHW, the gas heat exchanger is still switched on. The gas heat exchanger is modulated based on the PID.
The PID value (%) is calculated by the Smart X control.

Summer setup
Operation during the summer phase of chilled water production is very simple: a simple ON/OFF control of the heat pump with chiller operation is implemented based on:
SET_PDC_COOL heat pump setpoint in cool.
Xd ON/OFF differential.



4.7. Accessories

The LKH heater must be compulsorily combined with:
- a Smart X programmable thermostat (FW version higher than or equal to 2.07.21)
- an external NTC temperature probe

in order to regulate the room temperature and control the heater and the heat pump. Furthermore, if the latter is supplied by Apen Group, then it will be possible to manage its parameters, otherwise it will only be possible to manage the ON\OFF command and the summer/winter season change.

Programmable thermostat Smart X

The Smart X programmable thermostat is available in the Web (code G29700) or Easy (code G29500) version.

Through ModBus protocol, it can be used as a monitoring device for a single zone system at the same temperature, where up to 15 machines can be theoretically installed simultaneously, controlled by a single control. For faster machine interrogation, it is recommended to connect one Smart X programmable thermostat for every 5 machines.

The remote controls of the Smart X series are equipped with a colour TFT 4.3” touch screen (480x272 pixel resolution), from which it is possible to read and adjust all the parameters of the connected devices, performing the function of supervisor/viewer and controller (active part of the regulation) able to:
- display the status of the burners
- display the percentage of modulation
- manage alarms and resets
- manage the units in automatic or manual mode
- manage the weekly and annual calendar planning
- manage the scheduling of daily time slots.

To use the Smart X series programmable thermostat, simply set, on each heater, the CPU PCB address other than 0 (ModBus management). The address of the modulation boards of the heaters must be set as shown below.
To activate the heating request, close input ID0 of the heater modulation PCB (by closing ID0/GND terminals, voltage-free dry contact), and input ID1 of the Smart itself (by closing ID1/GND terminals, voltage-free dry contact).

NOTE: LKH heaters already have a CPU PCB address other than 0 and the ID0/GND contact closed.

The Smart X (WEB or EASY) remote controls are powered with a voltage of 12 Vdc +10%/-15%.
An integrated temperature probe allows room temperature management of the controlled area. The remote controls of the Smart X series also offer the possibility to connect up to 3 individually programmable remote probes, in addition to the one integrated on board, as main or additional probes, which allow obtaining an average room temperature on 4 points.

The remote controls of the Smart X series allow, through the PID regulation, calculating in real time a percentage of modulation of the power needed to reach the desired set-point and sending it to each heater, obtaining economic savings and ensuring a greater degree of room comfort.
The WEB version, in addition, allows the complete management of all the system functions, including unit resets, directly from a PC connected to the network, without having to install any additional software, but simply through a browser interface.

For more information on operation and installation diagrams, please refer to the manual
"SMART X WEB / SMART X EASY CHRONOTHERMOSTAT. Use, Installation and Programming Manual”.

External NTC temperature probe
The remote NTC probes that can be connected to the Smart X programmable thermostat must be of 10 KΩ, β 3435 type and connected to NTC/AGND terminals. A maximum of three temperature probes can be connected to the Smart X programmable thermostat, one is mandatory.

NOTE: The remote NTC probes are external probes (code G23300); not to be mistaken with the NTC1 modulation probe on board the heater.

Queen EC destratifier functioning
Please refer to data sheet KG0170

NOTE: For electrical connections, please refer to paragraph 5.6 "Electrical connections"

5. INSTALLATION INSTRUCTIONS

Instructions for installing and setting the heater are intended for suitably qualified personnel only.

5.1. General installation instructions

Where allowed, the heater can be installed directly in the room to be heated.
To install the heaters inside the rooms, different regulations and requirements must be complied with according to the type of fuel used and to the country of destination.
In fact, the installer must strictly comply with applicable standards and regulations in the country where the machine will be installed and therefore set up.

Air Vents
The room where gas fired heater will be installed must be provided with one or more air vents.
These air vents must be fitted:
- flush to the ceiling for gases with density lower than 0.8;
- flush to the floor for gases with density higher or equal to 0.8.

The air vents must be fitted to walls facing the open air. The sections must be sized according to the heat output installed.

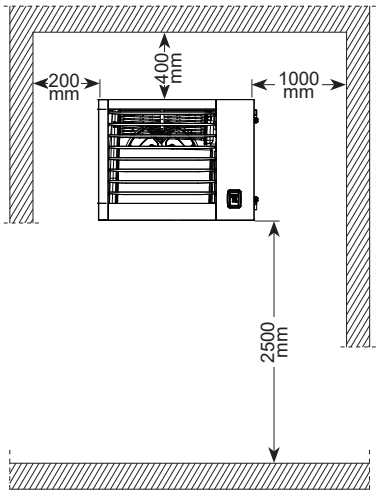
Condensate drain
The heater is supplied complete with water trap for flue gas condensate drain. The water trap is an integral part of the heater and is regarded as a safety component; therefore, replacing it with a different type, not approved by the heater's manufacturer is prohibited.
The condensate must be drained in compliance with standards applicable in the country where the heater is installed.

5.2. Installation

The minimum installation distances of the heaters from the walls and the floor, indicated in the following drawing, are necessary for the maintenance activities and are expressed in mm. They refer to walls of at least REI30 type and in class 0. Otherwise, the minimum distances must be:
- > 600 mm from walls
- > 1000 mm from the ceiling.

2500 mm is the minimum height required by the standard to consider the application of "suspended" machines.

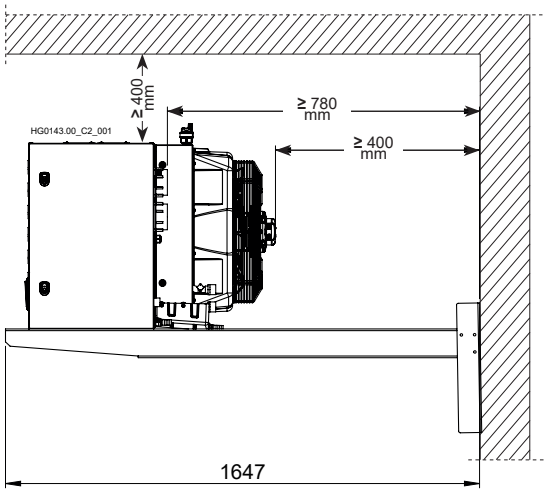
MINIMUM DISTANCES TO BE OBSERVED



Fixed shelf
For installation, a fixed bracket with kit code G13700.02 is available as an accessory.
For installation, follow the instructions on the paper template supplied with the kit.

NOTE: Make sure that the size of the screws and the type of plug are correct for the type of wall and suitable to withstand the weight of the heater.

During installation, place the suspended heater by centring it on the brackets in order to match the holes on the heater with the holes on the brackets, taking into account that the tips of the brackets protrude from the heater by approx. 80 mm.
Below are the minimum dimensions [mm] to be observed for proper ventilation



5.3. Hydraulic connections

Hydraulic connections must be carried out in compliance with national or local regulations; pipes can be made of steel or PVC. Pipes must be carefully sized according to the rated water capacity of the units and the pressure drops of the hydraulic circuit. All hydraulic connections must be insulated using closed cell material with suitable thickness. The heater must be connected to the piping using flexible couplings, respecting the supply and return direction of the finned coil indicated by the arrows.

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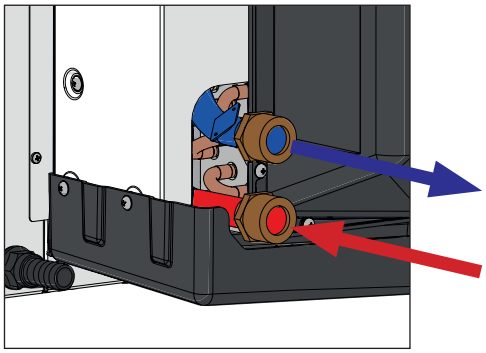

Vent valve
The LKH heater is supplied with a vent valve to be screwed onto the finned coil at the top.

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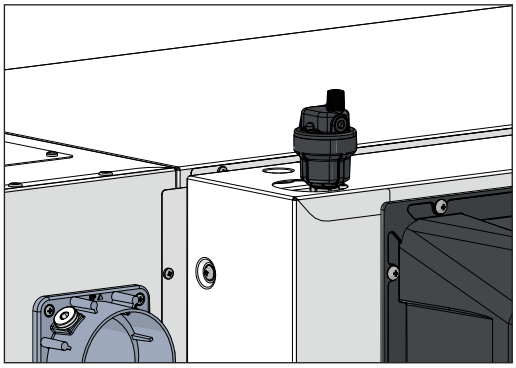


Expansion reservoir
An expansion reservoir of a size appropriate to the system and its operating conditions must be provided in the hydraulic circuit. The reservoir pre-charge must be equal to the system's filling value;
Before refilling the circuit check the expansion reservoir pre-charge pressure.

Antifreeze
The hydraulic circuit must be protected by an active or passive antifreeze system. In the case of a passive system, ethylene glycol or polypropylene glycol must be used as antifreeze fluid. The amount of glycol must be appropriate to the size and conditions of use of the system. Please refer to the operating and safety instructions of the product used.

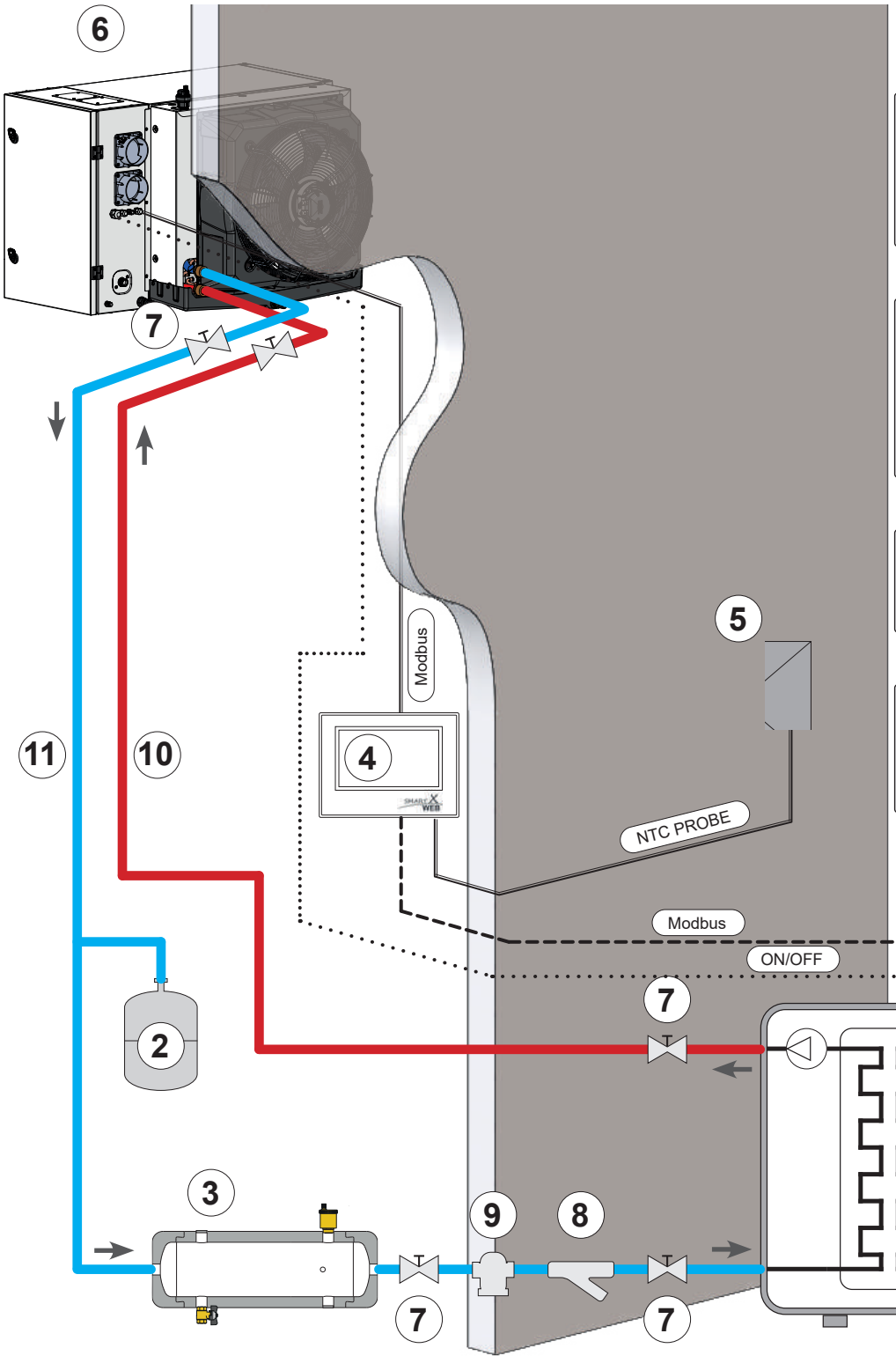
Safety valve
A safety valve set at 1.5 times the maximum pressure of the weakest element in the circuit must be provided in the hydraulic circuit.
For example, if of all the components in the hydraulic circuit, the expansion reservoir is the one at the lowest maximum pressure, i.e. 5 bar, then the safety valve must be set at 3.3 bar.
Typical values can be between 3 and 6 bar.

For further information please refer to the manual of the heat pump connected to the LKH heater

Recommended hydraulic - wiring diagram

1	Heat pump
2	Expansion reservoir
3	Inertial storage
4	Smart X
5	External probe
6	LKH heater

7	Shut-off valve
8	Y-shaped filter
9	Dirt separator
10	Delivery piping
11	Return piping



A suitably sized expansion reservoir (2) must be installed, of adequate capacity depending on the type and volume of fluid, temperature variation and system pressures.

Appropriately dimensioned pipes (10) (11) must be constructed so as to achieve the lowest possible heat loss. Avoid bends and reductions as much as possible, make the pipes with the shortest path.

Inertial storage is necessary if the volume of the hydraulic circuit is smaller than that foreseen by the HP

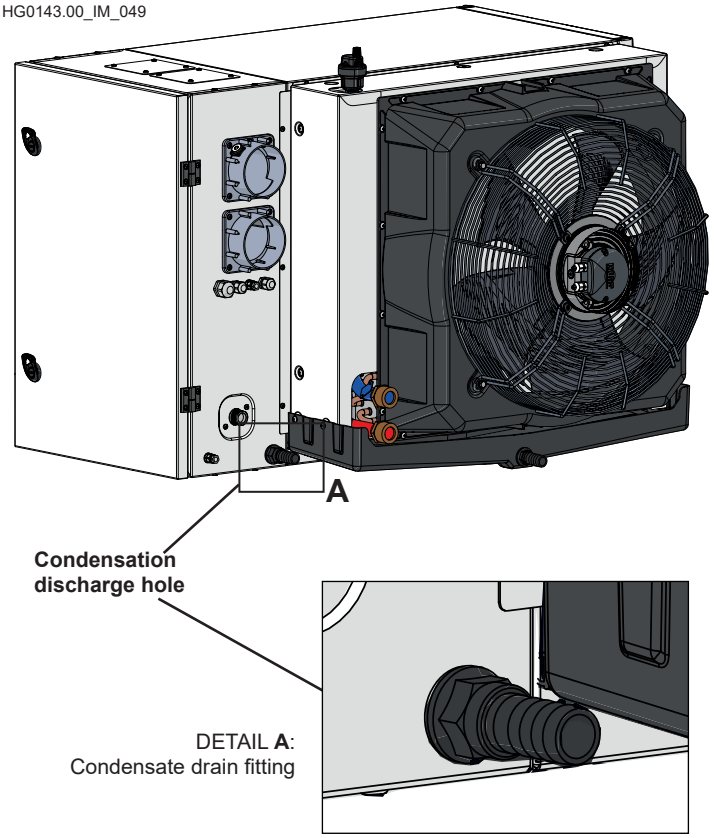
The connection to the HP is via Modbus if it is an ApenGroup's HP (---), otherwise it is a normal connection to the relays on board the LKH heater (...).

5.4. Condensate drain

The LKH series heaters are flue gas condensing appliances. The lowering of the flue gas temperature in the tube bundle of the heat exchanger causes the formation of condensate that must be duly drained outside the heat exchanger.
To this end, the appliances are already fitted as standard with a condensate drain kit made up of:

- trap equipped with a detection electrode;
- condensate drain fitting (condensate drain hole placed at the back of the appliance).

HG0143.00_IM_049



NOTE: during the first installation, remember to remove the condensation drain protection cap, to allow its regular operation.

Connection of the condensate drain fitting

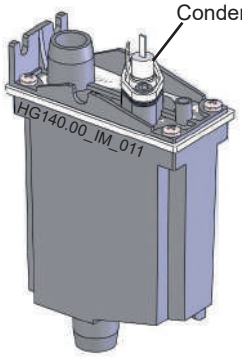
The condensate drain fitting must be connected with a drain pipe. The condensate drain fitting consists of a straight hose barb quick connector with an external diameter of Ø 19mm. The pipe must in any case be sized according to the maximum amount of condensate produced by the appliance (see paragraph 3.1 "Technical Data"), and made of a material suitable for the passage of condensate with an acidity degree between PH 2.8-3.9 (for example: aluminium, stainless steel, silicone, Viton, EPDM, PVC or other suitable plastic material).

ATTENTION: Do NOT use copper, galvanized iron or other material NOT suitable for condensate passage when connecting the condensate drain fitting.

Trap

The trap, installed inside the heater, has a condensate detection electrode that shuts down the generator in case the condensate does not flow out correctly from the drain, in order to prevent condensate from remaining inside the heat exchanger. A possible cause of condensate drain failure is the freezing of the condensate within a section of the draining circuit. To prevent the risk of freezing, it is advisable to install the condensate drain pipe as long as possible inside the rooms to be heated.

ATTENTION: The trap and condensate drain components must not be modified or plugged

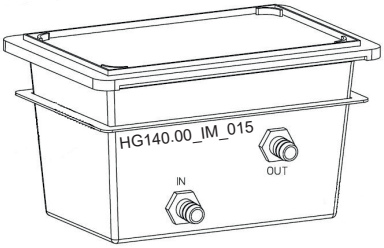


Neutralising the condensation

The condensate produced by the gas heat exchanger has an acidity degree between PH 2.8-3.9. If required by current regulation, install an acidity neutraliser.
Apen Group can supply different optional kits to neutralise the condensate.
The kits differ according to their capacity, as shown below, and are made up of:

- plastic tank for the collection of condensation.
- calcium carbonate bag.

Condensate neutralisation vessel



It is possible to convey the condensate deriving from several heaters into a single neutralisation kit, adding the power values together, according to the maximum limit of the kit itself, as follows:

	kW max	BxHxL [cm]	$CaCO_3$ [kg]
G14303	120	20x18x30	5
G05750	1500	30x24x64	25

Finned coil condensate
During conditioning, the LKH heater must drain the condensate that forms on the finned coil. To this end, a coil condensate collection tray is already supplied with the heater. The fittings provided for draining must be connected to the tray. It must then be fixed to the heater with four screws, through the four holes located at the bottom of the coil. Condensate from the coil already has a neutral Ph, so the drain can be connected after the condensate neutralisation tray.

CAUTIONS
Special attention must be paid to the condensate drain; an incorrectly installed draining system, in fact, could jeopardize the correct operation of the appliance.
The main factors to be taken into account are:
- risk of condensate build-up inside the heat exchanger;
- risk of condensate water freezing in the pipes.

During normal heater operation, condensate water must not be allowed to accumulate within the heat exchanger. When installing the heater, special attention must be paid to make sure it is perfectly level in order to maintain the typical inclination of the tube bundle.

Additional WARNINGS
- For the condensate drain pipe linear sections, provide for a slope of min. 1%, i.e. 1 cm for each metre (otherwise provide for a booster pump);
- if necessary, install the condensate neutralisation kit in the heated rooms, near the condensate drain fitting of the heater, to prevent condensate water from freezing inside the tray;
- do not drain the condensate in pipes made with materials incompatible with the condensate acidity: risk of corrosion;
- draining condensate into the ground, in a neutralising sump, is generally prohibited, but permitted in the case of isolated settlements, installations or buildings, provided that it complies with regional regulations.

ATTENTION: Heater condensate drain and disposal must be carried out in compliance with current technical standards and regulations in force in the installation country.

5.5. Connections to the Flue

The LKH heaters are fitted with a sealed combustion circuit and with the fan located upstream of the heat exchanger.
Connection to the flue, according to where the heater is installed, can be made as "C" type, with combustion air being drawn from outside, or as "B" type with combustion air being drawn from the heater installation site.
More specifically, the heater is certified for the following exhausts: C13-C33-C53-C63-B23P.
EC-CERTIFIED pipes and terminals must be used.
The air intake and fume exhaust terminals must prevent access to a sphere with a diameter higher than or equal to 12mm.

APEN GROUP can supply certified exhaust and intake terminals, which can be purchased separately.

The LKH heaters are fitted as standards with horizontal fittings, chimney and air intake, placed at the back of the heater. DURING the installation, the fume exhaust and air intake fittings can be moved to the top section; this is useful when fumes must be exhausted through the roof.
To make the flue outlet section for condensing LKH heaters, the following material must be used:
- Aluminium with a thickness higher than or equal to 1.5 mm;
- Stainless steel with a thickness of at least 0.6 mm; steel must have a carbon content of maximum 0.2%.

Sealed pipes must be used to prevent fumes from leaking from the pipes; the seal must be adequate to withstand fume temperature ranging between 25° and 130°C.

ATTENTION: IT IS STRICTLY PROHIBITED TO USE PLASTIC MATERIALS ON THE FUME EXHAUST DUCT.

IMPORTANT: If there is no chimney condensate drain, install the horizontal sections of piping that make up the flue outlet, with a slight inclination (1°- 3°) towards the heater, so as not to create accumulations of condensate inside the exhaust itself.

Insulate the pipe if required to protect the flue from accidental contact.

For the air intake, use:
- Aluminium with a thickness higher than or equal to 1.0 mm;
- Stainless steel with a thickness higher than or equal to 0.4 mm.

All components must be CE marked, certified in compliance with EN 1856-1 and EN1856-2 standards and identified by an ID plate showing their features. Below is an *example*:

0694-CPR-52977	1856-1	T200	P1	W	V2	L50050	O70

Certificate no.

Number of the Standard

Temperature class

Pressure level (N=negative, P=positive, H=high pressure, 1 and 2 = permissible loss, value 1 more restrictive)

Condensation resistance class (D = dry use, W = wet use)

Corrosion resistance class

Material and thickness

Inner resistance to fire (G=Yes, O=No) and distance (in mm) from combustible materials

In case of installation of ducts different from those supplied by the manufacturer, always make sure that they are suitable for the type of application and the type of equipment on which they are installed. Above all, always check that the temperature class and corrosion resistance class (EN1443) are suitable for the type of system and the operating characteristics of the equipment itself.
However, the following minimum resistance classes are recommended:

	LKH
Temperature class:	T120
Pressure level:	P1
Condensate Resistance Class:	W
Corrosion resistance class:	V1

Selection Guide
The table showing the fume exhaust system calculation data can be found in paragraph 7.2 "Gas settings data table".

The maximum permitted recirculation percentage is 11%.

The tables below show the pressure drop for the most used terminals and exhaust ducting.
If the terminal is not directly connected to the heater and, therefore, extra routing is required, according to the length of the ducting, the diameter of the selected terminals, extensions and bends must be checked.
After establishing the routing, the pressure drop must be calculated for each component by referring to the tables below according to the LKH unit used; each component has a different pressure drop value as the fume flow rate is different.
Add together the pressure drops of the single components, checking that the result is not higher than the available value for the heater to be used. If a combustion air supply pipe is fitted, the pressure drops must be added to the fume exhaust pressure drops.
If the sum of the pressure drops is higher than the available pressure, ducting with higher diameter must be used, rechecking the calculation; a pressure drop higher than the pressure available at the fume exhaust reduces the heater heat output.

NOTE: If the module is installed indoor:
- using coaxial connections is allowed for heaters with a maximum length of 3 metres; -the flue outlet terminal must be installed in compliance with the reference national regulation requirements.

NOTE: The following pictures show examples of fume exhausts and air intakes that can be made by using the kits available from our catalogue; the table shows the maximum length of the section between the heater and the terminal.

If the duct routing requires the use of bends, their length must be subtracted from the available length:

Bend Ø 80	90°	EqL 1.65 m
Bend Ø 80	45°	EqL 0.80 m
Bend Ø 100	90°	EqL 2.30 m
Bend Ø 100	45°	EqL 1.03 m
Bend Ø 130	90°	EqL 2.20 m
Bend Ø 130	45°	EqL 1.00 m

* Equivalent lengths valid for wide radius bends.

LKH models	044	
Pressure available at the exhaust	100	[Pa]
Component	*Heat loss*	*Code*
Ø80 SMOOTH PIPE [l=1m]	2.0	G15820-08-XXX
BEND Ø80 WIDE RADIUS 90°	3.4	G15810-08-90
BEND Ø80 WIDE RADIUS 45°	1.6	G15810-08-45
Ø80 WALL-MOUNTED TERMINAL FROM SEPARATE TO COAX	25.3	TC13-08-HC1
Ø80 ROOF-MOUNTED TERMINAL FROM SEPARATE TO COAX	29.6	TC33-08-VC1K
Ø80 ROOF-MOUNTED TERMINAL, WINDPROOF EXHAUST ONLY	0.1	TB23-08-VSW
Ø100 SMOOTH PIPE [l=1m]	0.7	G15820-10-XXX
BEND Ø100 WIDE RADIUS 90°	1.4	G15810-10-90
BEND Ø100 WIDE RADIUS 45°	0.6	G15810-10-45
Ø100 WALL-MOUNTED TERMINAL FROM SEPARATE TO COAX	14.1	TC13-10-HC2
Ø100 ROOF-MOUNTED TERMINAL FROM SEPARATE TO COAX	12.2	TC33-10-VC2K
Ø100 ROOF-MOUNTED TERMINAL, WINDPROOF EXHAUST ONLY	0.3	TB23-10-VSW
Ø130 SMOOTH PIPE [l=1m]	0.2	G15820-13-XXX
Ø130 WALL-MOUNTED TERMINAL FROM SEPARATE TO COAX	4.6	TC13-13-HC5
Ø130 ROOF-MOUNTED TERMINAL FROM SEPARATE TO COAX	4.4	TC33-13-VC5K
Ø130 ROOF-MOUNTED TERMINAL, WINDPROOF EXHAUST ONLY	0.3	TB23-13-VSW
ADAPTOR Ø80/100	0.7	G15815-08-10
ADAPTOR Ø100/80	0.7	G15815-10-08
ADAPTOR Ø100/130	0.6	G15815-10-13
ADAPTOR Ø130/100	0.4	G15815-13-10
COMBUSTION AIR UPTAKE ONLY		
Ø80 HORIZONTAL AIR UPTAKE ONLY	2.5	TB23-08-HS0
Ø100 HORIZONTAL AIR UPTAKE ONLY	1.3	TB23-10-HS0

NOTE: Values calculated on the flue gas maximum flow rate achieved with natural gas G20.

Installing the terminals

The LKH heaters have a rear and top air intake and fume exhaust. According to installation requirements, the terminals can be fitted at the back or at the top.

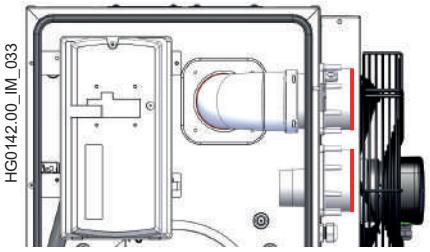
The inlet and outlet castings are normally installed on the rear side of the machine; if it is necessary to use the upper outputs, remove the castings from the rear side (with their gaskets), remove the covers closing the upper holes. Reverse the position of castings (with gaskets) with the closing covers.

ATTENTION: When changing the intake and exhaust side, pay attention to the mounting direction of the terminals (UP arrow). DO NOT INVERT the flue outlet terminal with the air intake terminal.

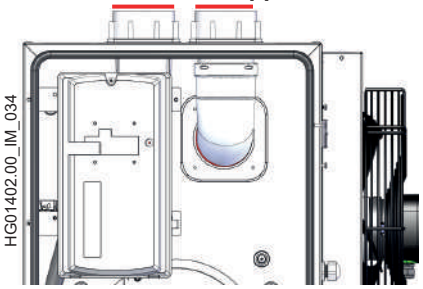
NOTE: In case of upper air intake terminal, add the drip cover kit.

NOTE: The terminals are supplied with silicone seals; on request, only for LKH models, a kit with EPDM seals can be requested.

Fume exhaust and rear air intake



Fume exhaust and upper air intake



Vertical B23 B23P terminal

Open combustion circuit, combustion air intake from the room and exhaust to the outdoor. Standards UNI-CIG 7129 and 7131 require the provision of suitable vents on the walls.

NOTE: In this configuration, combustion air intake requires an IP20 safety meshing to be fitted, which must prevent a solid object with a diameter higher than 12mm from going through; at the same time, the meshing must have holes larger than 8mm.

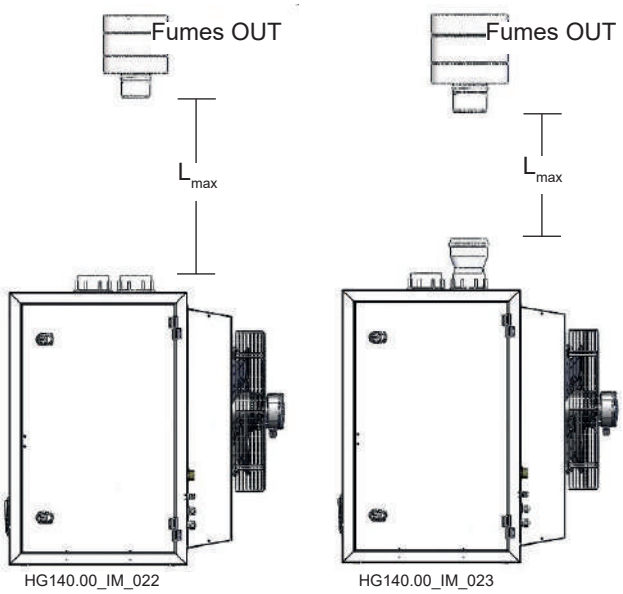
L_{max} of the pipe routing made with the Ø shown, excluding the terminal.

The terminal consists of:

- Adaptor from LKH outlet to exhaust Ø (where necessary);
- Roof-mounted terminal, only windproof exhaust.

Ø80 pipes and bends: TB23-08-VSW

Mod. LKH	044
L_{max} [m]	30



Type C53 terminal

Combustion circuit watertight to the environment. One of the ducts is connected to the roof, the other to the wall.

L_{max} of the pipe routing made with the Ø shown, excluding the terminal.

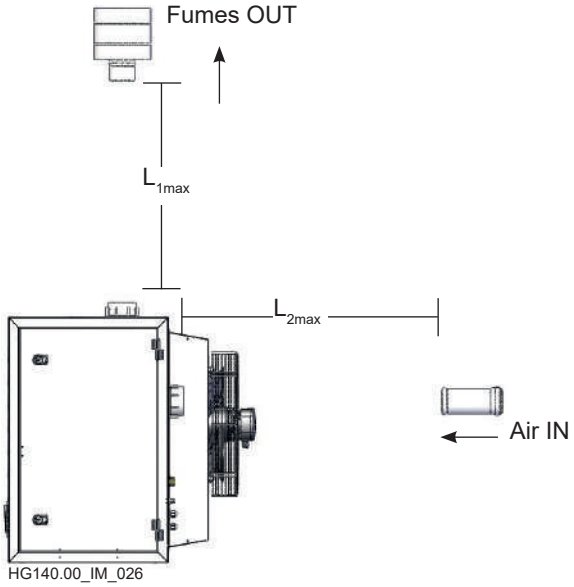
The terminal consists of:

- Adaptor from LKH outlet to exhaust Ø (where necessary);
- Adaptor from LKH outlet to intake Ø (where necessary);
- Roof-mounted terminal, only windproof exhaust.

NOTE: The maximum length available has been split in equal parts between the exhaust (L_{1max}) and the intake (L_{2max}); the lengths between intake and exhaust can also be split differently without exceeding the sum shown.

Ø80 pipes and bends: TB23-08-VSW + TB23-08-HS0

Mod. LKH	044
L_{max} [m]	20+20



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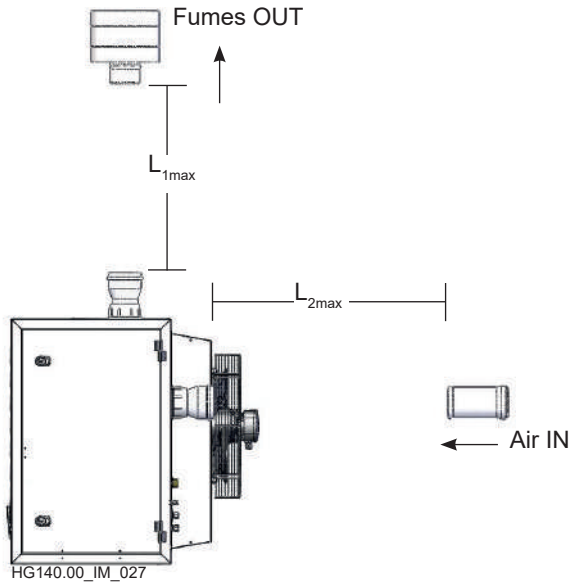

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Horizontal coaxial C13 terminal

Combustion circuit watertight to the environment. The ducts go directly through the wall.

L_{max} of the pipe routing made with the Ø shown, excluding the terminal.

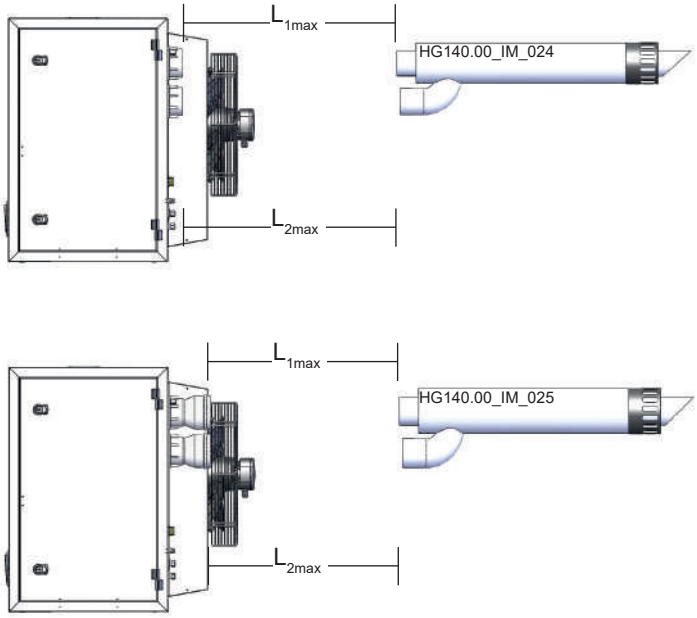
The terminal consists of:

- Adaptor from LKH outlet to exhaust Ø (where necessary);
- Adaptor from LKH outlet to intake Ø (where necessary);
- A horizontal coaxial terminal.

NOTE: The maximum length available has been split in equal parts between the exhaust (L_{1max}) and the intake (L_{2max}); the lengths between intake and exhaust can also be split differently without exceeding the sum shown.

Ø80 pipes and bends: TC13-08-HC1

Mod. LKH	044
L_{max} [m]	30+30



C33 type coaxial roof-mounted terminal

Combustion circuit watertight to the environment. The ducts are connected to the outside with a coaxial terminal.

L_{max} of the pipe routing made with the Ø shown, excluding the terminal.

The terminal consists of:

- Adaptor from LKH outlet to exhaust Ø (where necessary);
- Adaptor from LKH outlet to intake Ø (where necessary);
- Roof-mounted terminal from separate to coaxial.

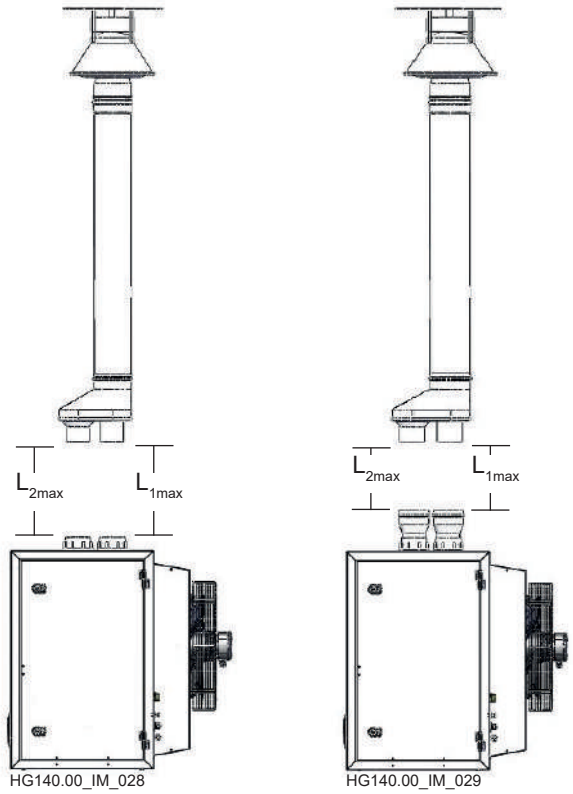
NOTE: The maximum length available has been split in equal parts between the exhaust (L_{1max}) and the intake (L_{2max}); the lengths between intake and exhaust can also be split differently without exceeding the sum shown.

Ø80 pipes and bends:
TC33-08-VC1K

Mod. LKH	044
L_{max} [m]	10+10

Ø100 pipes and bends:
TC33-10-VC2K + 2xG15835-08-10 (eccentric adaptors only for mod. LKH020-035 and LRN018-045)

Mod. LKH	044
L_{max} [m]	30+30



5.6. Electrical connections

Cautions

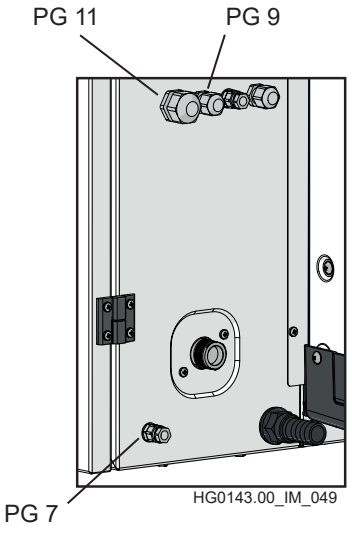
- The Smart X programmable thermostat connection must have a maximum length of less than 500 m.
- For safety reasons, the use of multi-pole cables for the simultaneous transport of loads at different voltages (power supply and control signals) is prohibited. Moreover, keep the cables well apart to avoid possible electromagnetic disturbances on the heater PCB. Never insert power cables and signal cables into the same cable duct.
- Keep cables away from heat sources.
- Powering off the unit before completing the cooling cycle and/or with machine set to ON is strictly prohibited. Failure to follow these instructions shall invalidate the warranty and cause early deterioration of the heat exchanger.

Power supply

The heater must be correctly connected to an effective earthing system, fitted in compliance with current legislation.
Single-phase 230 Vac power supply with neutral.
Insert the power cable into the heater through PG11 cable gland on the compartment. Connect to the PCB through the connector shown in the figure below. **Do not mistake the neutral for the live wire**.
Group the cable with the others in the compartment using ties.
For safety reasons, the flame monitoring device prevents operation if phase and neutral are swapped, fault E10.

ATTENTION: The electrical system and, more specifically, the cable section, must be suitable for the heater maximum power input, see table in paragraph 3.1 "Technical Data", and in any case not lower than 1.5mm². Use H05VV-F 3x1.5 mm² equal or greater cable with a maximum outer diameter of 9 mm

NOTE: IT IS compulsory to fit, upstream of the heater, a multipole isolator fitted with a suitable electric protection element.



Power connector on CPU PCB

Connection of Apen Group's HP

To connect an Apen Group's HP to the LKH heater, simply connect the Smart X to the LKH heater CPU and the Apen Group HP via ModBus.
See hydraulic\wiring diagram example.
Use the PG9 cable gland to connect the Smart X.
In this way, through Smart X, it will be possible to control all the parameters of the HP having a complete and integrated management of the system.

Connection of other supplier's HP

To connect a HP from another supplier to the LKH heater, it is necessary to connect to the two relays and terminals on board the LKH heater. Observe the wiring diagram at the end of the manual or inside the LKH heater door.
Use PG7 cable gland for Smart X connection and PG9 cable gland for relay and alarm terminal connections.
In this way, it will only be possible to manage the ON/OFF command, season change and the signalling of any HP alarms.

NOTE: The alarm signal to be connected to the respective terminals of the LKH heater must be a voltage-free, normally open contact.

Analogue and digital inputs

Should it be necessary to control one or more analogue inputs, through the connection of an external NTC probe, the relevant cable sections are indicated below according to the cable length:

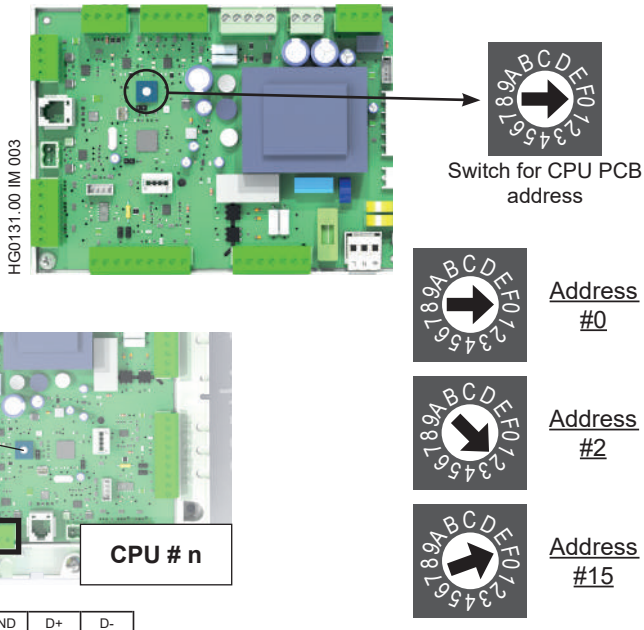
Type	Length < 50 m	Length < 100 m
NTC	0.5 mm²	1 mm²

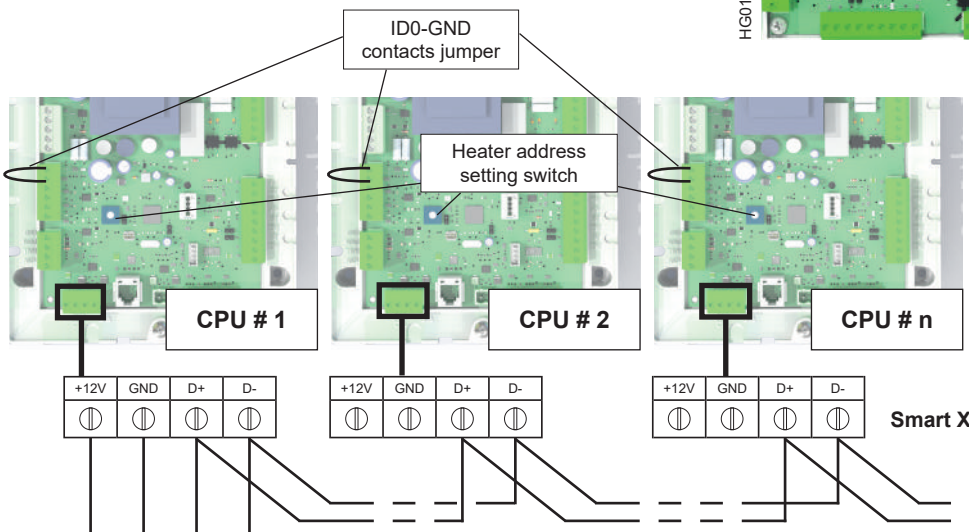
Smart X Web/Easy connection
Use the connector provided to connect the
Smart X Web/Easy. Connect power supply with shielded wiring with a minimum cross-section of 0.5 mm^2, respecting polarity.
Connect the RS485 network to its terminals, making sure polarity is correct.
For multiple heaters, connect terminals D+ and D-, making sure polarity is correct; the network can be made both as a serial and star network.

NOTE: THE correct address for each PCB must then be set up. Addresses must start from 1 to N without interruptions in the numbering sequence. The address of each PCB is displayed on the LCD as "Axx", where xx is the address. To program the Smart X Web/Easy, please read the operating manual supplied with the accessory.

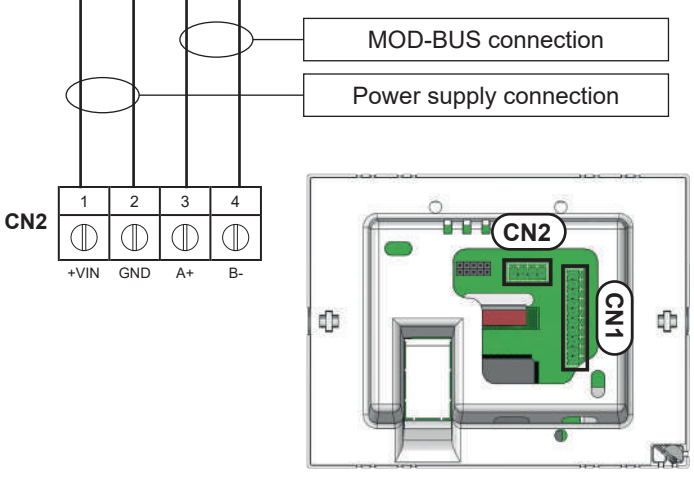
Connecting Queen EC destratifiers
Please refer to data sheet KG0170

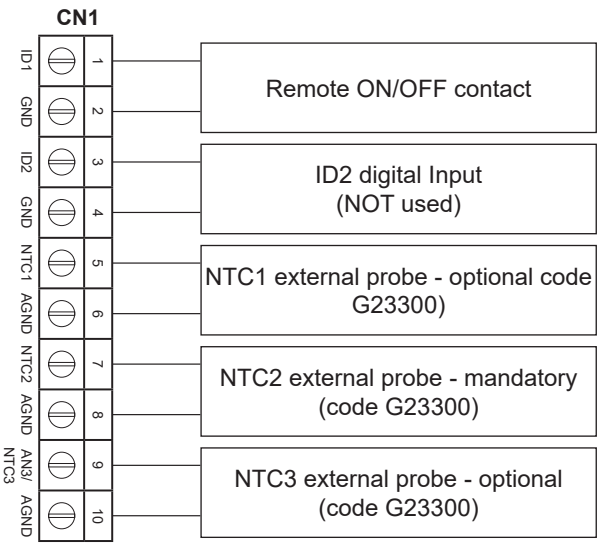
BY using the selector, a unique address can be assigned to each heater module, as follows.





Smart X Web/Easy electric connections





5.7. Modulation PCB parameters

All values of the parameters of the CPU PCB are shown for all LKH heater models.
The “LCD” column shows the parameters that could be modified with Password via remote LCD control (even with modbus address ≠ 0).
The “Smart” column shows the parameters that can only be modified with Smart X or via modbus with a second level Password, which can be requested to the manufacturer's Customer Service.

Parameters of G26800 CPU PCB version 8.03.xx				
Parameter Name			LKH044	DESCRIPTION
Smart	LCD	U.M.		
FUNC 00	**Fnu P00**		**Equipment operation**	
TER			1	TER presence
SMART			1	SMART presence *0 = Smart not present* *1 = uses PID and ON/OFF of the SMART* *2 = uses only ON/OFF command of the Smart*
PTH	P06		100	Maximum limit of PT%_OUT_BURNER OUTPUT
PTL	P07		0	Minimum limit of PT%_OUT_BURNER OUTPUT
FUNC 01	**Fnu P10**		**Burner operation**	
b1	P11	rpm	203	Motor RPM MINIMUM value (Y0): 90÷999 (1=10 rpm)- DO NOT CHANGE
b2	P12	rpm	607 (G20) 522 (3B/P G30)	Motor RPM MAXIMUM value (Y0): 90÷999 (1=10RPM) - DO NOT CHANGE
b3	P13	rpm	383	Motor RPM START-UP value (Y0): 90÷999 (1=10RPM) - DO NOT CHANGE
b4	P14		2	TACH signal divider
b5	P15	rpm	50	Error E3x; no. of revolutions x10 (50=500rpm): 0÷999
b6	P16	sec	20	Error E3x; error dwell time before fault F3x: 0÷999
b7	P17	sec	15	Pre-cleaning time with maximum output
b8	P18	sec	60	Flame stabilisation time (ignition)
b9	P19	%	45	Proportional factor value (kp_pwm) for PWM1 calculation
b10	P1A	%	20	Integral factor value (ki_pwm) for PWM1 calculation
b11	P1B	sec	90	Combustion chamber post-washing time
b12		sec	0	Flame monitoring equipment ON delay time (TER)
b13		kW	see table in Par. 3.1 "Technical Data"	MIN. value Furnace heat input
b14		kW	see table in Par. 3.1 "Technical Data"	MAX. value Furnace heat input
REG 01	**rGL R10**		**Modulation Probe NTC Control**	
REG_01	R11		1	Adjustment enabling (0=disabled; 1=enabled)
ST1	R12	°C	36	ST1 function setpoint
Xd1	R13	°C	2	ST1 hysteresis
Kp1		%	10	Proportional coefficient
Ki1		%	5	Integral coefficient
TH1	R16	°C	70	Alarm temperature for ST1 for fault E51; Autoresolve with NTC1<ST1
AC1			0	Modulation and/or ON/OFF *0 = modulation only* *1 = modulation and ON/OFF*
MOD1			1	Modulation configuration *0 = Reverse and/or Direct (changes according to the phase sent via modbus, heating, ventilation or conditioning)* *1 = Reverse only (for heating)* *2 = Direct only (for ventilation or conditioning)*
ING1A			1	Defines the analogue input to be used for calculation *1 = NTC1* *2 = NTC2* *3 =NTC3*

Parameters of G26800 CPU PCB version 8.03.xx				
Parameter Name			LKH044	DESCRIPTION
Smart	LCD	U.M.		
REG 02	**rGL R20**		**Control 02 - NOT USED ON LKH**	
REG_02	R21		0	Adjustment enabling *0 = disabled*
REG 03	**rGL R30**		**Control 03 - NOT USED ON LKH**	
REG_03	R31		0	Adjustment enabling *0 = disabled*
REG 04	**rGL R40**		**Modulation from 0/10 Vdc Control - NOT USED ON LKH**	
REG_04	R41		0	“Adjustment enabling *0 = disabled*
REG 05	**rGL R50**		**Adjustment 05 - NOT USED ON LKH**	
REG_05	R51		0	“Adjustment enabling *0 = disabled*
REG 06			**Adjustment 06 - NOT USED ON LKH**	
REG_06			0	Adjustment enabling *0 = disabled*
CTRL 01	**CrL C10**		**Control 01 - NOT USED ON LKH**	
CTRL_01	C11		0	Control enabling *0 = disabled*
CTRL 02	**CrL C20**		**Control 02 - NOT USED ON LKH**	
CTRL_02	C21		0	Control enabling *0 = disabled*
CTRL 03	**CrL C30**		**Control 03 - NOT USED ON LKH**	
CTRL_03	C31		0	*Control enabling* *0=disabled;*
CTRL 04	**CrL C40**		**No Voltage Control**	
CTRL_04	C41		1	Control enabling *0 = disabled* *1 = enabled*
T4_V	C42	sec	45	Time in seconds of post-ventilation
CTRL 05	**CrL C50**		**Remote Reset from Digital Input**	
CTRL_05	C51		1	Control enabling *0 = disabled* *1 = enabled*
ING05	C52		9 (ID1)	Digital input enabled as RESET
CTRL 06	**CrL C60**		**Remote alarm or flame presence signal**	
CTRL_06	C61		1	Control enabling *0 = disabled* *1 = enabled as lockout signal* *2 = enabled as flame signal*
OUT06	C62		5 (Q1)	Digital output enabled
CTRL 07	**CrL C70**		**Control 07 - NOT USED ON LKH**	
CTRL_07	C71		0	Control enabling *0 = disabled*
CTRL 08	**CrL C80**		**Counter and reset control**	
HOURS	C81		1	Burner operating hours counter
CYCLES	C82		1	Ignition cycles counter
FAULT			1	Fault counter
RESET	C84		0	Reset control *1 = PCB fault reset*
CTRL 09			**Control 09 - NOT USED ON LKH**	
CTRL_09			0	Control enabling *0 = disabled*

Parameters of G26800 CPU PCB version 8.03.xx				
Parameter Name			LKH044	DESCRIPTION
Smart	LCD	U.M.		
FUNC 02			**Function 02 - NOT USED ON LKH**	
FN_02			0	Control enabling *0 = disabled*
FUNC 03	**Fnu P30**		**Ventilation Management Function (EC-AC Fans)**	
FN_03	P31		1	Function enabling *0 = disabled* *1 = proportional POT%_OUT enabled* *2 = proportional enabled to PID%_PRESS, value of REG_04_05* *3 = start and modulation with temperatures TIN3, TFN3 and TCD3* *4 = proportionally enabled to analogue input ING3A*
T_ON	P32	sec	60	Seconds of delay for fan start
T_OFF	P33	sec	90	Seconds of delay for fan stop
OUT3A			8 (LBW)	Digital output for main fan
OUT3B			3 (Y2)	Analogue output for main fan
ING3A			1 (NTC1)	Reference analogue input
TIN3	P37	°C	35	Heating fan ON temperature
TFN3	P38	°C	65	Temperature for output linearisation
TCD3	P39	°C	20	Conditioning fan ON temperature
FUNC 04	**Fnu P40**		**Function 04 - NOT USED ON LKH**	
FN_04	P41		0	Function Enabling *0 = disabled*
FUNC 05	**Fnu P50**		**Function 05 - NOT USED ON LKH**	
S5	P51		0	Function enabling *0 = disabled*
FUNC 06			**Destratifier function (function can only be activated in combination with SMART X ver. >2.07)**	
FN06			1	Function Enabling *0=disabled;* *1= enable destratifier action*
OUTF06			4 (Y3)	*Analogue or digital output for destratifier fans*
FUNC 08	**Fnu P80**		**Damper Management Function**	
FN_08	P81		0	Function Enabling *0 = disabled* *1 = enables outdoor air and/or exhaust damper (ON/OFF)* *2 = enables mixture, outdoor and exhaust damper (modulating)*
FUNC_09			**Extractor management and free cooling function (function can only be activated in combination with SMART X ver. >2.07)**	
FN_09			0	Function Enabling *0 = disabled* *1 = enabled*
FUNC_10			**Hybrid warm air heat management function**	
FN_10			2	*Function Enabling* *0=disabled;* *1= enabled in conditioning phases;* *2 = enabled for external HP management*
OUT10A			6 (Q2)	*Digital output for EXTERNAL Heat pump ON/OFF*
OUT10B			7 (Q3)	*Digital output for EXTERNAL Heat pump CONDITIONING ON*
ING10			9 (ID2)	*Defines the input for EXTERNAL Heat pump alarm (Fault E50)*
	RTU		**RS485 Serial Communication Configurations**	
D_SL	SSL		0	slave serial baud rate (SMART X) *0 = baud rate 19,200 - Even Parity* *1 = baud rate 9,600 - Even Parity* *2 = baud rate 19,200 - Odd Parity* *3 = baud rate 9,600 - Odd Parity* *4 = baud rate 19,200 - No Parity* *5 = baud rate 9,600 - No Parity*

Parameters of G26800 CPU PCB version 8.03.xx				
Parameter Name			LKH044	DESCRIPTION
Smart	LCD	U.M.		
			NTC input configuration	
NTC1			1	Activates or deactivates NTC1 input
NTC2			0	Activates or deactivates NTC2 input
NTC3			0	Activates or deactivates NTC3 input
			B0 Input Configurations (flue gas fan speed) - DO NOT CHANGE!	
B0			1	B0 analogue input enabling *0 = disabled* *1 = enabled*
			B1 Input Configurations	
B1			1	B1 analogue input enabling *0 = disabled* *1=enabled as analogue input*
XA1			0	X-axis minimum value – minimum input voltage
XB1			9.99	X-axis maximum value – maximum input voltage
YA1			0	Y-axis minimum value – minimum magnitude value *
YB1			9.99	Y-axis maximum value – maximum magnitude value
CV1			0.01	Coefficient for PRØ displaying; value displayed on Smart and used for controls
UM1			8	1=°C; 2=bar; 3=mbar; 4=Pa; 5=%; 6=l/h; 7=mc/h; 8= V
			B2 Input Configurations - NOT USED ON LKH	
B2			0	B2 analogue input enabling *0 = disabled*
			B3 Input Configurations - NOT USED ON LKH	
B3			0	B3 analogue input enabling *0 = disabled*
			Digital Input Configurations	
ID1			4	ID1 digital input enabling *0 = disabled* *1 = N.C input (Fault with input Open) with manual reset* *2 = N.C input (Fault with input Open) with Autoresolve* *3 = N.O. input (Fault with input Closed) with Autoresolve* *4 = enabled as N.O. (to enable functions, without Faults)*
TD1			0	Alarm triggering or function enabling delay time
ID2			4	ID2 digital input enabling *0 = disabled* *1 = N.C input (Fault with input Open) with manual reset* *2 = N.C input (Fault with input Open) with Autoresolve* *3 = N.O. input (Fault with input Closed) with Autoresolve* *4 = enabled as N.O. (to enable functions, without Faults)*
TD2			0	Alarm triggering or function enabling delay time
ID3			3	ID3 digital input enabling *0 = disabled* *1 = N.C input (Fault with input Open) with manual reset* *2 = N.C input (Fault with input Open) with Autoresolve* *3 = N.O. input (Fault with input Closed) with Autoresolve* *4 = enabled as N.O. (to enable functions, without Faults)*
TD3			10	Alarm triggering or function enabling delay time

Parameters of G26800 CPU PCB version 8.03.xx				
Parameter Name			LKH044	DESCRIPTION
Smart	LCD	U.M.		
			Y0 Analogue Output Configuration - DO NOT CHANGE!	
YM0			1	Direct/reverse output configuration 0 = direct output: the maximum calculation value (100%) corresponds to the maximum output value 1 = reverse output: the maximum calculation value (100%) corresponds to the minimum output value
YL0			0	Minimum voltage (or PWM in %) output value
YH0			10	Maximum voltage (or PWM in %) output value
YF0			4	Fixed voltage or % output value (forced by program)
YT0			10	Voltage increase/decrease (or in %) every second*
YN0			0	Output Linearisation Mode *0 = linear output value between YL0 and YH0* *1 = output with values limited to YL0 and YH0 (for request values below YL1 the output will be YL1, for request values above YH1 the output will be YH1)*
			Y2 Analogue Output Configuration - EC FAN MANAGEMENT	
YM2			1	Direct/reverse output configuration 0 = direct output: the maximum calculation value (100%) corresponds to the maximum output value. 1 = reverse output: the maximum calculation value (100%) corresponds to the minimum output value"
YL2			5.4	Minimum voltage (or PWM in %) output value
YH2			9.4	Maximum voltage (or PWM in %) output value
YF2			5	Fixed voltage or % output value (forced by program) in conditioning mode)
YT2			1	Voltage increase/decrease (or in %) every second*
YN2			0	Output Linearisation Mode *0= linear output value between YL2 and YH2;* *1= output with values limited to YL2 and YH2 (for request values below YL1 the output will be YL1, for request values above YH2 the output will be YH2)"*
			Y3 Analogue Output Configuration - FOR EC QUEEN DESTRATIFIER MANAGEMENT	
YM3			0 (direct)	Direct/reverse output configuration 0 = direct output: the maximum calculation value (100%) corresponds to the maximum output value. 1 = reverse output: the maximum calculation value (100%) corresponds to the minimum output value"
YL3			2	Minimum voltage (or PWM in %) output value
YH3			10	Maximum voltage (or PWM in %) output value
YF3			5	Fixed voltage or % output value (forced by program)
YT3			1	Voltage increase/decrease (or in %) every second*
YN3			0	Output Linearisation Mode *0= linear output value between YL3 and YH3;* *1= output with values limited to YL2 and YH2 (for request values below YL1 the output will be YL1, for request values above YH3 the output will be YH3)"*

5.8. Analysis of lockouts- faults

The CPU-SMART manages two types of lockouts:
- preventive, it warns the customer that the LKH heaters require maintenance;
- operational, it stops the LKH heater for safety reasons or to ensure its correct operation.

Some operational faults require manual reset; others reset themselves when the problem that caused them is solved.
Below is a complete list of faults, possible causes and possible solutions.

CODE	DESCRIPTION	CAUSE	RESET
Flame Safety Alarms - Caused by the flame monitoring equipment (TER)			
E10	Failure to ignite the burner after 4 attempts performed by the equipment.	• No gas • Phase and neutral reversed; • Earth wire not connected; • Phase-Phase connection without neutral; • Ignition electrode failed or badly positioned; • Low CO2 value; • Gas supply pressure too high (>60mbar)	Manual
E11	Untimely (parasitic) flame. The equipment detects a flame presence signal with burner off	• Loss of insulation of TER equipment; • - Insulation loss of the ignition cable or single-electrode (ignition/detection)	Manual
E12	Ignition failure; not visible. The count, displayed in the event log, indicates problems with ignition	Check the causes as indicated in fault E10	
E13	TER equipment does not accept the reset from CPU (max 5 reset attempts in 15 minutes)	Check the causes as indicated in fault E10. Disconnect and restore power supply	Manual
E14	Lack of communication between TER equipment and CPU for more than 60 seconds	• TER equipment or CPU PCB fault; • Connections on the STB thermostat to earth; • Capillary of the STB thermostat that discharges on the earth faston of the thermostat body	Autoresolve
E15	The flame monitoring equipment (TER) does not reach the "Running" status after 300 seconds from the heat request by the CPU	• Faulty TER equipment; • No gas or wrong burner adjustment; • Insufficient gas pressure; • Total or partial obstruction of the fume outlet	Manual or Autoreset (every 5')
E16	General lockout of the flame monitoring equipment (TER)	• Reports a safety burner switching off following uninterrupted operation >24h; • Faulty TER equipment	Manual or Autoreset (every 5')
E17	Internal fault of TER equipment, that does not accept reset command from CPU	Faulty TER equipment	Manual or Autoreset (every 5')
E18	Flame loss with TER equipment in running phase. The count, which can be displayed in the event log, indicates that the burner will turn off after flame stabilisation time or when the maximum Heat Input is reached	• Reduced gas flow rate on the line or excessive pipeline heat loss; • Incorrect burner setting (CO2 too low)	
Alarms for safety device activation			
E20	Activation of safety thermostat STB	• Excess air temperature due to lack of air circulation/ flow; • Safety thermostat broken or not connected • Dirty finned coil	Manual
E22	STB safety thermostat activation in ignition phase	• Frost or temperature below -20°C; • Safety thermostat or flue gas thermostat broken or not connected	Autoresolve
E24	ID4 input alarm	• ID4 - ID5 (CN02) input open • ID4 - IDC (CN02) jumper missing	Autoresolve
E25	ID5 input alarm	• ID5 - IDC (CN02) input open • ID5 - IDC (CN02) jumper missing	Autoresolve

CODE	DESCRIPTION	CAUSE	RESET
		Flue Gas Fan Fault Alarms (VAG)	
E30	No flue gas fan (VAG) start-up or speed too low in start-up phase	• Flue gas fan (VAG) power supply interrupted; • Flue gas fan (VAG) fault; • CPU PCB fault. To check possible CPU failure, disconnect 4-wire connector (PWM) from flue gas fan (VAG) and check ABSENCE of voltage between GND-Y0 (HALL) and B0-Y0 contacts of terminal board CN03. The presence of voltage indicates a failure of the CPU PCB	Manual
E31	Flue gas fan speed (VAG) too high in stand-by phase	• Flue gas fan (VAG) power supply interrupted; • Flue gas fan (VAG) fault; • CPU PCB fault. • In order to check for any VAG failure: a) Keep the cables connected to the VAG; b) Make sure to be in stand-by condition ("Rdy" or "Sty" signal on the LCD display); c) Check the direct current voltage value (Vdc) between GND and B0 terminal of terminal board CN03. If a voltage of approx. 5-6 Vdc is detected, the VAG is faulty	Manual
E32	Flue gas fan speed (VAG), during operation, outside minimum and maximum set parameters	• VAG electric cables interrupted, not connected or wrongly connected; • Flue gas fan (VAG) fault	Manual or Autoreset (every 5')
		Digital input alarms	
E36	ID1 input alarm	Programming error of par. ID1. Set par. ID1=0 (if not used for connection with remote controls) or ID1=4	Manual or Autoresolve
E37	ID2 input alarm	Programming error of par. ID2. Set par. ID2=0 (if not used for connection with remote controls) or ID2=4	Manual or Autoresolve
E38	Condensate control electrode activation alarm (LKH)	• Clogged condensate drain (ice or impurities) - clean siphon and/or exhaust duct; • Condensate detection electrode grounded or faulty	Manual or Autoresolve
		Alarms of analogue inputs and NTC probes	
E41	NTC1 probe error	No signal from NTC probe or faulty NTC probe	Autoresolve
		Overtemperature Alarms	
E50	HP alarm (Digital Input ID2) - only for HP with management by digital contacts	Heat pump Alarm/Lockout	Autoresolve
E51	NTC1 probe temperature > TH1	• Faulty modulation probe; • Temperature measured by NTC1 probe (rear of device) > par. TH1; • Dirty finned coil	Autoresolve with NTC1 < ST1
		Modbus communication alarms	
E60	Communication error between CPU-SMART PCB and Modbus Slave, Smart (CN04) network	Modbus serial network disconnected; The address of the CPU PCB is wrong and/or not configured in the Modbus network	Autoresolve
		Alarms for no voltage or dirty filters	
E71	Dirty air filter, preventive warning	Not used. Programming error of par. CTRL_09. Set par. CTRL_09 = 0	
E72	Dirty air filter, lockout alarm	Not used. Programming error of par. CTRL_09. Set par. CTRL_09 = 0	
E75	No voltage during operating cycle (excluding standby); fault is not visible on remote control but only counted	No voltage during operation	

CODE	DESCRIPTION	CAUSE	RESET
Parameter configuration error alarms			
E80	Pressure probe error	Not used. Programming error of par. CTRL_01. Set par. CTRL_01 = 0	
E81	Pressure less than ST_H20 setpoint	Not used. Programming error of par. CTRL_01. Set par. CTRL_01 = 0	
E82	Pressure higher than TH_H20 limit value	Not used. Programming error of par. CTRL_01. Set par. CTRL_01 = 0	
E98	Input configuration error	No input enabling for functions or controls (e.g. no activation of NTC1 input combined with REG_01)	Autoresolve
E99	Function configuration error	No activation of compulsory functions for the product type (e.g. no activation of CTRL_04 for product type "LKH")	Autoresolve
EEPROM alarms			
E100 (CPU)	Eeprom access error	Eeprom missing or inserted partially or in the opposite direction	Autoresolve
E101 (EPr)	Eeprom data error	Eeprom removed during operation or damaged	Autoresolve

5.9. GAS Connection

Use the gas line connections only with CE certified components.

The heater is supplied complete with:
- double coil gas valve
- gas stabiliser and filter (inside the gas valve)

Al components are fitted inside the burner housing. To complete the installation, as required by current standards, the following components must be fitted by the installer:
- Anti-vibration joint
- Gas valve
- Gas filter [without stabiliser]

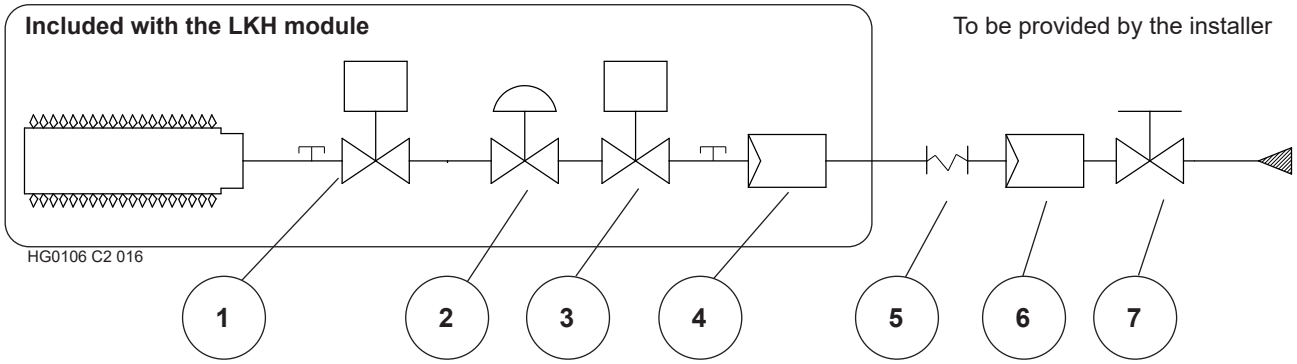
NOTE: AN EN126 certified gas filter with filtration level lower than or equal to 50 microns must be used, with no pressure stabiliser, with great capacity, since the filter supplied as standard, upstream of the gas valve, has a limited surface.

NOTE: For ease of maintenance, connect the heater by means of a seal and swivel gasket.

Avoid using threaded connections directly on the gas connection.

Current legislation allow a maximum pressure inside the rooms, or thermal station, of 40mbar; higher pressure must be reduced upstream of the boiler room or the site where the heater is installed.

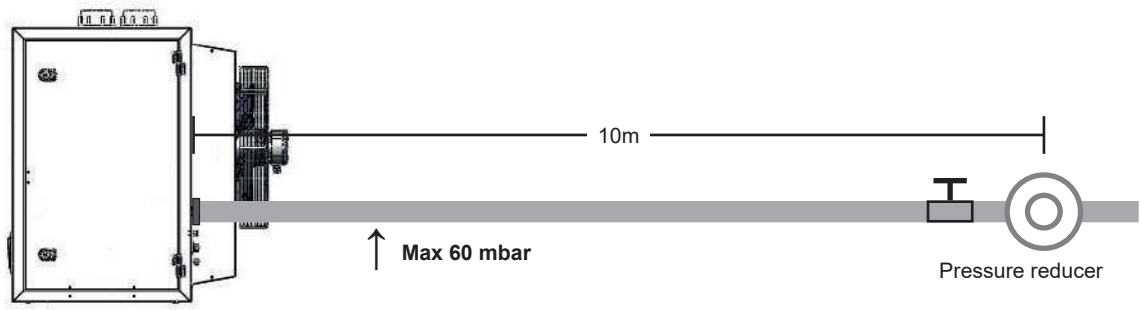
KEY
1 Main burner gas solenoid valve
2 Pressure stabiliser
3 Safety gas solenoid valve
4 Gas filter (small section)
5 Anti-vibration joint
6 Gas filter (large section)
7 Gas valve



ATTENTION: During the installation, it is recommended to tighten the external gas supply pipe nut without exceeding a tightening torque of 150 Nm for Ø 3/4".

ATTENTION: IT IS strictly prohibited to supply gas to the circuit with pressures higher than 60 mbar. Such pressures could cause the valve to break.

NOTE: If pressure is higher than 60 mbar, a pressure reducer must be installed at a distance of at least 10 m and no pressure stabiliser must be fitted between the pressure reducer and the heater, but leaving the gas filter.



6. SERVICING INSTRUCTIONS

The first start-up must be carried out only by authorised service centres.
The first start-up also includes a combustion analysis, which is compulsory.
The equipment is certified in the EC and non-EC countries, according to the gas categories shown below.

6.1. Country Table - Gas Category

Country	Category	Gas	Pressure	Gas	Pressure	Gas	Pressure
AT, CH	II2H3B/P, I2HY20	G20	20 mbar	G20Y20	20 mbar	G30/G31	50 mbar
BE <70kW	I2E(S)B, I3P, I2EY20	G20/G25	20/25 mbar	G20Y20	20 mbar	G31	37 mbar
BE >70kW	I2E(R)B, I3P, I2EY20	G20/G25	20/25 mbar	G20Y20	20 mbar	G31	37 mbar
DE	II2ELL3B/P, I2EY20	G20/G25	20 mbar	G20Y20	20 mbar	G30/G31	50 mbar
DK, FI, GR, SE, NO, IT, CZ, EE, LT, SI, AL, MK, BG, HR, TR, RU	II2H3B/P, I2HY20	G20	20 mbar	G20Y20	20 mbar	G30/G31	30 mbar
RO	II2H3B/P, I2HY20	G20	20 mbar	G20Y20	20 mbar	G30/G31	30 mbar
	II2L3B/P	G25	20 mbar			G30/G31	30 mbar
ES, GB, IE, PT, SK	II2H3P, I2HY20	G20	20 mbar	G20Y20	20 mbar	G31	37 mbar
FR	II2Esi3P, I2EY20	G20/G25	20/25 mbar	G20Y20	20 mbar	G31	37 mbar
LU	II2E3P, I2EY20	G20/G25	20 mbar	G20Y20	20 mbar	G31	37/50 mbar
NL	II2EK3B/P, I2EY20	G20/G25.3	20/25 mbar	G20Y20	20 mbar	G30/G31	30 mbar
HU	II2HS3B/P, I2HY20	G20/G25.1	25 mbar	G20Y20	25 mbar	G30/G31	30 mbar
CY, MT	I3B/P					G30/G31	30 mbar
LV*	II2H3B/P, I2HY20	G20	20 mbar	G20Y20	20 mbar	G30/G31	30 mbar
IS	I3P					G31	37 mbar
PL	II2ELwLsLn3B/P, I2EY20	G20/G27/ G2.350/ G2.300	20/20/ 13/ 13 mbar	G20Y20	20 mbar	G30/G31	37 mbar

(*) Gas Category in accordance with the declaration of the Member State pursuant to Art. 4, paragraph 1 of Regulation (EU) 2016/426 (ref. Official Journal EU 2018/C 206/01)
(G20Y20) The suffix “Y20” means that the equipment is suitable for operation with natural gas and a natural gas mixture with 20% hydrogen.

The following information is clearly printed on the heater packaging: country of destination, gas category and equipment code. The code allows finding out the factory settings.

NOTE: In compliance with standards EN17082, EN 437 and ISO3166, GB refers to the United Kingdom.

Codes with no extension:
- LKH044IT if there is no extension, it means that the equipment has been tested and set to run with natural gas [G20]

Codes with extension:
The fourth letter indicates the type of gas the equipment has been set up for:
- LKN044FR-xxx**0** 0 indicates that the equipment has been tested and set up for natural gas [G20];
- LK044MT-xxx**1** 1 indicates that the equipment has been tested and set up for LPG [G31];
- LK044NL-xxx**2** 2 indicates that the equipment has been tested and set up for 'L' [G25] or ‘K’ [G25.3] natural gas;
- LKN044HU-xxx**3** 3 indicates that the equipment has been tested and set up for natural gas [G25.1];
- LK044PL-xxx**4** 4 indicates that the equipment has been tested and set up for gas [G2.350].

Another adhesive label, located near the fuel connection of the equipment, specifically indicates the type of gas and the supply pressure for which the equipment has been set up and tested.

NOTE: The unit is supplied already set for natural gas [G20] and equipped with the kit for conversion to LPG. The kit for conversion to LPG is not supplied in countries where conversion is prohibited.

NOTE: Conversion is strictly prohibited in some countries, such as Belgium, which do not allow the double gas category.

6.2. Gas Settings Table

LKH-KONDENSA HYBRID table

If a Hydrogen-ready installation is provided for H2 percentages up to 20% (referred to gas distributed in the network), all gas valve calibration operations must refer to the O2 values in G20 table

TYPE OF GAS G20 - Cat. E-H			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	20* [min 17-max 25]	
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	0.8	3.2
CARBON DIOXIDE -CO_2 CONTENT	[%] ± 0.1	8.9	9.1
OXYGEN	[%] ± 0.2	5.0	4.7
AIR EXCESS	[-]	1.3	1.3
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
FLUE GAS MASS FLOW RATE (MAX.)	[kg/h]	52.1	
GAS ORIFICE PLATE	[mm]	5.8	
AIR ORIFICE PLATE	[mm]	Not required	
* For Hungary, supply pressure is 25 mbar			

TYPE OF GAS G25 - Cat. L-LL			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	25* [min 17-max 30]**	
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	0.9	3.7
CARBON DIOXIDE -CO_2 CONTENT	[%] ± 0.1	9.0	9.2
OXYGEN	[%] ± 0.2	4.6	4.2
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
GAS ORIFICE PLATE	[mm]	6.5	
AIR ORIFICE PLATE	[mm]	Not required	
* For Germany and Romania, supply pressure is 20 mbar ** For Romania, max. supply pressure is 25 mbar			

TYPE OF GAS G25.3 - Cat. K			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	25 [min 20-max 30]	
GAS CONSUMPTION (15°C-1013mbar)	[kg/h]	0.9	3.6
CARBON DIOXIDE -CO_2 CONTENT	[%] ± 0.1	9.4	9.6
OXYGEN	[%] ± 0.2	3.8	3.5
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
GAS ORIFICE PLATE	[mm]	6.5	
AIR ORIFICE PLATE	[mm]	Not required	

TYPE OF GAS G2.350 - Cat. Ls (Only for PL-Poland)			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	13 [min 10-max 16]	
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	1.1	4.4
CARBON DIOXIDE -CO_2 CONTENT	[%] ± 0.1	9.0	9.2
OXYGEN	[%] ± 0.2	4.3	3.9
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
GAS ORIFICE PLATE	[mm]	7.5	
AIR ORIFICE PLATE	[mm]	Not required	

TYPE OF GAS G25.1 - Cat. S (Only for HU-Hungary)			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	25 [min 20-max 33]	
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	0.9	3.7
CARBON DIOXIDE -CO_2 CONTENT	[%] ± 0.1	9.9	10.1
OXYGEN	[%] ± 0.2	5.4	5.1
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
GAS ORIFICE PLATE	[mm]	6.5	
AIR ORIFICE PLATE	[mm]	Not required	

TYPE OF GAS G27 - Cat. Lw (Only for PL-Poland)			
TYPE OF MACHINE		LKH044	
Output		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	20 [min 16-max 23]	
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	1.0	3.9
CARBON DIOXIDE -CO_2 CONTENT	[%] ± 0.1	8.8	9.1
OXYGEN	[%] ± 0.2	4.8	4.2
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
GAS ORIFICE PLATE	[mm]	6.7	
AIR ORIFICE PLATE	[mm]	Not required	

TYPE OF GAS G30 - cat. 3B-P *			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	30 [min 25-max 35] - 50 [min 42.5-max 57.5]	
GAS CONSUMPTION (15°C-1013mbar)	[kg/h]	0.6	2.5
CARBON DIOXIDE -CO_2 CONTENT	[%] ± 0.1	12.1	12.3
OXYGEN	[%] ± 0.2	2.9	2.6
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
GAS ORIFICE PLATE	[mm]	4.9	
AIR ORIFICE PLATE	[mm]	Not required	
* Modification of the modulation PCB b1-b2 parameters required:			
b1		203	
b2		626	

TYPE OF GAS G31 - Cat. 3P			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	30 [min 25-max 35] - 37 [min 25-max 45] - 50 [min 42.5-max 57.5]	
GAS CONSUMPTION (15°C-1013mbar)	[kg/h]	0.6	2.4
CARBON DIOXIDE -CO_2 CONTENT	[%] ±0.1	10.0	10.3
OXYGEN	[%] ±0.2	5.7	5.2
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
FLUE GAS MASS FLOW RATE (MAX.)	[kg/h]	60.5	
GAS ORIFICE PLATE	[mm]	4.9	
AIR ORIFICE PLATE	[mm]	Not required	

TYPE OF GAS G2.300 - Cat. Ln (Only for PL-Poland)			
TYPE OF MACHINE		LKH044	
		min	max
CATEGORY		according to the country of destination - see reference table	
SUPPLY PRESSURE	[mbar]	13 [min 10-max 16]	
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	1.3	5.0
CARBON DIOXIDE -CO_2 CONTENT	[%] ±0.1	9.0	9.2
FLUE GAS TEMPERATURE	[°C]	40.0	95.0
GAS ORIFICE PLATE	[mm]	8.7	
AIR ORIFICE PLATE	[mm]	Not required	

6.3. Starting up for the first time

The LKH heaters are supplied already set up and tested for the gas specified on the nameplate. Before turning on the heater, check the following:

- make sure the gas being supplied matches the gas for which the heater has been set up;
- check, with the pressure intake "IN" on the gas valve, that the valve input pressure corresponds to that required for the type of gas being used;
- check that electrical connections correspond to those indicated in this manual or other wiring diagrams enclosed with the unit;
- check that efficient earthing connections have been completed, carried out as specified by current safety regulations;
- energize the heater through the machine main switch

To turn on the heater, follow the instructions below:

Check that RDY or STY is displayed. If OFF is displayed, use the LCD control under FUN item to set the device to AUT;
Check that heat is being demanded by the connected control. When HEA appears on the LCD display, the heater starts the ignition cycle.

NOTE: Frequently, when turned on for the first time, the burner cannot ignite because there is air in the gas pipe. This will lock out the equipment. You will need to reset the equipment and repeat the operation until it ignites.

6.4. Analysis of combustion

Wait until the heater is switched on. Check that the heater reaches its maximum power: from the LCD display, access the REG menu, then use the Hi and Lo controls to force operation at maximum or minimum output.
If the heater is controlled via the Smart X Web/Easy, the function shown is valid and the switches must not be reset to control the operation from the LCD panel.
At maximum output, check again that the input pressure in the valve corresponds to the value required; adjust if necessary.
Perform the combustion analysis to verify that the level of CO_2 corresponds to the values indicated in the tables in paragraph 6.2 "Gas Settings Table".
If the measured value is different, turn the adjustment screw on the gas valve. Screwing the screw will increase the CO_2 level, loosening it will decrease the level.
Set the heater to minimum output, and verify that the level of CO_2 corresponds to the values in the tables in paragraph 6.2 "Gas Settings Table". If the values do not match, screw or loosen the offset screw respectively to increase or decrease the CO_2 level and repeat the procedure.

NOTE: The heater directly supplied to function with LPG is set up for G31 gas. If the unit runs on G30, it is necessary to verify and possibly adjust settings for CO_2 as shown in the tables in paragraph 6.2 "Gas Settings Table".

ATTENTION: IT IS FORBIDDEN to loosen the gas connections, the pressure connectors or any other gas connection point located inside the burner housing, to purge the air or inert gas that may be present inside the main feeding piping. The purging of air or inert gas from gas feeding lines must be carried out in accordance with current legislation.

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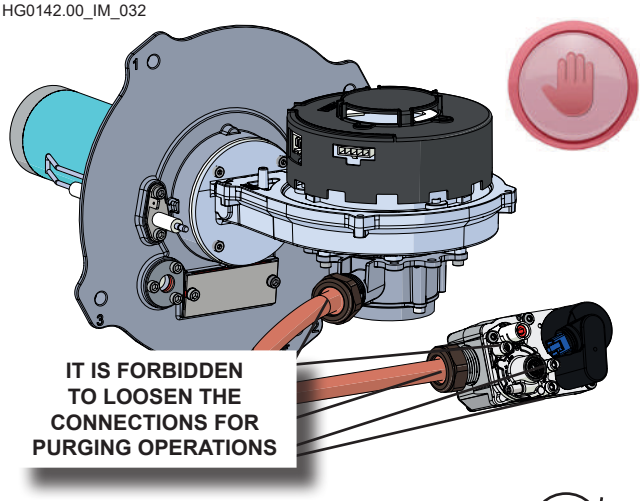

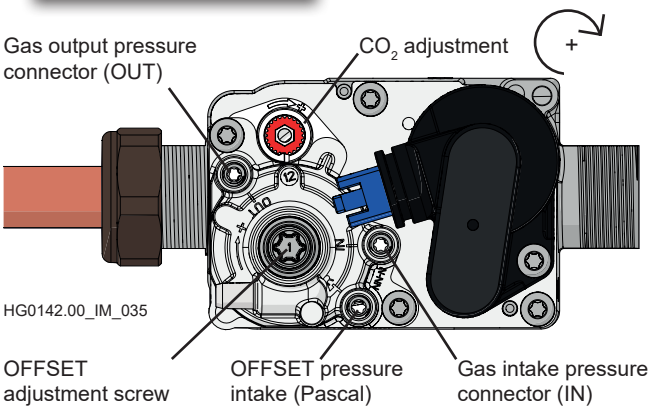

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6.5. Conversion to LPG

Conversion is strictly prohibited in some countries, such as Belgium, which do not allow the double gas category.

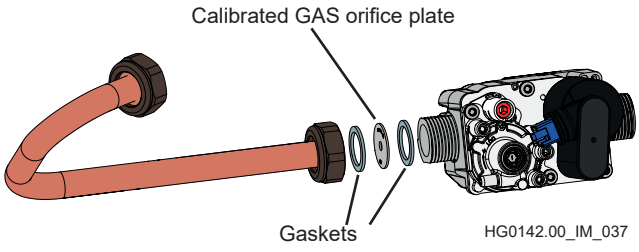
The unit is supplied already set for natural gas and with the kit for conversion to LPG, including:
- calibrated gas orifice plate;
- adhesive plate "Equipment converted...".

The kit is not supplied in countries where conversion is prohibited.
To convert the unit, follow these instructions:
- disconnect from power supply;
- replace the gas orifice plate fitted (natural gas) with the one supplied with the kit (LPG);
- restore power supply and set the heater up for ignition;
- while the start-up electrode is sparking, make sure there are no gas leaks.

When the burner is lit and working at maximum capacity, verify that the valve intake pressure corresponds to the value required for the type of gas that you are using.

Perform the combustion analysis as described in paragraph 6.4 "Analysis of combustion" and check that:
- the value of CO_2, at maximum and minimum heat output, is within the limits indicated for the type of gas being used (tables in paragraph 6.2 "Gas Settings Table"). If a different value is detected, change it by turning the adjustment screw: loosening it decreases the CO_2 level, screwing it increases the level.
- that the gas valve Venturi pipe connector does not leak.

After converting and regulating the unit, replace the nameplate indicating "Equipment regulated for natural gas" with the one in the kit that indicates "Equipment converted ...".



6.6. Conversion to gas G25 - G25.1 - G25.3 - G27

Conversion for gasses from G20 to G25 or G25.1 or G25.3 or G27 is allowed only in countries of category II2ELL3B/P [Germany], II2Esi3P [France], II2E3P [Luxembourg] and category II2HS3B/P [Hungary] and category II2ELwLsLn3B/P [Poland]. For countries in category II2EK3B/P [Netherlands] the unit is supplied already set up and regulated for G25.3.
For category I2E countries, where conversion from G20 to G25 is not permitted [Belgium], the unit is supplied set for operation with G20 gas.
Conversion from one type of gas to another can only be performed by authorised service centres.
Conversion to G25 and/or G25.1, G25.3, G27 where possible, consists in:
- insertion of orifice plate (according to the gas type and the equipment model)

After the conversion, relight the burner and:
- check that the intake pressure to the gas valve corresponds to the level required for the type of gas [see tables in paragraph 6.2 "Gas Settings Table"];
- check that the level of CO_2, at maximum and minimum heat output, is between the values indicated for the type of gas. If the value is different, change it by turning the adjustment screw on the gas valve: loosening it decreases the value, screwing it increases the value.

Stick the nameplate "Equipment converted for gas G25...." in place of the one that says "Equipment set up for .....".

NOTE: The conversion kit to G25 , G25.1 and G27 is only supplied on request. The conversion kit to G25 is included in the standard supply for France, Germany and Luxembourg.

6.7. Conversion to gas G2.350

Conversion is allowed only for Poland.
Conversion from one type of gas to another can only be performed by authorised service centres.
Conversion to G2.350 consists in:
- for all models: orifice place replacement (see "Gas settings tables").

After the conversion, relight the burner and:
- check that the intake pressure to the gas valve corresponds to the level required for the type of gas [see tables in paragraph 6.2 "Gas Settings Table"];
- check that the level of CO_2, at maximum and minimum heat output, is between the values indicated for the type of gas. If the value is different, change it by turning the adjustment screw on the gas valve: loosening it decreases the value, screwing it increases the value.

Stick the nameplate "Equipment converted for gas G2.350...." in place of the one that says "Equipment set up for .....".

NOTE: The conversion kit is supplied on request

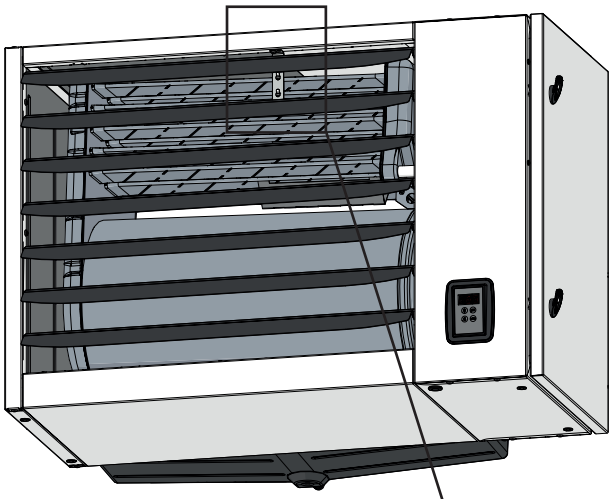
6.8. Replacing the Gas Valve

If the gas valve must be replaced, it is required to proceed with an inspection and possibly calibrate the CO_2 level through the adjustment on the valve.
It is advisable not to calibrate the offset: the valve calibration is performed by the manufacturer.
Carry out the combustion analysis procedure as described in paragraph 6.4 "Analysis of combustion".

6.9. Replacing STB and NTC

If it is necessary to replace the STB thermostat or the NTC probe, the initial position must be maintained, as shown in the figure.

HG0143.00_IM_038



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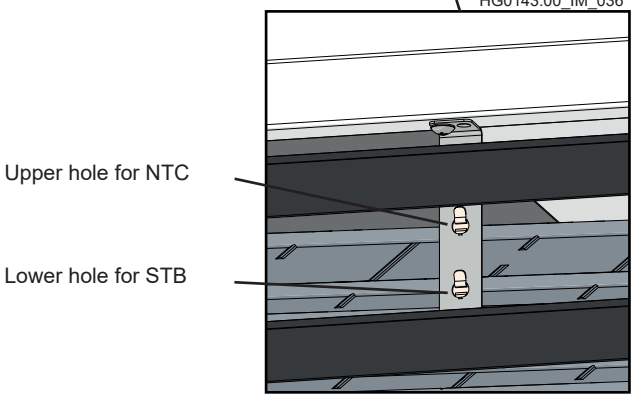
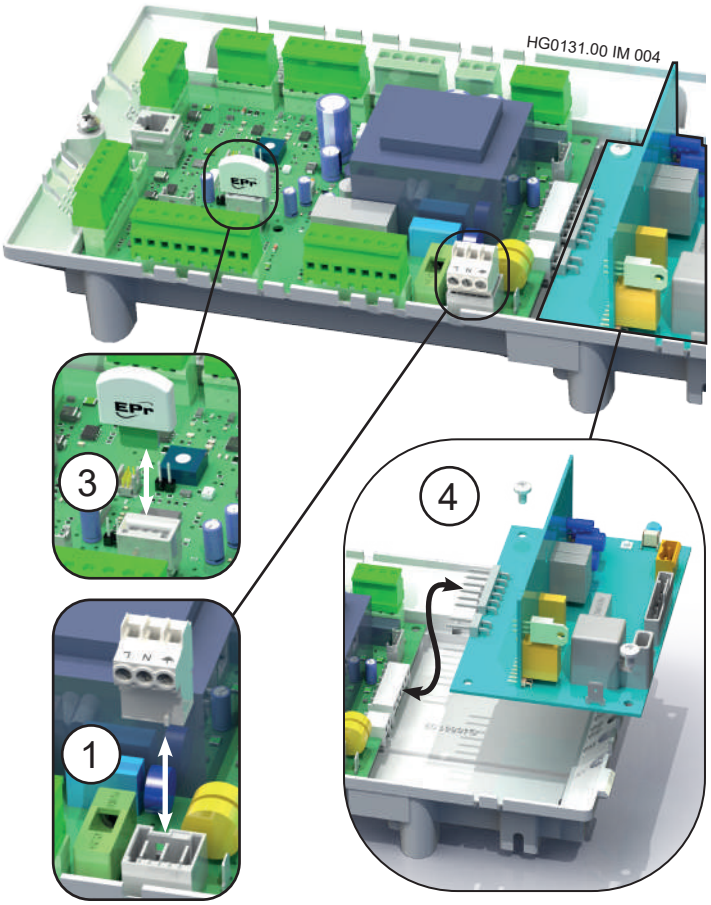


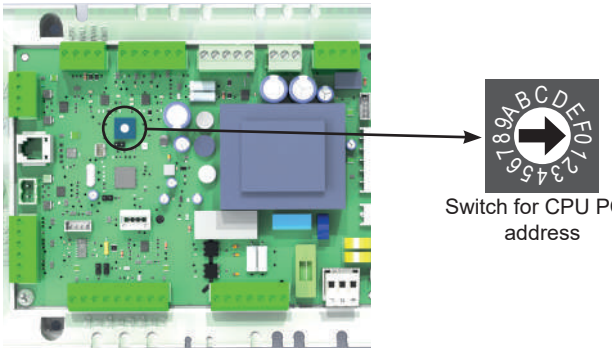
6.10. Replacing the modulation PCB

When replacing the CPU modulation PCB, it is required to carry out some essential operations, described below.
1. Disconnect voltage to the module
2. Disconnect all terminals from the CPU PCB
3. Remove and **store** the EEPROM memory card (point 3)
4. Disconnect the TER safety PCB
5. Remove and replace the CPU modulation PCB
6. Reposition the new CPU PCB, insert the previously stored EEPROM memory card (point 3.) (**The EEPROM card contains all the configured parameters, by inserting it into the new CPU, it is not necessary to reprogram the parameters**)
7. Reconnect the TER safety PCB and all terminals respecting the original positions.

HG0131.00 IM 004



Check the hardware configuration of the PCB
Modify the address of the PCB with the switch selector, copying that of the PCB that was just replaced.



7. MAINTENANCE

To keep the heater efficient and guarantee a long lifetime of the same, it is advisable to run some inspections at regular intervals:
1) check the status of the electrode and its seal;
2) check the status of flue exhaust and air intake ducts and terminals;
3) check the status of the Venturi pipe;
4) check and if necessary clean the exchanger, burner and compartment;
5) check and clean the water trap;
6) check the intake pressure at the gas valve;
7) check the operation of flame monitoring equipment;
8) check the safety thermostat(s);
9) check the ionization current.
10) check the status of ventilation units
At the end of each maintenance work, the heater must always be commissioned.

NOTE: Operations at points 1, 2, 3, 4 and 5 must be performed after disconnecting the heater from the electrical mains and closed the gas supply. Operations at point 6, 7, 8 and 9 must be done with the heater on.

NOTE: For any maintenance work on components other than those specified, please contact the manufacturer's technical service department.

Maintenance interval chart

Maintenance	Every year	Extraordinary
1) Electrode	●	
2) Flue gas/Air Terminals	●	
3) Venturi pipes	●	
4) Exchanger/Burner/ Compartment		●
5) Condensate collection tray and trap	●	
6) Gas valve	●	
7) Flame Equipment	●	
8) Safety thermostat(s)	●	
9) Ionization current	●	
10) Ventilation units	●	
11) Finned coil	●	
12) Hydraulic circuit	●	

1) Inspection of electrodes
Remove the electrode. Check the integrity of the ceramic and use sandpaper to remove any oxidation on the metal parts of the electrodes. Check the correct position of the electrodes (see drawing). The spark must occur between the two electrode stems. Replace the seal. Refit the electrode. Tighten the two screws to 2.5 Nm.

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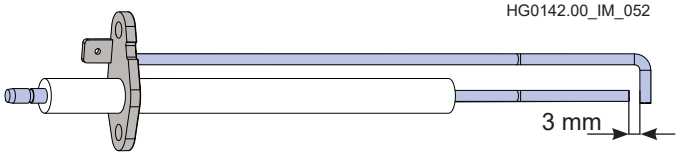

2) Inspection of flue gas exhaust and air intake ducts
Visually inspect where possible or use specific tools to check the status of the ducts.
Remove dust that forms on the air intake terminal.

3) Inspection and cleaning of the Venturi pipe
Remove any dirt at the mouth of the Venturi pipe with a brush, and be careful to not let it fall inside the piece.

4) Inspection and cleaning of the exchanger and burner
Good combustion in LKH heaters prevents dirt, which is normally caused by bad combustion. It is advisable, therefore, to not clean the exchanger and burner unless there are exceptional circumstances.
An accumulation of dirt inside the exchanger could be revealed by a considerable variation in the gas capacity that is not caused by improper functioning of the gas valve.
If the burner and/or heat exchanger is to be cleaned, it is necessary to check the correct distance between the burner electrode and torch (see drawing), replace all seals fitted between the burner and heat exchanger, and tighten the four burner nuts to 8 Nm.

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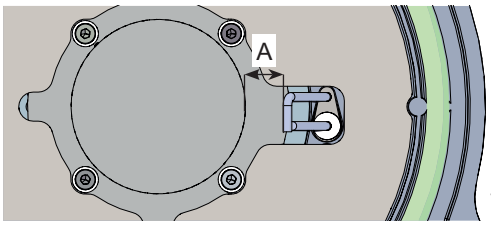
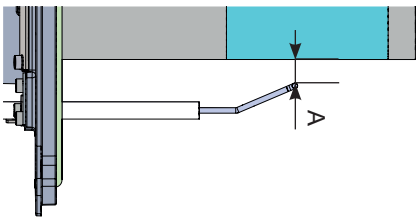


Value A:
13 mm



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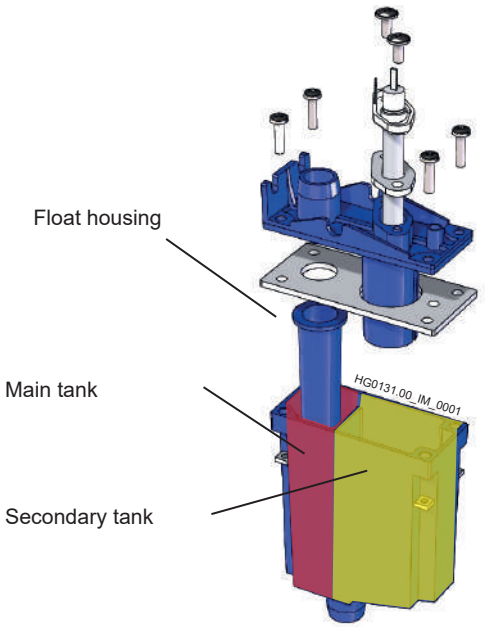
5) Inspection and cleaning of the condensate collection tray
Clean the trap every year, and check the connections. Make sure there are no traces of metallic residue. If metallic residue has formed, increase the number of inspections.
Remove the cover retaining screws and clean the internal part of the trap and the relevant float (it is possible to clean the trap under running water) by checking that all ducts are free. Check the integrity of the detection electrode and use sandpaper to remove any oxidation on the metal part.
Fill in the main tank with clean water and close the cover. Reconnect the trap to the condensate drain system. Proceed to replace the gaskets.
To check that the salts inside the tray are still active, use litmus paper to check that the pH level of water flowing out of is greater than 6.
If the pH is lower, replace the calcium carbonate present in the tray.



6) Inspection of gas pressure at valve input
Check that the intake pressure at the valve corresponds to the value required for the type of gas that you are using.
This verification must be done with the heater on at the maximum heat capacity.

7) Inspection of flame monitoring equipment
With the heater running, close the gas tap and verify that the machine is locked out, signalled on the LCD display of the CPU PCB on the machine with E10. Reopen the gas tap, reset the lockout and wait for the heater to restart.

8) Inspection of the safety thermostat(s)
This procedure must be done with the heater on and the burner lit. Open the thermostat series with an insulated tool [230 V], remove the fast-on from the safety thermostat, wait for the E20 block signal to appear on the LCD display on the CPU PCB on the machine. Close again the thermostat series, then reset the lockout.

9) Inspection of the ionization current
This procedure can be done directly from the LCD display by entering into the Out menu. The ion parameter indicates the value of the ionization current, and the reading is as follows:
- 100, indicates that the value is more than 2 microAmperes, which is plenty for the equipment to function;
- from 0 to 100, indicates a value from 0 to 2 microAmperes; for example, 35 corresponds to 0.7 microAmperes, which is the minimum threshold detectable for the flame monitoring equipment.

The value of the ionisation current must not be below 2 microAmperes. Lower values indicate: electrode in a bad position, rusted or about to stop functioning.

10) Check the status of ventilation units
Check whether the (external and internal) ventilation units are running correctly, without excessive vibration or clattering. Clean the rotating elements with compressed air to remove any deposits. If necessary, remove the ventilation units from the heater for better cleaning. When reassembling, replace any seals.

11) Inspection and cleaning of the finned coil
In order to ensure the correct air flow through the gas heat exchanger and the finned coil, the latter must be kept clean.
Access the finned coil by unscrewing the four air fan screws.
Remove any dirt deposited using compressed air, taking care to keep the air flow perpendicular to the surface of the coil to avoid bending the aluminium fins.
If necessary, wash with water or specific detergents.
Check for bent fins and restore their correct shape if necessary.

12) Inspection and cleaning of the hydraulic circuit
Check that there are no air bubbles in the circuit and that the air valve is functioning properly.
Check for water leaks.
Clean the filters in the system.
Check that the connections are tightened correctly.
Check the pre-charge of the expansion reservoir.
Check the quality of the water and the presence of any glycol.

8. WIRING DIAGRAM

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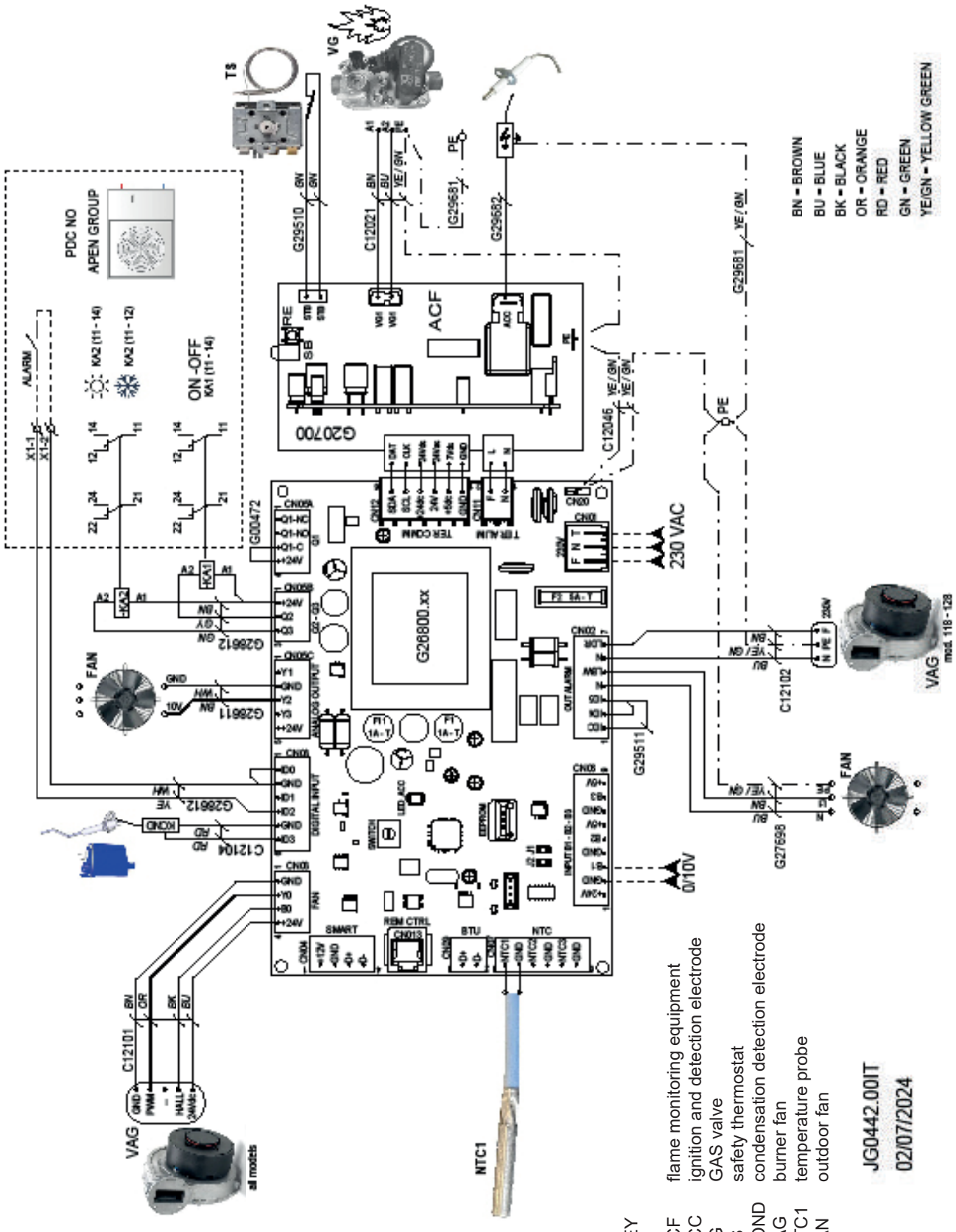

Apen Group S.p.A.
Via Isonzo, 1
Casella Postale 69
20042 Pessano con Bornago (MI) Italia
Tel. +39 02 9596931
Fax +39 02 95742758

Cap. Soc. Euro 928.800,00 i.v.
Cod. Fisc. - P.IVA 08767740155
Registro AEE N. IT18080000010550
www.apengroup.com
apen@apengroup.com
apen@pec.apengroup.com