EN	*Use, Installation and Maintenance Manual* *AKN-0X00 condensing boiler*

Thermal Account for Public Authorities	
Tax deduction	
Yield up to	**108%**
Energy Efficiency Class	**A**
NOx Class:	**6**

kiwa tested
H_2
20% HYDROGEN READY

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VER. 01.2020

Dichiarazione di Conformità
Statement of Compliance

CE

APEN GROUP S.p.A.
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Fax +39.02.95742758
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Il presente documento dichiara che la macchina:
With this document we declare that the unit:

Modello: ***Model:***	**Caldaia AKN: AKN032, AKN034, AKN050, AKN070, AKN100** ***Hot Water Boiler AKN: AKN032, AKN034, AKN050, AKN070, AKN100***

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
- **Direttive Rendimenti 92/42/CE**
  Efficiency Requirements Directive 92/42/CE
- **Regolamento UE 813/2013**
  EU Regulation 813/2013
- **Regolamento UE 811/2013**
  EU Regulation 811/2013
- **Direttiva compatibilità elettromagnetica 2014/30/UE**
  Electromagnetic Compatibility Directive 2014/30/UE
- **Direttiva Bassa Tensione 2014/35/UE**
  Low Voltage Directive 2014/35/UE
- **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:

- **EN15502-1:2021+AC:2022**
- **EN15502-2-1 :2022**
- **EN60335-1**
- **EN60335-2-102**
- **EN60730-1**
- **EN 60068-2-1**
- **EN 60068-2-2**

Organismo Notificato:
Notified body:
Kiwa Cermet Italia S.p.A
0476
PIN 0476CR1226

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, 01/02/2024

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 consultation by the new owner and/or installer.

The manufacturer shall not be held civilly or criminally responsible for injuries to people or animals or damage to property caused by incorrect installation, calibration and maintenance, misuse, or partial or superficial reading of the information contained in this manual or by operations carried out by unqualified staff.

This equipment must be used only for the applications for which it was designed (paragrafo 2.6). 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 this use and instruction manual.

The equipment must be installed in compliance with current regulations and according to the manufacturer's instructions by qualified staff, technically specialised in the heating 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 specified in this manual, and in any case in compliance with the regulations in force in the country where the equipment 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.
ONLY FOR ITALY: We remind that Presidential Decree no. 74/2013 provides that annual maintenance of the equipment and check of thermal efficiency with a yearly or biennial frequency (according to the heat output of the equipment) are mandatory.
The warranty conditions are specified on the warranty certificate supplied with this equipment.
The manufacturer declares that the equipment has been workmanlike manufactured in compliance with EN technical standards and with all relevant legislation, as well as with the Gas Appliances Regulation 2016/426/EU and the other applicable directives.

For Swiss market, reference standards are:
- SSIGA G1 Directive: Directive for natural gas equipment in buildings;
- Cantonal requirements (AICAA- Firefighting directives, Thermal technical systems (2015))

1.1. Graphic symbols used in this manual

The following symbols are used in this manual whenever it is necessary to draw the operator's attention on a safety issue:

	**Notes**.
	**Cautions**.
	**Instructions for the correct assembly**.
	**Safety rules for users or operators of the equipment and for nearby workers**.

2. SAFETY-RELATED WARNINGS

Please find below the safety regulations for the installation room and the air vents.

2.1. Fuel

Before starting up the boiler, make sure that:
- the gas mains supply data are compatible with the data stated on the nameplate;
- the combustion air intake ducts and the fume exhaust pipes are only those specified by Apen Group;
- the gas seal of the feeding system has been tested and approved in compliance with the applicable standards;
- the boiler 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 internal cleaning of gas and water pipes has been correctly carried out;
- the size of fuel supply pipes is suitable for the power required by the boiler;
- the fuel supply pressure is between the range specified on the nameplate.

2.2. Gas Leaks

If you smell gas:
- do not operate electrical switches, the telephone or any other object/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. Personal protective equipment

While using and maintaining the units, personal protective equipment must be used, i.e.:

	**Clothing: The operator that carries out maintenance or uses the system must compulsorily wear clothing compliant with the essential safety requirements in force. Moreover, he/she must wear safety shoes with non-slip sole, in particular in environments with slippery floor.**
	**Gloves: Suitable protective gloves must be used during cleaning and maintenance operations.**
	**Mask and goggles: A respiration protection mask and goggles must be used during cleaning operations.**

2.4. Safety signals

The unit is provided with the following safety signals, that the staff must necessarily respect:

	**General danger**
	**Dangerous electrical voltage**

2.5. Power supply

The equipment shall be properly connected to an efficient grounding system, complying with existing regulations.

Cautions

- Check the efficiency of the grounding system with the help of qualified personnel;
- 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 equipment 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;
- The electric cables must be kept away from heat sources.

It is compulsory to install, upstream of the power cable, a fused omnipolar switch with contact opening greater than 3 mm. The switch must be visible, accessible and positioned less than 3 metres away from the equipment. All electrical operations (installation and maintenance) must be carried out by qualified staff.

2.6. Use

These units are manufactured for water heating. A different application, not expressly authorised by the manufactured, is considered improper and therefore not permitted. The fluid to be used is exclusively water or a mixture of water and glycol in case of low water temperatures.

It is strictly FORBIDDEN to directly connect heated water delivery from the machine to the domestic circuit taps. This fluid is not intended for domestic use and must not be ingested.

Do not allow children or inexperienced people to use any electrically powered equipment.
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 use the pipes to earth electrical equipment;
- do not touch the hot parts of the equipment, such as the flue outlet duct;
- do not place any object over the equipment;
- do not touch the moving parts of the equipment.

2.7. Maintenance

Before carrying out any cleaning and maintenance operations, isolate the unit from the mains power supply using the switch located on the electrical system and/or on the shut-off devices.
If the equipment is faulty and/or incorrectly operating, switch it off and do not attempt to repair it yourself, but contact our local Technical Service Centre.
Use only original spare parts for repairs. Failure to follow above instructions could compromise the unit safety and shall void 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 boiler is to be put out of service, in addition to the above operations, potential sources of hazard on the unit must be disabled.

In order to ensure the correct operation of the equipment, preventing its damage or problems for persons, it is mandatory to add a percentage of glycol to the filling water, proportional to the minimum winter temperature of the area where the machine is installed.

It is strictly FORBIDDEN to connect a system filling circuit to the waterworks mains in case of outdoor installation.

We recommend to check the water and glycol content inside the circuit by means of a refractometer on a yearly basis.

Using galvanised iron/steel pipes may bring about corrosive phenomena when using antifreeze. Therefore we DO NOT suggest using this material.

Warnings for glycol use. In case of ingestion, the product may cause effects on the central nervous system, respiratory diseases and kidney damage. Avoid contact with skin and eyes, protect the respiratory tract. Do not allow the product to enter sewers, surface water and groundwater, ground. Use gloves, rubber boots and normal tight working clothing. Wear tight goggles.

For further information, refer to the safety data sheet of:

Cookson Electronics, Alpha Metals S.p.A., Via Ghisalba 1, 20021 Bollate, Milano, Italy
Ph: +39.02.383311 Fax: +39.02.38300398
email: fernox_italy@cooksonelectronics.com
www.fernox.com

For its machines, APEN GROUP tested and recommends to use ALPHI-11 glycol by Fernox or X500 glycol by Sentinel; the following KITS contain ALPHI-11 packs by Fernox with different capacity:

C07200-05	5 litres
C07200-25	25 litres

2.8. 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.

2.9. 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.

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 AKN series condensing boilers at the end of their life are considered "waste electrical and electronic equipment", classified as "professional WEEE". According to Decree 49/2014 the "professional WEEE" classification sets forth the obligation to dispose of the products in treatment facilities suitable for this kind of waste.
Apen Group is part of a collective system (Union Ecoped/ Ridomus) for the sorted waste management of professional WEEE according to art. 13 of Legislative Decree 49/2014.
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.

3. TECHNICAL FEATURES

Operation
The AKN boiler, working with natural gas or LPG, is suitable for use of fuel gases of group H and/or group E and mixtures of natural gas and hydrogen up to 20% by volume, and is designed to meet the heating needs of locations such as car repair shops, body shops, carpenter's shops, industrial and commercial buildings, etc.
In the typical installation, for the above-mentioned locations, the AKN boiler is positioned outdoor, with respect to the room to be heated, and is combined with one or more fan units (AB) positioned inside the room. In this configuration, both the combustion flue circuit (B23P type) and the gas circuit are located outside the room to be heated.
The system can operate independently. To start up the unit, simply connect it to the gas mains and to the mains power supply.
The boiler is equipped with active antifreeze protection, operated by power supply; to prevent any frost problem in the absence of power supply, refill the system with a water-glycol mix in a percentage that varies according to external operating temperatures [see below].
AKN models are not pre-filled.
AKN boilers are compliant with regulations EN15502-1 and EN15502-2-1.
Condensing and premixing technology, together with flame modulation, allow achieving efficiency above 108%.
The boiler exchanger, made of stainless steel, ensures a high yield and a high corrosion resistance.
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.
According to the model, the different remote controls (optional) allow operation parameter setting, ambient temperature control, time programming, working phase and fault display.

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 equipment safety as the gas valve supplies the fuel according to the air flow rate, based on an adjustment preset. Unlike atmospheric burners, the CO2 content remains constant throughout the boiler operating range, allowing the boiler 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 low emissions.

3.1. Models and Efficiency

All the AKN boilers are of condensing type with modulating burner, with seasonal efficiency ErP ≥90% (corresponding to a Class A Energy Efficiency). AKN series boilers are in compliance with the efficiency demand set forth by all regional resolutions, even the strictest ones.
All models are supplied as standard with an electronic circulator characterised by variable speed and low electrical consumption.

All models have been designed to achieve efficiency above 100% with respect to the lower calorific value, when the boiler supplies maximum heat output, and up to 108% with minimum heat output.

Water operating temperature is 72°C.
To increase the boiler's efficiency, the AB fan heaters have been designed to operate with water delivery at 72/75°C, increasing the exchange surface and allowing the boiler to be always condensing also at maximum heat output.
The boiler efficiency, with water delivery at 72/75°C, has been tested and certified by the external certification body.

Remote control accessories, such as ordinary remote control and Smart X, may be used with all models.

By means of the Smart X remote control [optional], it is possible to use the "ambient compensation" function (PID) that allows reducing water delivery temperature, "sliding temperature", in inverse proportion to ambient temperature increase, thereby reaching boiler efficiency above 108% [Hi].

The documentation required to access current tax bonuses is available at www.apengroup.it.

For AKN032, AKN034, AKN050 and AKN070, the "cold door" heat exchanger is used, which allows to reduce the heat losses in the casing, increasing the boiler yield.

3.2. Technical Data:

BOILER			AKN032		AKN034		AKN050		AKN070		AKN100	
Type of equipment			B23P - C63 (1)									
EC approval		P.I.N.	0476CR1226									
Seasonal space heating energy efficiency - [Reg.813/2013/EC] (2)		η_s	91		91.8		92.2		92.8		92.3	
Energy efficiency class [Reg.811/2013/EC]			A								-	
NOx class [EN 15502-1]			6									
Boiler yields												
	*Symbol**		MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
Burner heat output [Hi] (3)	*Qn*	kW	31.0	6.4	34.8	6.8	49.9	8.4	69.6	11.8	96.6	16.6
Useful heat output [Hi] [80/60°C]	*P4*	kW	29.9	6.2	33.6	6.6	48.3	8.1	67.5	11.4	94.1	16.4
Useful heat output [Hi] [50/30°C]		kW	32.4	6.8	36.5	7.2	52.3	8.8	74.8	12.7	103.9	17.9
Useful heat output at 30% of load [Hi]	*P1*	kW	10		11.3		16.2		22.7			
Useful heat output [Hi] [72/45°C]	*Pn*	kW	31.1	6.7	35.4	7.0	50.6	8.5	70.5	12.3	97.6	17.3
Useful efficiency [Hi] [80/60°C]	*η4*	%	96.3	96.5	96.6	96.5	96.7	96	97	96.9	97.4	98.6
Useful efficiency [Hi] [50/30°C]		%	104.5	106.5	104.8	105.8	104.8	105.3	104.5	107.5	104.3	107.6
Useful efficiency at 30% of Pn [Hi]	*η1*	%	106.7		107.7		108		108.6		108.4	
Useful efficiency [Hi] [72/45°C]		%	100.4	104.2	101.8	103.5	101.5	101.7	101.3	104	101	104
Flue losses with burner on [Qn;80/60°C]		%	2.9		2.7		2.7		2.7		2.2	
Heat loss in standby [EN15502-2]	$P_{stand\text{-}by}$	kW	0.073		0.073		0.098		0.098		0.183	
Flue losses with burner off		%	0.1									
Housing losses [Taverage=60°C]		%	0.4		0.35		0.40		0.40		0.50	
Condensate quantity [Qn;72/45°C]		l/h	1.2		1.3		1.7		2.6		3.9	
Condensate quantity [Qn;50/30°C]		l/h	3.1		3.6		5.1		7.4		8.0	
Flue gas emissions												
Carbon monoxide - CO - [Hi] [3% of 0_2] - [80/60°C] - Pn (4)		mg/kWh	97		95		93		98		97	
Carbon monoxide - CO - [Hi] [0% of 0_2] (4)		ppm	47		38		66		50		51	
Nitrogen oxides - NOx - [Hi] [0% of 0_2] (4)			27Ppm - 47mg/kWh		23ppm - 40mg/kWh		24ppm - 42mg/kWh		29ppm - 52mg/kWh		21ppm - 38mg/kWh	
Nitrogen oxides - NOx - [Hs] [0% of 0_2] (4)			24ppm - 42mg/kWh		20ppm - 36mg/kWh		21ppm - 38mg/kWh		26ppm - 47mg/kWh		19ppm - 34mg/kWh	
Fumes temperature		°C	80	43	77	42	75	40	74	41	73	38
Pressure available at the flue		Pa	110		110		100		120		100	
Electrical Characteristics												
Supply voltage		V-HZ-F	230 V - 50 Hz - 1F									
Rated power		kW	0.122	0.068	0.125	0.048	0.177	0.074	0.186	0.07	0.378	0.18
Electric power of auxiliary components (excluding circulator)	*elmax*	kW	0.073	0.018	0.075	0.014	0.107	0.012	0.114	0.015	0.216	0.02
Electric power of auxiliary components at 30% of load (excluding circulator)	*elmin*	kW	0.02		0.015		0.015		0.02		0.025	
Electric power of auxiliary components in standby	*PSB*	kW	0.005									
Operating Temperatures		°C	-15°C to +50°C									
Protection Rating		IP	IPX5D									
Hydraulic connections												
Maximum working pressure	*PMS*	bar	3.0									
Maximum water temperature in the circuit (5)	*°C*		90±3									
Boiler water content		l	4.5		5.0		6.3		7.0		10.8	
Delivery/return connections - UNI ISO 7/1		Ø	G 3/4" M		G 3/4" M		G 1" M				G 1 1/2" M	
Gas connection		Ø	G 3/4" M									
Operating weight (water excluded)		kg	32		34		40		46		71	
Weight with packaging		kg	37		39		45		51		75	

* Abbreviation compliant with reg. EU/811/2013.

1 The boiler is supplied as standard with C63 configuration; other configurations are possible using accessories available from our catalogue.

2 Reg. 813/2013/EU art.2 point 20. It is calculated starting from the weighted average of useful efficiency at the rated heat output and of the useful efficiency at 30% of rated heat output, expressed in %. For calculation purposes, the efficiency value is referred to the higher calorific value [Hs].

3 With natural gas mixture with 20% hydrogen rated heat input decreased by 5%.

4 CO and NOx values refer to the average weighted value of emission between maximum and minimum rated heat output according to the product standard. Values referred to cat. H (gas G20).

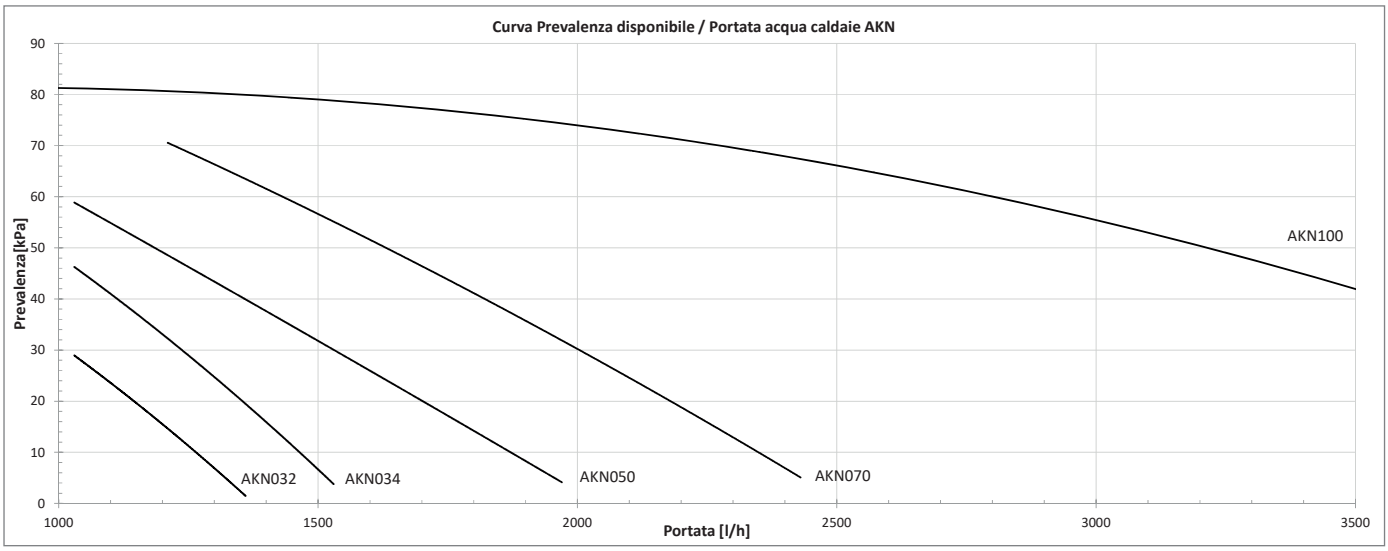
5 Safety thermostat activation temperature.

3.2.1. Flow rate curve - boiler available head

For its proper operation, the AKN system requires the following water flow rates through the boiler:

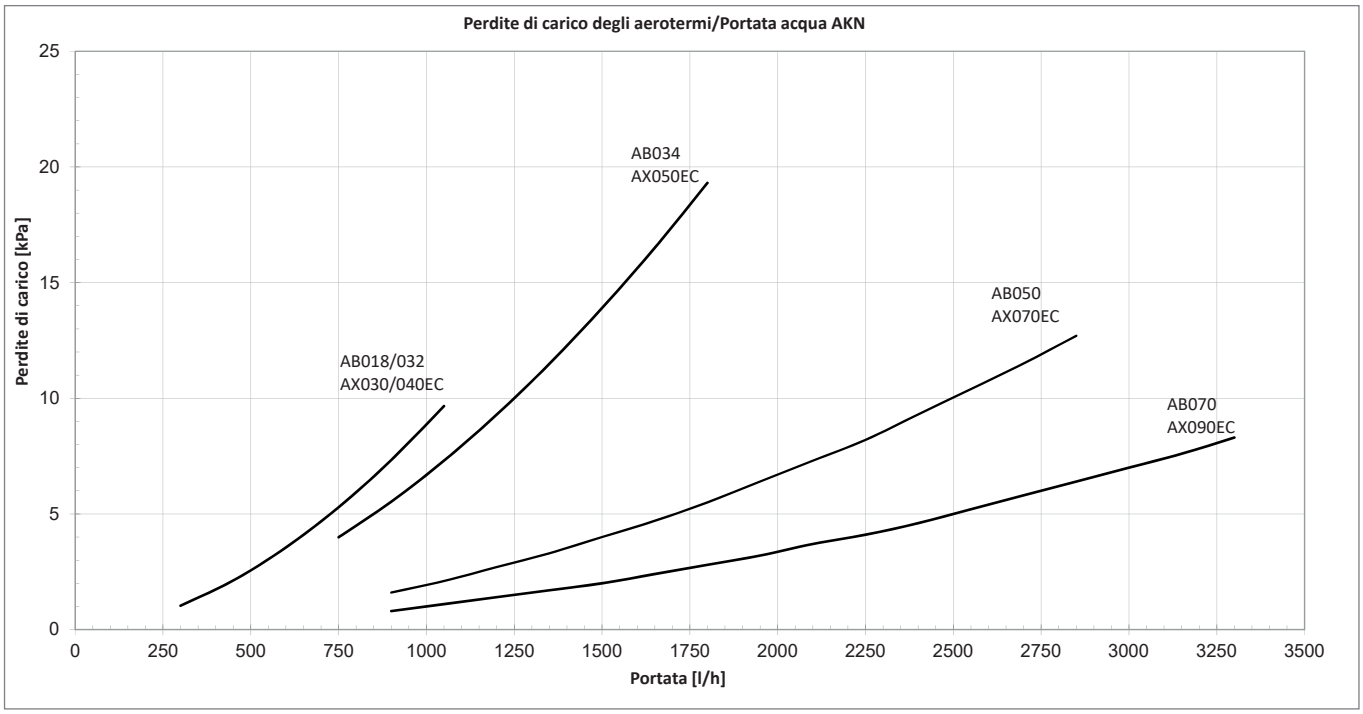
FLOW RATE RANGE										
BOILER	AKN032		AKN034		AKN050		AKN070		AKN100	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
l/h	900	1100	1000	1200	1200	1700	1700	2350	3100	3400

The boiler can operate correctly even with lower water flow rates. In this case, to achieve the maximum heat input, increase fan heater delivery temperature, thereby increasing its heat drop.



3.2.2. Fan heater pressure drop

Drops are estimated with glycol-free 72°C water; increase the drop depending on the glycol percentage according to the provided coefficients (paragrafo 5.11.2)



3.3. Hydraulic circuit characteristics

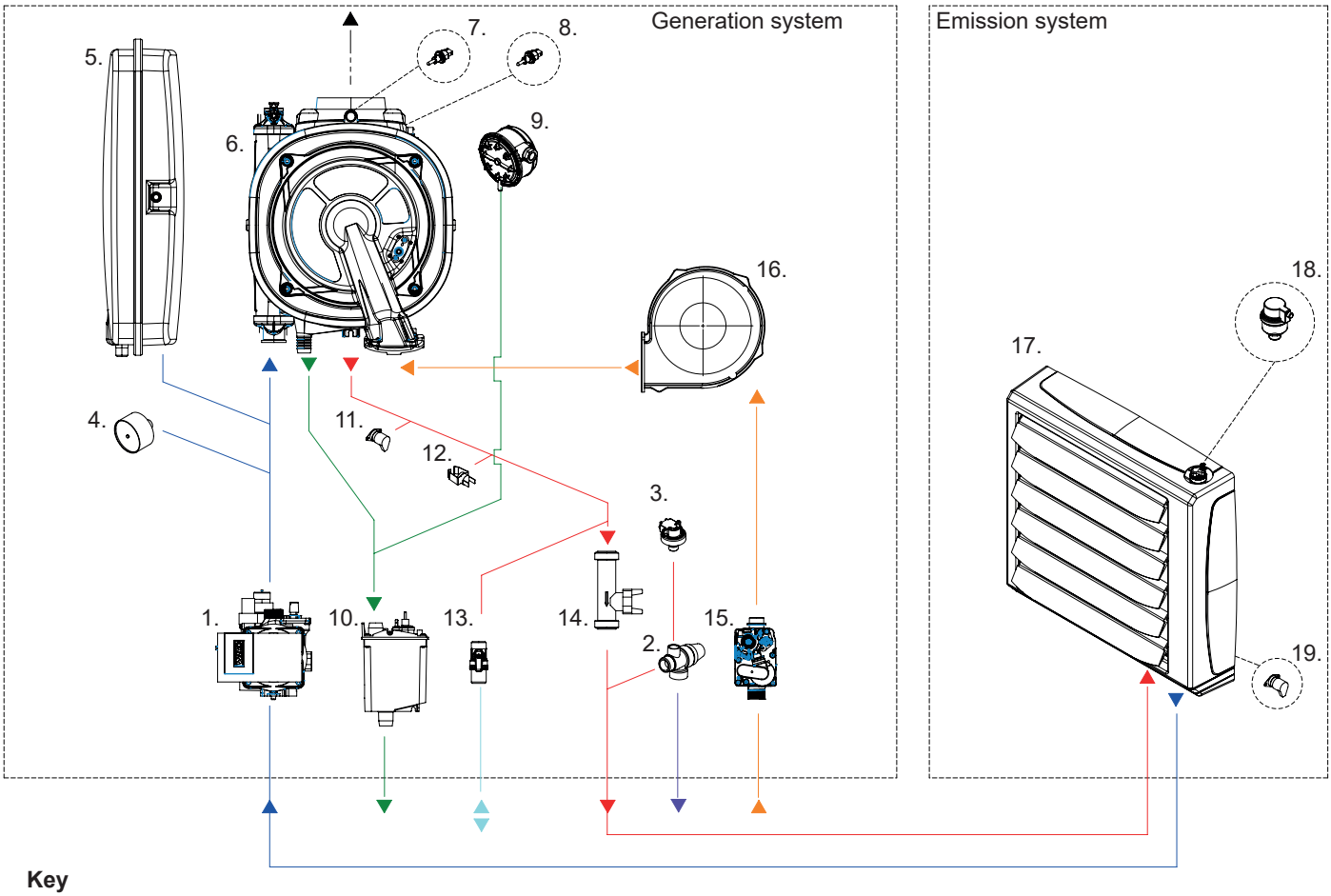
AKN boilers have similar hydraulic circuits. AKN050/070/100 models are characterised by some additional components with respect to AKN032/034 models, which nominal heat input is below 35kW and therefore do not need INAIL declaration.

When several systems are installed, the sum of the heat outputs is allowed only if the hydraulic circuit is shared among several boilers.

AKN050/070/100 models, with rated heat input above 35 kW, are included in INAIL standard; therefore, the components of the boiler and the system must comply with this directive.
A declaration must be submitted to the competent body. We suggest sending the declaration at the time of installation.

IT is forbidden to change the offset calibration/lacquering of valve, flue gas pressure switch and maximum limit water pressure switch.

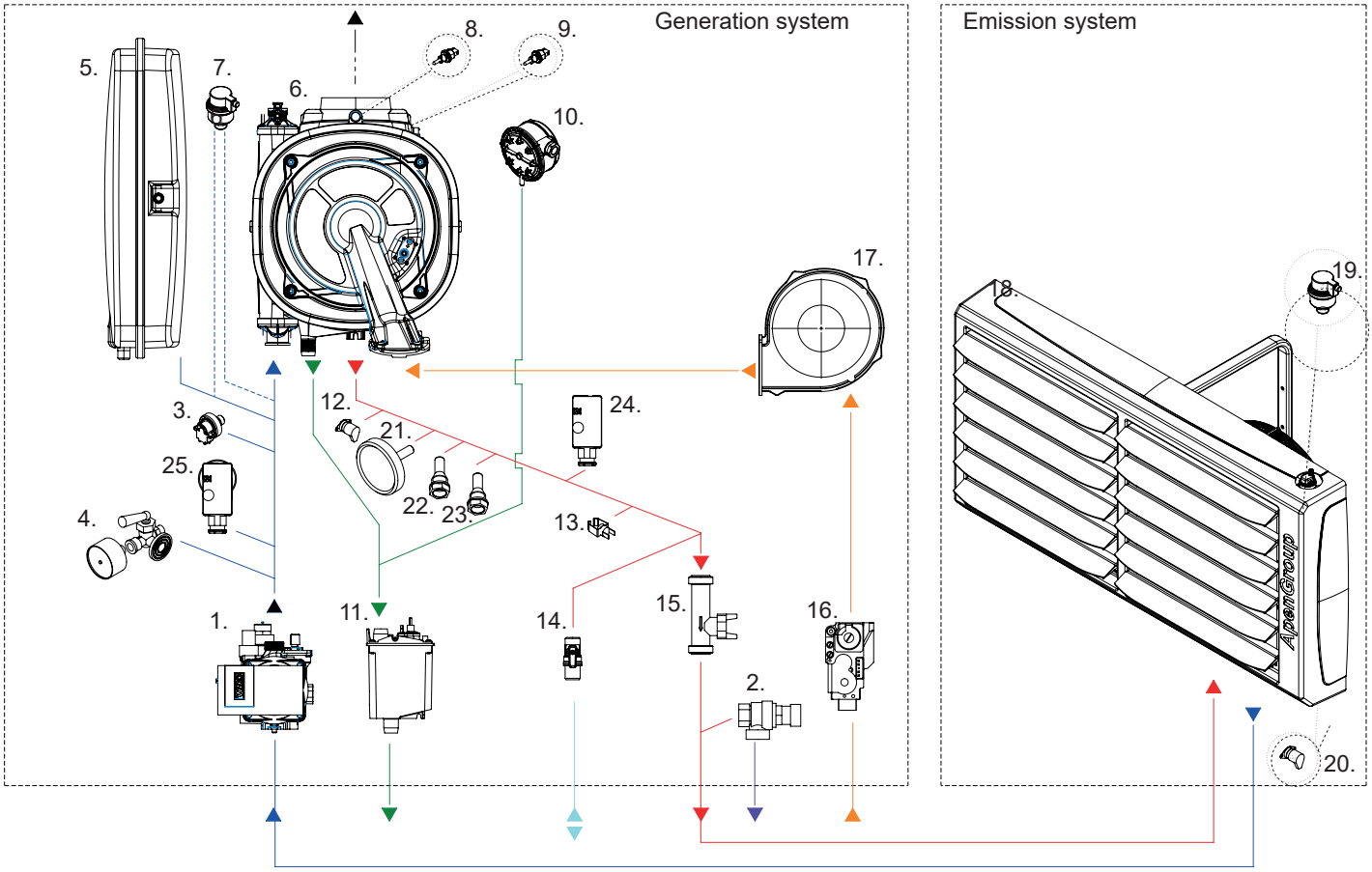
3.3.1. AKN032 and AKN034



Key

1.	System pump (circulator) [**P**]	11.	STB safety thermostat 90°C [**TS**]
2.	Safety valve [**VS1**]	12	NTC water delivery modulation temperature probe [**NTC1**]
3.	Pressure probe [**PREX**]		
4.	Hydrometer [**IDROM**]	13.	Filling tap
5.	Expansion reservoir [**VE**]	14.	Water flow gauge (flowmeter) [**FLUX**]
6.	Heat exchanger unit	15.	Gas valve [**VG**]
7.	Flue gas thermal fuse [**TFUMI**]	16.	Burner fan [**VAG**]
8.	Heat exchanger protection thermal fuse [**TF**]	17.	Internal unit
9.	Flue gas pressure switch [**PFLUE**]	18.	Battery vent valve
10.	Condensate drain trap [**KOND**]	19.	Fan microthermostat

3.3.2. AKN050, AKN070 and AKN100



Key

1. System pump (circulator) [**P**]
2. AKN050 safety valve (2.5bar), AKN070 (2.5bar), AKN100(2.7bar) [**VS2**]
3. Pressure probe [**PREX**]
4. Hydrometer and three-way control valve [**IDROM**]
5. Expansion reservoir [**VE**]
6. Heat exchanger unit
7. Boiler vent valve (for AKN070 only)
8. Flue gas thermal fuse [**TFUMI**]
9. Heat exchanger protection thermal fuse [**TF**]
10. Flue gas pressure switch [**PFLUE**]
11. Condensate drain trap [**KOND**]
12. STB safety thermostat 90°C [**TS**]
13. NTC water delivery modulation temperature probe [**NTC1**]
14. Filling tap
15. Water flow gauge (flowmeter) [**FLUX**]
16. Gas valve [**VG**]
17. Burner fan [**VAG**]
18. Internal unit
19. Battery vent valve
20. Fan microthermostat
21. INAIL thermometer [**TERM**]
22. Temperature inspection well [**PIT**]
23. Well for fuel cut-off valve
24. Limit water pressure switch [manual reset] [**IPMAX**]
25. Minimum water pressure switch [manual reset] [**IPMIN**]

EXTRA: For AKN100 only: [**TDOOR**] burner door thermostat

3.4. Pipe pressure drops

The table below contains pressure drop values of pipes for flow rate multiple values of fan heaters.
The drop is indicated in kPa per 1 metre of linear length; the calculation must be made by calculating the equivalent length of the pipe. The distance of the fan heater from the boiler must be duplicated. Drops are given for glycol-free 70-75°C water; for water glycol mix, multiply the drops by the factor indicated in the tables below. The last line contains the volume in litres per 1 metre of pipe.

PRESSURE DROPS IN kPa FOR 1 METRE OF LINEAR LENGTH															
Water flow rate	**Steel pipes**					**Copper pipes(1)**					**Multilayer pipes(1)**				
l/h	DN20 3/4"	DN25 1"	DN32 1"1/4	DN40 1"1/2	DN50 2"	DN20 20/22	DN25 25/28	DN32 32/35	DN40 39/42	DN50 51/54	DN20 20/25	DN25 26/32	DN32 32/40	DN40 40/50	DN50 51/63
600	0.15	0.05				0.18	0.06	0.02							
900	0.31	0.10	0.03			0.35	0.12	0.04			0.24	0.07	0.02		
1200	0.55	0.18	0.05	0.02		0.60	0.20	0.07	0.03		0.51	0.14	0.05		
1500	0.82	0.26	0.07	0.03			0.30	0.10	0.04		0.85	0.24	0.08	0.03	
1800		0.36	0.10	0.04	0.01		0.42	0.13	0.05	0.01	1.27	0.36	0.12	0.04	
2100		0.49	0.13	0.06	0.02		0.52	0.17	0.07	0.02	1.76	0.50	0.17	0.06	
2400		0.65	0.16	0.08	0.03		0.70	0.21	0.09	0.03	2.33	0.65	0.22	0.07	
3000			0.24	0.11	0.04			0.27	0.12	0.04	2.97	0.83	0.28	0.10	0.03
3600			0.34	0.16	0.06			0.35	0.17	0.06	4.44	1.25	0.42	0.14	0.05
4200			0.45	0.21	0.07			0.53	0.22	0.07	6.17	1.73	0.59	0.20	0.06
4800			0.59	0.21	0.08				0.28	0.08	8.15	2.29	0.78	0.26	0.09
Water content [l/m]	0.37	0.59	1.20	1.39	2.22	0.31	0.49	0.80	1.19	2.04	0.31	0.53	0.83	1.24	2.05

(1) Internal measurement/external measurement

Pressure drops identified due to the various components inserted in the hydraulic system must be added up to the pipe length, according to the values indicated in the table below.

It is advisable not to use steel, galvanised steel or iron pipes, but rather to choose cross-linked polyethylene pipes.

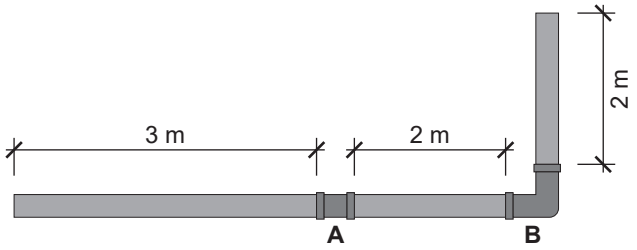
EQUIVALENT LENGTH IN m										
Type	**Steel pipes**					**Copper pipes(1)**				
	DN20 3/4"	DN25 1"	DN32 1"1/4	DN40 1"1/2	DN50 2"	DN20 20/22	DN25 25/28	DN32 32/35	DN40 39/42	DN50 51/54
45° bend	0.3	0.3	0.6	0.6	0.6	0.3	0.3	0.6	0.6	0.6
90° bend	0.6	0.6	0.9	1.2	1.5	0.6	0.6	0.9	1.2	1.5
90° bend with wide radius	0.6	0.6	0.6	0.6	0.9	0.6	0.6	0.6	0.6	0.9
T-shaped fitting	1.5	1.5	1.8	2.4	3.0	1.5	1.5	1.8	2.4	3.0
One-way	1.5	1.5	2.1	2.7	3.3	1.5	1.5	2.1	2.7	3.3
Gate valve	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3

(1) Internal measurement/external measurement

EQUIVALENT LENGTH IN m						
Type		**Multilayer pipes(1)**				
		DN20 20/25	DN25 26/32	DN32 32/40	DN40 40/50	DN50 51/63
Sleeve		0.7	0.5	0.3	0.4	0.45
Reduction		0.75	0.8	1.05	1.1	1.15
90° elbow		1.95	2.3	2.6	2.95	3.15
Pass-through Tee		2.2	2.5	3	3.5	3.75
Derivative Tee		0.5	0.6	0.75	0.8	0.9
Partitioned Tee		1.9	2.45	2.6	3.1	3.4

Check that the minimum water content of pipes for the system is equal to or higher than what indicated in paragraph 3.2.2.

Example of pressure drop calculation
Multilayer DN32 pipe, Flow rate = 1,800 l/h, Heat loss = 0.12 kPa/m:
Pipe length = 3+2+2 = 7 metres
Corresponding length of fittings used = 0.30 (A) + 2.60 (B) = 2.90 metres
Total circuit length (pipes + fittings) = 7 (pipe) + 2.90 (fittings) = 9.90 metres
Total circuit heat loss = 0.12 (kPa/m) x 9.90 (m) = 1.188 kPa.



3.4.1. Equivalent lengths of possible applications

Below we suggest some possible types of installation on the basis of a delta T of 25 K:

INSTALLATION TYPES: m_{eq} max						
Pipe of	**Diameter**		**AKN032+AB032**	**AKN034+AB034**	**AKN050+AB050**	**AKN070+AB070**
	Øint	Øext	delivery+return+connections	delivery+return+connections	delivery+return+connections	delivery+return+connections
Steel	3/4"		10	30	-	-
	1"		30	100	30	-
	1"1/4		-	-	120	20
	1"1/2		-	-	-	50
	2"		-	-	-	130
Copper	20	22	10	30	-	-
	25	28	30	100	20	-
	32	35	-	-	110	10
	39	42	-	-	-	30
	51	54	-	-	-	130
Cross-linked PE	20.4	25	10	40	-	-
	26.2	32	30	130	30	5
	32.6	40	-	-	120	15
	40.8	50	-	-	-	50
	51.4	63	-	-	-	-

The maximum equivalent lengths indicated here take into account the pressure losses distributed throughout the pipe and the concentrated pressure losses due to the various fittings along the system.

3.5. INAIL components - AKN050, AKN070 and AKN100

Technical implementation specification of Title II of Italian Ministerial Decree 1/12/75 - “Collection R” ed. 2009

INAIL			
Component	**Abbreviation**	**Model**	**Description**
Hydrometer	IDROM	PB3204BB06 WATTS INDUSTRIES	Pressure gauge, UNI 2.5 class, scale 0-4 bar $p_{max,es.=}$+25% f.s., T=20/90°C compliant with INAIL
Limit pressure switch	IPMAX	B01BMX FANTINI & COSMI	Pressure switch p=2÷5.5 bar PED/0497/2936/15, PED/0497/2941/15 certificates
Minimum pressure switch	IPMIN	B01FML FANTINI & COSMI	Pressure switch p=0.5÷2.5 bar PED/0497/2936/15, PED/0497/2941/15 certificates
Inspection well	PIT	ITALTECNICA PGUAOTT003 WATTS INDUSTRIES	Control well L=45 mm, 1/2" connection, INAIL compliant INAIL approval certificate No. PS/001/10
3-way control valve	R3VIE	403R14 WATTS INDUSTRIES	Three-way valve, 1/4" connection, $T_{max,\ e.g.}$ = 90°C, $P_{max,\ e.g.}$ = 15 bar Compliant with INAIL
Thermometer	TERM	PT4A507011 WATTS INDUSTRIES	Thermometer, 1/2" connection with well, T=0-120°C, UNI accuracy class = 2. Compliant with INAIL
Expansion reservoir	VE	13S6001006 ZILMET	Expansion reservoir, capacity 10 l, connection 3/4", pre-charge 1.3 bar, $T_{max,\ e.g.}$ = 99°C, $P_{max,e.g,}$ = 3 bar. Approved according to Directive 97/238/EC
Safety valve AKN100	VS	527427 CALEFFI	Safety valve, connections 1/2 "Fx3/4 "F, setting to 2.7 bar, diameter 15 mm, discharge capacity 152.2 kW, T_{max} = 110°CV INAIL approval certificate no. VS/319/00
AKN050/070 safety valve	VS	527425 CALEFFI	Safety valve, connections 1/2 "Fx3/4 "F, setting to 2.5 bar, diameter 15 mm, discharge capacity 143.3 kW, T_{max} = 110°CV INAIL approval certificate no. VS/319/00
Safety thermostat	TS	KSD301 MILANO COMPONENTI	Thermostat, NC contact, opening T = 90 ± 3°C, closing T = 82 ± 5°C. TUV Certificate R 50466007

Water circuit test

According to INAIL standard, the boiler body is tested at a pressure of 4.5 bar, i.e. 1.5 times the maximum working pressure.

Minimum pressure switch

The minimum pressure switch C09469 is reset with a system pressure above 1.3 bar.

Distance between the expansion reservoir and the safety valve [AKN050, AKN070 and AKN100 only]

According to INAIL standard, the distance between the expansion reservoir centreline surface and the safety valve centreline surface is equal to 425 mm for AKN050 and AKN070, but it is 275 mm for AKN100.

Fuel cut-off valve [AKN050/070/100 only]

In case of equipment above 35kW, INAIL standard compulsorily requires that a fuel cut-off valve must be used. The boiler is equipped with the well for the sensitive component of the fuel cut-off valve: the valve kit is available as an accessory (code C09073 size 3/4’ for AKN050/070 and C09464 size 1' for AKN070/100). This well is suitable for the Caleffi fuel cut-off valve available in the indicated kits; to use other valves it is necessary to check their coupling.
The choice of fuel cut-off valve must be made on the basis of the fuel used and its flow rate and heat loss diagrams.

Expansion reservoir

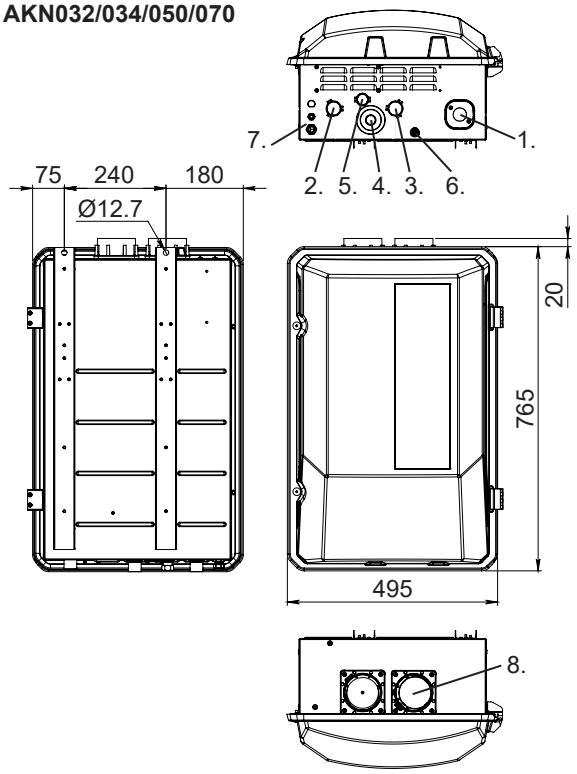
All boilers are equipped with a 10-litre expansion reservoir, whose pre-charge is 1.3 bar for all AKN series.
When the system water content exceeds 65-70 litres, an expansion reservoir with suitable capacity must be added.

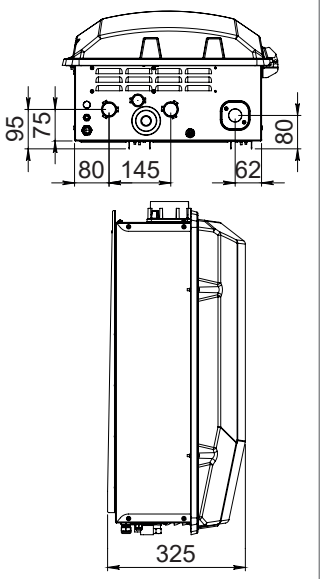
Control thermostat

The control thermostat function is integrated into the electronic temperature control system of the boiler, in accordance with paragraph 10.1 of chapter R.1, Collection R. ed. 2009.

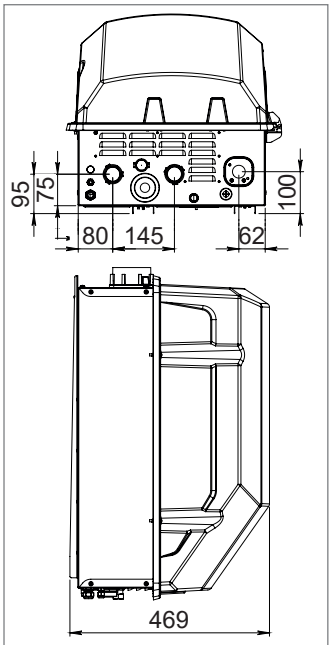
3.6. Boiler size

AKN032/034/050/070



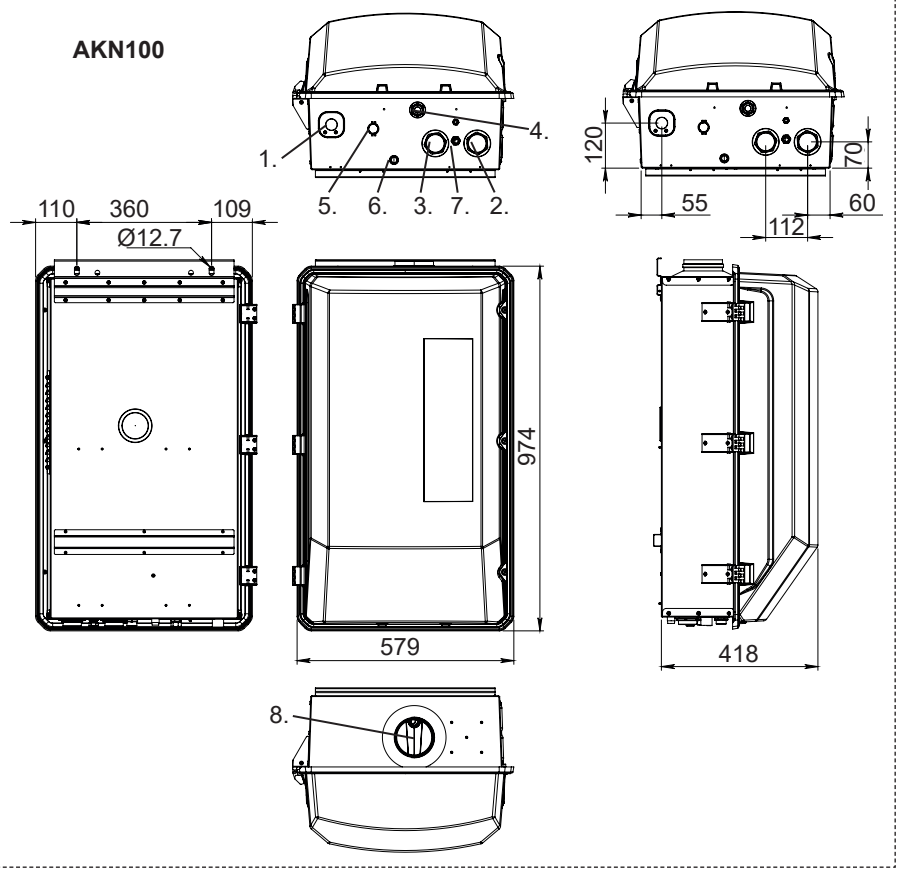


AKN032/034



AKN050/070

AKN100



AKN				
	Description	**032 034**	**050 070**	**100**
1.	Gas supply	G3/4"		
2.	Water return	G3/4"	G1"	G1 1/2"
3.	Water supply	G3/4"	G1"	G1 1/2"
4.	Safety valve	G1/2"	G3/4"	G3/4"
5.	System filling tap	G1/2"		
6.	Condensate drain	Ø18 mm		
7.	Electrical connections	PG13.5 + PG 09		
8.	Flue outlet chimney	80mm		100mm

3.7. Operation and accessories

The boiler is fitted as standard with a multifunction LCD panel located inside it, and is used to control, configure and diagnose all operating parameters of the equipment.
Its operation is explained in paragrafo 4.2.

This panel cannot be remotely controlled.

3.7.1. Ambient Temperature adjustment

The boiler is supplied without remote control and/or ambient thermostat as it can operate with different remote controls, some of which are supplied by APEN GROUP as accessories, whilst others are commercially available.

Operating modes:

A) Ordinary remote control, with a dry digital contact to be connected to the boiler ID0/GND terminals

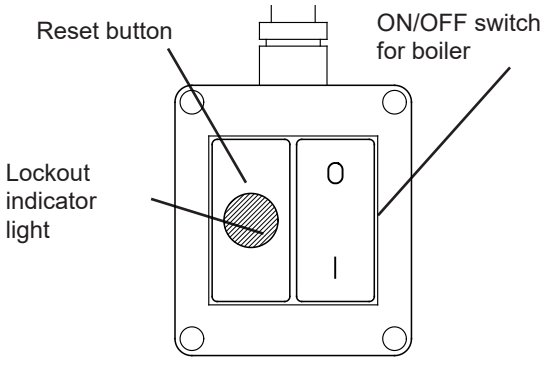
B) Smart X series chronothermostat

C) Ordinary chronothermostat

This manual will mainly describe the operation of mode type "A", with information on the AKN system capabilities. For operation with the Smart X chronothermostat, please refer to the manual supplied with this accessory.

Equipment main functions
The equipment features the following functions:
- Circulator anti-lock and variable speed;
- Antifreeze.

Operation A) - C09660 ordinary remote control
By means of the ON/OFF key, the User switches the boiler on or off. The modulation occurs on the delivery water temperature, which remains fixed to the factory value pre-set to 72°C. When several fan heaters are connected and one of them is turned off, the boiler automatically reduces the heat output while keeping the delivery temperature fixed. Boiler lockout signalling and reset, available inside it, are located on the C09660 remote control.



Operation B) - Smart X chronothermostat
Smart X touchscreen control has been designed to control several ApenGroup units for heating, ventilation and cooling. The control facilitates programming when several systems are installed (possibility to connect up to 15 systems), allows to have a view of the whole system, to reset the systems directly from the panel, as well as to control and manage lockouts.

Main features
- Simultaneous management of all devices connected to it (switching on and switching off)
- Simplified connection by means of two modbus polarised cables and two power cables
- A temperature probe installed on the control
- Possibility to connect up to three remote temperature probes
- Multilingual 4.3" touchscreen colour display
- Complete management of the operating parameters
- Yearly and weekly calendar programme
- Built-in or flush with the wall installation
- In the SMART X WEB version, complete management of the control and its functions through the network
- Possibility to connect an external probe for climate control

For details on operation and installation diagrams, please refer to the manual supplied with the Smart X remote control.

Operation C) - Ordinary chronothermostat
A chronothermostat with a clean contact can be connected to the ID0/GND terminals. By opening and closing the contact, the boiler is switched on and off.

4. USER'S INSTRUCTIONS

Please read the safety warnings described in the previous pages. The operations that the user must carry out are limited to the use of the controls placed in the remote control.

4.1. Boiler operation

Boiler operation is fully automatic; it is equipped with electronic equipment with self check facility that manages all the burner control and monitoring operations and with a microprocessor based electronic PCB that controls the heat output regulation. As mentioned in the previous paragraphs, this manual will only describe the operation of the boiler without accessories. For operation with Smart X remote control, please refer to the relevant manuals supplied with the accessories.
The boiler is switched on when the following two conditions are met:

- the boiler is powered on and has not been locked out;
- the contact on ID0/GND terminals of the boiler PCB is closed

In these conditions the burner circulator and 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 delivery temperature: water delivery temperature setpoint is set to 72°C.
If a lockout occurs because there is no flame during the ignition phase, the boiler will make other 4 ignition attempts; at the fifth attempt, if ignition is not successful, the boiler will be locked out.
The boiler is switched off by opening the ID0/GND contact on the boiler terminal board.

IMPORTANT: disconnecting the boiler power supply is prohibited, except for emergencies, because, when the boiler is switched off, the circulator will continue to work for approximately 3÷5 minutes so as to eliminate any residual heat in the boiler (water post-circulation); the fume fan too will continue to work for a preset time to clean up the combustion chamber (combustion chamber post-cleaning phase).

4.1.1. Ambient temperature setting

Connecting an ambient thermostat (chronothermostat) or an ON/OFF switch is compulsory.
If a thermostat supplied by third parties is installed, the ambient temperature must be programmed on the thermostat.

In this type of installation, we recommend that a C09660 remote control is used (see paragrafo 3.7.1) to allow users to check the conditions for the lockout and, if necessary, to remotely reset it without accessing the external boiler.

4.1.2. Lockout and Reset

Any operation fault is signalled on the **C09660** remote control by means of a red light.
The light indicates an alarm, but it does not indicate the type of alarm occurred. To reset, press the button below the light.
The error code, from E10 to E99, is signalled on the LCD display located inside the boiler and/or by the Smart X, if connected.
Using the LCD panel located inside the boiler, unlock by pressing the two arrows simultaneously for a few seconds and wait for the LCD display to flash. The error codes are described below.

4.1.3. Boiler temperature setting

The boiler is programmed by default with the R12/ST1 value (water delivery temperature setpoint) set to 72°C; the parameter can be modified by means of the LCD panel inside the boiler or through Smart X.

4.1.4. Circulator anti-lock and variable speed

The function, which is enabled by default, starts the circulator when it fails to operate for twenty-four hours in a row; the circulator works for 120 seconds and then it stops.
The circulator modifies its speed according to the heat output; two parameters set the level under which the minimum speed is activated.

4.1.5. Degasser function

To facilitate the venting of the air trapped inside the system, it is advisable to force the circulation of water in the system by activating the dEg parameter on the LCD display: see paragrafo 4.2.
If the boiler is installed at a height exceeding the height of the fan heater, refill the circuit and degas the system using the manual degasser located inside the boiler.
If the system piping runs at a height exceeding the installation height of the boiler or fan heater, a degasser must be installed at the highest point of the system; the degasser can be either manual or automatic.

4.2. Multifunction LCD panel

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 is protected by 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 the room temperature control system
Sty	REMOTE OFF Unit turned off by ID0/GND remote digital input
rOF	Temperature control OFF condition
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)*

*(*only in the presence of Smart)*

During normal operation, the display will show the wording **HEA** if the burner is on; **rdy** or **Sty** when the boiler is being switched off; **rOF** if the delivery temperature control has been met.

Air	**Active ventilation.** If the Smart X sends the ventilation command (for example for AX-EC fan heaters)
Axx	**Unit address;** If the module has an address other than Ø, the display will show, alternating it with the operation in progress, the address assigned to the module. (e.g. "A01")

In the event of communication problems between the CPU PCB and the LCD panel, the word **CPU** will flash on the display if the problem is caused by the CPU or by the display PCB. 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. EPr will be displayed if the problem is caused by the EEPROM PCB. If so, check that the EEPROM PCB is properly inserted inside 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/OFF/HEA/Air/COO/SAn)
Axx	Shows the address assigned to the CPU OCB of the unit (1 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	Allows to activate the system deaeration cycle; the cycle involves circulator ON 20" - circulator OFF 5", until exit from the menu
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
With “ID0” contact closed, allows to force the burner operation at maximum (Hi) or minimum (Lo) output, to carry out any combustion tests. 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

Degasser - dEG Menu
Allows to activate the system deaeration function, i.e. the function to eliminate any air contained within the system itself. The cycle involves alternating between circulator ON status, for 20", and circulator OFF status, for 5", repeated until the menu is exited via the ESC key. The dEG function remains active until the item is exited via the ESC key.

On	Activation of function
OFF	Deactivation of function

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 of capitolo 7 "Modulation PCB Parameters".

nt1	“Value” for NTC1 probe temperature (Water delivery)
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	Water pressure [bar]
An3	Water flow rate [cu.m/h]
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 (PFLUE-TFUMI N.C. contact)
id3	Open/closed status of "OPn/CLS" Id3 digital input (Condensation detection electrode)
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 of capitolo 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 (Lockout signal)
U2	Open/closed status of "OPn/CLS" Q2 output
U3	Open/closed status of "OPn/CLS" Q3 output
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 of capitolo 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/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.

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 operate the lockout reset remotely using one of the following solutions:
- the digital input ID1-GND - button N.O.;
- the Smart X Web/Easy control - optional;
- the ModBus protocol.

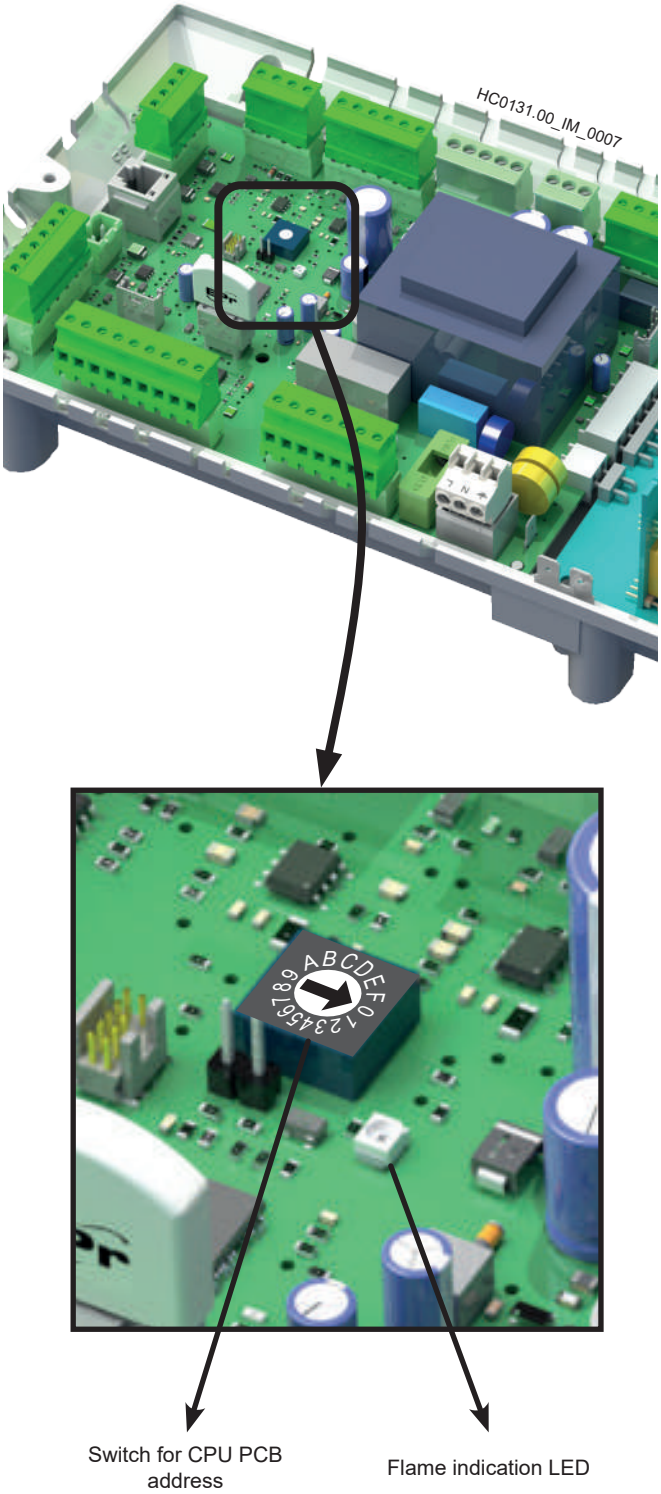
If ignition fails, the flame monitoring PCB reattempts ignition four times. After four failed attempts, it will lock out and will display the code E10.
The lockout codes and their cause are shown in the ERRORS table in capitolo 8 “Analysis of Lockouts - Exx".
If the flame monitoring equipment has locked 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.

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.

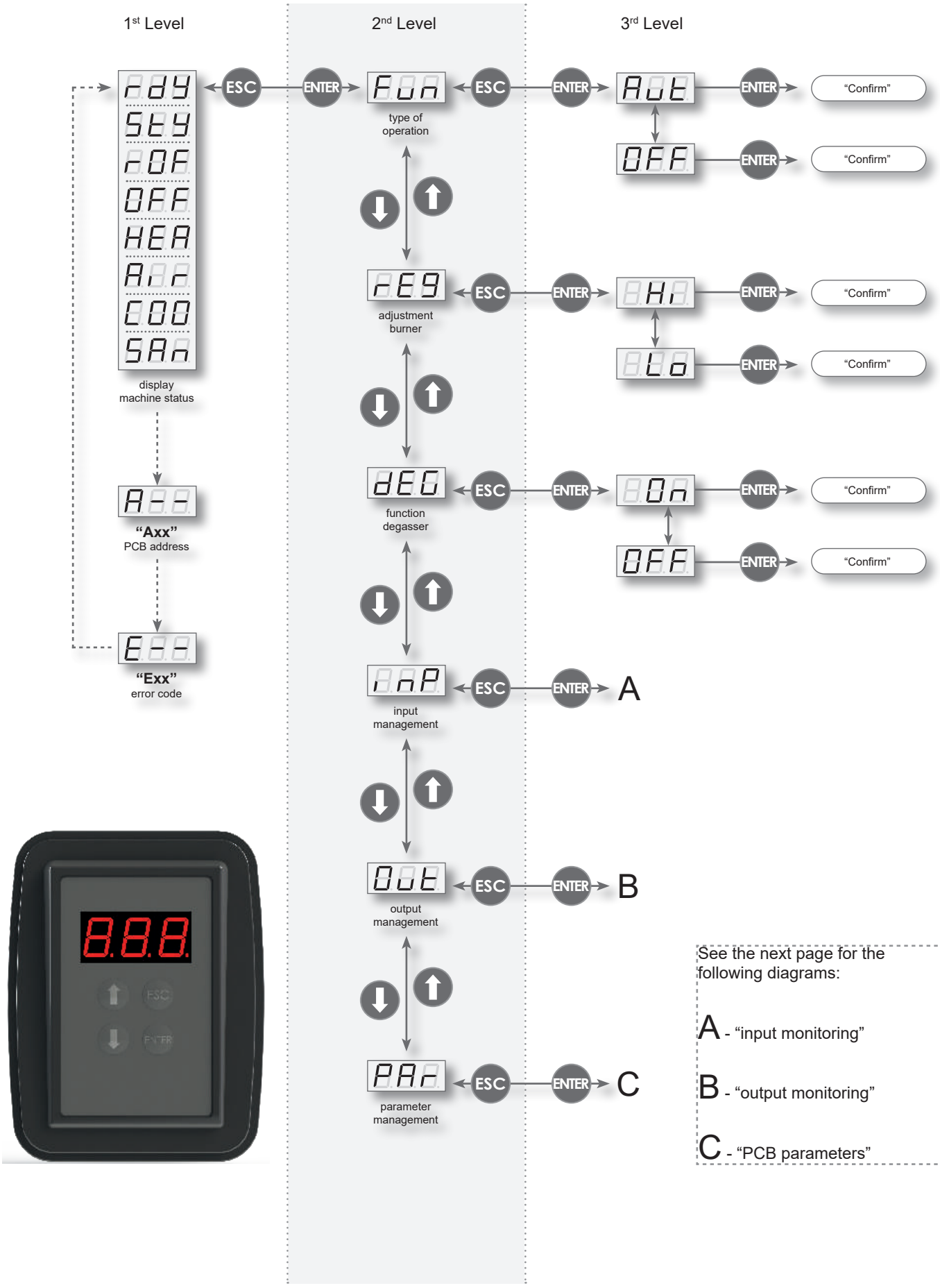
Should the safety thermostat (STB) open before starting the start-up cycle, the flame MONITORING equipment is kept in "stand-by" and E22 lockout is shown.

4.3. Flame indication LED

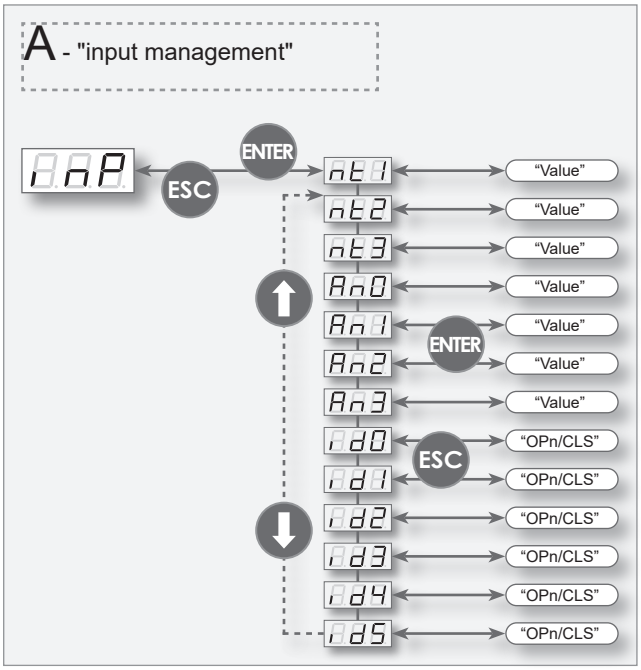
An orange LED is present on board the CPU PCB, indicating the opening of the gas valve and the presence of flame.



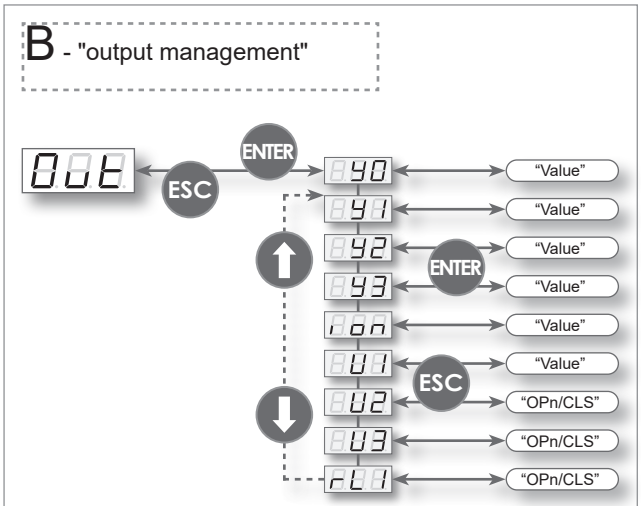
Navigation map of LCD display menu CPUE G26800



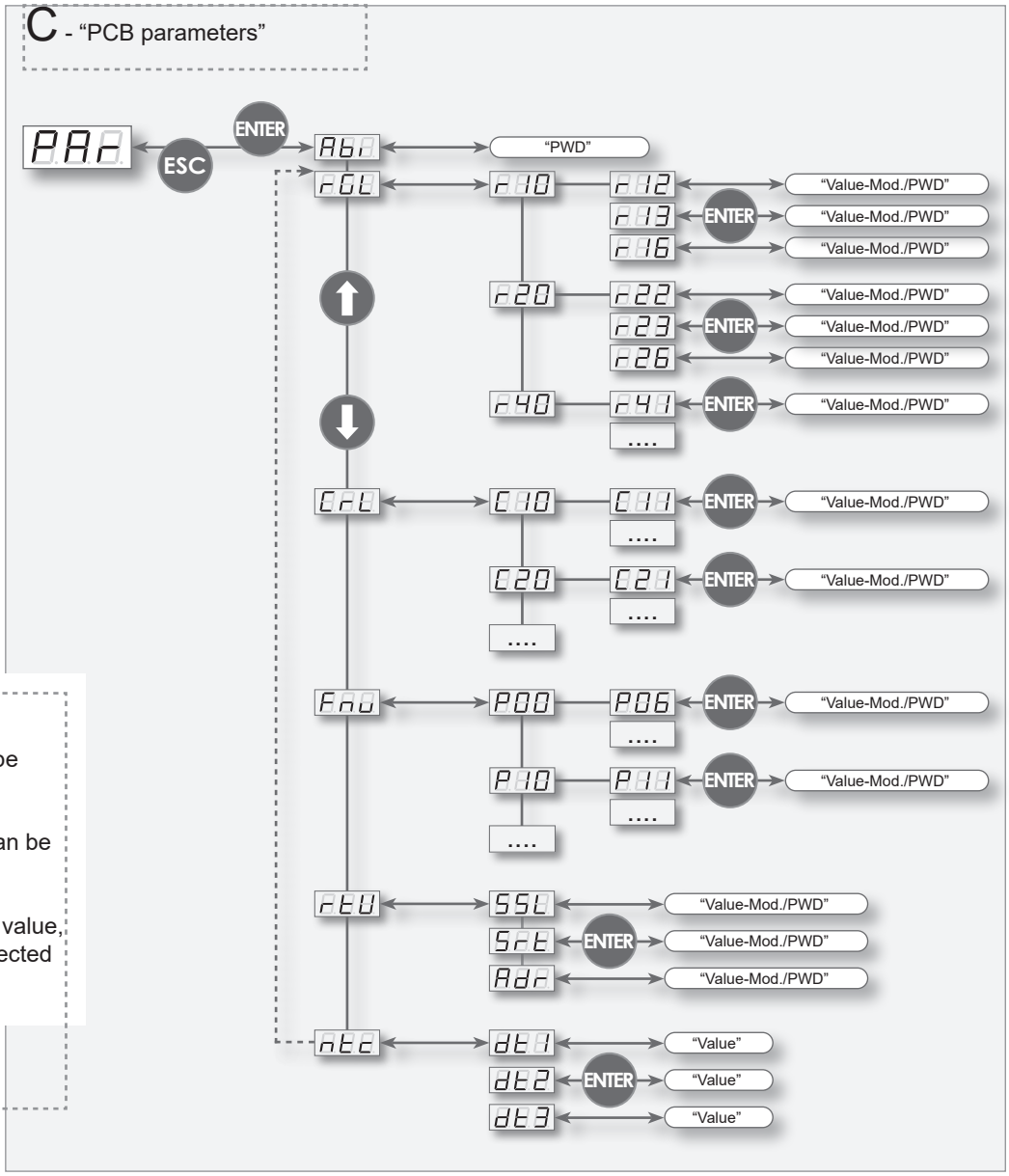
A - "input management"



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" =

5. INSTALLATION INSTRUCTIONS

Instructions for installing and setting the boiler are intended for suitably qualified personnel only. Please read the safety warnings.

The installer must instruct the user about the use of the machine and inform him/her about the presence, in this manual, of a chapter fully intended for the final user.

5.1. General Installation Instructions (ITALY)

The boiler installation must be carried out in compliance with the current regulations concerning design, installation and maintenance of thermal systems.
Reference standards:

- Ministerial Decree of 8/11/2019 replacing the Ministerial Decree of 12/04/1996, containing the fire prevention rules for design, construction and operation of thermal systems fired with gaseous fuels;
- Presidential Decree no.412/93 which regulates design, installation, operation and maintenance of thermal systems;
- Law no.10/91: rules for implementing the national energy plan in the field of the rational use of energy, energy savings and the development of renewable energy sources;
- Standard UNI-CIG 7129 regarding the installation of natural gas equipment;
- Standard UNI-CIG 7131 and UNI 11528 regulating the installation of LPG equipment;
- Law 186 of 01 March 1986 regarding the installation of electrical systems;
- Legislative Decree no. 192/05 of 19/08/05;
- Ministerial Decree no. 37 of 22/01/2008;

and subsequent amendments and/or integrations.

5.2. Transport and Handling

The boiler and fan heaters are supplied separately.
Unload the equipment 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 its weight.
If the thermal 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.
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 damage is visible or parts of the supply are missing, immediately contact the supplier.

The manufacturer is not liable for any damage occurred during transport, handling, unloading, etc.

5.3. Accessories and standard equipment

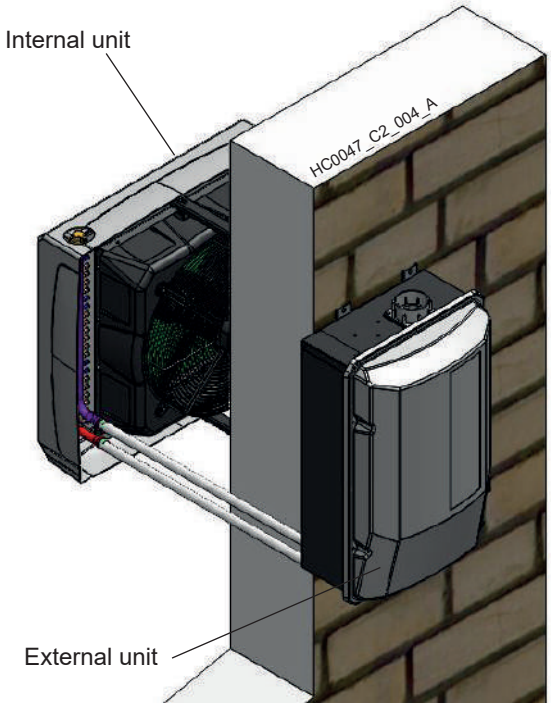
The supply of the equipment includes

AKY boilers

- no. 1 paper template to position the external module;
- no. 2 flexible hoses for every single boiler (G1" for AKN050/070, G3/4" for AKN032/034), length 0.5 metres, with relevant gaskets;
- no. 1 gas tap (G3/4") complete with gaskets to connect it to the gas valve.

AKN100 boilers

- no. 1 paper template to position the external module;
- no. 2 G1 taps 1/2";
- no. 1 gas tap (G3/4") complete with gaskets to connect it to the gas valve.



AB fan heaters
The fan heater consists of a multi-row copper/aluminium battery, 1 or 2 axial fans and a composite material frame.
AB fan heaters are supplied as standard with:

- vent valve
- microthermostat for activating the fan only when the water temperature is >42°C (Winter function)
- 5-speed air flow rate regulator
- hydraulic connection hoses

If equipped with the "condensate collection tray" they may be used also for summer air conditioning.
The fan heater size shows the possible combination with the AKN boiler.
For details, please refer the manual supplied with the fan heater.

AX-EC electronic fan heaters
A range of electronic fan heaters has been designed to match the AKN boiler system, with high efficiency batteries with high exchange surfaces, axial fans with automatic speed control, brushless DC motor.
The electronic fan heaters come as standard with a vent valve. The “hose” kit for the hydraulic connection can be purchased as an accessory.
If equipped with the “condensate collection tray” they may be used also for summer air conditioning.
For sizing and details, please refer to the manual supplied with the fan heater

delivery and return connections, inserting the corresponding gaskets and preventing foreign bodies from entering.

The installation of the fan heater is allowed in horizontal position with roof-mounting and vertical air blow; for this application it is FORBIDDEN to use the bracket supplied with the equipment, therefore another type of mounting, not provided by APEN GROUP, is necessary. In addition, a suitable and safe fan heater air vent must be provided so as to replace the one already present on the equipment.

5.4. Boiler and fan heater installation

The boiler can be installed:
- INDOOR:
  - in a dedicated heating plant
  - inside the served environment
- OUTDOOR:
  - in an unprotected outdoor location
  - in a partially protected location (**recommended**).

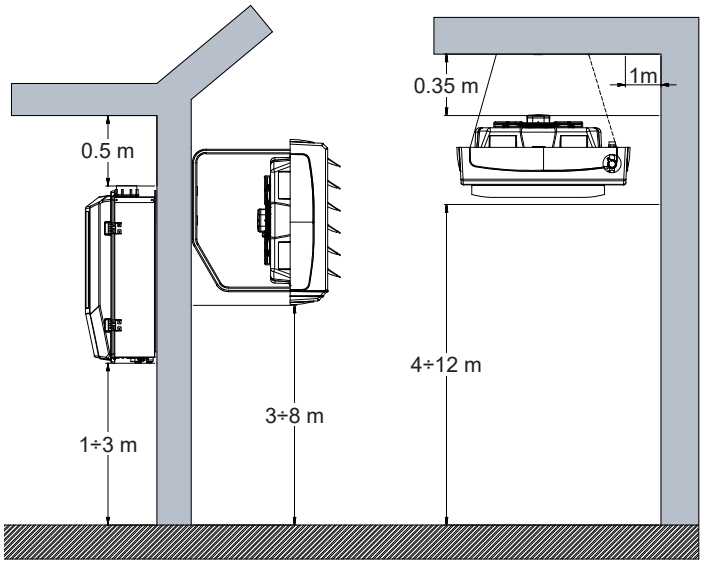
A too high installation level would cause excessive upward stratification of the hot air exiting the fan unit; on the other hand, at an insufficient installation height the hot air would directly reach the people below.

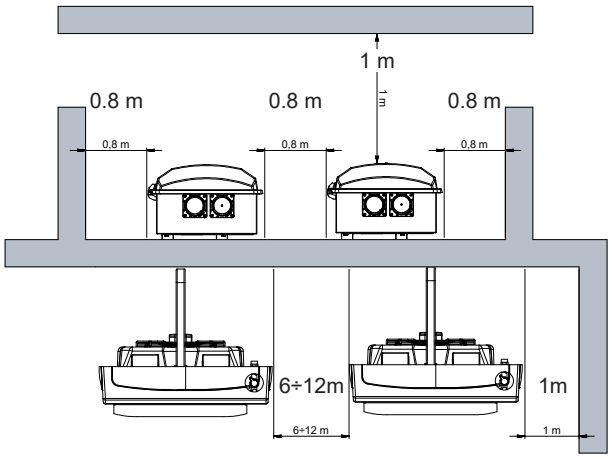
We suggest installing the boiler at a height not exceeding the one of the fan heater so as to avoid air vent problems in the water circuit.

Thoroughly vent the air in case of boiler installation higher than the fan heater (see “dEg” function in paragrafo 4.1.5 and paragrafo 4.2).

Do not place flammable material nearby and on the ground within a radius of 4 m of the installed boiler.

Minimum distances to be observed





5.4.1. Boiler installation procedure

- Observe the minimum distances shown in the images below. They refer to walls of at least REI30 type and in class 0. If the walls and ceiling do not comply with these requirements (for example in case of structures covering sports facilities), the minimum distances must be 0.60 m from vertical walls, with a supporting element/bracket in-between, and 1.00 m from the ceiling.
- Fix the template supplied to the wall and level it; make two holes to fix the boiler to the wall and a through hole for the internal unit connections.
- To hang the boiler, apply rawlplugs with M8 external screws (M10 for AKN100).

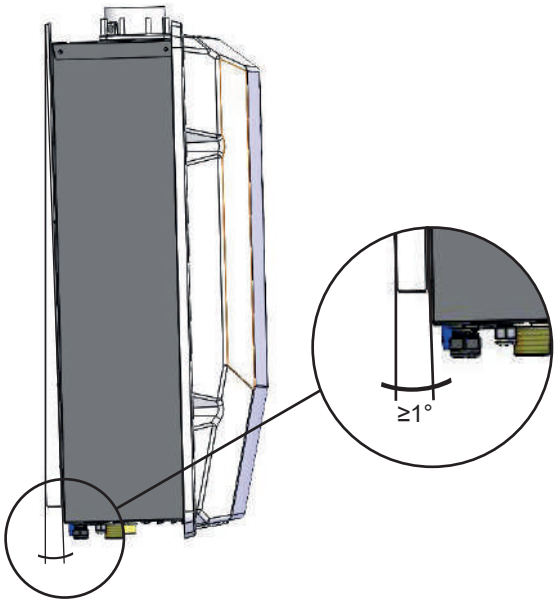
Make sure that the type of dowel (not supplied with the boiler) is suitable for the type of wall and sufficient to support the weight of the boiler.

- Hang the boiler and secure it using star washers.
- For AKN032, AKN034, AKN050 and AKN070, connect the flexible hoses supplied with the equipment to the boiler

It is compulsory to install a Y-shaped filter (on the return pipe from the system) with metal mesh of no more than 1 mm on the water inlet to the boiler, to prevent the boiler heat exchanger from clogging.

To connect the boiler and the internal unit to the rigid pipe, use the flexible hoses L=0.5m supplied with the equipment both with fan heater and boiler (for AKN032, AKN034, AKN050 and AKN070 only).
If the fan heater is installed at a distance from the boiler greater than the one possible with hoses, it is necessary to use rigid pipes with suitable diameter, sized according to flow rate and pressure drops.
Technical data chapter contains the “available flow rate/head” diagrams for the boilers and fan heaters and information for indicative sizing.

At the end of the installation, visually make sure that the boiler is slanted backwards in order to facilitate the flow of rainwater. Alternatively, insert a shim between the lower part of the boiler and the wall to increase the slope.

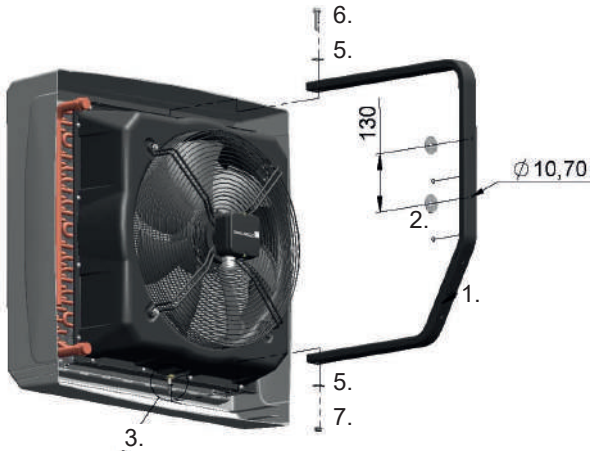


5.4.2. Fan heater installation procedure

1. Make two holes, centre distance 130 mm, on the wall where the fan heater must be fixed.
2. To fix the shelf (1) use dowels suitable for the type of wall with maximum screw diameter of M10.

Make sure that the type of dowel (not supplied with the fan heater) is suitable for the type of wall and sufficient to support the weight of the fan heater.

3. Fix the shelf to the wall making sure that it is vertically aligned. During fixing, insert the two washers Ø40 (2) supplied with the fan heater
4. Screw the stud ØM8 (3) in the nut screw placed in the lower wall of the fan heater.
5. Hook the unit to the shelf by inserting the stud (3) in the lower slot of the shelf, then fix the fan heater using the screw (6).
6. Lock the stud using the nut M8 (7)
7. Some fastening washers (5) are supplied with the fan heater: it is mandatory to use such washers to lock the fan heater.



5.5. Boiler/fan heater connections

For AKN032, AKN034, AKN050 and AKN070
Connect the two flexible hoses, previously used on the boiler, to the indoor unit using the gaskets supplied with the equipment; the boiler delivery must be connected to the indoor unit input and the boiler return to the indoor unit output (see the arrows on the fan heater);
Fix the fan heater remote control to the wall, in a comfortable position for the user's handling of the controls.

For AKN100
Connect the hydraulic circuit with flexible hoses to the indoor unit using the proper gaskets; the boiler delivery must be connected to the indoor unit input and the boiler return to the indoor unit output (see the arrows on the fan heater);
Fix the fan heater remote control to the wall, in a comfortable position for the user's handling of the controls.

AX-EC fan heaters are not supplied with hoses, which must be supplied separately.
The AX-EC fan heaters are not equipped with a remote control, but can be connected directly to the boiler with a 0-10 Vdc

connection or controlled with the G24200 or G24500 panels to be purchased separately.

5.6. Special installations

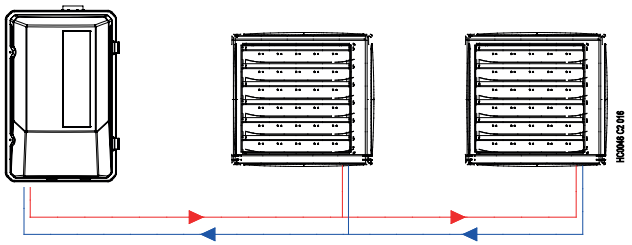
5.6.1. Fan heater remote connection

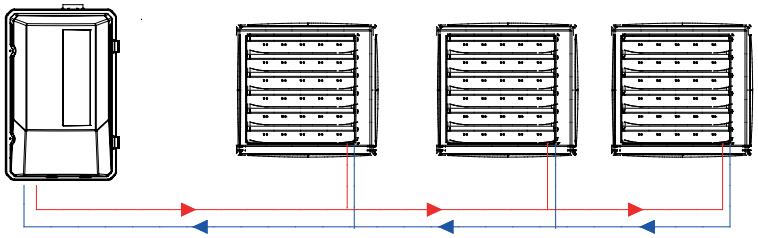
If the fan heater is installed at a distance greater than the one possible with the flexible hoses supplied with the equipment (0.5+0.5m), the piping must be sized according to the data indicated in Sections 3.2.4 - 3.2.9 based on the distance between boiler and fan heater.

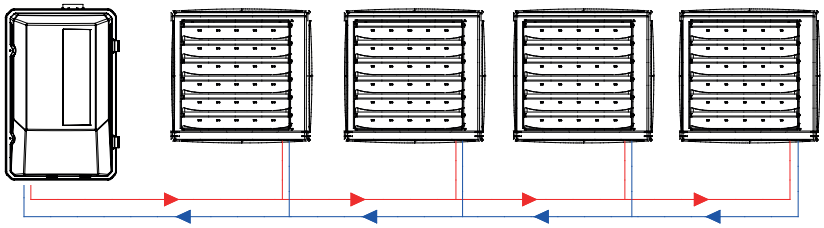
5.6.2. Connection of more than one fan heater

It is possible to connect to the boiler several fan heaters according to the following combinations:

AKN/AB and AKN/AX-EC COMBINATION		
AKN	**AB**	**AX-EC**
032	n.1 AB032	n.1 AX040EC
	n.2 AB018	n.2 AX030EC
034	n.1 AB034	n.1 AX050EC
	n.2 AB018	n.2 AX030EC
050	n.1 AB050	n.1 AX070EC
	n.2 AB032	n.2 AX040EC
	n.3 AB018	n.3 AX030EC
070	n.1 AB070	n.1 AX090EC
	n.2 AB034	n.2 AX050EC
	n.2 AB018 + n.1 AB034	n.2 AX030EC + n.1 AX050EC
	n.4 AB018	n.4 AX030EC
100	n.2 AB050	n.2 AX070EC
	n.3 AB034	n.3 AX050EC
	n.5 AB018	n.5 AX030EC

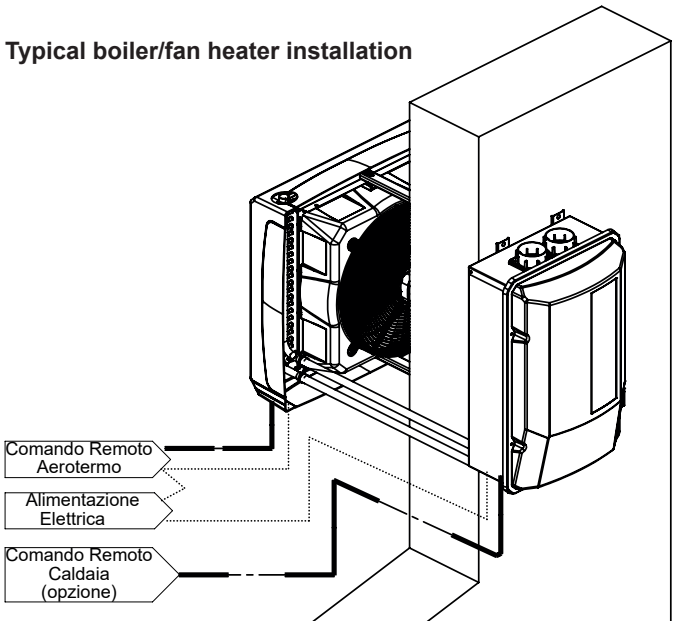


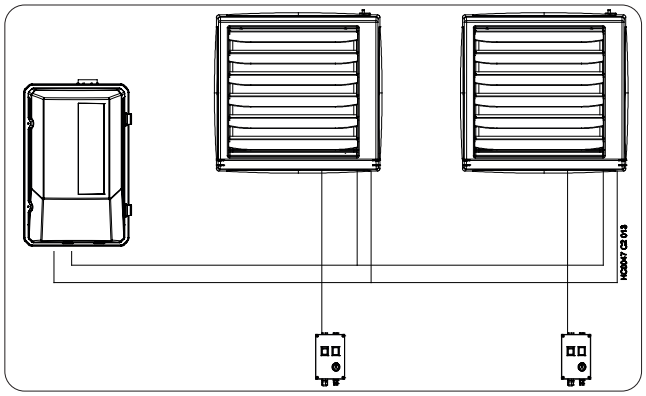




IT is also possible to install several fan heaters of smaller size; We suggest installing hydraulic balancing valves on the fan heater water infeed lines for regulating the water flow rate on each fan heater in a balanced manner.

Typical boiler/fan heater installation





5.6.3. Ambient temperature adjustment

We can discriminate between two different types of installation and, therefore, ambient temperature adjustment:
- boiler with fan heaters installed in a single room;
- boiler with fan heaters installed in different rooms.

Temperature control

The heat output value sent to the burner is calculated from the percentage heat output associated with one or more activated settings. The burner operates at the lowest input of the set settings.

Installation in a single room

To heat a single room with more than one fan heater connected to only one boiler, only one Smart X regulator or ambient thermostat controlling boiler start-up is required.
When hot water reaches the fan heaters, they will start operating autonomously when the incoming water rises to 42°C. Similarly, when the boiler is switched off and colder water reaches the fan heaters, they will stop their operation. This is true for one or more than one fan heater connected to the boiler.

Smart X allows to control several boilers (up to 15 boilers max), provided that they are located in a single zone: ambient temperature and start-up times are the same for all the connected boilers.

Installation in different rooms

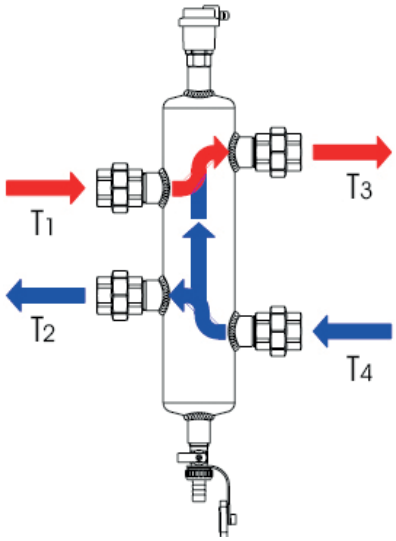
To heat different rooms with one boiler, the temperature regulator allows to either control only the fan heater ventilation or to divide the hydraulic system into several zones.
If you only want to control the ventilation of the fan heater:
- install an ambient thermostat, or chronothermostat in each room;
- use the ambient thermostat contact to control the relay coil with two free contacts;
- use a relay contact to power the fan heater;
- use the other relay contact, in parallel to the other contacts of other relays, to close the boiler ID0/GND terminals; this allows the boiler to start when a thermostat sends the heat demand. Water circulates inside all the fan heaters, partially heating also the rooms that are not involved. When all the thermostats are set to OFF, the boiler is off too;

If it is necessary to divide the hydraulic system into several zones:
- install a zone valve and an ambient thermostat or chronothermostat for each room;
- use the zone valve limit switch, in parallel to the other zone valve contacts, to close the boiler ID0/GND terminals, or Smart X ID1/GND terminals.
- Set the "SMART" parameter of the CPU to 2

In this case, when a zone is closed, the boiler starts and water circulates only in the fan heater of the zone involved. When all the zones are open, the boiler is off.

In both cases, the boiler may be connected to Smart X paying attention not to activate the ambient thermostat function; it is therefore necessary to set the required temperature to a value that does not interfere with the other thermostats, e.g. 35°C.

If the boiler available head is not sufficient for the hydraulic system circuit, supply the system with another circulator compatible with the boiler circulator flow rate.
To install another circulator, the boiler and the circulator must be divided by a hydraulic separator between primary circuit [T1 and T2 boiler] and secondary circuit [T3 and T4 device].



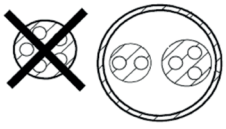
5.7. Electrical connections

5.7.1. Boiler power supply

The boiler must be correctly connected to an effective earthing system, fitted in compliance with current legislation.
Single phase 230 Vac power supply with neutral; do not swap the neutral with the live wire. For safety reasons, if the live and neutral wires are swapped, the flame control prevents operation reaching E10.
The boiler 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 consumption (see technical features table).

Keep electric cables away from heat sources.

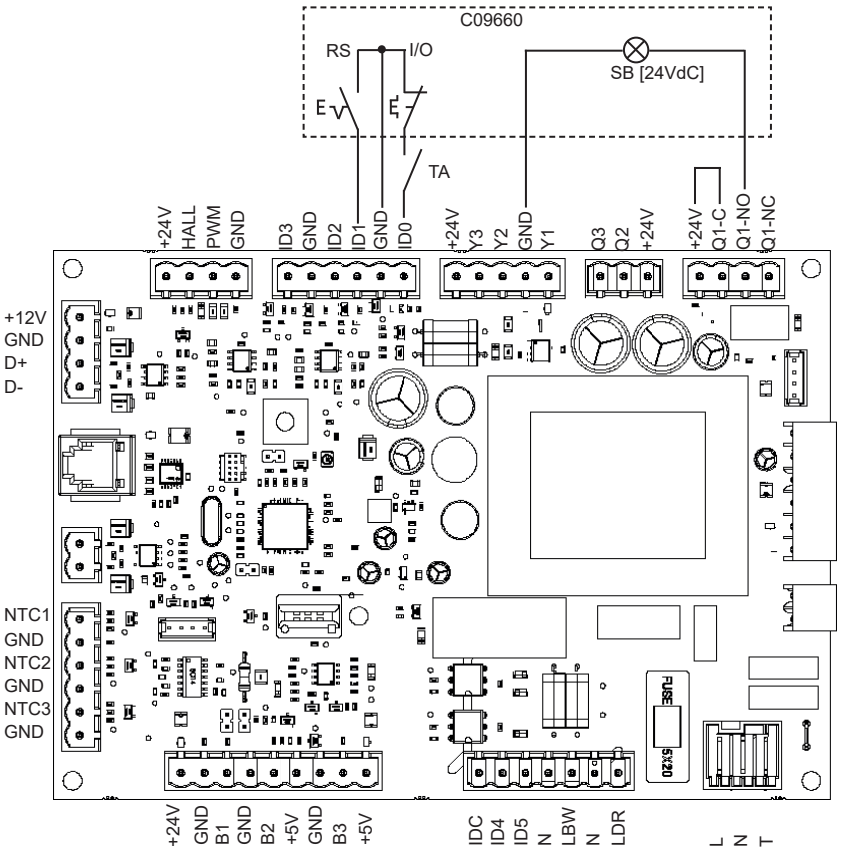
It is compulsory to fit, upstream of the boiler, a multipole isolator fitted with a suitable electric protection element. Using a multipole cable carrying both the power supply and the control cables is prohibited, both because of different voltages and since this could cause electromagnetic interference on the heater PCB.

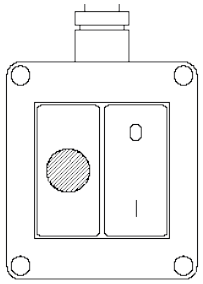


5.7.2. Connecting the ambient thermostat and the C09660 remote control

The boiler must be compulsorily connected to an ambient thermostat; the C09660 remote control should at least be connected to allow the user to remotely reset.
Connect the TA ambient thermostat to the ID0/GND terminals of the boiler PCB. If used with the C09660 remote control, connect it according to the diagram below.

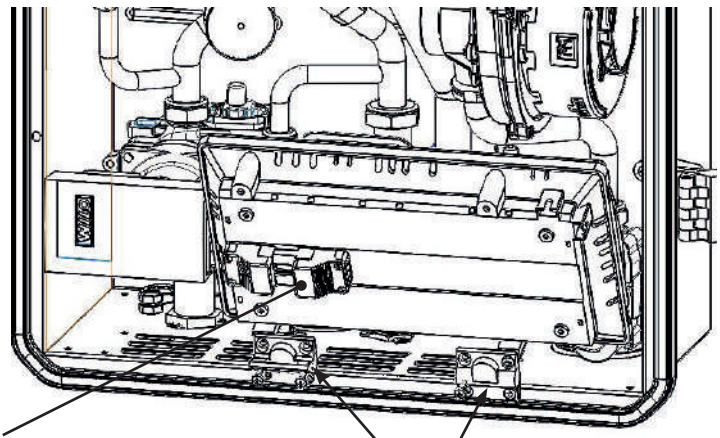
The thermostat, switch and lamp contacts are supplied by low voltage.
The thermostat contact must be “dry”, i.e. have zero voltage.
Should the installer decide to fit a lockout warning light, its power supply must be 24VDC and its maximum power input must be < 25 mA.





KEY	
SB	Lockout indicator light
RS	Reset button
I/O	ON-OFF switch
TA (Room thermostat)	Room Thermostat [to be provided by the installer]

Minimum cable cross-sections	
Phase	3 x 1.5 mm²
Neutral	
Ground	
Contact and lamp	0.5 mm²
Smart X	0.5÷1 mm² shielded (depending on distances)



Control panel fitted with clutch hinges. Loosen the screw to move the panel.

5.7.3. Smart X remote control connection

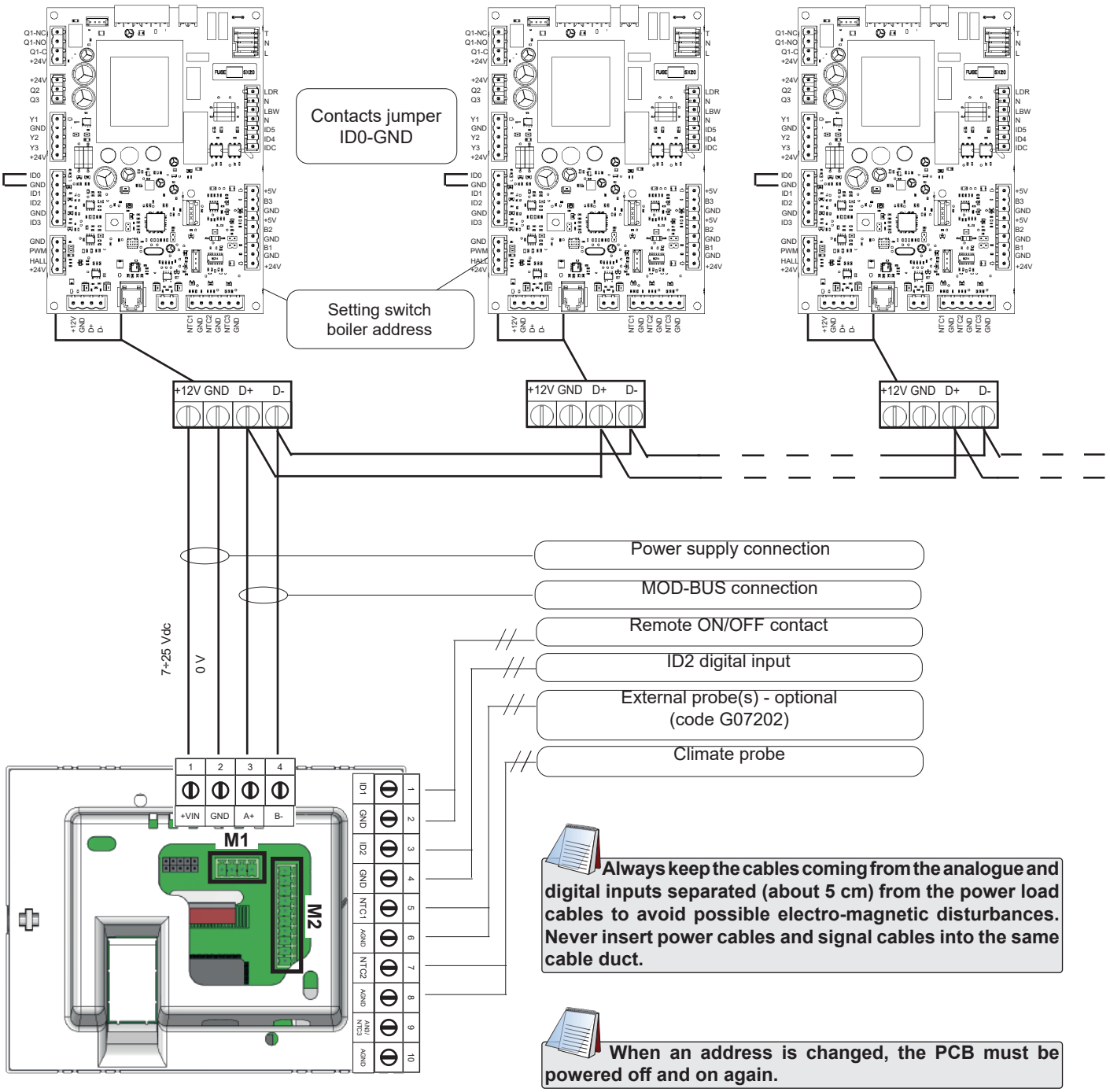
Use the CN04 terminal to connect the Smart X. Connect the power supply, making sure polarity is correct. Connect the RS485 Modbus network, making sure polarity is correct.
In case of several boilers, the remote control must be electrically connected to a single boiler and the D+ and D- terminals must be connected making sure polarity is correct; the network can be made both as a serial and star network.

Use a twisted cable of the AWG20/22 type with a cross-section between 0.25 and 1.5 mm2.

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, if different from zero, is displayed on the LCD as Axx, where xx is the address.

To program the Smart X, please refer to the operating manual supplied with the accessory.

For multiple boiler cascading management with manifold in a single zone, it is necessary to connect a single Smart X remote control.



Always keep the cables coming from the analogue and digital inputs separated (about 5 cm) from the power load cables to avoid possible electro-magnetic disturbances. Never insert power cables and signal cables into the same cable duct.

When an address is changed, the PCB must be powered off and on again.

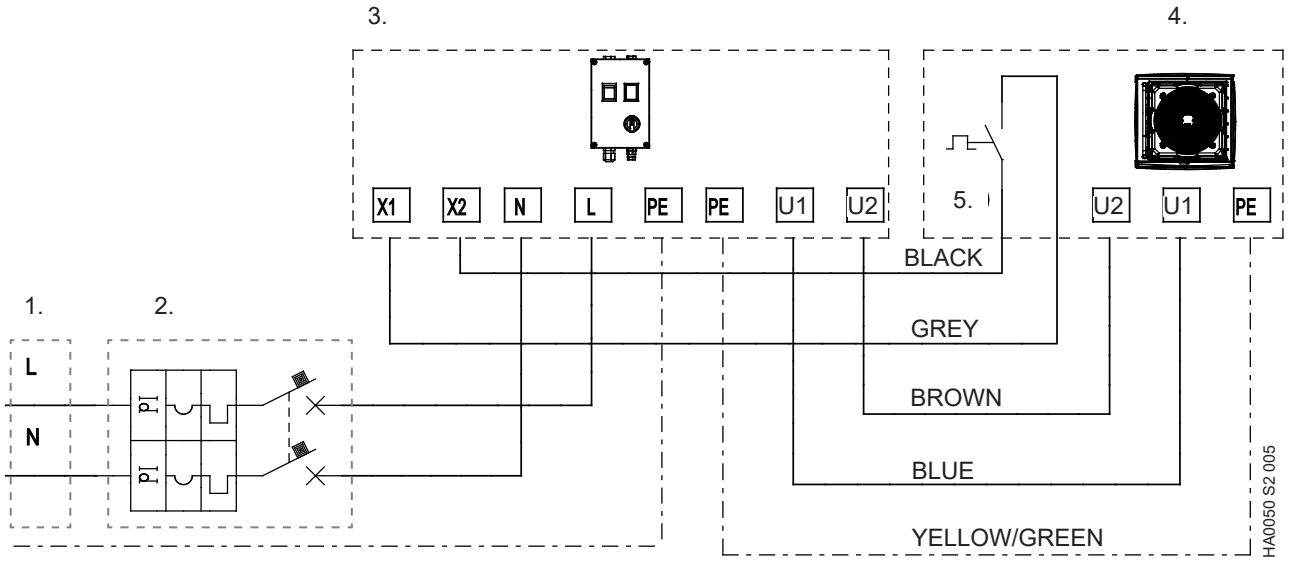
5.7.4. AB fan heater electric connections

The electrical system, and more specifically the cable section, must be suitable for the equipment maximum power consumption (see technical features table).

Fan heater connection:
Carry out the connections according to the diagram below.

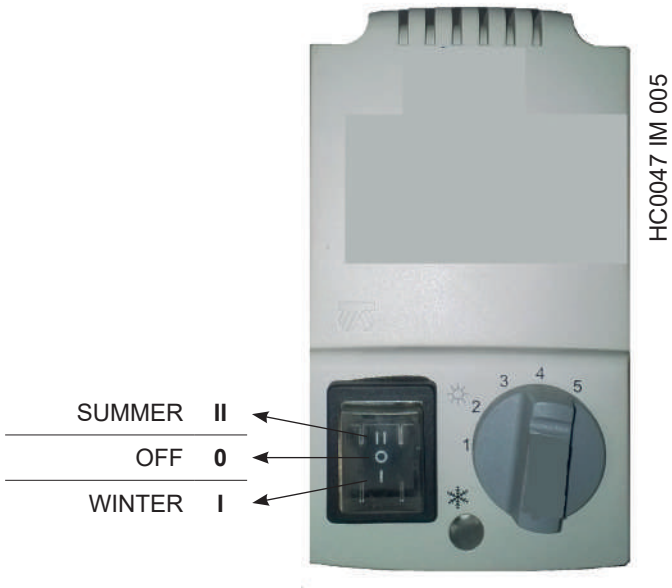
Keep electric cables away from heat sources.

It is compulsory to fit, upstream of the fan heater, a multipole isolator fitted with a suitable electric protection element.



Key
1. Power supply 230V-50Hz;
2. Main switch with fuse;
3. Fan speed control;
4. Fan heater (fan heaters AB050/070 have no.2 fans connected in parallel);
5. Water thermostat (on the fan heater).

5-Speed regulator technical features
Power supply 230V ac ± 10% 50/60Hz;
5-speed adjusting switch;
Output voltage 115/135/155/180/230V;
IP54 protection class;
Thermal protection;
Operating temperature up to 40°C;
Wall-mounting.



Do not connect more than one fan heater to the regulator. Each fan heater must have its own regulator connected.

Minimum cable cross-sections	
Power cables	3 x 1.5 mm²

The regulator does NOT switch the boiler off and therefore must NOT be set to "0". Always keep the I/0/II switch in position "I" (WINTER) throughout the heating season. Move the switch to zero only at the end of the season or when the entire system is stopped. Position "II" means "SUMMER" mode operation.

5.7.5. AX-EC electronic fan heater electric connections and operating parameters

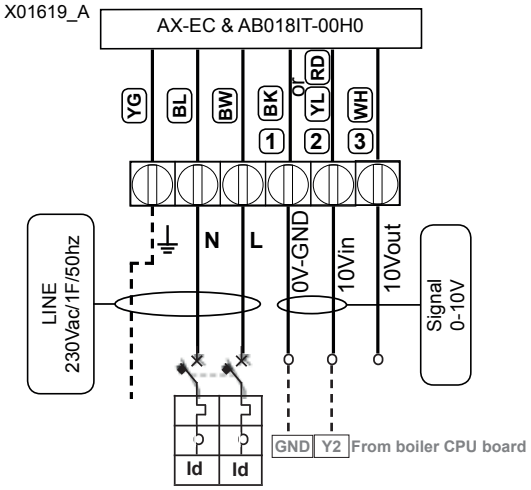
AX-EC electronic fan heaters require a single-phase 230 Vac power supply.
The electric system, and in particular the cable cross-section, must be suitable for the maximum power absorbed by the equipment (refer to the technical data in the manual supplied with the fan heater).

Keep electric cables away from heat sources.

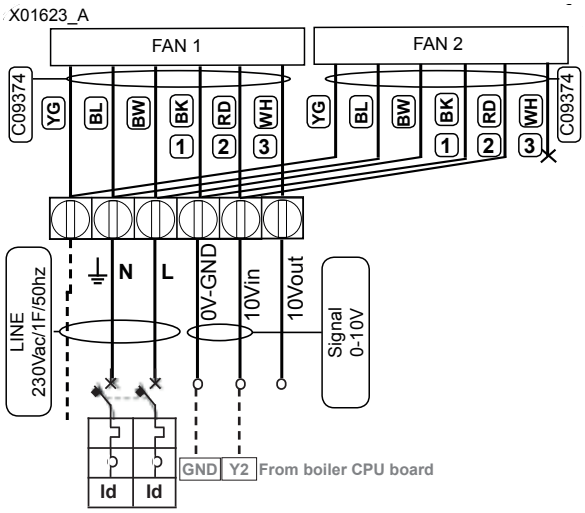
It is compulsory to fit, upstream of the fan heater, a multipole isolator fitted with a suitable electric protection element.

Minimum cable cross-sections	
Phase	3 x 1.5 mm²
Neutral	
Ground	

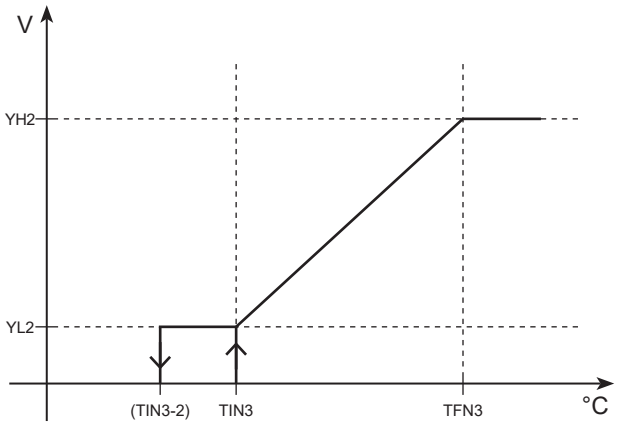
AX020EC-AX050EC



AX070EC-AX090EC



The AX-EC fan heaters must be connected directly to the boiler with a 0-10 Vdc connection to terminals Y2-GND (refer to the wiring diagram supplied with AX-EC fan heaters).
The CPU PCB is pre-set at the factory for operation with electronic fan heaters (FUNC_03 with a value of 3).
If the user wishes to change the fan variation speed according to the delivery temperature, the parameters P37 (TIN3) and P38 (TFN3) of FUNC_03 must be changed. The analogue output (0-10 Vdc signal) sent to the fan heaters will have a maximum value when the temperature of the reference input is ING3A ≥ TFN3 (10Vdc).
Y=0 (OFF) with ING3A<TIN3-2°C.
The Y output is activated with ING3A > TIN3.
Parameter ING3A defines the temperature probe used to calculate the analogue output. For boilers it is NTC1, the same probe used for temperature control.



Tips

To delay the AX-EC fan start-up, avoiding cold air at boiler start-up, increase the TIN3 parameter value.

Do NOT set TIN3 parameter to values above 40/42°C.

To reduce fan noise, decrease the YH2 parameter value (option only possible with Smart X remote control connected).

Do NOT set LH2 parameter to values below 7.

5.8. GAS Connections

ONLY FOR ITALY:
According to the current standards UNI-CIG, carry out the line for gas supply; for gas line connections, use CE certified components only.
AKN boilers are supplied with:
- Double coil gas valve;
- Gas stabiliser (inside the gas valve);
- Gas tap;

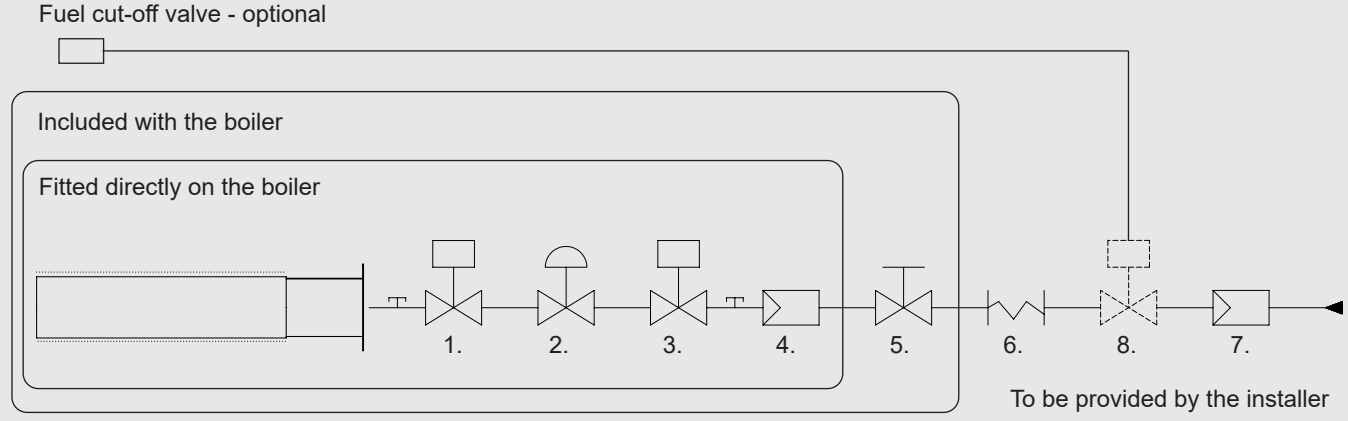
All components, except for the tap, are fitted inside the boiler.
To complete the installation, as required by the current regulations, the following components must be fitted:
- Anti-vibration joint;
- Gas filter [without stabiliser].

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 of the equipment.

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

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.

AKN050/070/100 installation diagram

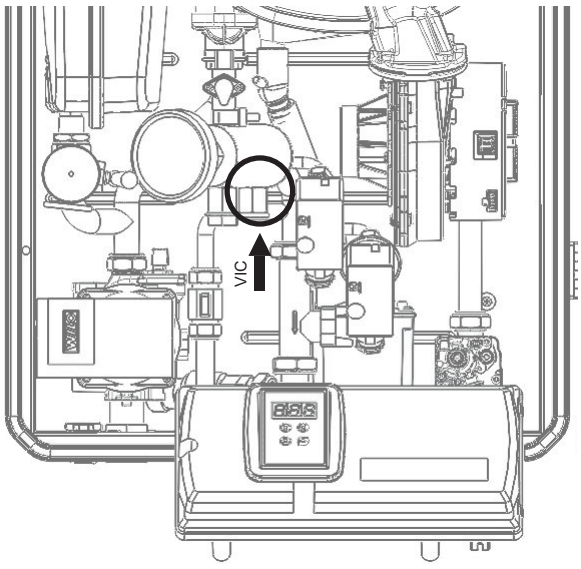


KEY
1. Main burner gas solenoid valve
2. Pressure stabiliser
3. Safety gas solenoid valve
4. Gas filter - (small cross-section, installed in the gas valve)
5. Gas tap (supplied by APEN GROUP)
6. Vibration damping joint
7. Gas filter (large cross-section)
8. Fuel cut-off valve - optional code **C09073** for AKN050/070 and code **C09464** for AKN100

ONLY FOR ITALY:
Ministerial Decree 1-12-75 and the corresponding technical specifications ["R" collection ed. 2009] require, for boilers having burner heat output greater than 35 kW, the installation of the fuel cut-off valve with manual reset. Apen Group supplies boilers with the well to insert the sensitive component and, on request, with kits:
- 3/4' **C09073** for AKN050/070
- 1' **C09464** for AKN100.

The choice of fuel cut-off valve must be made on the basis of the fuel used and its flow rate and heat loss diagrams.

The antifreeze function of the CPU PCB (already active by default, parameter CTRL_02=1) prevents the triggering of the element sensitive to the temperatures below zero degrees.



5.9. Connections to the Flue

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 boiler installation site.
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.

AKN boilers are supplied with an aluminium flue outlet casting with a special flue gas analysis socket and a special gasket to protect the components inside the boiler.
The combustion air is drawn in through a series of holes in the casing.

To make the fume exhaust, taking into account that AKN boilers can condense, the following must be used:
- Double wall flue duct with internal stainless steel pipe, air gap insulated with air or insulating material and external stainless steel pipe.
- Double wall flue duct with internal PP pipe, air gap insulated with air or insulating material and external stainless steel pipe.
- Single wall stainless steel flue pipe.

Use pipes equipped with the sealing gasket (suitable to withstand fume temperature) to prevent fumes from exiting the pipes.

The boiler is provided with a thermal fuse on flue gas outlet protecting the flue and with a thermal fuse on the exchanger.

The boiler can discharge directly on the wall only if it is installed to replace an existing one, also equipped with exhaust on the wall. In the case of exhaust on the wall, it is possible to make the duct with stainless steel pipes, taking care to:
- create the correct slope of the pipes in order to allow the condensate to flow inside the boiler;
- install the terminal at a suitable distance from the boiler casing to prevent the condensate generated on the terminal from dripping on the casing itself.

New installations require exhaust on the roof.
CERTIFIED pipes and terminals must be used.

5.9.1. Selection Guide

The table below shows the pressure drops 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 boiler used; each component has a different pressure drop value as their 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 boiler 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 flue gas exhaust reduces the boiler heat output and could trigger the flue gas pressure switch.

Only flue outlet and combustion air inlet ducts with circular cross-section are permitted. Other shapes are not permitted.

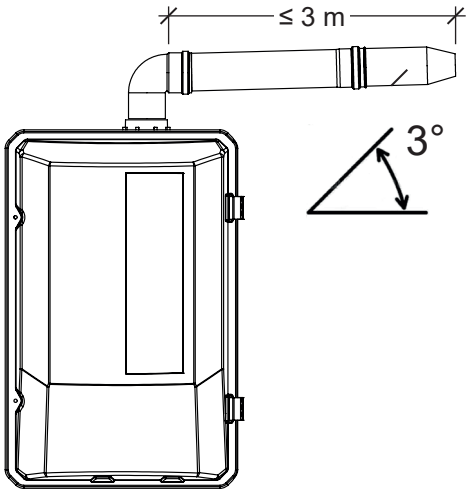
UNIT SET FOR G20 [NATURAL GAS]			
Model	**Temperature of fumes [°C]**	**Content of CO_2**	**Flue gas flow rate [kg/h]**
032	75	9.1	51.1
034	67	9.1	57.3
050	67	9.1	82.2
070	67	9.1	114.7
100	65	9.1	159.2

UNIT SET FOR G31 [LPG]			
Model	**Temperature of fumes [°C]**	**Content of CO_2**	**Flue gas flow rate [kg/h]**
032	75	9.8	39.8
034	68	9.8	44.7
050	67	9.9	63.8
070	67	9.8	89.4
100	65	9.8	124.1

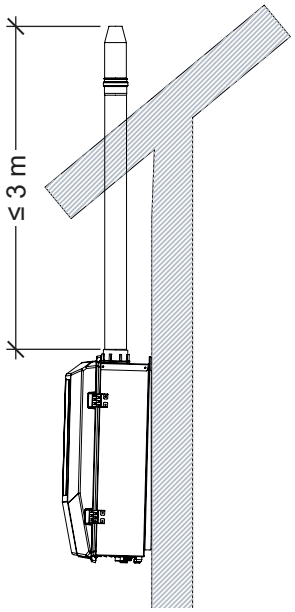
AKN: Component pressure losses [Pa]					
AKN models	**032**	**034**	**050**	**070**	**100**
Pressure available at the exhaust	110	110	100	120	100
COMPONENT					
Smooth Ø80 pipe [l=1 m]	2.1	2.1	4.9	8.1	-
Ø80 Bend Wide Radius 90°	3.4	3.5	7.9	13.6	-
90° Elbow Ø80 Bend	5.6	7.0	14.5	28.2	-
Ø80 Bend Wide Radius 45°	1.7	1.9	3.9	7.6	-
Ø80 condensate drain adapter	3.8	4.8	9.8	19.1	-
Ø80 TEE adapter	5.0	6.3	13.1	25.4	-
Ø80 Roof-Mounted Terminal (only windproof exhaust)	4.5	5.6	11.5	22.5	-
Ø80/100 adapter	0.7	0.8	2.2	8.2	-
Ø80 Horiz. UPTAKE ONLY	2.6	2.6	4.6	6.4	-
Smooth Ø100 pipe [l=1 m]	0.6	0.7	1.5	2.9	5.6
Ø100 Bend Wide Radius 90°	1.3	1.4	3.1	5.3	11.1
90° Elbow Ø100 Bend	2.2	2.8	5.7	11.1	21.5
Ø100 Bend Wide Radius 45°	0.6	0.8	1.6	3.1	6.1
Ø100 condensate drain adapter	1.5	1.9	3.8	7.5	14.4
Ø100 TEE adapter	2.0	2.6	5.3	10.3	19.8
Ø100 Roof-Mounted Terminal (only windproof exhaust)	1.8	2.3	4.7	9.1	17.5
Ø100 Horiz. UPTAKE ONLY	1.5	1.5	2.0	2.4	4.3

5.9.2. Tips for the installation

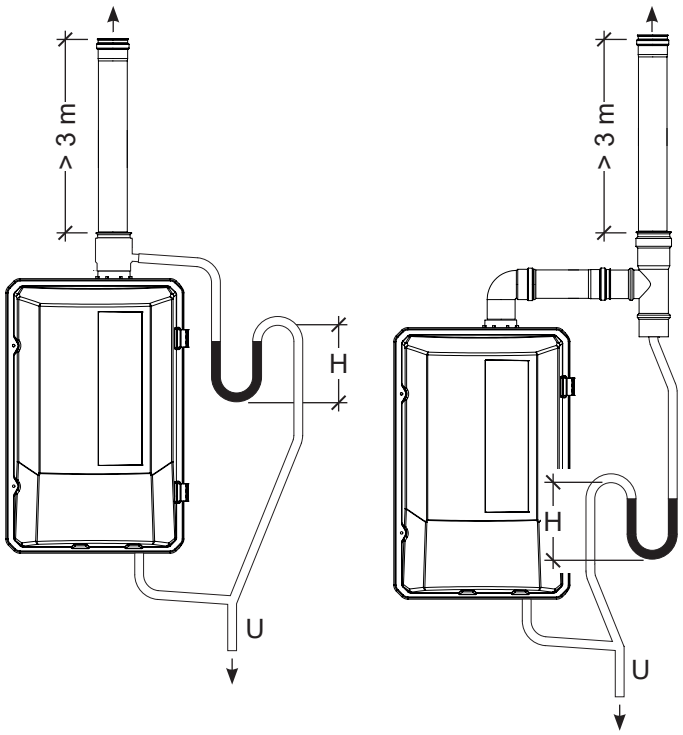
It is advisable to make the direct exhaust on the roof or on the wall (which can be used only for simple replacements of existing equipment) only for lengths of max. 3 m and for double-wall ducts, moving the outlet terminal away from the boiler and keeping the horizontal section of the flue duct with a slight slope (1° - 3°) to guarantee the correct flow and discharge of the condensation through the boiler. This prevents the condensate from dripping on the boiler.



Direct exhaust on the roof is only recommended for vertical straight sections of flue outlets that are less than 3 m long and for double-walled flue ducts.



In case of installation of flue outlet longer than 3 m, it is necessary to drain the condensate generated inside the chimney before the boiler inlet by inserting a condensate collector at the chimney connection or by offsetting it, placing it outside the overall dimensions of the boiler and inserting a T-shaped component, as shown in the following examples.



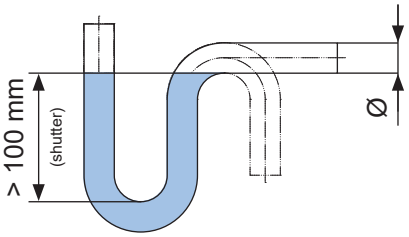
It is possible to make a connection between the two flue condensate discharge systems and the boiler (U).

The condensate drain system must have a slope equal to or greater than 3° to allow for proper flow.

In the cases above, where it is necessary to provide for a condensate drain system inside the flue duct, it is important to provide a trap to prevent the escape of combustion products.

ONLY FOR ITALY:
Standard UNI 7129 requires that the trap has a shutter at least twice the maximum head of the equipment fan and, in any case, not smaller than 100 mm.

Always check the standards and regulations in force in the relevant countries of destination



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

Bend Ø 80	90°	EqL 1.68 m
Bend Ø 80	45°	EqL 0.90 m
Bend Ø 100	90°	EqL 2.30 m
Bend Ø 100	45°	EqL 1.10 m

*Equivalent lengths valid for wide radius bends.

The table shows the maximum equivalent lengths for the installation of AKN boilers.
The maximum exhaust length is obtained by adding the measurement of the linear pipe to the equivalent length of each additional bend/connection.

Elements of the flue pipe

MAXIMUM EQUIVALENT LENGTH FOR FLUE OUTLET [m]		
AKN	**Ø80**	**Ø100**
032	25	-
034	25	-
050	15	25
070	12	25
100	-	8

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 (Vm=resistance class without test, only based on material and minimum thickness; V1 or 1=gaseous fuels, natural gas, LPG, and gas with nitrogen ≤50 mg/m³; V2 or 2=liquid fuels, natural gas, LPG and gas with nitrogen >50 mg/m³; V3 or 3=solid fuels, natural gas, LPG and gas with nitrogen >50 mg/m³, diesel with sulphur >0.2%							
Material and thickness (example L50=STAINLESS AISI316, 050=0.5mm thick)							
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.

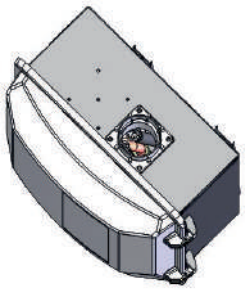
5.9.3. "C" TYPE installation

The boiler is C63 certified; therefore, accessories compliant with current regulations must be used to manufacture the customer's intake and exhaust ducts.
If a C type installation (sealed chamber) is required, proceed as follows:

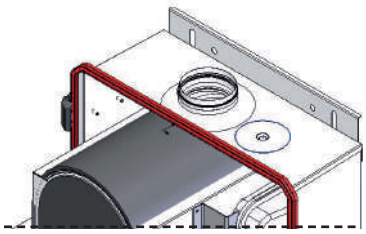
- close the air inlet inside the boiler by means of the corresponding accessory C12033 (for AKN032/070) or C12035 (for AKN100);
- pierce at the protrusion
- install the air inlet terminal.

Ask Apen Group Customer Service for the documentation of the kits C12033 or C12035 or order directly the code AKNxxxIT-0XC0 which includes the boiler with the kit already installed.

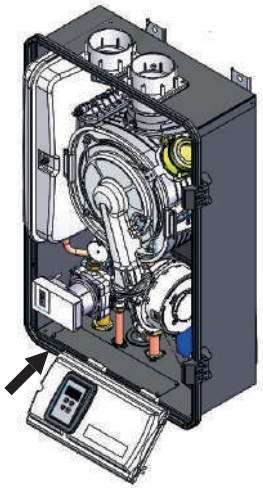
Protrusions



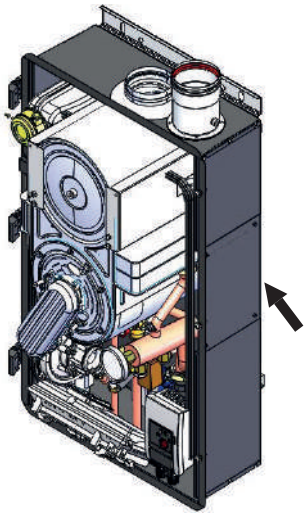
AKN032/034/050/070



AKN100



Suction terminal and closing panel AKN032/034/050/070



Suction terminal and closing panel AKN100

5.10. Connection to the condensate drain

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

- trap equipped with a detection electrode;
- condensate drain fitting (Ø 18mm quick connection, placed at the bottom of the boiler).

Precautions
Condensate water flows out at temperatures lower than or equal to 50°C.
The pipe must be sized according to the maximum amount of condensate produced by the appliance (see Par. "Technical data") and made of material suitable for the passage of hot condensate with acidity level of approx. PH 3.5-3.8 (for example: PVC, stainless steel, silicone, or other suitable plastic materials).

Do not use galvanised iron, galvanised steel or copper pipes to connect the condensate drain fitting.

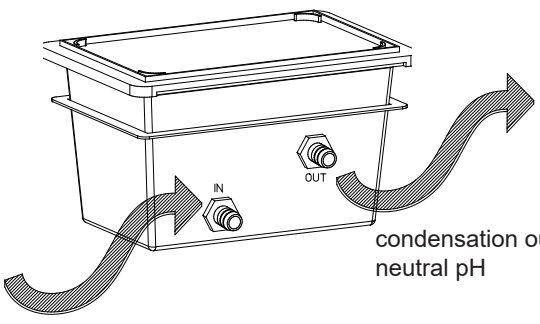
Neutralising the condensation.
The condensation produced by the combustion of natural gas has an acid pH of 3.5-3.8.
On request, Apen Group can supply the kit (cod. G14303) required to neutralise the condensation, consisting of:

- Plastic tank for the collection of condensation;
- Calcium carbonate.

For more information, contact Apen Group Customer Service.

Protection from frost
In case of outdoor installations or in very cold places, with the risk of condensation freezing, we recommend to protect the condensation drain system.
We recommend that the condensation collection system is located inside heated rooms.
If the system is located outdoors, the pipe must have an open type connection to make sure that any ice formed inside the external system does not prevent the condensation from being drained away.
In any case, it is recommend that the longest pipe should be laid inside the heated room, for example by collecting the condensation flush to the floor with the down pipe located inside the room.

KIT G14303 to neutralise acid condensation



CAUTIONS
Special attention must be paid when making the condensate drain system; an incorrectly installed drain, in fact, could jeopardize the correct operation of the appliance. The factors to be taken into account are:

- risk of condensation build-up inside the heat exchanger;
- risk of condensation water freezing in the pipes;

During normal operation, condensate water must not be allowed to accumulate within the heat exchanger. An electrode fitted in the heater internal water trap checks and stops the burner from operating before the condensate reaches a potentially dangerous level inside the fume collection hood.

Additional cautions

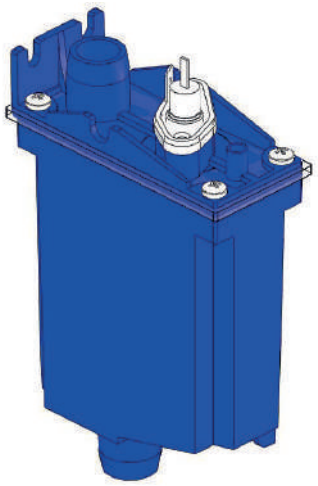
- For the condensate drain pipe linear sections, provide for a slope equal to or greater than 3%, i.e. 3 cm per metre (otherwise provide for a booster pump);
- Install the condensate neutralisation kit in the rooms, near the condensate drain fitting of the heater, to prevent condensate water from freezing inside the container;
- Do not drain the condensate in pipes made with materials incompatible with the condensate acidity: risk of corrosion.

Not all countries allow the types of condensation drains described here. Please refer to the requirements specified by local legislation.

Exhaust with Sealed fume trap
The trap, code C09385.01, prevents the flue gases from coming out also when there is no water.
The trap is equipped with a detection electrode.

- To connect the trap to the condensation drain system, use PVC or silicone pipes.
- Condensation collection pipe water tightness must be guaranteed.

C09385.01 Trap



5.11. Hydraulic circuit and water treatment

AKN boiler models are NOT pre-filled (check the capacity of the expansion reservoir according to the water content of the system).

5.11.1. Antifreeze

Automatic antifreeze system

The boiler system is equipped with an automatic antifreeze function active by default. However, in case of power failure and with outdoor temperatures below 4°C, freezing of water inside the pipes may occur. If the characteristics of the installation site cannot exclude the above-mentioned condition, it is necessary to provide for a passive antifreeze system, otherwise the warranty will be voided.

In order to avoid voiding the warranty, it is mandatory to install a passive antifreeze system, such as the addition of glycol into the circuit.

Antifreeze control

In AKN boilers, the antifreeze control (parameter C21) is activated by default as a precaution to avoid any fuel cut-off valve activation when temperatures are near zero. Filling the system with the right amount of water and glycol is deemed the best antifreeze method (to protect the system even in case of blackout).

Antifreeze control logic is the following:

- If the water temperature (probe NTC1) falls below the antifreeze setpoint (parameter C22), the circulator is activated to circulate the water inside the system.
- If the water temperature (probe NTC1) falls below the antifreeze setpoint by a value higher than the set hysteresis (parameters C22 - C23), both circulator and burner are activated
- When the water temperature (probe NTC1) returns above the sum of antifreeze setpoint and hysteresis (parameters C22+C23) the boiler goes back to standby mode.

NTC1>(C22+C23):	equipment in standby mode;
NTC1<(C22):	water circulation on;
NTC1<(C22-C23):	water circulation and burner on.

5.11.2. Glycol

The type of glycol required is the same for all models.

For its AKN boilers, APEN GROUP tested and recommends to use **ALPHI-11** glycol by Fernox or **X500** glycol by Sentinel; the following KITS contain ALPHI-11 packs by Fernox with different capacity:

Code	Capacity
C07200-05	5 litres
C07200-25	25 litres

Other types of glycol, different from the recommended one, invalidate the product warranty.

The table below contains the freezing temperatures of water and glycol mixes.

GLYCOL				
Quantity	10%	20%	25%	30%
Freezing temperature	-3°C	-8°C	-11°C	-15°C
Correction factor for heat loss	1.07	1.15	1.18	1.22

Using a water and glycol mix, it is necessary to increase heat drops of pipes and fan heaters according to the indicated correction factors.

All data refer to a FERNOX ALPHI-11 or SENTINEL X500 polypropylene glycol and water mix recommended by Apen Group. These products also contain inhibitors and protective agents that provide protection against internal corrosion and limescale formation (see paragrafo 5.12).

The indicated glycol percentages refer to the parts contained in the mix (water/glycol) and not in addition to water, e.g.: a 10-litre mix with 30% glycol is composed of 7 litres of water (70%) and 3 litres of glycol (30%).

Glycol percentages and limit temperatures indicated have information purposes; we remind that the boiler is certified for use with external temperatures up to, and not exceeding, -15°C.

It is necessary to periodically check the percentage of glycol in the system and replace the glycol and/or check the acidity level of the system liquid, considering that for 25% mixture pH value can be 6.4 to 7.4.

5.11.3. Y-shaped filter

It is compulsory to install a Y-shaped filter (on the return pipe from the system) with metal mesh of no more than 1 mm on the water inlet to the boiler, to prevent the boiler heat exchanger from clogging.

It is necessary to provide for periodic cleaning of the filter mesh; if the filter clogs, pressure drops progressively increase, causing problems (insufficient circulator head) until possible circulation stop.

For filter cleaning and maintenance, install two cut-off valves upstream and downstream of the filter.

5.11.4. Expansion reservoir

- The reservoir pre-charge must be equal to the system's filling value;
- Before refilling the circuit check the expansion reservoir pre-charge pressure.

5.11.5. Filling

Filling or water replenishment operations are the same for all models, as indicated below.

To identify the delivery, return and filling position, refer to paragrafo 3.6 “Boiler dimensions”.

Make sure that connections between the internal and external units have been carried out correctly, respecting delivery and return direction.

- Make sure that automatic vent valves, placed on the circulator or on the boiler and on the fan heater coil(s) are open.
- Connect the filling tap, by means of a 1/2” flexible hose, to a pump for system test with reservoir filled with water and glycol. Load the mix until a pressure of approx. 2 bar is reached.
- Vent the pipe;
- When venting operation is over check, through the display, that the pressure inside the circuit is greater than 1bar; lower values will cause an E80 or E25 (for AKN050/070/100) because of the activation of minimum water pressure sensor [calibration 0.5bar].

It is compulsory to perform an adequate air bleed inside the hydraulic circuit, especially if the boiler is installed higher with respect to the corresponding fan heater. See degasser function dEG paragrafo 4.1.5.

5.11.6. Water-glycol mix restoration

In the event of water leakage and/or need to refill the hydraulic circuit, after having detected and solved any leakages, it is necessary to restore water-glycol mix by following the instructions described in the previous Section.

5.11.7. Water content of boilers and fan heaters

WATER CONTENT	
Model	**Litres [l]**
AKN032	4.5
AKN034	5.0
AKN050	6.3
AKN070	7.0
AKN100	10.8
AB018; AB023;AX025EC; AX030EC; AX040EC	2.5
AB034; AX050EC	3.2
AB050; AX070EC	5.3
AB070; AX090EC	6.5
AX020EC	1.8

Refer to paragrafo 3.4 for the water content of the pipes.

5.12. Chemical conditioning

The **Italian Ministerial Decree of 26/06/2015**, with regard to the quality of water used in thermal systems for winter air conditioning (with or without domestic hot water production), without prejudice to the application of technical standard UNI 8065, requires that **chemical conditioning** treatment is **always mandatory**.

For systems with burner heat output >100 kW (for example cascading systems) and in the presence of supply water with total hardness >15 French degrees, a system **water softening** treatment is **mandatory**. For the above-mentioned treatments, refer to technical standard UNI 8065.

“**Chemical conditioning**” means the addition of chemical additives to the system water. Chemical conditioning allows mitigating the undesirable effects of water on system components, such as: inhibition of limescale and corrosion phenomena; dispersion of organic and non-organic deposits; pH correction; formation of protective films; control of biological growth; protection from frost.

ONLY FOR ITALY (ITALIAN MINISTERIAL DECREE OF 26/06/2015):

The use of specific products allows compliance with regulatory and legislative requirements in terms of chemical conditioning treatment of water used in thermal systems.

The following products are permitted and recommended by Apen Group:

Product	Fernox	Sentinel
Inhibitors	F1 Protector / Alphi-11	X100 / X500
Sludge removal	F1 Protector / F3 Cleaner	
Frost protection	Alphi-11	X500

Treatment	Preventive	Curative
Alphi-11	X	
F1 Protector	X	
F3 Cleaner	X	X
X100	X	
X500	X	

Other types of antifreeze glycol or conditioning products, different from the recommended ones, invalidate the product warranty.

5.13. Precautions for use

AKN boiler 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 or alkalis, sulphur powder, sulphides; installation near swimming pools or laundries exposes the boiler to the effects of such agents;
- Water hardness, TA, must be within 5°F and 15°F;
- During the first start-up, the air in the hydraulic system must be accurately removed; subsequently, do not close the automatic vent valves installed as standard on the boiler;
- The use of inhibitors to prevent the exchanger steel oxidation is absolutely necessary. The antifreeze recommended by Aper Group serves as inhibitor and preserves the heat exchanger from oxidation;
- Do not block or plug, with any object, the safety valve outlet.

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	II2H3B/P; I2HY20; 3B/P	G20	20 mbar	G20Y20	20 mbar	G30/G31	50 mbar
BE	I2E(S)B; I2EY20; I3P	G20/G25	20/25 mbar	G20Y20	20 mbar	G31	37 mbar
DE	II2ELL3B/P; IE2Y20	G20/G25	20 mbar	G20Y20	20 mbar	G30/G31	50 mbar
	II2E3B/P; IE2Y20 (AKN100 only)	G20	20 mbar	G20Y20	20 mbar	G30/G31	50 mbar
DK, FI, GR, SE, NO, IT, CZ, EE, LT, SI, AL, MK, BG, HR, TR	II2H3B/P; I2HY20	G20	20 mbar	G20Y20	20 mbar	G30/G31	30 mbar
ES, GB, IE, PT, SK	II2H3P; I2HY20	G20	20 mbar	G20Y20	20 mbar	G31	37 mbar
FR	IIEr3P; 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 [1]	II2EK3B/P; I2EY20 (from AKN032 to AKN070 only)	G20/G25.3	20/25 mbar	G20Y20	20 mbar	G30/G31	30 mbar
	I3B/P (AKN100 only)					G30/G31	30 mbar
HU	II2H3B/P; I2HY20	G20	25 mbar	G20Y20	25 mbar	G30/G31	30 mbar
CY, MT	I3B/P					G30/G31	30 mbar
LV [3]	II2H3B/P; I2HY20	G20	20 mbar	G20Y20	20 mbar	G30/G31	30 mbar
IS	I3P					G31	37 mbar
PL	II2E3B/P; I2EY20	G20/G2.350	20/13 mbar	G20Y20	20 mbar	G30/G31	37 mbar
RO	II2H3B/P; I2HY20	G20	20 mbar	G20Y20	20 mbar	G30/G31	30 mbar
	II2L3B/P [2]	G25	20 mbar			G30/G31	30 mbar

1. Category valid for AKN 032-034-050-070 models only. The AKN100 model can be sold in the Netherlands for LPG operation only.
2. Category valid for AKN 032-034-050-070 models only. The AKN100 model is not suitable for installation in Romania in areas where G25 gas is distributed.
3. 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)

The suffix “Y20” means that the equipment is suitable for operation with natural gas and natural gas mixture with 20% hydrogen.
The following information is clearly printed on the equipment packaging: country of destination, gas category and equipment code, all translated into the language of the destination country.
The code allows finding out the factory settings.

Codes with no extension:
- AKN070IT 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:
- AKN070FR-xxx0 0 indicates that the equipment has been tested and set up for natural gas [G20]
- AKN070MT-xxx1 1 indicates that the equipment has been tested and set up for LPG [G31]
- AKN070DE-xxx2 2 indicates that the equipment has been tested and set up for 'L' natural gas [G25]

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

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 table G20

TYPE OF GAS G20											
TYPE OF MACHINE		AKN032		AKN 034		AKN 050		AKN 070		AKN 100	
CATEGORY		According to the country of destination See previous table									
SUPPLY PRESSURE	[mbar]	**20** [min 17 - max 23]									
Ø GAS ORIFICE PLATE	[mm]	5.9		5.9		8.2		12.5		10.0	
CARBON DIOXIDE CO_2	(Q_{max}) [%]	9.1± 0.2		9.1± 0.2		9.1± 0.2		9.1± 0.2		9.1± 0.2	
	(Q_{min}) [%]	8.7± 0.2		8.7± 0.2		8.7± 0.2		8.7± 0.2		8.7± 0.2	
OXYGEN [± 0.3%]	(Q_{max}-Q_{min}) [%]	4.7	5.4	4.7	5.4	4.7	5.4	4.7	5.4	4.7	5.4
AIR EXCESS	λ (Q_{max}-Q_{min}) [%]	1.22	1.26	1.22	1.26	1.22	1.26	1.22	1.26	1.22	1.26
GAS VALVE OFFSET	Pa (Q_{max}-Q_{min})	-10	-3	-9	-3	-11	-4	-4	0	-17	-1
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	3.28	0.68	3.68	0.72	5.28	0.89	7.37	1.25	10.22	1.76
MAXIMUM CO VALUE*	[ppm]	500		450		700		800		850	

* Referred to dry flue gas without air under throttle gas valve fully open conditions up to the adjustment limit defined by the gas orifice plate

TYPE OF GAS G25									
TYPE OF MACHINE		AKN032		AKN 034		AKN 050		AKN 070*	
CATEGORY		According to the country of destination See previous table							
SUPPLY PRESSURE	[mbar]	**25** [min 20 - max 30]							
Ø GAS ORIFICE PLATE	[mm]	6.6		6.6		9.8		nn	
CARBON DIOXIDE CO_2	(Q_{max}) [%]	9.1± 0.2		9.1± 0.2		9.1± 0.2		8.6 ± 0.1	
	(Q_{min}) [%]	8.7± 0.2		8.7± 0.2		8.7± 0.2		8.3± 0.1	
OXYGEN [± 0.3%]	(Q_{max}-Q_{min}) [%]	4.4	5.1	4.4	5.1	4.4	5.1	5.3	5.8
AIR EXCESS	λ (Q_{max}-Q_{min}) [%]	1.21	1.24	1.21	1.24	1.21	1.24	1.25	1.28
GAS VALVE OFFSET	Pa (Q_{max}-Q_{min})	-9	-3	-6	-1	-12	-3	-15	0
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	3.81	0.79	4.28	0.84	6.14	1.03	8.56	1.45

* Rated heat input 67.4 kW

TYPE OF GAS G25.3									
TYPE OF MACHINE		AKN032		AKN 034		AKN 050		AKN 070*	
CATEGORY		According to the country of destination See previous table							
SUPPLY PRESSURE	[mbar]	**25** [min 20 - max 30]							
Ø GAS ORIFICE PLATE	[mm]	6.6		6.6		9.8		nn	
CARBON DIOXIDE CO_2	(Q_{max}) [%]	9.1± 0.2		9.1 ± 0.2		9.1± 0.2		8.6± 0.1	
	(Q_{min}) [%]	8.7± 0.2		8.7± 0.2		8.7± 0.2		8.3 ± 0.1	
OXYGEN [± 0.3%]	(Q_{max}-Q_{min}) [%]	4.4	5.1	4.4	5.1	4.4	5.1	5.3	5.8
AIR EXCESS	λ (Q_{max}-Q_{min}) [%]	1.21	1.24	1.21	1.24	1.21	1.24	1.25	1.28
GAS VALVE OFFSET	Pa (Q_{max}-Q_{min})	-9	-3	-6	-1	-12	-3	-15	0
GAS CONSUMPTION (15°C-1013mbar)	[m^3/h]	3.73	0.77	4.19	0.82	6.00	1.01	8.38	1.42

* Rated heat input 67.4 kW

TYPE OF GAS G30**											
TYPE OF MACHINE		**AKN032***		**AKN 034**		**AKN 050**		**AKN 070**		**AKN 100**	
CATEGORY		According to the country of destination See previous table									
SUPPLY PRESSURE	[mbar]	**30** [min 25 - max 35] - **37** [min 25 - max 45] - **50** [min 42.5 - max 57.5]									
Ø GAS ORIFICE PLATE	[mm]	4.6		4.6		6.1		7.9		7.0	
CARBON DIOXIDE CO_2	(Q_{max}) [%]	11.5± 0.2		11.6± 0.2		11.5 ± 0.1		11.5 ± 0.1		11.5 ± 0.1	
	(Q_{min}) [%]	11.1± 0.2		11.2± 0.2		11.3± 0.1		11.3± 0.1		11.3± 0.1	
OXYGEN [± 0.3%]	(Q_{max}-Q_{min}) [%]	3.8	4.4	3.6	4.2	4	4.1	3.8	4.1	3.8	4.1
AIR EXCESS	λ (Q_{max}-Q_{min}) [%]	1.18	1.21	1.17	1.20	1.18	1.19	1.18	1.19	1.18	1.19
GAS VALVE OFFSET	Pa (Q_{max}-Q_{min})	-5	-3	-5	0	-6	-0.5	-14	1	-8	8
GAS CONSUMPTION (15°C-1013mbar)	[kg/h]	2.57	0.56	2.89	0.56	4.14	0.70	5.78	0.98	8.02	1.38
MAXIMUM CO VALUE***	[ppm]	900									

* Minimum Heat Input 6.7 kW

** Modification of the modulation PCB b1-b2 parameters required:

b1	172	166	132	123	137
b2	674	682	606	576	652

*** Referred to dry flue gas without air under throttle gas valve fully open conditions up to the adjustment limit defined by the gas orifice plate

TYPE OF GAS G31											
TYPE OF MACHINE		**AKN032**		**AKN 034**		**AKN 050**		**AKN 070**		**AKN 100**	
CATEGORY		According to the country of destination See previous table									
SUPPLY PRESSURE	[mbar]	**30** [min 25 - max 35] - **37** [min 25 - max 45] - **50** [min 42.5 - max 57.5]									
Ø GAS ORIFICE PLATE	[mm]	4.6		4.6		6.1		7.9		7.0	
CARBON DIOXIDE CO_2	(Q_{max}) [%]	9.8± 0.2		9.8± 0.2		9.9 ± 0.2		9.8± 0.2		9.8± 0.2	
	(Q_{min}) [%]	9.5 ± 0.2		9.5± 0.2		9.5 ± 0.2		9.4 ± 0.2		9.4 ± 0.2	
OXYGEN [± 0.3%]	(Q_{max}-Q_{min}) [%]	6.0	6.4	6.0	6.4	5.8	6.4	6.0	6.6	6.0	6.6
AIR EXCESS	λ (Q_{max}-Q_{min}) [%]	1.28	1.31	1.28	1.31	1.28	1.38	1.31	1.31	1.28	1.31
GAS VALVE OFFSET	Pa (Q_{max}-Q_{min})	-10	-3	-5	1	-8	0	-15	0	-16	6
GAS CONSUMPTION (15°C-1013mbar)	[kg/h]	2.53	0.52	2.85	0.56	4.08	0.69	5.69	0.96	7.90	1.36
MAXIMUM CO VALUE*	[ppm]	300		380		400		450		450	

* Referred to dry flue gas without air under throttle gas valve fully open conditions up to the adjustment limit defined by the gas orifice plate

6.3. First start-up

The boiler is supplied already set up and tested for the gas specified on the nameplate. Before turning on the boiler, check the following:

- make sure the gas being supplied matches the gas for which the boiler 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 the pressure inside the hydraulic circuit is between 1.2 and 1.6 bar;
- check that electrical connections correspond to those indicated in this manual or other wiring diagrams enclosed with the machine;
- check that efficient earthing connections have been completed, carried out as specified by current safety regulations.

To turn on the boiler, follow the instructions below:

- provide voltage to the fan heater and, in case of fan heaters equipped with a speed regulator, set the switch to winter position and select maximum speed (5);
- make sure that an ambient thermostat or Smart X control is connected to the boiler.
- provide voltage to the boiler using the main switch after having ensured that the three-pin plug is connected to the boiler;
- when power voltage is provided to the boiler and ID0-GND contact is closed on boiler PCB, the ignition cycle starts;
- if APEN or Smart X remote control is connected, refer to the relevant manual for the ignition cycle start procedure, then continue with the following instruction.

Sometimes, when turned on for the first time, the burner cannot ignite because there is air in the gas pipe. This will lock out the boiler. You will need to reset the equipment and repeat the operation until it ignites (for unlocking operations use the buttons on boiler display).

The presence of a flame is indicated by the LED on the CPU board base.

If, during the first start-up, adjustment problems occur with the adjustment screw fully open, it is necessary to remove the gas supply pipe and remove burrs from the gas orifice plate (at the gas valve outlet, see the images below).

6.4. Analysis of combustion

Wait until the boiler reaches the 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 the values contained in the table "GAS SETTINGS".
If the measured value is different, turn the CO_2 adjustment throttle:

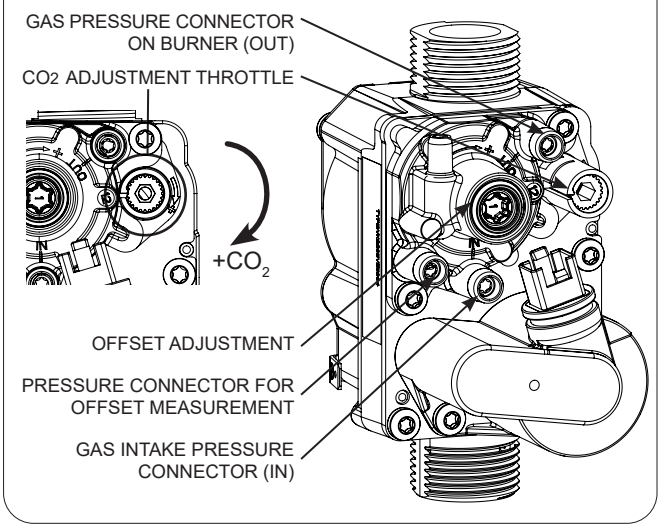
- For AKN032/034/050: to increase the CO_2 value, turn the screw clockwise, and anti-clockwise to decrease it.
- For AKN070/100: to increase the CO_2 value, turn the screw anti-clockwise, and clockwise to decrease it.

Set the boiler to minimum output, and verify that the level of CO_2 corresponds to the figures in the “GAS SETTINGS” table. If the values do not match, screw or loosen the offset adjustment screw respectively to increase or decrease the CO_2 level and repeat the procedure.

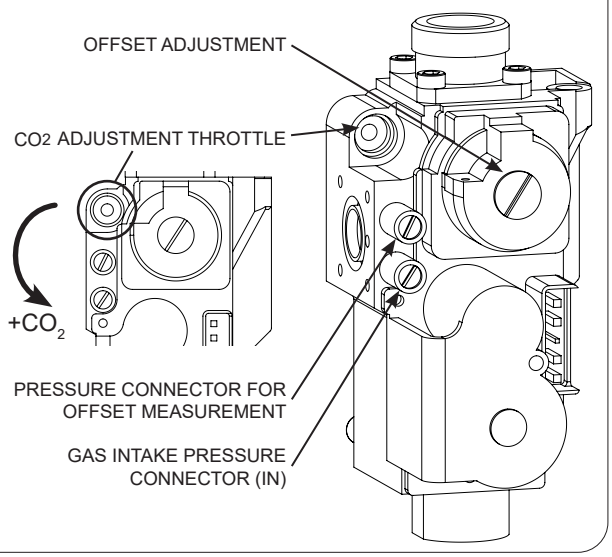
6.4.1. Flue cleaning function

The boiler can be forced to the maximum or minimum capacity with the flue cleaning function. This function can be carried out from the LCD display in rEg menu (paragrafo 4.2) with Hi (maximum heat input) or Lo (minimum heat input) function.

AKN032/034/050



AKN070/100



6.5. Conversion to LPG

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

Conversion from one type of gas to another can only be performed by authorised service centres.
The equipment is supplied already set for natural gas and with the kit for conversion to LPG, including:
- calibrated gas orifice plate;
- adhesive plate "equipment converted..."

To convert the unit, follow these instructions:
- disconnect boiler from power supply;
- **replace the gas orifice plate fitted with the one supplied with the kit;**
- restore power supply and set the boiler 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:
1. the valve intake pressure corresponds to the value required for the type of gas that you are using;
2. the combustion analysis procedure is performed as described in Section 6.4;
3. the CO_2 level is within the values indicated for the type of gas used. If the detected value is different, change it using the CO_2 adjustment throttle:
   - For **AKN032/034/050**: to **increase** the CO_2 value, turn the screw **clockwise**, and anti-clockwise to decrease it.
   - For A**KN070/100**: to **increase** the CO_2 value, turn the screw **anti-clockwise**, and clockwise to decrease it.
4. 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 ...".

The boiler supplied to function with LPG is set up for G31 gas [Propane].

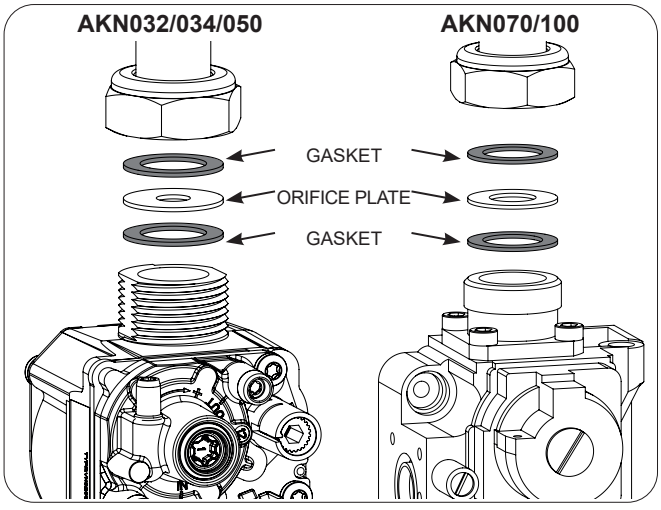
If the unit runs on G30 [Butane], it is necessary to verify and possibly adjust settings for CO_2 value as shown in table paragrafo 6.2. It is also necessary to change the "RPM" parameter value of the burner as shown in table paragrafo 6.2.

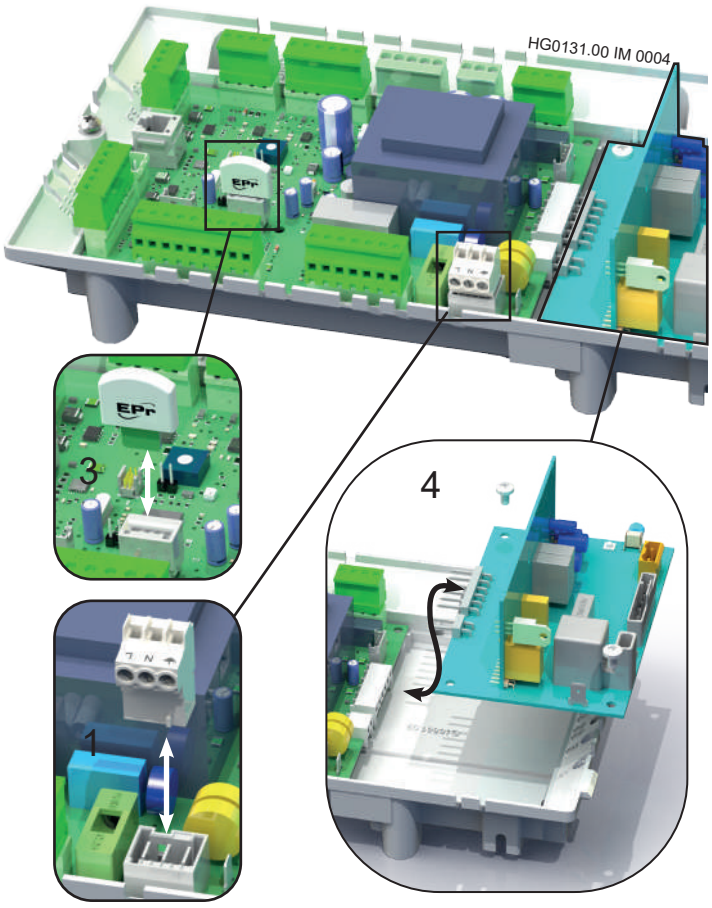
6.6. Replacing the Gas Valve

If the gas valve must be replaced, it is required to proceed with an inspection and possibly calibrate the CO_2 level.
To carry out the calibration, refer to the paragraph concerning the combustion analysis paragrafo 6.4 and to table paragrafo 6.2.

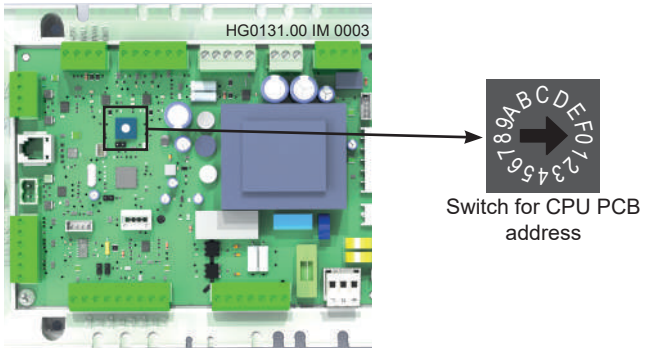
6.7. Replacing the modulation PCB

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 removable EEPROM memory card**
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.)
7. Reconnect the TER safety PCB and all terminals respecting the original positions.





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.



Switch for CPU PCB address

6.7.1. EEPROM board

The G26800 CPU PCB is equipped with a removable EEPROM card, a type of non-volatile memory, used to store functions, settings and controls, which are retained when the power supply is disconnected.
This CPU PCB avoids having to reprogram system parameters due to electrical or CPU PCB malfunctions.

To correctly install the EEPROM, insert the PCB in the proper compartment, taking care to point the smooth side towards the nearest green terminals. If the EEPROM PCB is provided with cap, the wording on the cap must face the nearest green terminals.

Do not install EEPROM PCBs of different products.

Programming the parameters
In the case of a new EEPROM, the parameters required to be programmed (error E99. No programming) are shown in the table below:

Par.	Command	Error	Description
TER	yes	E99	TER=1, the TER is present
REG01	yes	E99	Enables REGUL_01 - calculation of PT%_RIF
REG02	Optional		Enables REGUL_02 - calculation of PT%_FLUE
REG03	Optional		Enables REGUL_03 - calculation of PT%_SAN
REG04	Optional		Enables REGUL_04 from analogue input
CTRL01	yes	E99	Enables CTRL_01 - water pressure control
CTRL02	yes		Enables CTRL_02 - water-side antifreeze control
CTRL04	Optional		Enables CTRL_04 - power failure control
CTRL05	Optional		Enables CTRL_05 - remote CPU and TER reset
CTRL06	Optional		Enables CTRL_06 - lockout or flame presence signalling
FUNC01	yes	E99	Enables FUNC_01 - burner with TER
FUNC03	Optional		Enables FUNC_03 - electronic fan control or STD (Blower)
FUNC05	yes	E99	Enables FUNC_05 - water flow and circulator control

Programming the parameters - Operating mode
Parameters can be modified from the LCD display on the machine or, alternatively, from the Smart X.
The Smart X can be used to access all parameters (paragrafo 7); parameters have password, which is issued by the Apen Group Customer Service.
Please refer to the Smart X manual for instructions for the procedure for access and modification of functional parameters.
Please remember that all changes to parameters must be done with the burner OFF (boiler in standby).

6.8. Programming with LCD Display

The parameters can be changed only if they have been enabled by entering the password from **Abi** menu.

Abi (enabling change of parameters)
The **Abi** function has the following password:
- 007: enables the change of boiler parameters under **Par** menu.

Once the password is enabled, if no key is pressed for 10 minutes, the programme automatically returns to the machine status.
Move using the menu arrows, select the parameter or setpoint to be displayed with ENTER, change the parameter by pressing the arrow keys (↑ to increase ↓ to decrease) until the desired value, then press and hold ENTER for at least 3 seconds; the display flashes to indicate that the value has been stored.

6.9. Maintenance

To keep the product efficient and guarantee a long lifetime of the same, it is necessary to run some inspections at regular intervals.

6.9.1. Exchanger maintenance

It is necessary to perform inspection and maintenance of the heat exchanger on a yearly basis, as follows:
- **Combustion chamber:** If, during the annual inspection, some deposits inside the combustion chamber are observed, it is necessary to aspirate them; if the deposits are strongly attached, the pipes must be brushed. It is forbidden to use sharp objects and acid or alkaline substances.
- **Insulation:** The insulation of the combustion chamber must be inspected on a yearly basis; if signs of deterioration are detected, it must be compulsorily replaced. In this case the condensation drain must be checked, because the damage causes the stagnation of the condensation inside the exchanger.
- **Burner**

No maintenance is required. If the burner surface is damaged, replace the burner door

NOTE: Every time the burner or parts of it (e.g.: electrodes, pilot, flue fan) are removed, it is necessary to replace all the gaskets involved.

Tightening torque of burner door 5Nm.

- **Burner flange gaskets**

If gaskets are damaged, they must be replaced.

NOTE: The silicone seal of burner flange (cod. C12026) must be compulsorily replaced every two years and whenever the combustion chamber is inspected.

6.9.2. Maintenance of components and devices

During annual maintenance, the following components must be checked:

- **Fume pressure switch activation:** The pressure switch has an adjustable activation value set to 5 mbar. To make sure that the pressure switch electrical contact is not stuck on N.C. position:
  - open the pressure switch and move the wheel from 5 mbar to 1 mbar;
  - switch the boiler on normally and wait until the burner is switched off immediately and the “E37” non-volatile safety lockout is signalled for all models.
  - bring the pressure switch wheel back to 5 mbar. If these conditions do not occur (contact stuck), the pressure switch must be replaced. After the activation test, the pressure switch calibration value must be reset to the original factory value (identifiable by the red lacquering).
- **Electrodes**

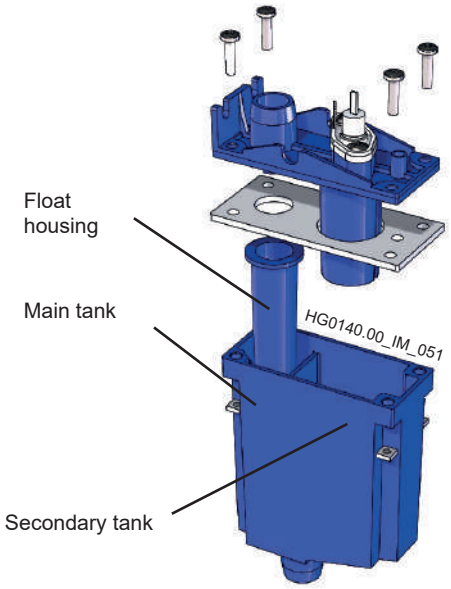
Check the position, the absence of alumina deposits and the integrity of the ceramic. In case of damage, replace the electrode and the relevant sealing gasket.

The electrode is secured with screws M4x10. Tightening torque 2.5Nm.

- **Trap**

Clean the plastic trap on a yearly basis.
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 (it is possible to clean the trap under running water) by checking that all ducts are free. Check the seal conditions.
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.
To check that the salts inside the condensation tray are still active, use litmus paper to check that the pH level of water flowing out of it is greater than 6.
If the pH is lower, replace the calcium carbonate present in the tray.

NOTE: Every time the condensate drain trap or parts of it (e.g.: electrodes) are cleaned, it is necessary to replace all the gaskets involved.



- **Y-shaped filter**

Clean the Y filter on a yearly basis. Refer to paragrafo 5.11.3.

- **Expansion reservoir**

Check the pre-charge status of the expansion reservoir on a yearly basis. Make sure that the pre-charge value is 1.3 bar.

- **Control panel**

Check that the tightening screws of terminals inside the control panel are not loose.

6.10. Spare parts

The list of spare parts is available in the exploded views manual supplied with the machine.

Use Apen Group original spare parts only.

7. MODULATION PCB PARAMETERS

All values of the parameters of the CPU PCB are shown for all boiler models.
The “LCD” column shows the parameters that could be modified with “007” 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 from the Manufacturer's Customer Service.

Parameters of G26800 CPU PCB version 8.03.xx								
Smart	**LCD**	**U.M.**	**AKN 032**	**AKN 034**	**AKN 050**	**AKN 070**	**AKN 100**	**DESCRIPTION**
FUNC_00	**Fnu-P00**				**Equipment operation**			
TER					1			TER presence
SMART					0			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	188	176	145	135	156	Motor RPM MINIMUM value (Y0): 90÷999 (1=10 RPM)
b2	P12	rpm	724	737	656	626	749	Motor RPM MAXIMUM value (Y0): 90÷999 (1=10RPM)
b3	P13	rpm	346	334	324	374	305	Motor RPM START-UP value (Y0): 90÷999 (1=10RPM)
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			30			Flame stabilisation time (ignition)
b9	P19	%			45		20	Proportional factor value (kp_pwm) for PWM1 calculation
b10	P1A	%			20		10	Integral factor value (ki_pwm) for PWM1 calculation
b11	P1B	sec			30			Combustion chamber post-washing time
b12		sec			0			Flame monitoring equipment ON delay time (TER)
b13		kW	6	7	8	12	17	MIN. value Furnace heat input
b14		kW	31	35	50	70	97	MAX. value Furnace heat input
REG_01	**rGL R10**				**Modulation Probe NTC Control**			
REG_01					1			Adjustment enabling (0=disabled; 1=enabled)
ST1	R12	°C			72			ST1 function setpoint
Xd1	R13	°C			8			ST1 hysteresis
Kp1		%			10			Proportional coefficient
Ki1		%			5			Integral coefficient
TH1	R16	°C			82			Alarm temperature for ST1 for fault E51; Autoresolve with NTC1<ST1
AC1					1			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 (NTC1)			Defines the analogue input to be used for calculation
REG_02	**rGL R20**				**Adjustment 02 - NOT USED ON AKN**			
REG_02					0			Adjustment enabling *0 = disabled*

Parameters of G26800 CPU PCB version 8.03.xx

Smart	LCD	U.M.	AKN 032	AKN 034	AKN 050	AKN 070	AKN 100	DESCRIPTION
REG_03	**rGL R30**		**Probe NTC Control for ACS (DHW) Function - NOT USED ON AKN**					
REG_03			0					Adjustment enabling *0 = disabled* *2= enabled by SMART through "Domestic water" request; not active in heating and/or conditioning mode.*
BR_03	R38		0					Adjustment enabling in Manual mode *0 = Uses automatic mode (par. REG_03)* *1 = Forces mode as standard Setting* *2 = Blocks change par. REG_03 from Smart*
ST3			Value received from Smart X					Setpoint (changed by Smart according to the phase in progress)
SM3	R3A		50					Setpoint in manual mode (BR_03=1)
Xd3			5					ST3 hysteresis
Kp3			10					Proportional coefficient
Ki3			5					Integral coefficient
TH3			65					Alarm temperature for ST3 for fault E53; Autoresolve with NTCx<ST3
ING3A			3 (NTC3)					Defines the analogue input to be used for calculation *1 = NTC1* *2 = NTC2* *3 =NTC3*
OUT3A			0					Defines the digital output to be adjusted
REG_04	**rGL R40**		**Modulation from 0/10 Vdc Control - NOT USED ON AKN**					
REG_04	R41		0					Adjustment enabling *0 = disabled* *1 = enabled as modulation only* *2 = enabled as modulation and burner ON/OFF*
V4_ON	R42	V	1.0					Voltage value for burner OFF
V4_DIF	R43	V	0.5					Differential for burner ON
T4_ON	R44	sec	5					Signal dwell time for ON
T4_OFF	R45	sec	5					OFF signal dwell time
ING4A	R46		5					Defines the analogue input to be used for calculation
REG_05	**rGL R50**		**Adjustment 05 - NOT USED ON AKN**					
REG_05			0					*Adjustment enabling* *0 = disabled*
REG_06	**rGL R60**		**Adjustment 06 - NOT USED ON AKN**					
REG_06			0					Adjustment enabling *0 = disabled*
REG_07	**rGL R70**		**Adjustment 07 - NOT USED ON AKN**					
REG_07			0					Adjustment enabling *0 = disabled*
CTRL_01	**CrL C10**		**Water pressure control**					
CTRL_01	C11		1					Control enabling *0 = disabled* *1 = enabled*
ST_H20	C12	bar/100	60					Pressure setpoint
TL_H20	C13	bar/100	30					Lower pressure limit value: alarm E80
PT_H20	C14	bar/100	20					Hysteresis for alarm E82
ING_H20	C15		6 (B2)					Analogue input
MD5	C16		2		3			Alarm mode *0 = no ST_H20 (E81) and/or TH_H2O (E82) alarm* *1 = actual ST_H20 (E81) and preventive TH_H2O (E82) alarm* *2 = preventive ST_H20 (E81) and actual TH_H2O (E82) alarm* *3 = actual ST_H20 (E81) and TH_H2O (E82) alarms*
TH_H20		bar/100	250	250	230	230	250	Upper pressure limit value; alarm E82

Parameters of G26800 CPU PCB version 8.03.xx

Smart	LCD	U.M.	AKN 032	AKN 034	AKN 050	AKN 070	AKN 100	DESCRIPTION
CTRL_02	**CrL C20**							**Water Antifreeze Control**
CTRL_02	C21				1			Control enabling *0 = disabled* *1 = enabled*
ST_Ant	C22	°C			4			Water antifreeze setpoint:
P2	C23	°C			2			Hysteresis on antifreeze setpoint
ING_Ant					1			Analogue input
MD2		%			30			Percentage burner heat output
CTRL_03	**CrL C30**							**Control 03 - NOT USED ON AKN**
CTRL_03	C31				0			Control enabling *0 = disabled*
ST_Van	C32	°C			4			Burner compartment antifreeze setpoint
P3	C33	°C			2			Hysteresis on antifreeze setpoint
ING_Van	C34				0			Compartment temperature analogue input
OUT_Van	C35				6			Digital output for resistance control
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 AKN**
CTRL_07	C71				0			Control enabling *0 = disabled*
ING07	C72				0			Digital input enabled
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	**CrL C90**							**Control 09 - NOT USED ON AKN**
CTRL_09	n.a				0			Control enabling *0 = disabled*
FUNC_02	**Fnu-P20**							**Function 02 - NOT USED ON AKN**
FN_02					0			Control enabling *0 = disabled*

Parameters of G26800 CPU PCB version 8.03.xx

Smart	LCD	U.M.	AKN 032	AKN 034	AKN 050	AKN 070	AKN 100	DESCRIPTION
FUNC_03	**Fnu-P30**		**Ventilation Management Function (EC-AC Fans)**					
FN_03			3					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	0					Seconds of delay for fan start
T_OFF	P33	sec	0					Seconds of delay for fan stop
OUT3A			0					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	18					Conditioning fan ON temperature
FUNC_04	**Fnu-P40**		**Function 04 - NOT USED ON AKN**					
FN_04			0					Function Enabling *0 = disabled*
FUNC_05	**Fnu-P50**		**Circulator Management and Water flow rate Function**					
S5			1					Function enabling *0 = disabled* *1 = enabled with autoreset for E85/86* *2 = enabled without autoreset for E85/86*
ST5	P52	From l/h	56	56	70	80	130	Set-point in l/10/m’
P5		From l/h	5				10	ST6 hysteresis in l/10/m
ING5			7 (B3)					Analogue AN0-3 or digital ID1-3 input
OUT5A			8 (LBW)					Circulator control (digital) output
OUT5B			2 (Y1)					Circulator modulation control (analogue) output
OUT5C			0					Alarm (digital) output
TF5		sec	2					Delay in seconds for flow alarm E85
TI5	P59	sec	20					Delay in seconds for flow alarm E86
TOFF_5	P5A	sec	300					Circulator switch-off delay in OFF phase
ANT5			1					Anti-lock function enabling
FUNC_06			**Destratifier Function**					
FN06			0					Function Enabling *0 = disabled* *1 = enabled*
OUTF06			4 (Y3)					Analogue or digital output for destratifier fans
FUNC_08	**Fnu-P80**		**Function 08 - NOT USED ON AKN**					
FN_08			0					Function Enabling *0 = disabled*
FUNC_09	**Fnu-P90**		**Function 09 - NOT USED ON AKN**					
FN_09			0					Function Enabling *0 = disabled*
FUNC_10	**Fnu-PA0**		**Function 10 - NOT USED ON AKN**					
FN_10			0					Function Enabling *0 = disabled*
OUT10A			0					Defines the digital output used
OUT10B			0					Defines the analogue or digital output used
ING10			0					Defines the input for PdC alarm (Fault E50)

Parameters of G26800 CPU PCB version 8.03.xx

Smart X	LCD	AKN 032	AKN 034	AKN 050	AKN 070	AKN 100	DESCRIPTION
	rtU	**RS485 Serial Communication Configurations**					
D_SL	SSL	0					Slave serial baud rate (SMART X) 0= baud rate 19,200 - Even Parity
		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)					
B0		1					B0 analogue input enabling *0 = disabled* *1 = enabled*
		B1 Input Configurations - NOT USED ON AKN					
B1		0					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		1					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 (Pressure Probe)					
B2		1					B2 analogue input enabling *0 = disabled* *1=enabled as analogue input*
XA2		0.4					X-axis minimum value – minimum input voltage
XB2		2.8					X-axis maximum value – maximum input voltage
YA2		0					Y-axis minimum value – minimum magnitude value
YB2		4					Y-axis maximum value – maximum magnitude value
CV2		0.01					Coefficient for PRØ displaying; value displayed on Smart and used for controls
UM2		2					1=°C; 2=bar; 3=mbar; 4=Pa; 5=%; 6=l/h; 7=mc/h; 8= V
		B3 Input Configurations (Circulator and Flow Control)					
B3		2					B3 analogue input enabling *0 = disabled* *1=enabled as analogue input* *2=enabled as frequency input*
XA3		0.14				0.12	X-axis minimum value – minimum input voltage
XB3		2.29				2.02	X-axis maximum value – maximum input voltage
YA3		0.29				0.54	Y-axis minimum value – minimum magnitude value
YB3		5				9	Y-axis maximum value – maximum magnitude value
CV3		0.01					Coefficient for PRØ displaying; value displayed on Smart and used for controls
UM3		7					1=°C; 2=bar; 3=mbar; 4=Pa; 5=%; 6=l/h; 7=mc/h; 8= V

Parameters of G26800 CPU PCB version 8.03.xx

Smart X	LCD	AKN 032	AKN 034	AKN 050	AKN 070	AKN 100	DESCRIPTION
		Digital Input Configurations					
ID1		4					ID1 digital input enabling *0 =disabled* *1 = N.C input (Fault activated with input Open) with manual reset* *2 = N.C input (Fault activated with input Open) with Autoresolve* *3 = N.O. input (Fault activated with input Closed) with Autoresolve* *4 = enabled as N.O. (open input to enable functions, without alarm signalling)*
TD1		0					Alarm triggering or function enabling delay time
ID2		2					ID2 digital input enabling *0 = disabled* *1 = N.C input (Fault activated with input Open) with manual reset* *2 = N.C input (Fault activated with input Open) with Autoresolve* *3 = N.O. input (Fault activated with input Closed) with Autoresolve* *4 = enabled as N.O. (open input to enable functions, without alarm signalling)*
TD2		10					Alarm triggering or function enabling delay time
ID3		3					ID3 digital input enabling *0 = disabled* *1 = N.C input (Fault activated with input Open) with manual reset* *2 = N.C input (Fault activated with input Open) with Autoresolve* *3 = N.O. input (Fault activated with input Closed) with Autoresolve* *4 = enabled as N.O. (open input to enable functions, without alarm signalling)*
TD3		10					Alarm triggering or function enabling delay time
		Y0 Analogue Output Configuration					
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		3					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 YL0 the output will be YL0, for request values above YH0 the output will be YH0)*
		Y1 Analogue Output Configuration					
YM1		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*
YL1		8					Minimum voltage (or PWM in %) output value
YH1		10					Maximum voltage (or PWM in %) output value
YF1		0					Fixed voltage or % output value (forced by program)
YT1		1					Voltage increase/decrease (or in %) every second
YN1		0					Output Linearisation Mode *0 = linear output value between YL1 and YH1* *1 = output with values limited to YL1 and YH1 (for request values below YL1 the output will be YL1, for request values above YH1 the output will be YH1)*

Parameters of G26800 CPU PCB version 8.03.xx			
Smart X	LCD	AKN 032 AKN 034 AKN 050 AKN 070 AKN 100	DESCRIPTION
		Y2 Analogue Outputs Configuration	
YM2		0	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		4	Minimum voltage (or PWM in %) output value
YH2		10	Maximum voltage (or PWM in %) output value
YF2		8	Fixed voltage or % output value (forced by program)
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 YL2 the output will be YL2, for request values above YH2 the output will be YH2)*
		Y3 Analogue Output Configuration - Not Used on AKN	
YM3		0	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		4	Minimum voltage (or PWM in %) output value
YH3		10	Maximum voltage (or PWM in %) output value
YF3		8	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 YL3 and YH3 (for request values below YL3 the output will be YL3, for request values above YH3 the output will be YH3)*

8. ANALYSIS OF LOCKOUTS - ERRORS

The CPU manages two types of lockouts:
- preventive, it warns the customer that the boiler requires maintenance
- operational, it stops the boiler for safety or warranty reasons.

Some operational faults require manual reset; others reset themselves when the problem that caused them is solved.

CODE	DESCRIPTION	CAUSE	RESET	AKN 032 034	AKN 050 070	AKN 100
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 • Live and neutral reversed • Earth wire not connected • Phase-Phase connection without neutral • Start-up electrode failed or badly positioned • Low CO_2 value • Gas supply pressure too high (>60mbar)	Manual	x	x	x
E11	Untimely (parasitic) flame. The equipment detects a flame presence signal with burner off	• Insulation loss of the safety module (SRM) of TER equipment • Insulation loss of the ignition cable or single-electrode (ignition/detection)	Manual	x	x	
E11	Untimely (parasitic) flame. The equipment detects a flame presence signal with burner off	• Insulation loss of the safety module (SRM) of TER equipment • Loss of insulation of the detection cable or detection electrode	Manual			x
E12	Ignition failure; not visible. The count, displayed in the event log, indicates whether the boiler has had problems with ignition	See E10		x	x	x
E13	TER equipment does not accept the reset from CPU (max 5 reset attempts in 15 minutes).	Disconnect and restore power supply. Check the causes as indicated in fault E10	Manual	x	x	x
E14	Lack of communication between TER equipment and CPU for more than 60 seconds	TER equipment or CPU PCB broken	Autoresolve	x	x	x
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 • Flame failure immediately after safety time (spark) due to lack of gas or incorrect burner adjustment	Manual or Autoreset (every 5')	x	x	x
E16	General lockout of the flame monitoring equipment (TER)	• Faulty TER equipment • Reports a safety burner switching off following uninterrupted operation >24h	Manual or Autoreset (every 5')	x	x	x
E17	Internal fault of TER equipment, that does not accept reset command from CPU	TER equipment broken, replace	Manual or Autoreset (every 5')	x	x	x
E18	Flame loss when TER equipment is already 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 (CO_2 too low)		x	x	x

CODE	DESCRIPTION	CAUSE	RESET	AKN 032 034	AKN 050 070	AKN 100
Alarms for safety device activation						
E20	Activation of safety thermostat STB	• Excess water temperature due to lack of water circulation • Safety thermostat broken or not connected	Manual	x	x	
E20	Activation of safety thermostat STB or burner door thermostat (TDOOR)	• Excess air or water temperature due to lack of water circulation/air flow • Safety thermostat broken or not connected • Closed flue/fume exhaust clogging/flue pressure drop greater than the permitted value • Worn/incorrectly fitted/missing burner flange gasket	Manual			x
E22	Activation of STB Safety Thermostat or Flue Gas Thermostat in ignition phase	• Safety Thermostat or Flue Gas Thermostat broken or not connected	Autoresolve	x	x	
E22	Activation of STB Safety thermostat or Burner door Thermostat (TDOOR) in ignition phase	• Safety Thermostat or Burner Door Thermostat broken or not connected	Autoresolve			x
E24	Activation of heat exchanger thermal fuse - TF	The water temperature inside the heat exchanger has exceeded the safety limit of the thermal fuse. Disassemble the heat exchanger and check for damage, otherwise replace it	Autoresolve	x	x	x
E25	Activation of INAIL PRESSURE SWITCHES (IPMIN or IPMAX)	• Increased pressure value in the hydraulic circuit above the pressure switch IP MAX INAIL adjustment set - check that there are no closed taps in the water circuit; check the size of the reservoir and its status (pre-charge value, diaphragm tightness) • Decrease of the pressure value within the water circuit below the pressure switch IP MIN INAIL adjustment set (0.5 bar) - check that there are no water leaks in the circuit and restore minimum pressure	Autoresolve		x	x
Flue Gas Fan Fault Alarms (VAG)						
E30	Flue gas fan speed (VAG) too low in start-up phase or failure to start the FLUE GAS fan	• FAN electric cables interrupted, not connected or wrongly connected • Faulty burner fan or CPU board not receiving speed signal from the flue gas fan (HALL). To check possible CPU failure, disconnect 4-wire connector (PWM) from flue gas fan and check ABSENCE of voltage between GND-Y0 (HALL) and B0-Y0 contacts of terminal board CN03. If there is voltage between these contacts, fault E30 is caused by a failure in the CPU board. Otherwise, fault E30 is caused by a failure in the flue gas fan	Manual	x	x	x

CODE	DESCRIPTION	CAUSE	RESET	AKN 032 034	AKN 050 070	AKN 100
E31	Flue gas fan speed (VAG) too high in stand-by phase	• FAN electric cables interrupted, not connected or wrongly connected • Faulty burner fan or CPU board not receiving speed signal from the flue gas fan (HALL). To check possible Flue Gas Fan failure: a) Keep the cables connected to the flue gas fan; 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 terminals in the terminal board CN03. If a voltage of approx. 5-6 Vdc is detected, it means that the fan inverter is faulty (it is not receiving the PWM signal from CPU board).	Manual	x	x	x
E32	Flue gas fan speed (VAG), during operation, outside minimum and maximum set parameters	• FAN electric cables interrupted, not connected or wrongly connected • Flue gas fan failure or mechanical failure of the flue gas fan impeller. Replace the flue gas fan (VAG)	Manual or Autoreset (every 5')	x	x	x
		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	x	x	x
E37	Alarm for Flue Gas Thermostat (TFUMI) or Flue Gas Pressure Switch (PFLUE) activation	• The gas flow rate might exceed the boiler adjustment parameters (Overload) • Check the exchanger cleaning • Total or partial obstruction of the flue gas outlet • Flue heat loss greater than the permitted value	Manual or Autoresolve	x	x	x
E38	Condensate control Electrode activation alarm	• Condensate detection electrode grounded or faulty • Clogged condensate drain (by impurities or frozen drain) - clean trap and/or drain outlet	Manual or Autoresolve	x	x	x
		Alarms of analogue inputs and NTC probes				
E41	NTC1 probe error	No signal from probe or broken probe	Autoresolve	x	x	x
		Overtemperature Alarms				
E51	Temperature of the water delivery probe NTC1>TH1	• Minimum heat output of the boiler over-sized compared to the heat output required by the environment • Check the TH1 parameter - water delivery setpoint	Autoresolve with NTC1<ST1	x	x	x
		Modbus communication alarms				
E60	Communication error between CPU PCB and Modbus Slave, Smart (CN04) network	• ModBus network is disconnected. • The address of the PCB is wrong and/or not configured in the ModBus network.	Autoresolve	x	x	x
		Alarms for no voltage or dirty filters				
E71	Not used;	Not used. Programming error of par. CTRL_09. Set par. CTRL_09 = 0		x	x	x
E72	Not used;	Not used. Programming error of par. CTRL_09. Set par. CTRL_09 = 0		x	x	x
E75	No voltage during operating cycle (excluding standby); fault is not visible on remote control but only counted	No voltage during operation		x	x	x

CODE	DESCRIPTION	CAUSE	RESET	AKN 032 034	AKN 050 070	AKN 100
Water flow and water pressure alarms						
E80	Insufficient water pressure in the hydraulic circuit. Water pressure is < ST_H20 - TL_H20	Decrease of the pressure value within the water circuit below the Pressure and Hysteresis set (ST_H20 and TL_H20). If this happens frequently, check the presence of leakages in water circuit	Autoresolve	x	x	x
E81	Water pressure inside hydraulic circuit < ST_H20 (Preventive alarm)	Decreasing hydraulic pressure value inside water circuit. It does not stop the burner cycle. Restore water pressure value of the hydraulic circuit	Autoresolve	x		
E81	Insufficient water pressure in the hydraulic circuit. Water pressure is < ST_H20 (Actual alarm)	Decrease of the pressure value within the water circuit below the Pressure set ST_H20. It stops the burner cycle. If this happens frequently, check the presence of leakages in water circuit	Autoresolve		x	x
E82	Excessive water pressure inside hydraulic circuit, > TH_H20 (Preventive alarm)	Excessive pressure inside water circuit, check the hydraulic circuit load or the expansion reservoir. It does not stop the burner cycle	Autoresolve when ING_H20<TH_H20-PT_H20	x		
E82	Excessive water pressure inside hydraulic circuit, > TH_H20 (Actual Alarm)	Excessive pressure inside water circuit, check the hydraulic circuit load or the expansion reservoir. It stops the burner cycle	Autoresolve when ING_H20<TH_H20-PT_H20		x	x
E85	No water circulation, the water flow value (FLH) is equal to zero	• Water circuit clogged, taps closed or circulator not operating, dirty filters • Flowmeter not connected or faulty	Manual or Autoreset (every 5')			
E86	Water flow rate lower than minimum setpoint. The FLH flow value FLH < ST5 - P5	• Check water circuit length and diameters • Dirty filters	Manual or Autoreset (every 5')	x	x	x
Parameter configuration error alarms						
E98	Input configuration error	No input enabling for functions or controls (e.g. no activation of NTC1 input combined with REG_01)	Autoresolve	x	x	x
E99	Function configuration error	No activation of compulsory functions for the product (e.g. no activation of FUNC_05 for product type “Boiler”)	Autoresolve	x	x	x
EEPROM alarms						
E100 (CPU)	Eeprom access error	Eeprom missing, inserted in the opposite direction or partially inserted	Autoresolve	x	x	x
E101 (EPr)	Eeprom data error	Eeprom removed during operation or damaged	Autoresolve	x	x	x

If there are communication problems between CPU PCB and LCD panel, the display will show the word **CPU** flashing.
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.

9. WIRING DIAGRAMS

Connection details are described in the installation chapter.
AKN boilers have the same wiring diagram and operating principle. Differences concern some points indicated in the notes below.

IP	AKN050/070/100 boilers have an additional protection located on water maximum pressure. The activation of this device causes error E25.
STB	Safety thermostat with automatic reset; the activation causes an error E20, detected by the PCB, and requires PCB manual reset by means of the reset key located on the TER flame monitoring equipment.
ON/OFF	We remind that all boilers compulsorily require ambient thermostat connection. If Smart X control is used, use jumpers between ID0/GND terminals.

9.1. Fan heater electric connection

Refer to paragrafo 5.7.4 for AB fan heaters and paragrafo 5.7.5 for AX-EC fan heaters.

9.2. AKN electrical connection

Key of the components in the following wiring diagrams

ACF	Flame monitoring equipment
ACC	Ignition electrode
F1	1 AT fuse on the PCB (delay - 24 V side) NOT REPLACEABLE
F2	5.0 AT fuse on the PCB (delay - 230 V side)
FLUX	Water flowmeter
IPMIN	MIN INAIL pressure switch (AKN050/070/100 only)
IPMAX	MAX INAIL pressure switch (AKN050/070/100 only)
KOND	Condensation detection electrode
LED_ACC	Flame detection LED - ON THE CPU PCB
NTC	Water delivery temperature probe
P	Hydraulic circuit pump [Circulator]
PFLUE	Flue gas pressure switch
PREX	Circuit minimum pressure control switch
RE	ACF equipment lockout signalling LED - ON ACF
SB	TER equipment reset button - ON ACF
TDOOR	Burner door thermostat (AKN100 only)
TF	Heat exchanger protection thermal fuse 167°C
TFUMI	Flue gas thermal fuse
TS	Safety thermostat
VAG	Burner fan
VG	Gas solenoid valve

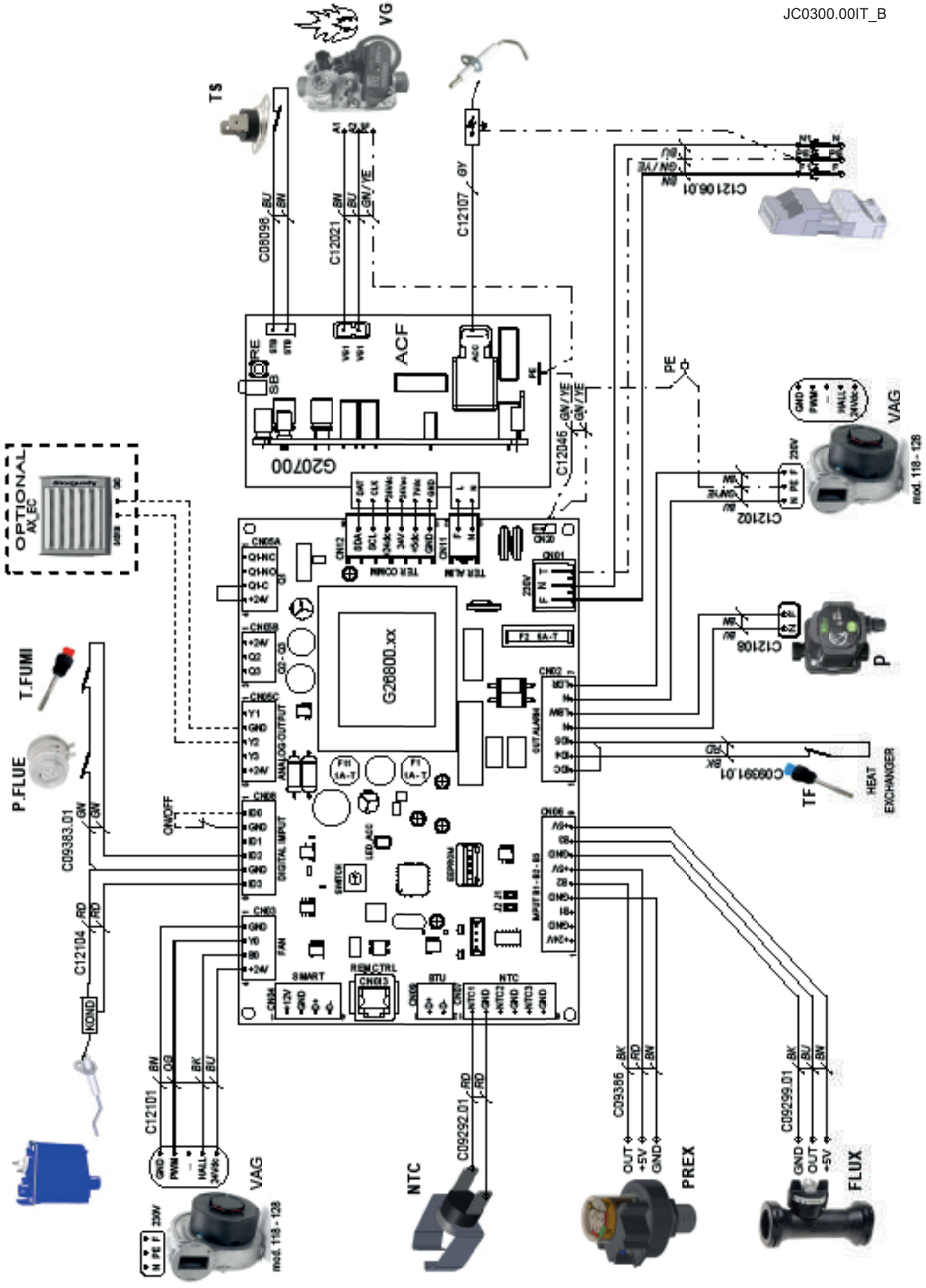
In the following wiring diagrams, the codes at the terminal output indicate the corresponding terminal-to-component wiring.

Cable colour key

BK	Black
BN	Brown
BU	Blue
GN	Green
GY	Grey
OG	Orange
PK	Pink
RD	Red
TQ	Turquoise
VT	Violet
WH	White
YE	Yellow
YE / GN	Yellow/Green

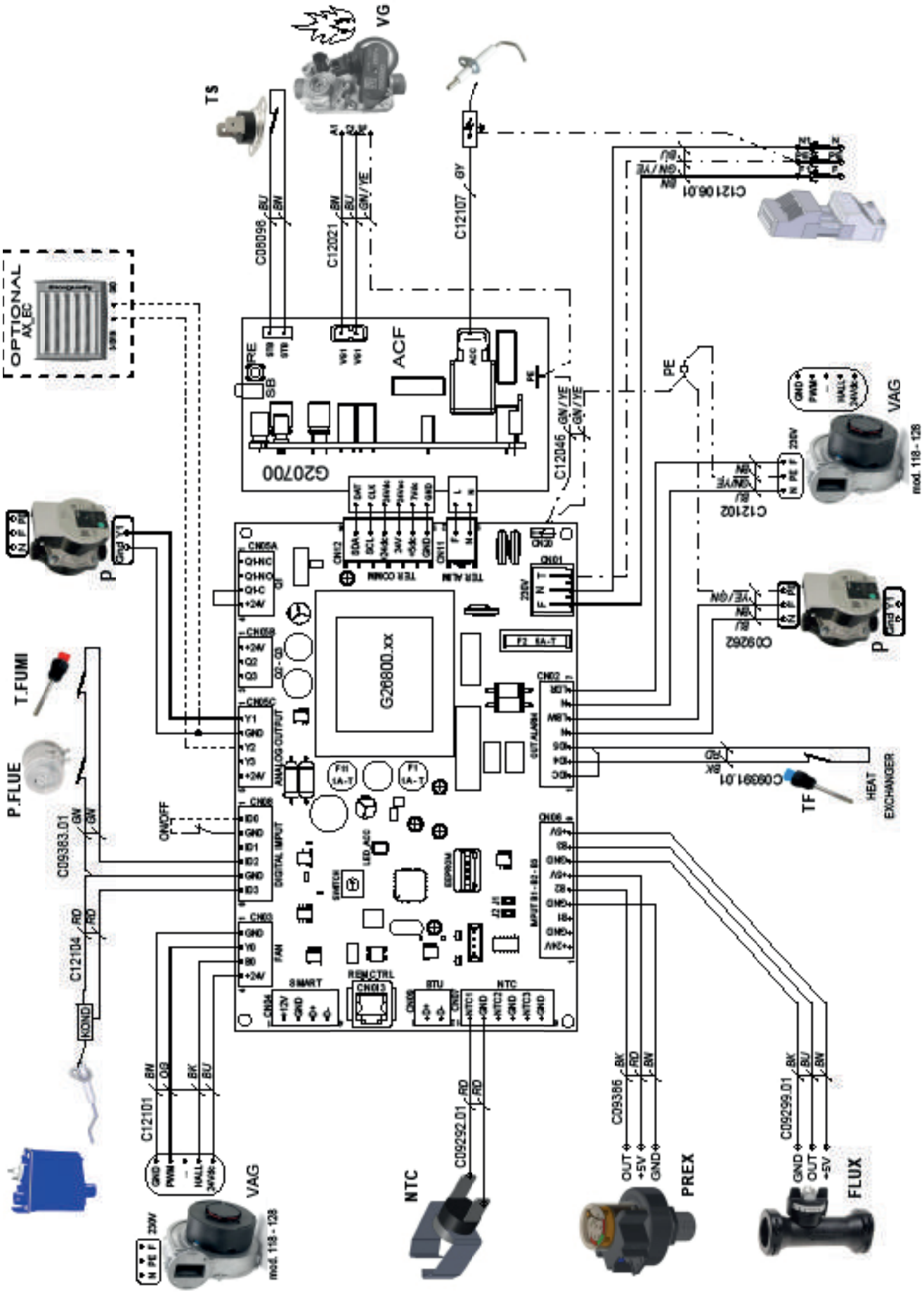
9.2.1. AKN032 electric connection

JC0300.00IT_B

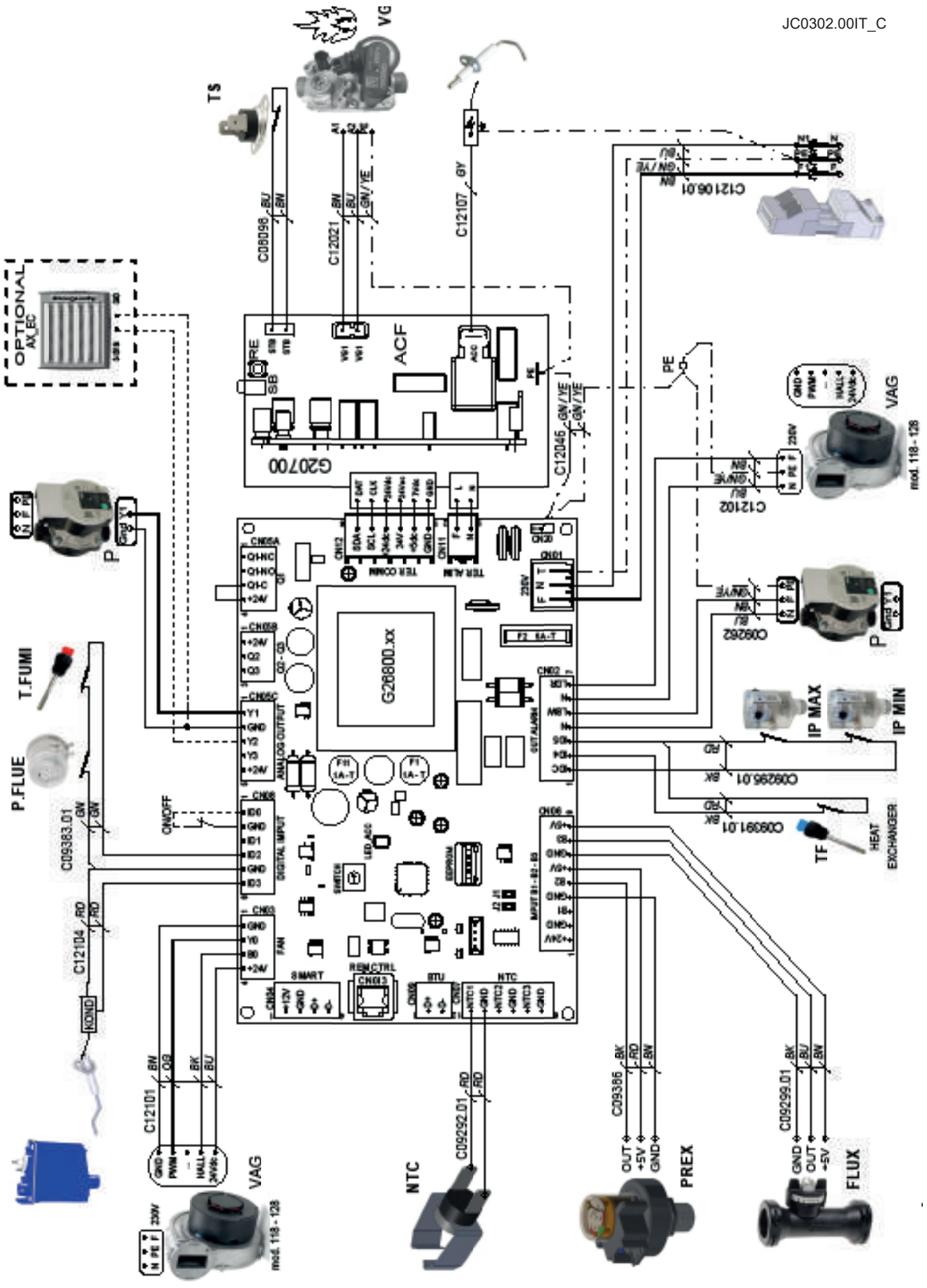


9.2.2. AKN034 electric connection

JC0301.00IT_C

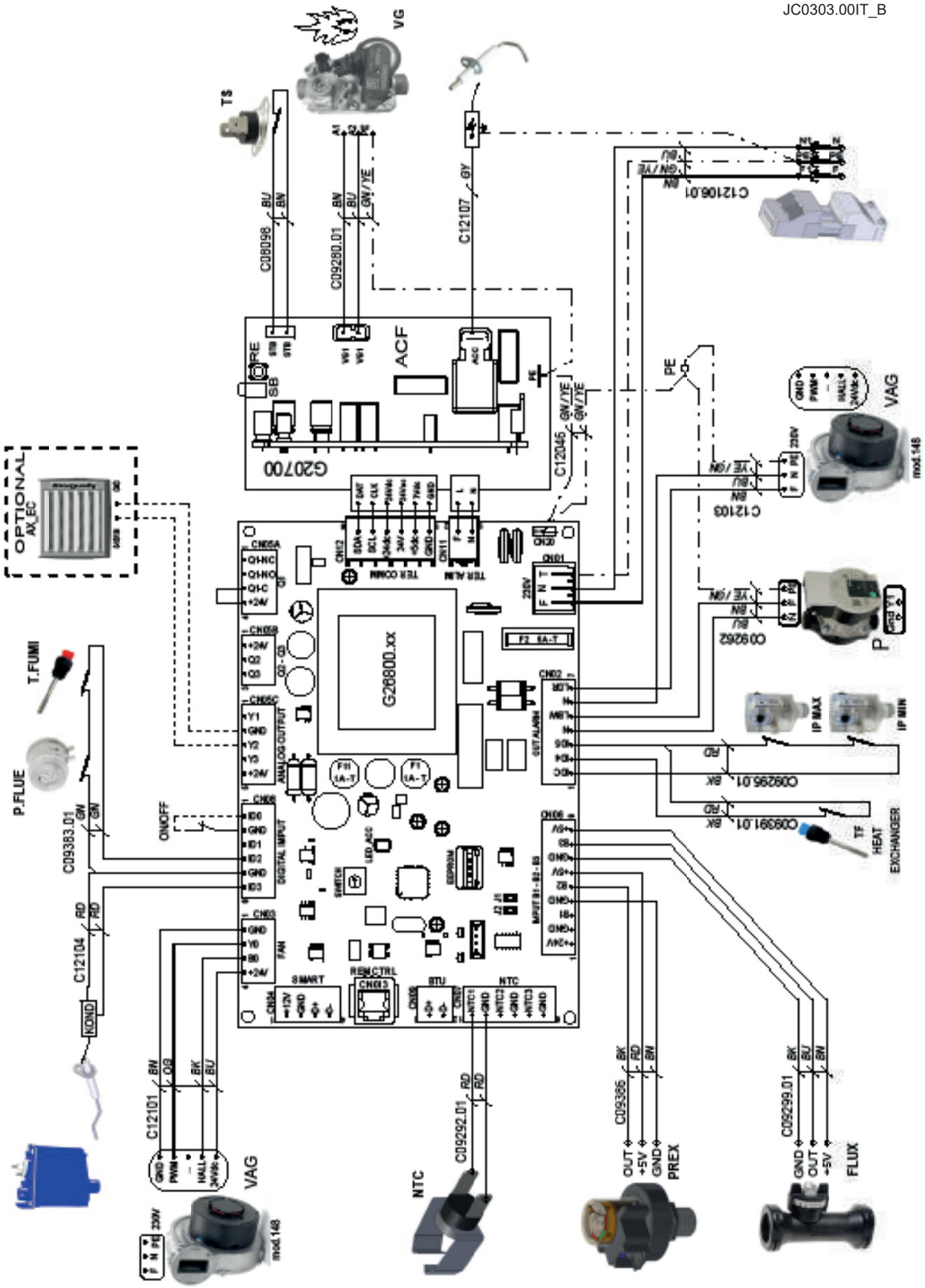


9.2.3. AKN050 electric connection

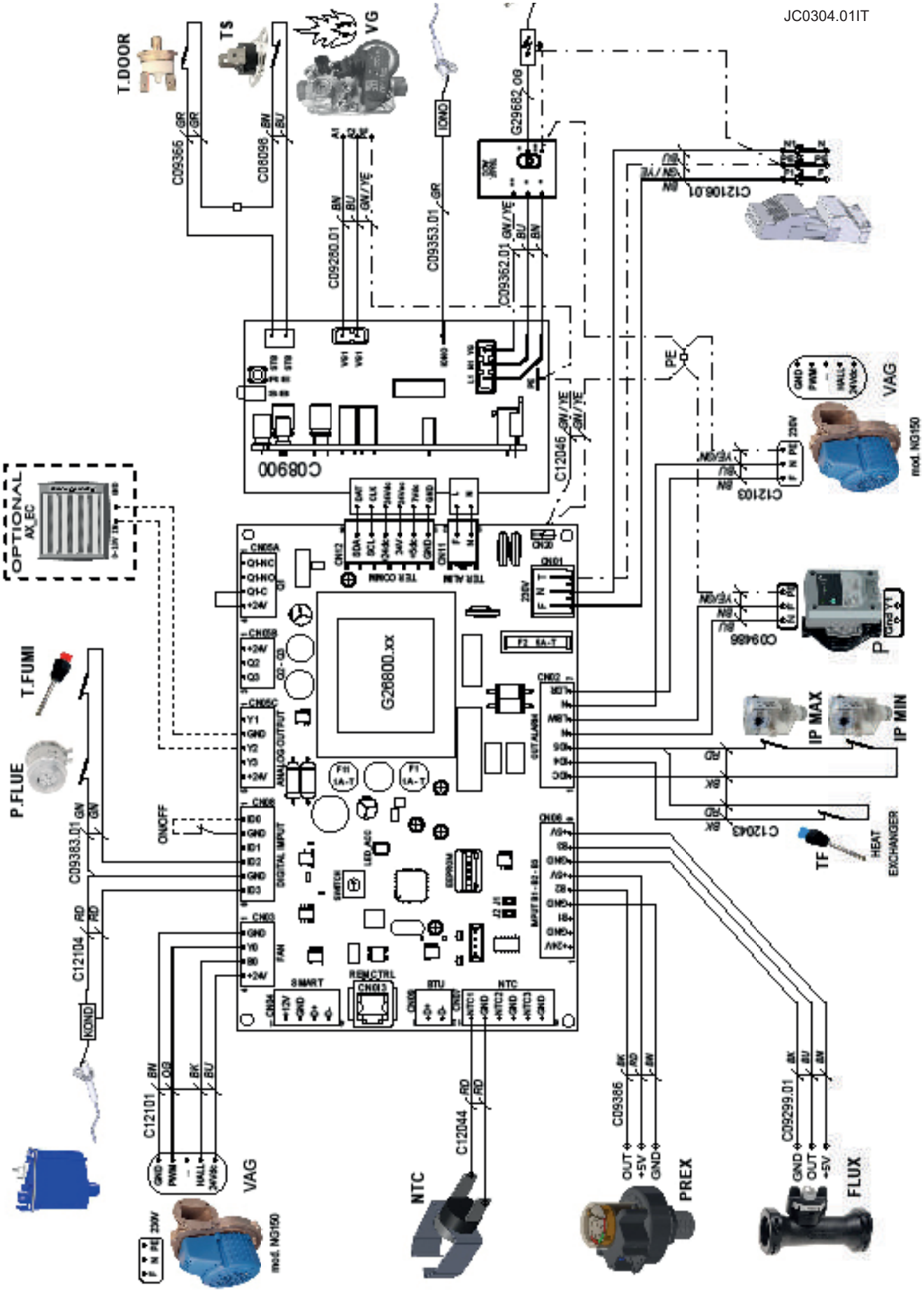


9.2.4. AKN070 electric connection

JC0303.00IT_B



9.2.5. AKN100 electric connection



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