

INSTRUCTION MANUAL

INSTALLATION, OPERATION AND MAINTENANCE

Gas-fired condensing
central heating boilers

SYSTEM BOILERS

ECOCONDENS CRYSTAL 80
ECOCONDENS CRYSTAL 100

DEAR CUSTOMER

Congratulations on having chosen **termet** product.

We offer you modern, economical and environmentally friendly product, meeting particularly high requirements of European Standards. Please read this instruction manual carefully as the knowledge of service rules and manufacturer's recommendations are the conditions of reliable, efficient and safe operation of the appliance.

Please keep this instruction manual for the whole operation life of the boiler.

We wish you satisfaction in using our product.

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IMPORTANT TIPS

- Read the instruction manual before you perform the installation and operation of the boiler.
- This instruction manual is an integral equipment of the boiler. It should be kept through the whole operation life of the boiler and carefully read. It contains all the information and warnings for safety during installation, use and maintenance to be followed.
- The boiler is complicated appliance as it contains numerous precise mechanisms.
- Reliable operation of the boiler depends mainly on appropriate performance of systems that boiler cooperates with such as:
 - gas system,
 - flue gas-air system,
 - central heating system,
 - domestic hot water system.
- Flue gas - air installation for C type boilers should be made of separately approved and introduced on the market gas - air system. Adapters connecting the boiler with a pipe system must have a measuring points. Flue gas – air system must meet the specifications set out in section 3.8 of this manual.
- Flue gas - air system must be tight. Leaks on the connections of flue gas pipes can result in flooding of the boiler by condensate. Manufacturer is not liable for damage and malfunction of the boiler arising out from above mentioned reason.
- **Installation of the boiler should be performed only by a qualified person¹⁾. Make sure that the installer has confirmed in writing the tightness of the gas installation had been checked after connecting the boiler to the system.**
- Boiler may be installed and operated only in a room where all building works have been completed. It is not allowed to install and operate the boiler in a room where building works are still in progress.
- The cleanliness of air in a room where the boiler will be installed must meet the same requirements as for rooms designer for people.
- There should be installed appropriate filters on a central heating system and gas system . Filters are not included in a basic boiler equipment.
- An example of connecting a boiler to these systems is presented on fig. 3.5.1.
- All defects caused by lack of filters on central heating or gas supply will not be repaired under guarantee.
- Central heating system must be thoroughly rinsed with water, cleanliness of the heating water should be comparable to cleanliness of domestic water.
- To avoid malicious calcification process of flue gas - water heat exchanger there should be:
 - proper tightness of central heating system ensured by avoiding frequent refilling it with water,
 - the water hardness checked, if it exceeds 15 °n it should be softened by using of softeners available on the market,
 - written confirmation of the analysis of water hardness ensured; in the absence of such confirmation any claim under flue gas-water heat exchanger calcification will not be included under warranty.
- The initial start-up of the boiler as well as its repairs, adjustments and maintenance works must be performed only by **AUTHORISED SERVICE COMPANY**.
- The boiler must be operated only by an adult.
- Do not do any repairs and modifications by yourself.
- Do not cover any ventilation grilles.
- Do not keep in the vicinity of the boiler any containers with flammable, aggressive and corrosive liquids and other similar substances.
- Any failures that are result of operation discordant to recommendations included in this instruction manual can not be subject to warranty claims.
- Manufacturer is not responsible for any failures being the result of faults during the process of installation and inobservance the regulations and instructions given by the manufacturer.
- Complying with recommendations given in this instruction manual ensures a long, reliable and safe operation of the boiler.

When you smell gas:

- do not use any electrical switches that could cause any spark,
- open the door and windows,
- shut down the main gas valve,
- contact your gas supplier.

In case of any failure you should:

- disconnect the boiler from a power source,
- shut down the gas supply valve,
- cut off a water supply and drain a water from the boiler and whole central heating system as well (when there is any risk of freezing of the system),
- drain the water from the system in any case of leakage that could cause a flood ,
- contact the nearest **AUTHORISED SERVICE COMPANY** or the producer.

¹⁾ 'Qualified person', means the one that has all required technical qualifications in an area of doing all the works necessary to connect appliances to the gas mains, central heating system and flue gas duct, accordingly to local regulations.

1. INTRODUCTION.....	1
2. BOILER DESCRIPTION	1
2.1. TECHNICAL SPECIFICATION	1
2.1.1. Technical features	1
2.2. DESIGN AND TECHNICAL SPECIFICATIONS OF THE BOILER	1
2.2.1. Main units of the boiler	1
2.3. PROTECTION EQUIPMENT	1
2.4. OPERATION DESCRIPTION	2
2.4.1. Way of heating the water for central heating system	2
2.4.2. Temperature regulation dependent on outside temperature	2
2.4.3. The way of heating the water in the monofunctional boiler cooperating with domestic water tank (option)	2
2.5 DESCRIPTION OF THE CONTROL PANEL	3
3. BOILER INSTALLATION.....	3
3.1. REQUIREMENTS OF BOILER INSTALLATION	4
3.1.1. The regulations on the water installation, gas and the flue gas system	4
3.1.2. Regulations related to the room	4
3.1.3. Requirements for electrical installation	4
3.2. PRELIMINARY CHECK ACTIVITIES	4
3.3. BOILER INSTALLATION	4
3.4. CONNECTION TO THE GAS INSTALLATION	6
3.5. CONNECTION OF THE BOILER TO A WATER SYSTEM	6
3.5.2. Cleaning the installation and water treatment for filling the CH installation	6
3.6. SELECTION OF EXPANSION VESSEL	7
3.7. CONDENSATE OUTLET	7
3.8. FLUE GAS OUTLET	7
3.8.1. Configuration Type B with open chamber and forced draft	7
3.8.3. Maximum length of the air-flue system.....	8
3.8.4. Horizontal outlet of air- flue gas system through the wall.....	8
3.8.5. Vertical outlet of air- flue gas system through the roof.....	8
3.8.6. Connection to the existing flue gas duct.....	8
3.9. CONNECTION OF ADDITIONAL DEVICES	8
3.9.1. Description of connection terminals	9
3.9.2. Connection of a room temperature regulator	9
3.9.3. Connecting the outdoor temperature sensor.....	9
3.9.4. Connecting the hot water tank to the system boiler	9
3.9.5. Connecting the solar system	10
3.9.6. Connecting the boilers in the cascade system	10
4. BOILER ADJUSTMENT AND PRELIMINARY SETTING	10
4.1. INTRODUCTORY REMARKS.....	10
4.2. ADJUSTING THE BOILER TO COMBUST ANOTHER TYPE OF GAS.....	11
BOILER CAN BE ADJUSTED TO COMBUST ANOTHER TYPE OF GAS BUT ONLY FOR THIS ONE WHICH THE BOILER IS CERTIFIED FOR. THE TYPES OF GASES ARE GIVEN ON THE RATING PLATE - IN THE INDEX DESIGNATION:	11
4.3. Boiler setting – regulation of CO ₂ value.....	11
4.4. ADJUSTMENT OF HEATING AND DOMESTIC WATER POWER	12
4.5. CONTROLLER CONFIGURATION – SETTING OF BOILER PARAMETERS	12
4.5.1. Preview of parameters value.....	12
5. STARTUP AND OPERATION OF THE BOILER	13
5.1. INITIAL STARTUP OF THE BOILER	13
5.2. OPERATING MODES.....	13
5.3. SETTINGS.....	14
5.3.1. Change the setting of heating water	14
5.3.2. Change the setting of domestic water	14
5.3.3. Switching the SUMMER / WINTER mode.....	14
5.3.4. Turn off the heating of domestic water.....	14
5.3.5. Stand-by mode	14
5.4. DIAGNOSIS.....	14
5.4.1. Errors history.....	15
5.5. ANTIFREEZE FUNCTION	15
5.6. FUNCTION TO PREVENT BLOCKAGE OF PUMP AND THREE-WAY VALVE	15
5.7. BREAK IN OPERATION OF THE BOILER.....	15
6. MAINTENANCE, INSPECTIONS, CHECKING OF THE OPERATION	16
6.1. INSPECTION AND MAINTENANCE	16
6.1.1. Preparing the boiler for service	16
6.1.2. Maintenance of the combustion chamber, burner, ignition electrode and ionization electrode	16
6.1.3. Thermal protection of the heat exchanger.....	17
6.1.4. Cleaning the condensate siphon.....	17
6.2. REPLACING A DAMAGED CONTROL BOARD IN THE CONTROL PANEL.....	17
6.2.1. Replacing the fuse in the controller.....	17
6.3. THE MAINTENANCE OPERATIONS TO BE PERFORMED BY USER	18
6.4. PUMP CHARACTERISTIC	18
6.5. PARAMETERS OF BOILER COMPONENTS	19
7. CASCADE SYSTEM.....	20
7.1. AUTODETECTION	20
7.2. CASCADE OPERATION MODE	20
7.2.1. TEST mode for cascade.....	20
7.2.2. Cascade operation in CH mode	20
7.2.3. Cascade operation in DHW mode.....	20
7.3. ALGORITHM OF CASCADE OPERATION.....	21
TECHNICAL DATA	22

1. INTRODUCTION

In this instruction manual is described condensing gas system boiler ECOCONDENS CRYSTAL designed for supplying a central heating system and heating domestic water in separately connected a domestic water tank.



Adaptation of the following boiler to work with the tank needs to be made by AUTHORISED SERVICE COMPANY.

ECOCONDENS CRYSTAL boiler take the air for combustion process from outside the room (in which combustion circuit is sealed) with respect to the residential area of the building in which it is installed - type of installation: C13, C33, C43, C63 or take the air for combustion process from the room that meets appropriate conditions (required by law) - type of installation: B23 .

Further information regarding the type – according section 3.8 or PN-EN 15502 Standard.

2. BOILER DESCRIPTION

2.1. Technical specification

2.1.1. Technical features

- Electronic fluent flame modulation for central heating system and domestic hot water (option);
- Electronic ignition with ionization flame control;
- Adjustable boiler power;
- Regulation of heating water and domestic water temperature (option);
- Function of soft ignition;
- Inlet gas pressure stabilization;
- Adopted to cooperate with closed circuit in central heating system
- Integrated boiler cascade operation

2.2. Design and technical specifications of the boiler

2.2.1. Main units of the boiler

- 2.1 – Flue gas-water heat exchanger
- 2.2 – Temperature limiter of flue gas
- 2.3 – Temperature limiter of air collector
- 2.4 – Ignitron electrode
- 2.5 – Flame control electrode
- 2.6 – Control console
- 2.7 – Controller
- 2.8 – Pressure transducer
- 2.9 – Safety valve
- 2.10 – Condensate siphon
- 2.11 – Fan
- 2.12 – Spark generator
- 2.13 – Automatic air vent
- 2.14 – NTC temperature sensor - return
- 2.15 – NTC temperature sensor - supply
- 2.16 – Temperature limiter 95°C
- 2.17 – Flow sensor
- 2.18 – Circulation pump PWM
- 2.19 – Gas valve
- 2.20 – Mixing orifice
- 2.21 – Flue gas adapter DN100
- 2.22 – Air adapter DN100
- 2.23 – Drain valve

2.3. Protection equipment

- Protection against outflow of gas
- Protection against explosive switch on of the gas
- Protection against exceeding the max temperature in domestic hot water tank
- Protection against exceeding the upper limit of heating water temperature

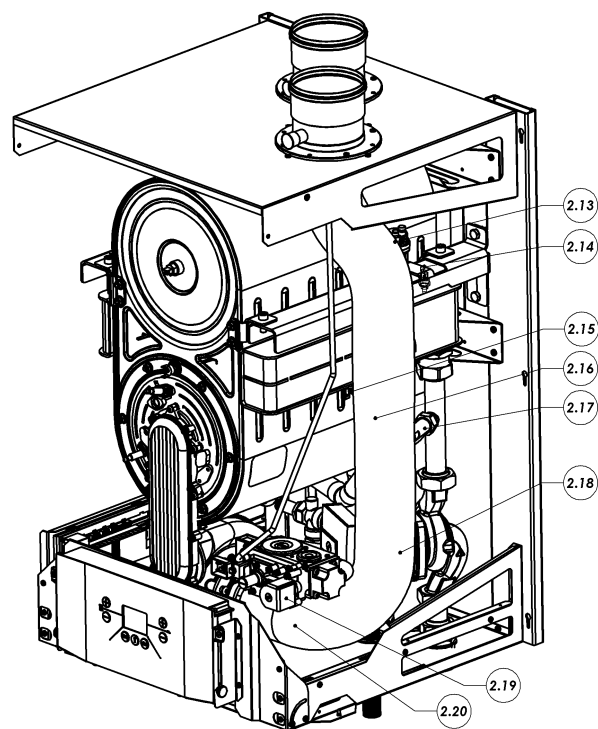
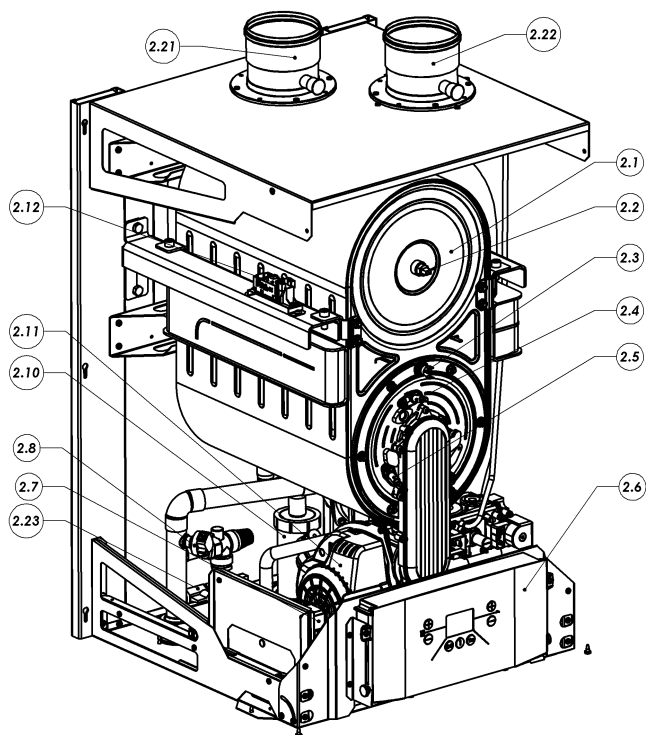


Fig. 2.2.1.1 – Boiler's construction

- Protection against water pressure increase (1-st degree) - electronic
- Protection against water pressure increase (2-nd degree) - mechanical
- Protection against drop of water pressure
- Protection against water overheating
- Antifreeze protection of the boiler
- Protection against the pump blockade
- Monitoring of the correct operation of the fan
- Protection against exceeding the upper limit temperature of flue gas
- Protection against too small flow through the heat exchanger
- Protection against overheating the exchanger due to incorrect installation

Errors which do not require manual reset will cause return of the boiler to the normal operation after automatic disappearance of failure - see section 5.4 - boiler diagnostics.



In case of noticing repeated emergency boiler shut-down by any of the protection it is necessary to contact an Authorized Service Company in order to check the reason of boiler switching off and to repair it.



It is forbidden to make any unauthorized modifications in the protection system.



IT IS RECOMMENDED TO CARRY OUT A CONTROL BY AUTHORIZED SERVICE PROVIDED AT LEAST ONCE PER YEAR. REPLACEMENT OF COMPONENTS IS ALLOWED ONLY ON ORIGINAL SPARE PARTS.

• HYDRAULIC COUPLING

In order to ensure a proper operation of the boiler, without any problems of too small flows (e.g. caused by radiators off or various types of pollution), it is recommended to install a hydraulic coupling or alternatively a plate heat exchanger that separates the boiler's hydraulic circuit from the installation.

The choice of separation method is dictated by the type of installation only.

• PLATE EXCHANGER

In case of replacing a traditional boiler, and an old and contaminated system, you may encounter problems with thorough cleaning of the system. In order to avoid contamination of the internal boiler system and, as a result of its malfunctioning, it is recommended to install an indirect heat exchanger. An additional exchanger between the primary and secondary circuits ensures effective separation of the system and, as a consequence, full protection of the boiler against contamination.

2.4. Operation description

2.4.1. Way of heating the water for central heating system

The boiler switches on if the heating water temperature is lower than the temperature set by buttons [E] or [D] and the room thermostat gives the signal to heat. Then the following conditions occur simultaneously:

- power supply of the three-way valve towards the central heating installation,
- power supply of the pump (item. 2.18). If the heating water flow through the boiler is ≥ 19 l/min, a short-circuit of flow sensor contacts occurs (item. 2.17),
- power supply of the fan (item 2.11),
- followed by a sequence of ignition and the fan speed is set to ignition value [parameter P33],
- then the boiler reduces the power by changing the fan speed to the minimum value [Parameter P12] and maintains it until the minimum operating time [Parameter P05] has expired. After that the controller starts the fan speed regulation taking into account a value of the central heating slope [parameter P06]. If the heating water temperature exceeds 97°C, an additional temperature limiter is activated, the burner is turned off until the hot water temperature drops below 81°C.

The system of continuous flame modulation uses the PI control algorithm to minimize the difference between the temperature read by the NTC sensor - supply (item 2.15) and the value of the set temperature of central heating. The boiler switches off when the room temperature control unit is signaling reaching the desired temperature in the room or when the heating water temperature exceeds the setpoint by the hysteresis value of central heating [parameter P03].

After turning off the boiler pump is running during the pump overrun [parameter P07]. Simultaneously the time of break in operation is metered [parameter P04].

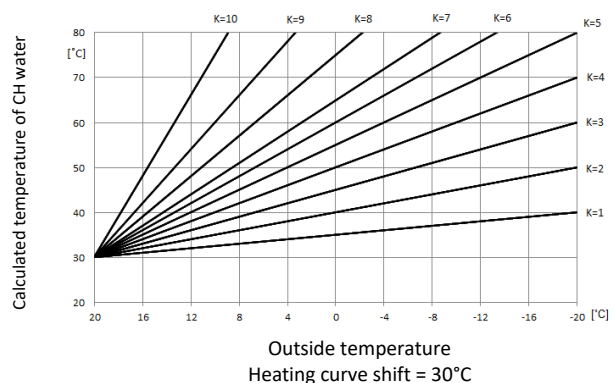
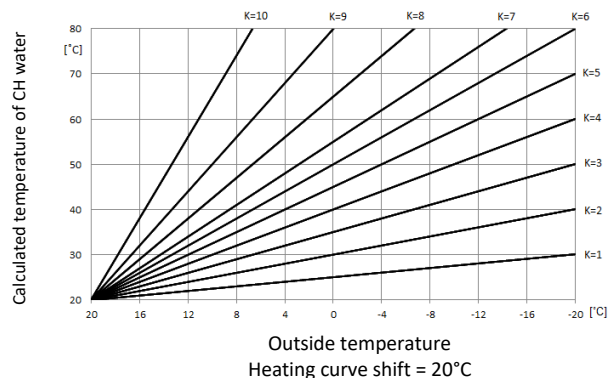
Restart of the boiler will be done automatically under the following conditions simultaneously:

- heating water temperature is lower than the set temperature,
 - break time in the central heating operation has elapsed [parameter P04],
 - room temperature control unit provides the signal "heat".
- The list of driver parameters according to table 4.5.1.

2.4.2. Temperature regulation dependent on outside temperature

If an external temperature sensor has been connected the controller detects it automatically and it is signaled by displaying W10 on the control console display.

If the "K number" (parameter P14) is set to the value different than zero there is a possibility to manually set the CH temperature with buttons on control console. Controller enters a weather function and adjusts the heating water temperature making it dependent on outside temperature, the number of heating curve [parameter P14] and its shift [parameter P15]. Max temperature is limited by max CH setting [parameter P02].



2.4.3. The way of heating the water in the monofunctional boiler cooperating with domestic water tank (option).

The boiler may cooperate with domestic water tank type ZWU-200/N which is offered by Termet company. Adjustment and display of domestic water temperature are done on the controller of the boiler. Adjusting the boiler to cooperate with the tank see section 3.9.4.

The process of heating the domestic water is as follows:

When the water temperature sensor finds the temperature lower by the hysteresis value of domestic water [parameter P18] than set on the control panel with buttons [G] or [F] then the process of pumping the water to the central heating system will be stopped and the heating water temperature will be controlled in an optimal way

by the driver of the boiler. Heating the domestic water with the boiler cooperation with the tank of domestic water is as follows:

- water temperature sensor in the tank indicates the water temperature drop below the set temperature by the hysteresis value of domestic water [parameter P18] (e.g. due to opening of inlet tap valve);
- boiler control unit makes the three-way valve to draw the heating water to a short circuit while giving a signal to the spark generator and gas valve;
- heating water flows through the coil of tank (short circuit);
- driver of the boiler controls the heating water temperature in an optimal way so as not to exceed a permissible value. If the heating water temperature exceeds 97°C, an additional temperature limiter is activated (item 2.16), the burner is turned off until the hot water temperature drops below 81°C;
- after exceeding the set water temperature in the tank the boiler controller gets distorted the three-way valve for long circuit and at fulfillment of the following conditions the heating water is pumped into the central heating system:
 - heating water temperature is lower than the set temperature
 - room thermostat gives a signal "heat".

Hot water temperature at the point of consumption may differ from the set value, and therefore it is advisable to install a mixing valve for domestic hot water systems.



When using a water tank in the ECOCONDENS CRYSTAL 100 boiler, to ensure proper operation of the boiler the required coil power in the tank is minimum 25kW.



To eradicate legionella bacteria in the tray, the boiler is turned on every 168h to work with the tank and heats water to 60°C. To prevent excessive energy consumption, the timing function is reset when the water temperature in tank will reach 60°C during normal use.

2.5 Description of the control panel

The boiler control panel has 7 function buttons and an LCD display for displaying boiler settings and information about operating states of the boiler.

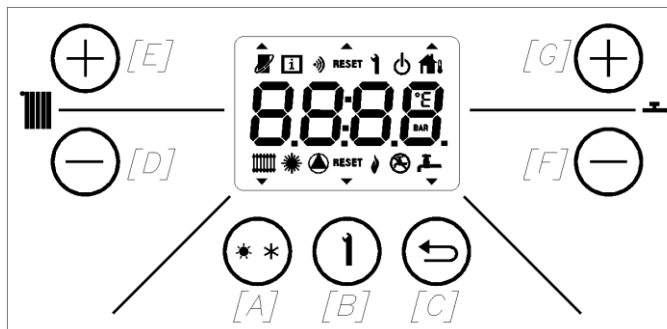


Fig. 2.5.1 – Description of control panel buttons

Description of the basic functions of the individual buttons of the controller:

- [A] – Changes the operating state of the boiler from the SUMMER function (CH only) to the WINTER function (CH and DHW).
- [A]_{3sec} – The entrance to the TEST mode
- [B] – The reset the displayed error
- [B]_{3sec} – Preview of the parameters
- [C] – Turns on or off the DHW heating function
- [C]_{3sec} – Errors history
- [D] – Reduces the setting for CH
- [D]_{3sec} – Autodetection procedure
- [E] – Increases the setting for CH

[E]_{3sec} – sends parameters from the controller in MASTER boiler to all boilers connected in series.

[F] – Reduces the setting for DHW

[G] – Increases setting for DHW

[A+C]_{3sec} – Standby mode

[A+B]_{3sec} – Test for the cascade mode

[B+C]_{3sec} – Controller programming mode



Fig. 2.5.2 – Description of the display symbols

W1 – Operation in CH mode

W2 – Function of operation only in DHW mode (SUMMER), CH inactive

W3 – Signalization of the pump power

W4 – Signalization the fault requiring reset

W5 – Signalization of the flame presence

W6 – Inactive domestic water function

W7 – Operation in DHW mode

W8 – Unit of displayed pressure

W9 – Unit of displayed temperature

W10 – Active outdoor temperature sensor

W11 – Standby mode

W12 – Signalization the mode of changing the parameters

W13 – Inactive

W14 – Inactive

W15 – Signalization the mode of previewing the parameter

W16 – Presence of connected OpenTherm

W17 – Information display field

3. BOILER INSTALLATION

Important safety information

FAULTER TO COMPLY WITH LISTED RECOMMENDATION WILL RESULT IN LOSS OF THE WARRANTY

- The boiler must be installed by an authorized service company accordingly with local regulations;
- After the boiler installation check the tightness of all connections of gas and water systems;
- Service company is responsible for the proper installation of the boiler;
- Installation of the boiler must be made so as not to cause any tension of the installation that may cause increased volume of work;
- Packages should not be left within reach of children;
- Check whether the chimney is perfectly clean and free of dirt;
- The boiler must be connected to the heating system corresponding to its power;
- Check whether the boiler is adapted to burn a certain type of gas;
- Check the water hardness, if it exceeds 20° F (1F = 10 mg calcium carbonate per liter of water) proceed to the water softening;
- It is mandatory to thoroughly clean all installation wires in order to eliminate possible residues from threading, welding, solvents or sludge and any other contaminants from the heating circuit.

3.1. Requirements of boiler installation

3.1.1. The regulations on the water installation, gas and the flue gas system

Water, gas and flue gas systems must meet local regulations as well as use of the gas, ventilation and flue gas installation.

The use of gas appliances, flues and ventilation by the user should be consistent with local requirements on technical conditions of tenant buildings use.

Before installing the boiler the consent from the District Department of Gas, Chimney sweep company and Building administration must be obtained.

3.1.2. Regulations related to the room

Requirements for premises where gas appliances are installed shall be in accordance with local regulations. The room where appliance is to be installed should ensure the air supply and venting system necessary for gas combustion in accordance with local regulations. The room should be protected against freezing, free from dust and aggressive gases. It is forbidden to install the device in a laundry rooms, drying rooms and in varnish, cleaners, solvents and sprays storages.

The boiler should be installed in a technical room.



Gas appliances supplied with liquefied gas must not be installed in room with a floor below ground level.

3.1.3. Requirements for electrical installation

The boiler has been designed for operation with single-phase alternating current with rated voltage of 230 V / 50 Hz. Max power consumption – please see rating plate or technical data table. The main socket from which boiler is powered must meet the local requirements.

The boiler has been designed as a Class I device and must be connected to an electrical outlet with ground terminal in accordance with PN IEC 60364-4-41. The boiler has a degree of electrical protection provided by the housing – X4D.

It should be checked by a suitably qualified person whether the electrical installation is suitable for the maximum power consumption of the device, making sure in particular that the cross-section of the cables is suitable for the power consumed by the device.

If the boiler is permanently connected to the power source, it should be executed by junction box. The junction box must be equipped with protection degree appropriate for the defined assembly zone. If the boiler is connected through the junction box, electric system must be equipped with measures which can disconnecting the boiler from the power source.

In order to connect the boiler to the junction box, it is recommended to:

- cut the power cord to a suitable length for connection to the box
- pull off cable insulation
- put the cable-end sleeve with the appropriate diameter

This prepared cables connect according to Fig 3.1.3.1.

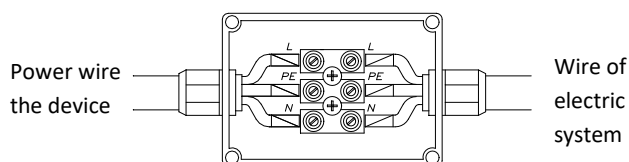


Fig 3.1.3.1 – Wire colors: L – brown; N – blue; PE – yellow-green

If you need to replace the supply wire, use a minimum cord of 3 x 0.75 mm². The boiler supply wire is screwed to the connection list on the control panel to terminals marked with ~ 230 V (see section 3.9.1).

The power cord of the device cannot be replaced by the user. To replace it please contact with qualified personnel.

The use of any device powered by electricity requires to compliance with the basic principles, i.e.:

- do not touch the device with wet or damp body parts and / or being barefoot;
- do not jerk the electrical cables;
- do not expose the device to weather conditions (rain, sun, etc.);
- do not allow children or persons with no experience or knowledge to operate the device.

3.2. Preliminary check activities

Before proceeding with the boiler installation:

- check whether the boiler is factory designed for the type of gas supplied from the gas system. The type of gas which the boiler is adjusted to is specified on the rating plate on the cover of the boiler;
- check whether the water system and radiators have been rinsed with water in order to remove rust, fillings scale, sand and other dusts that could disturb the proper operation of the boiler (for example increase the water flow resistance in central heating system) or to pollute the heat exchanger,
- whether the mains voltage has a value of 230V and the phase wire (L) is in the right place; and that the socket has an efficient safety contact (complies with IEC-60 364-6-61: 2000)
- whether the flue-gas air installation is tightly connected and not obstructed.

3.3. Boiler installation



The device may only be installed on a vertical wall sufficiently strong to maintain its weight. For mounting, use a fastening system adapted to the wall structure.

- The most important mounting dimensions are shown on Fig. 3.3.1
- In order to ensure free access during inspections and maintenance, it is advisable to maintain the minimum distances according to Fig. 3.3.3.

Delivery range:

Part	Quantity
Gas boiler	1
Instruction manual	1
Mounting template	1
Hanger	1
Wall plugs $\Phi 12 \times 60$	6
Wood screws $\Phi 8 \times 70$	6
Elements of the siphon (bucket, nut, gasket)	1
Flue gas / air adapter	2
Package with screws	1
Wire of cascade serial connection	1
NTC temperature sensor (cascade)	1

The boiler has two mounting possibilities presented on Fig. 3.3.2

- Using the attached hanger
- Hanging on mounting hooks (min. size of wall plug is $\phi 16 \times 100$)

Mounting method:

1. In order to facilitate assembly, use the mounting template attached to the boiler.
2. Attach the template to the wall and mark all the space needed for installation.
3. Remove the template and drill the necessary mounting holes.
4. Screw the hanger (attached to the boiler) to the wall or mount the hooks.

5. Hang the boiler on the hanger, grabbing the back and bottom of the boiler. Due to the heavy weight, 2 people are required.

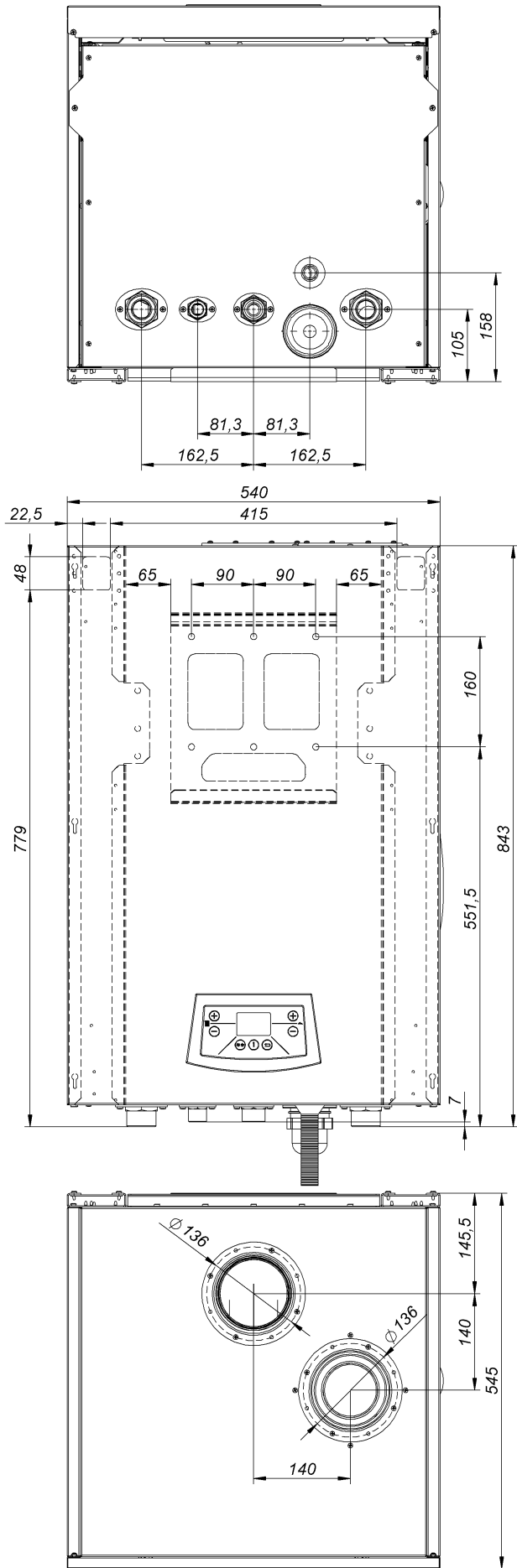


Fig. 3.3.1 – Mounting dimensions

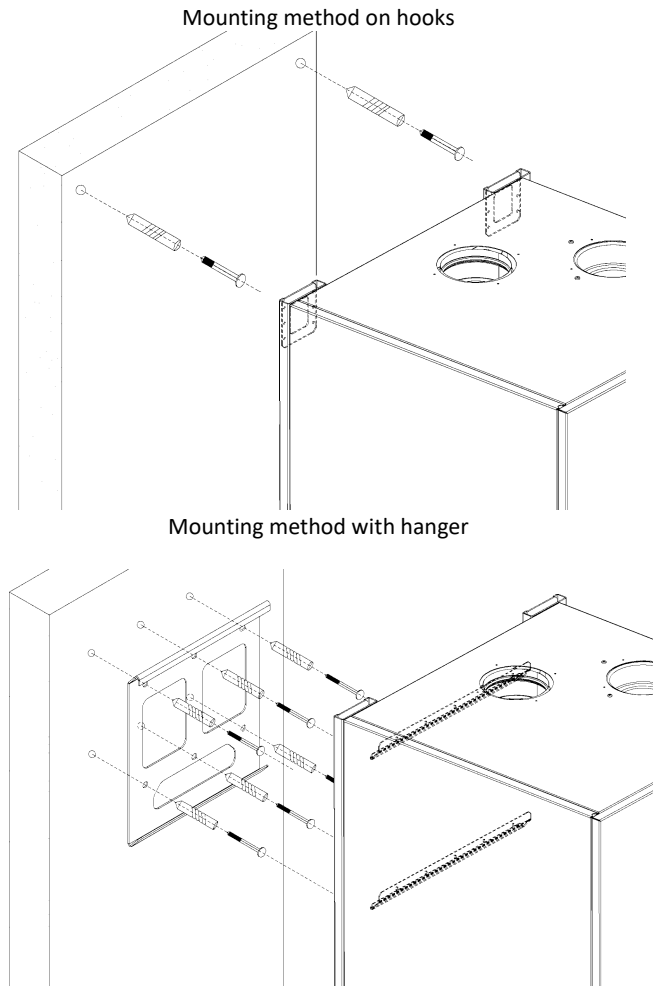


Fig. 3.3.2 – Mounting method

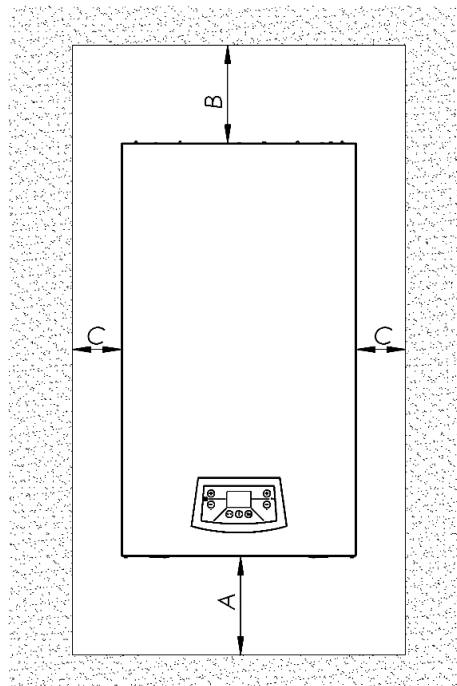


Fig. 3.3.3 – Required mounting distances

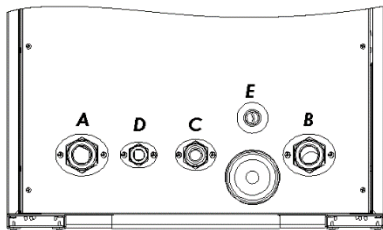
A = 400mm
B = 300mm
C = 200mm

3.4. Connection to the gas installation



All connections should be made by an appropriately qualified person, in accordance with applicable standards and regulations, in particular those relating to safety.

Connect a gas supply pipe directly to the connector of the boiler gas unit by means of standard connector subassembly. It is necessary to install a gas filter on the gas supply pipe. This filter is not included in the standard boiler equipment. The gas filter is necessary for a proper operation of a gas unit and a burner. Install a cut-off valve on the gas pipe in an accessible place.



A – (G5/4") – Power supply of the CH installation
 B – (G5/4") – return from the CH installation
 C – (G1") – Gas connection
 D – (G3/4") – Drain from the safety valve / emptying the boiler
 E – (Ø 25) – Condensate drain

Fig. 3.4.1 – Description of the connectors

3.5. Connection of the boiler to a water system

Power connector and connector of return of the central heating boiler should be screwed to the installation. Install a water filter on a water return from central heating system (in front of the connection with the pump). The filter is not included in standard boiler equipment. The central heating system should be thoroughly rinsed out before the boiler is connected. In the central heating system it is permitted to use as a heat carrier any antifreeze fluids which can be used in central heating systems.

The cut-off valves needs to be installed between the boiler and central heating system so that the boiler could be dismantled without draining the system.



Before installing the boiler thoroughly flush the central heating system to free it from any solid impurities. It is recommended that after first start-up of the boiler and heating up of the installation drain the water from the system to remove residues of pastes metallurgical and precautionary measures of heaters. These activities would benefit for the operation of the device, its parameters and components life.

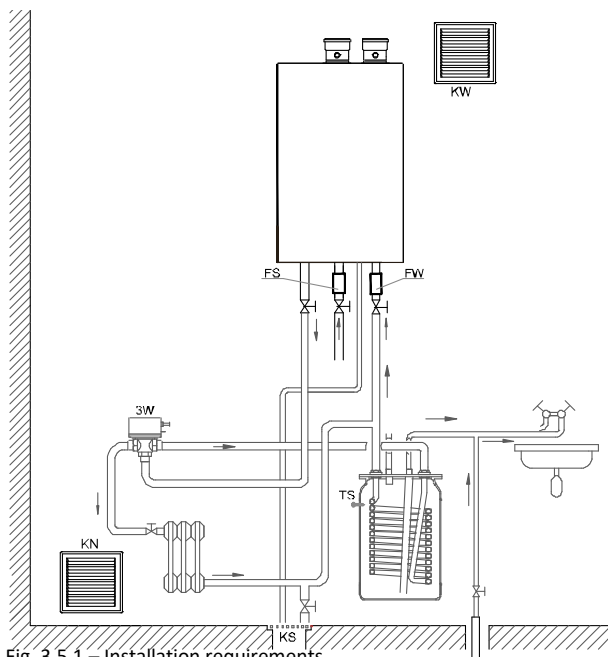


Fig. 3.5.1 – Installation requirements

After the boiler installation it is necessary to:

- Fill the heating system with water. Filling the system should be done slowly to allow the air outflow through the air vent valve mounted in the boiler; also check the complete air outlet from all components of the system. The pressure in the cold installation should be $1.2 \div 1.5$ bar.
- Check whether connections of the boiler and in the central heating system are tight.
- Ensure that pipes of water and heating installation are not used as grounding the electrical installation.
- Connect the outlet of safety valves to the floor drain to avoid flooding the room (where the boiler is installed) as a result of protection devices. Such outlets should be carried out so as to avoid damage in the case of opening of the valve and outflowing of the hot fluid.

3.5.2. Cleaning the installation and water treatment for filling the CH installation

In all elements of the CH installation there are processes of scaling, corrosion and similar phenomena. The boiler is the most expensive part of the installation and it is important to ensure that the heat exchanger and other components are protected against these processes. Correct preparation of the CH system for the operation shall be carried out by two operation: cleaning the installation and water treatment for the operation of the installation.

Cleaning the installation

In new installation there may be remnants of the installation such as solder residues, welding residues, flux residues, oil residues, grease residues, or corrosion products - especially in old installation. In the first place, both new and old installations should be cleaned with clean water to remove solid waste. This operation must be carried out without the boiler installed. The next step is to chemical cleaning the installation. For cleaning new and old installations, use a suitable cleaning agent, like Fernox Cleaner F3 (for old and heavily contaminated installations use Cleaner F5). After this cleaning the system should be rinsed with mains water.

Water treatment for filling the installation

Use the water with following parameters to fill the installation: pH from 6,5 to 8,5 units, general hardness not more than $10 \text{ }^{\circ}\text{n}$ ($\sim 18^{\circ}\text{F}$). For filling do not use demineralized water or distilled water. For proper protection against scale and corrosion of the installation, use a suitable inhibitor (passivator) e.g. Fernox Protector F1. In addition, there can also be used a liquid heat carrier such as HP-5 or antifreeze such as Fernox Alphi 11. In situations where water is very hard, the use of the HP-5 liquid heat carrier effectively reduces the risk of scaling of the heat exchanger.

Low-temperature circuits

In low-temperature zones it is recommended to treat the water by using HP-5 liquid heat carrier or alternatively Fernox biocide AF10.

Filtering technology

In addition, modern filters with magnetic and cyclone effects are recommended for the high quality of the current heating system.

The method and amount of use of the particular products for cleaning the installation and for water treatment should be used according to the instructions of the product given by the manufacturer.

Cleaning the installation and water treatment should be made by authorized installers or service personnel.

3.6. Selection of expansion vessel

The boiler is not equipped with an expansion vessel, the vessel must be mounted on the installation. In installation with additional hydraulic coupling or plate heat exchanger, an individual expansion vessel should be installed in the boiler's circuit. A proper expansion vessel should be selected by the designer of central heating system. Installation of expansion vessel should be made by an installation contractor in accordance with applicable regulations.

3.7. Condensate outlet

Each boiler has a condensate drainage system installed and already connected.

The flexible pipe for condensate drainage must be connected to the condensate collection and removal system in accordance with the applicable regulations. The designer, considering the power of the installation and the utility of the building, should adapt the system to neutralization of the resulting condensate. The condensate drain installation must be made of corrosion-resistant material.

The installation should be carried out in a way that prevents the condensate from freezing. Check the condensate drain before starting. The connection of drain the condensation water cannot be blocked.

The bottom of the siphon (2) was dismantled during transport. All parts necessary for installation: 1-gasket, 2-bottom of siphon, 3-nut, are in the package of the boiler. Before starting the boiler, the siphon should be assembled in accordance with Fig. 3.7.1.

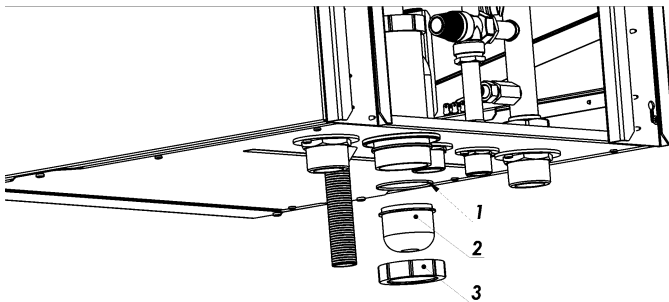
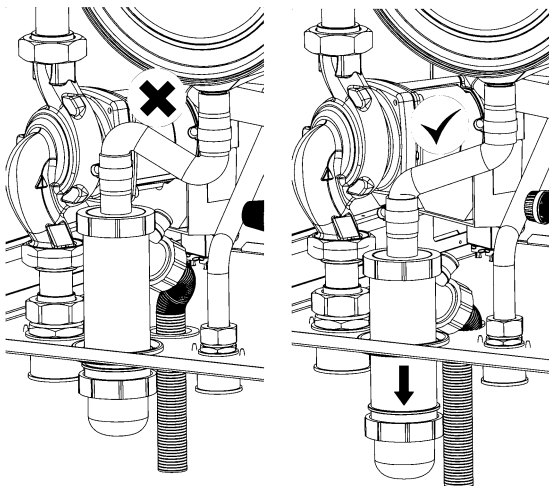


Fig. 3.7.1 – Mounting the siphon



Before the start-up of the boiler move the siphon to the lowest position, to enable the hose (which connect heat exchanger with siphon) to a proper condensate outlet (see the Fig. below). A bent hose may cause the flooding of heat exchanger by produced condensate.



During the start-up or after a long downtime, make sure that the condensate is properly drained through the drain (E) see Fig 3.4.1.

3.8. Flue gas outlet

Flue gas outlet from the boiler must be made in accordance with applicable regulations and this instruction manual and it needs to be agreed with the district chimney sweep service company.

For flue systems, the boiler is made according to type: C13, C33, C43, C63, B23.

- it has closed combustion chamber in relation to the room where it is installed (C),
- is adjusted to be connected to separately approved and marketed air-flue gas systems,
- it is equipped with a blowing fan (3).

The boiler is designed for cooperation with the flue gas – air system with a diameter of $\Phi 100$ (flue gas and air) and in a collective cascade system where the flue gas exhaust from a single boiler is realized by a pipe with diameter of $\Phi 100$. To install the flue gas – air system to the boiler, it is recommended to mount the flue gas adapters according to this manual, the adapters are supplied with the boiler and are added to the boiler's package.

Other components of the flue gas – air system of the boiler should be purchased according to the design of the installation.



The boiler is factory adjusted with mounted exhaust pipe $\Phi 100$ of the maximum length 0,5m without air pipe. Settings CO_2 – 9% for natural gas. To use the other systems and longer pipes it is required to adjust the boiler as specified in point 4.3.

Connections and chimney duct must be designed and constructed in accordance with applicable regulations. They must be made of suitable material. They also must be corrosion-resistant, smooth inside and tight, impervious to condensate.

Use the appropriate wire size (diameter, maximum length, resistance on the knees), depending on the combustion system used. The dimensions of the wires should be adequately compatible as given in table. Resistance of flue gas flow on each elbow depending on the bending angle and related reduction of the maximum wire length are given in section 3.8.2.

Connection of the boiler to the air-flue gas system and installation of the system itself should be sealed. Each system should be installed with the windproof outlet protecting against external factors.

Before turning on the boiler check if flue-gas system is made according to the project and air- and flue ducts lengths are shorter than maximum lengths showed in above tables. Make sure flue-gas system is tight.

After turning on the boiler check if it operates correctly. Also check combustion parameters by checking concentration of CO_2 and/or O_2 in flue-gas.

3.8.1. Configuration Type B with open chamber and forced draft

The air is sucked directly from the environment in which the boiler is installed through the hole made in the boiler's top cover. The exhaust outlet should be connected to your own single chimney or directed directly to the outside of the building according to the requirements of applicable regulations.

Boilers with open combustion chamber type B can not be installed in rooms exposed to vapors or volatile substances (e.g. vapors of acids, paints, adhesives, solvents, fuels, etc.), as well as areas dusty with wood, coal, cement, etc.

In the operating system type B, the boiler must be equipped only with a flue gas adapter as shown on Fig. 3.8.1.1. The air is sucked from the room through the hole in the boiler's top cover.

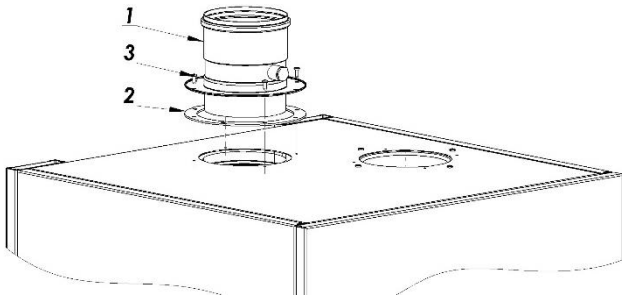


Fig. 3.8.1.1 – Adjusting the boiler for operation in system B₂₃

3.8.2. Configuration Type B with closed chamber and forced draft

The air is sucked from the outside through an individual air duct. In case of using a separate flue gas-air system, the boiler should be equipped with the appropriate adapters according to Fig. 3.8.2.1.

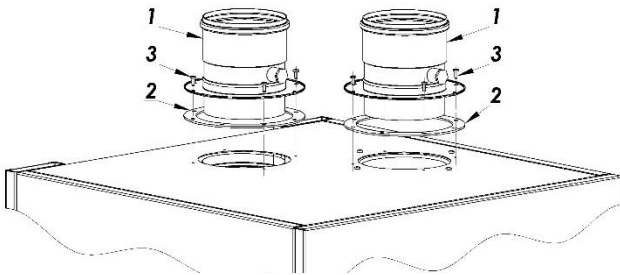


Fig. 3.8.2.1 – Mounting the flue gas adapter and the separate air system

No	Name	Attached to the boiler	Quantity
1	Adapter ø100	Yes	2
2	Flat gasket	Yes	2
3	Sheet screw	Yes	8

3.8.3. Maximum length of the air-flue system



The maximum length of the flue pipe for a boiler that co-operates with flue gas and air pipes with diameter of Φ 100 is: L_{MAX} = 30m.

The following table shows the values which have to be added to the sum of the lengths of the flue gas-air system when the elbow is mounted on the flue gas system or the air supply system to the boiler.

Elbow 15°	Elbow 45°	Elbow 90°
0.25	0.5	1m

Table 3.8.3.1 - Reduce the length of the installation elbows

Example of calculation of flue gas system length:

$$L_{MAX} \geq H_1 + H_2 + K_{90} \times 1m + K_{45} \times 0.5m$$

- L_{MAX} - declared maximum length of the flue gas pipe
- H₁ - sum of straight pipe lengths in the flue gas system
- H₂ - sum of pipe lengths in the air system
- K₉₀ - quantity of used 90° elbows in the flue gas and air system
- K₄₅ - quantity of used 45° elbows in the flue gas and air system

3.8.4. Horizontal outlet of air- flue gas system through the wall

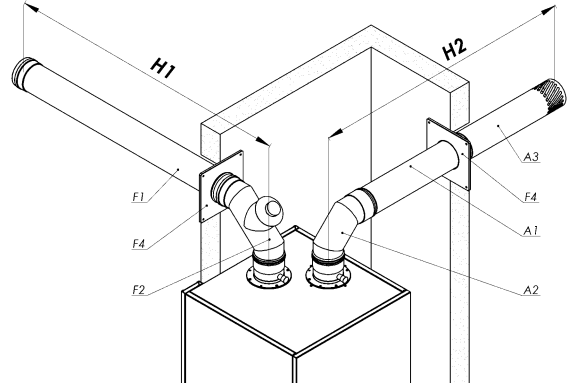


Fig. 3.8.4.1 – Horizontal outlet of air- flue gas system through the wall



The horizontal air tube should be mounted at an angle of ~ 3° so that rain water that gets into the pipes would not flood the boiler and flowed outside the building.

3.8.5. Vertical outlet of air- flue gas system through the roof

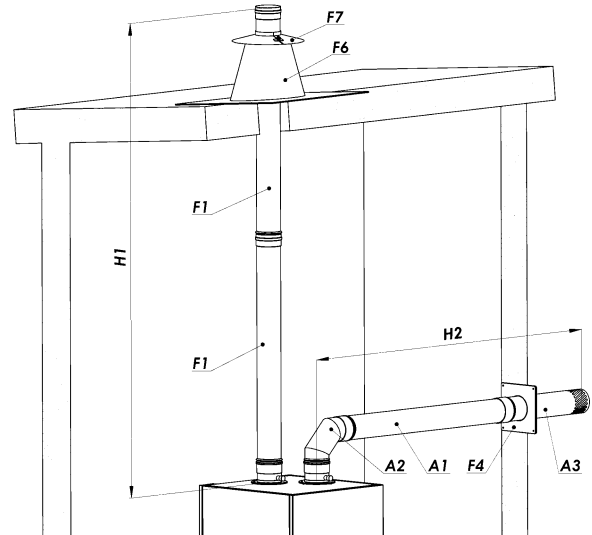


Fig. 3.8.5.1 – Horizontal outlet of air- flue as system through the wall or on the roof

3.8.6. Connection to the existing flue gas duct

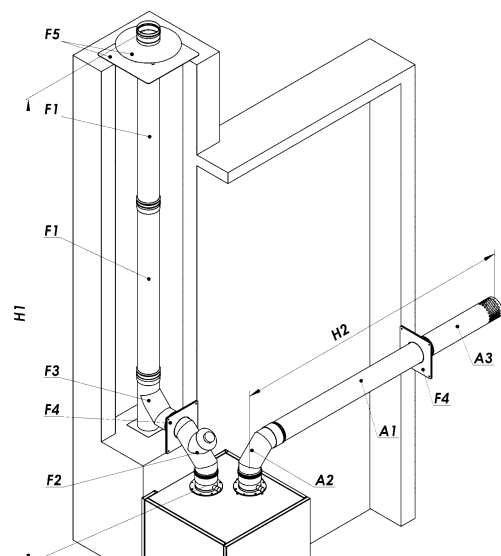


Fig. 3.8.6.1 – Connection to the existing flue gas outlet duct

3.9. Connection of additional devices



An improperly made electrical connection may Cause injury or material losses. Touching live connections may cause electric shock and as a consequence, it may cause a serious injury. Remember to disconnect the boiler electrical power before starting work.

Electrical connections may only be carried out by an appropriately qualified person.

The boiler is equipped with additional electrical terminals, which allow for connection of external devices to the boiler:

- Room regulator
- Remote control OpenTherm®
- Outdoor temperature sensor
- Three-way valve for connecting the domestic hot water
- Temperature sensor in domestic hot water tank
- Cascade sensor (temperature measurement on hydraulic coupling)
- PWM signal cable for external pump
- Power supply of the solar pump
- Solar sensor (temperature measurement in solar collector)
- Alarm (relay which close the contact in case of error)

To access the terminals (see Fig. 3.9.1):

- remove the front cover of the boiler see Fig. 6.1.1.1
- unscrew 2 screws (1)
- move the control panel (2)
- after unscrewing the screws (3) and removing the cover (4) we get access to terminals.

During the connection, wires of the additional devices should be passed through the appropriate holes in the controller bracket (6) and the proper culvert (5), then screw the ends of the wires to the correct terminals.

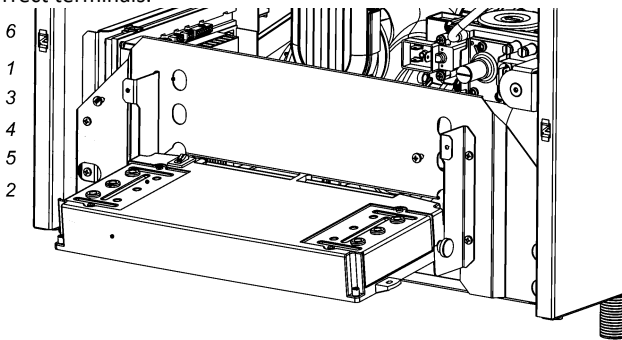


Fig. 3.9.1 – Access to electrical terminals

3.9.1. Description of connection terminals

High-voltage terminals:

~230 – power cord

ALARM – in case of an error the contact is closed

CH, DHW, COM – connection terminals of a three-way valve

SOLAR PUMP – solar pump

Low-voltage terminals:

RT – room temperature regulator

OT – remote control OpenTherm®

EXTERNAL SENSOR – outdoor temperature sensor

TANK SENSOR – temperature sensor in tank

CASC. SENSOR – cascade sensor

CASC. PWM – PWM signal for external pump

SOLAR SENSOR – solar sensor

MASTER – master connector of series connection of boilers into cascade

SLAVE – slave connector of series connection of boilers into cascade / diagnostic connector of the boiler – connection with PC



MASTER and SLAVE communication connectors are not located in the control console casing. Connectors appropriately described are located in bulk inside the boiler.

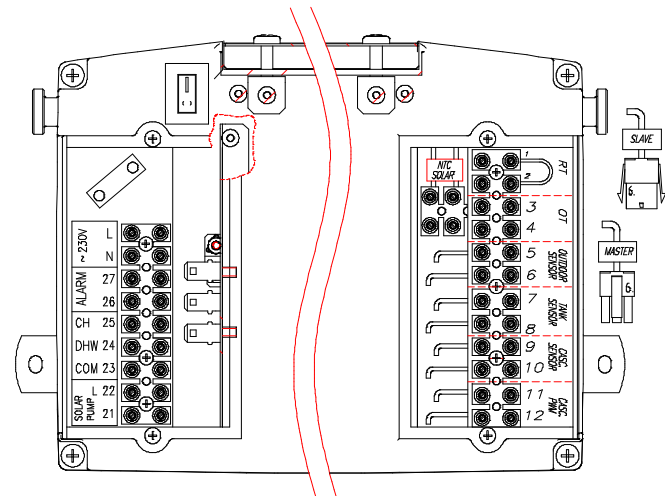


Fig. 3.9.1.1 – Description of electrical terminals

3.9.2. Connection of a room temperature regulator

3.9.2.1. Room regulator with contact

The boiler has been designed to cooperate with a room temperature regulator which has got its own supply source and control contact free from potential. Connections must be made according to the instructions of regulator manufacturer. In order to connect the temperature thermostat to the boiler the appropriate length two-core wire is needed. It needs to be connected to terminals 1 and 2 marked as **RT** - previously separating the electrical bridge.

3.9.2.2. OpenTherm® remote control by Honeywell

The boiler is also adapted to connect the OpenTherm® remote control by Honeywell. In order to connect the OpenTherm® to the boiler the appropriate length two-core cable is needed. It needs to be connected to terminals 3 and 4 marked as **OT**. For any technical information about the remote control OpenTherm® - see the instruction manual supplied by the manufacturer of remote control devices.

Note: When using OpenTherm® remote control, the RT terminals must be free of electrical bridge and left unconnected.

3.9.3. Connecting the outdoor temperature sensor

To connect the outdoor temperature sensor use the 2 wire cable with 0,5mm² cross section and connect it to terminals 5 and 6 **OUTDOOR SENSOR**. Connection must be made in accordance with the instructions provided by the sensor manufacturer. It is the best to place the outside temperature sensor on the north wall of the building and it should not be exposed to direct sunlight.

3.9.4. Connecting the hot water tank to the system boiler

Domestic hot water tank must be connected to the boiler in accordance with the Fig.3.5.1.

Connect the temperature sensor to the terminals in the control panel marked with **TANK SENSOR** (remove the resistor).

The other end of the cable together with the sensor should be placed in the tank in the place of the domestic water temperature sensor.

The electrical connection of the three-way valve shall be made according to Fig. 3.9.3.1.

Connect the valve connection cord (2) to the terminals in the control panel (3) according to indications.
 CH (heating) – black cord,
 DHW (domestic hot water) – brown cord,
 COM – blue cord.

Three-way valve and a temperature sensor in the tank are not supplied with the boiler, they are available as optional elements.

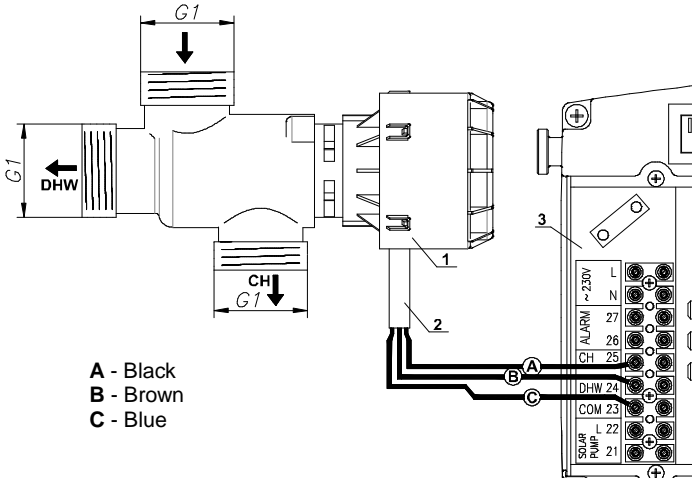


Fig. 3.9.3.1 – Connecting of the three-way valve

3.9.5. Connecting the solar system

The boiler has the ability to control the solar system. The connections should be made according to the Fig. 3.9.5.1.

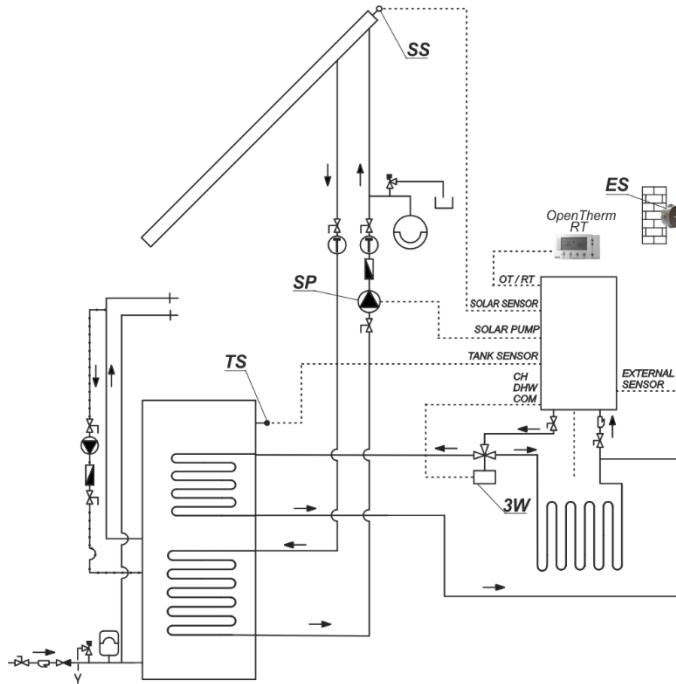


Fig. 3.9.5.1 – Solar system

TS – Temperature sensor in tank, SP – Solar pump, ES – Outdoor temperature sensor, SS – Temperature sensor in solar collector, 3W – three-way valve

The temperature sensor of solar collector Pt1000 (SS) must be connected to the control panel at the terminals marked with SOLAR SENSOR.

Connect the solar circuit pump (SP) to the control panel to the SOLAR PUMP terminals. Connect the three-way valve (3W) and the temperature sensor of tank (TS) according to section 3.9.4.

3.9.6. Connecting the boilers in the cascade system

Boilers have the ability to cooperate in a cascade. Up to 6 boilers can be connected into one cascade, as shown on Fig. 3.9.6.1.



Below listed designs should be made by people who have been authorized to do this:

- design of the flue gas outlet system and air inlet system,
- gas system design,
- hydraulic system design.

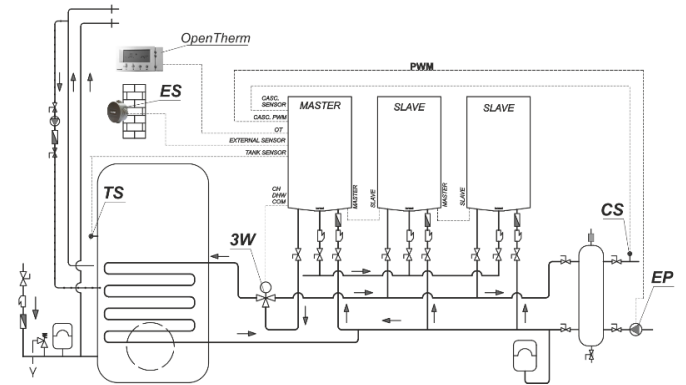


Fig. 3.9.6.1 – Cascade system

TS – Temperature sensor in tank, EP – External cascade pump, ES – Outdoor temperature sensor, CS – Temperature sensor in supply collector, 3W – three-way valve

Boilers cooperating in the cascade system are connected in series by a cable attached to the boiler. The connection should be realized according to Fig. 3.9.6.2. First boiler always functions as master boiler MASTER, the other boilers work as subordinate boiler SLAVE.

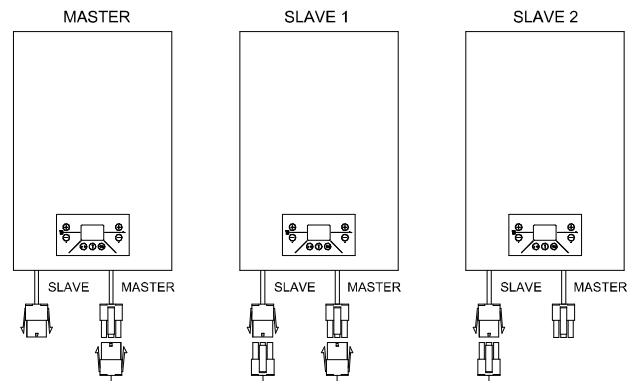


Fig. 3.9.6.2 – Series connection of boilers

Connection of temperature sensor on cascade collector.

The sensor is used to measure the temperature of water supplying CH circuits, it must be installed at the central collector of heating water just behind a hydraulic coupling. Connect the sensor to the terminals of the control panel marked with CASC. SENSOR using a two-wire cable of cross-section 0.5 mm² for the wire.

The boiler has an additional PWM control connector for the external circulation pump. To connect the pump, connect the two-wire pump control cable to the CASC. PWM terminals in the control panel. For detailed information of connecting the pump, refer to the instructions supplied with the pump. Please see note in section 6.4.

In order to ensure a proper operation of the boilers, it is necessary to install check valves in front of each boiler.

4. BOILER ADJUSTMENT AND PRELIMINARY SETTING

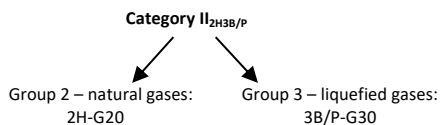
4.1. Introductory remarks

Purchased boiler is factory adjusted according parameters for the type of gas that is provided on the rating plate and in and the documentation of the boiler. Only AUTHORIZED FACTORY SERVICE can do any and parameter settings of the boiler if there is any need

to change the parameters or to adjust the boiler to another type of gas.

4.2. Adjusting the boiler to combust another type of gas

Boiler can be adjusted to combust another type of gas but only for this one which the boiler is certified for. The types of gases are given on the rating plate - in the index designation:



If there is any necessary to adapt the boiler to work with a different type of gas than the one to which it was originally fitted, you should:

- In the parameter programming mode, change the values of parameter P27 - Maximum fan speed and parameter P28 - Minimum fan speed (displayed value multiplied by 50), to the value according to the type of gas to which we adjust the boiler shown in Table 4.3.1;
- Start the TEST service function;
- Check the CO₂ content for min. power t = 0 and max. power t = 100, compare with the data in Table 4.3.1, if necessary - adjust;
- After adjustment, check settings for max. and min. gas flow;
- Turn off the TEST function;
- Seal the adjusting elements.

After adapting the boiler to combust another type of gas:

- Cross out on a rating plate the type of gas to which the boiler was adapted by the manufacturer,
- Write down the symbol of the gas, to which the boiler has been adjusted and the set heat load on the appropriate label that is attached bulk to the user manual. The entry must be written legibly and indelibly.
- Label filled in as above should be stucked on the cover near rating plate.



Adapting the boiler to combust another type of gas can be performed only by a qualified service team. This operation is not included in the warranty repairs.

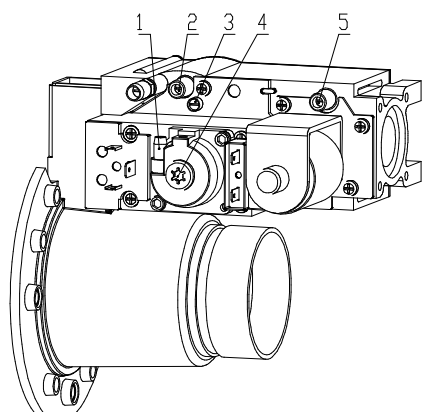


Fig. 4.2.1 – Gas valve by Honeywell with mixer
 1 – Feedback (air pressure), 2 – Gas pressure behind the valve, 3 – Adjustment of maximum flow, 4 – Adjustment of minimum flow, 5 – Gas pressure before the valve

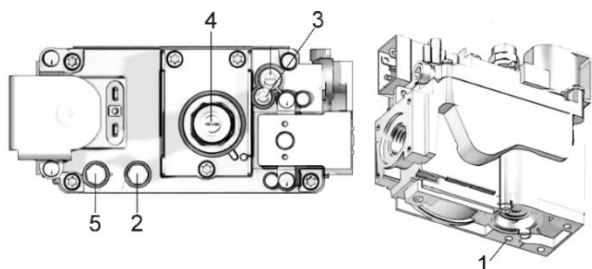


Fig. 4.2.2 – Gas valve by SIT

- 1 – Feedback (air pressure), 2 – Gas pressure behind the valve, 3 – Adjustment of maximum flow, 4 – Adjustment of minimum flow, 5 – Gas pressure before the valve

It is allowed to perform above mentioned operations if:

- the tightness of the gas system connections was checked after the boiler installation and it was confirmed with the signature and the stamp of the installer,
- the electrical installation was made in accordance with applicable regulations,
- the correctness of connections between the boiler and the chimney was checked and confirmed by a qualified chimney service.

4.3. Boiler setting – regulation of CO₂ value

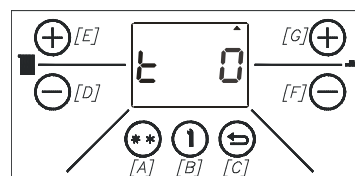
When the boiler was installed and properly connected, check the CO₂ value (read it from the exhaust gas analyzer) and compare to the values shown in the table, according to the type of operated gas. If you need to adjust the device, it is necessary to make correction by screw for maximum flow regulation marked as **3** on Fig. 4.2.1 or 4.2.2.

POWER	GAS TYPE	Pressure of supply [mbar]	Ecocondens Crystal 100			
			Min. Speed [rotation/min.]	Max. speed [rotation/min.]	Gas flow min./max. [l/h]	CO ₂ [%]
100 kW	2E-G20	20 i 13	1200 (P28 = 24)	6000 (P27 = 120)	25,5 / 181 ¹⁶	9,00 ^{10,5}
	3P-G31	37	1200 (P28 = 24)	5900 (P27 = 118)	12 / 70 ¹³	11,0 ^{10,5}
	3B/P-G30	37	1200 (P28 = 24)	5900 (P27 = 118)	10 / 53 ¹²	10,5 ^{10,5}
80 kW	2E-G20	20 i 13	1200 (P28 = 24)	4900 (P27 = 98)	25,5 / 145 ¹⁶	9,00 ^{10,5}
	3P-G31	37	1200 (P28 = 24)	4750 (P27 = 95)	12 / 56 ¹³	11,0 ^{10,5}
	3B/P-G30	37	1200 (P28 = 24)	4750 (P27 = 95)	10 / 42,5 ¹²	10,5 ^{10,5}

Table 4.3.1 – Regulation parameters for boiler

Adjustments should be made only with replacement of the gas valve. All adjustments must be carried out basing on the appliance technical data.

Switching on the service function (TEST)



In order to activate the TEST function press the **[A]_{3sec}** button. The LCD display shows the symbol "t" and a value of 0..100 indicating the boiler power (min. - max.) which can be changed using **[D]** and **[E]** buttons – change for 1% or using **[F]** button – set the min. power, using **[G]** button – set the max. power. If during operation of the TEST function the temperature on the NTC sensor of central heating exceeds 97°C the burner is turned off until the temperature drops below 81°C

Pump during the test mode works with maximum efficiency.

Use **[A]_{3sec}** button to turn off the TEST function.

Minimum power adjustment

- In the parameter programming mode, check the value of parameter P28 - Minimum fan speed (displayed value multiplied by 50), is it in accordance with data shown in Table 4.3.1.
- In the TEST mode, set the boiler power t=0 (fan operates with factory-set minimum speed).
- After starting the boiler measure the gas inlet pressure on the measuring point (Fig. 4.2.1. or 4.2.2., item 5.). The values of pressure depending on the type of gas are shown in Table 4.3.1.
- Connect the flue gas analyzer to the screw in the flue gas adapter of the boiler.
- Remove the cap from the measuring point number 4 (Fig.4.2.1. or

4.2.2).

- Use the adjusting screw number 4 (Fig.4.2.1. or 4.2.2.) set the gas flow to obtain the required composition of the flue gas listed in Table 4.3.1

Maximum power adjustment

- In the parameter programming mode, check the value of parameter P27 - Maximum fan speed (displayed value multiplied by 50), is it in accordance with data shown in Table 4.3.1.
- In the TEST mode, set the boiler power t=100 (fan operates with factory-set maximum speed with P28 Parameter).
- After starting the boiler measure the gas inlet pressure on the measuring point (Fig. 4.2.1. or 4.2.2., item 5.) The values of pressure depending on the type of gas are shown in Table 4.3.1.
- Connect the flue gas analyzer to the screw in the flue gas adapter of the boiler.
- Use the adjusting screw number 4 (Fig.4.2.1. or 4.2.2.) set the gas flow to obtain the required composition of the flue gas listed in Table 4.3.1



The data specified for gases at normal conditions (15 o C, pressure 1013 mbar), having regard to boiler efficiency - 95%. Depending on the atmospheric pressure and gas temperature, the gas consumption may differ from those listed in the table.



After setting all the test points they should be sealed and leak testing and re-seal should be done.

The boiler heat output depends on the length of the air inlet and flue gas exhaust pipes. Slightly decreases as their length increases.

4.4. Adjustment of heating and domestic water power

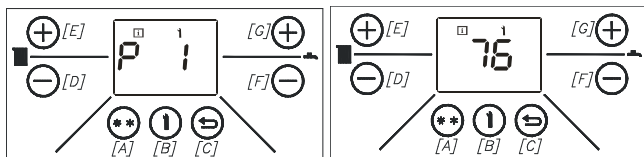
If necessary the power limitation in system, change the value of P08-power CH max. parameter or P09-power CH min. parameter. Power limitation in DHW system can only be done by connecting to the boiler the domestic hot water tank. In order to limit the power for heating the domestic water, change the P20-power DHW max. parameter or P21-power DHW min.

4.5. Controller configuration – setting of boiler parameters



Configuration of parameters can be made only by AUTHORIZED SERVICE COMPANY.

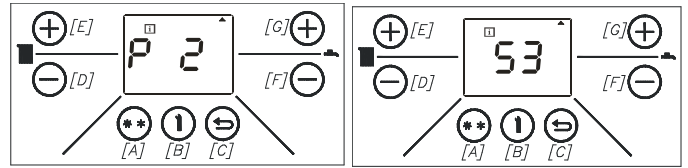
To activate parameters programming process press the [B+C]_{3sec} buttons. Accessing the configuration requires a 4-digit security password (8149). After entering the correct password on the display, there is shown number parameter, starting from 1. After one second, the parameter number is replaced by the value of the parameter. If the password is entered incorrectly, the boiler enters in stand-by mode.



Press the [E] or [D] buttons to move to the next parameter. The value of the parameter changes with [G] or [F] buttons. To save the parameter value, go to another parameter or briefly press the [B] button. The [B] button is also used to switch between the number and the parameter value. By pressing [B+C]_{3sec} the programming mode is switched off.

4.5.1. Preview of parameters value.

You can review the parameter values without the need of change. To do this, use the [B]_{3sec} button.



After starting LOCAL INSTALLATION mode, the parameter index is indicated, starting from number 1. After one second index is replaced by value of the parameter. The parameter value is updated every three seconds. Press the [E] or [D] buttons to move to the next parameter. Press the [B]_{3sec} button again to exit the parameter preview mode. The list of available parameters is shown in Table 4.5.1.1.

No	Parameter	Description	Range	Factory setting
P01	CH setting	Currently set CH temperature	20-P2 °C	40
P02	Max. CH setting	Max. CH temp. limit	20-95 °C	80
P03	CH hysteresis	Burner shutdown hysteresis	2-10 °C	3
P04	Blocking time of CH	Break between subsequent burner starts-up	0-15 min	2
P05	Min. CH time	Operating time with min. power for CH	3-10 min	2
P06	Temperature increase - CH	Rate of rise the heating temperature in the initial heating phase	0-60°C/min	4
P07	Pump rundown - CH	Pump operating time after switching off the burner in CH mode	1-30 min	5
P08	Max. power - CH	CH power limitation	P9 - 100%	100%
P09	Min. power - CH	Min. CH power specified in %	0-P8%	0%
P10	Kp coefficient for CH	-	---	4**
P11	Ki coef. for CH	-	---	228**
P12	Min. modulation - CH	Min. modulation level for the cascade boiler	20-100 %	20%**
P13	Max. burner power	Max. burner power for the cascade boiler	0-255kW	70 for 80kW 90 for 100kW
P14	Heating curve	Number of heating curve	0-10	0
P15	Heating curve shift	Parallel shift of heating curve	20-70°C	30°C
P16	DHW setting	Currently set DHW temperature	20-65°C	65°C
P17	Max. DHW setting	Specifies the maximum setting temperature for DHW	65-90°C	65°C
P18	DHW hysteresis	Hysteresis of temperature in tank	2-10°C	3°C
P19	Pump rundown-DHW	Pump rundown after end of operation in DHW mode. Does not apply to cascade pump	0-180 sec.	30 sec.
P20	Max. power - DHW	DHW power limitation	P21 - 100%	100%
P21	Min. power - DHW	Min. DHW power specified in %	0-P20%	0%
P22	Kp coef. for DHW	--	---	4**
P23	Ki coef. for DHW	--	---	228**
P24	DHW setting in tank	Unused	°C	80
P25	Additional value of setting for DHW	Added value to setting for DHW		5
P26	Time of tank overheating	Protection against frequent switching on. The time at which the overheat temperature is increased by another 5°C	min	0
P27	Max. fan rotation	Absolute maximum value of the fan speed	P28 – 255 rpm*50	according to Table 4.3.1**
P28	Min. fan rotation	Absolute minimum value of the fan speed	0-P27 rpm*50	
P29	Kp fan coef. - up	Coefficient of fan control	---	10
P30	Ki fan coef. - up		---	244
P31	Kp fan coef. - down		---	10
P32	Ki fan coef. - down		---	250
P33	Ignitron level	Percentage specified level, at which the burner is ignited	P25-P26%	20
P34	Unit type	0..127 – metric units 128..256 – imperial units		0
P35*	Min. of cascade pump	Minimum PWM signal for cascade pump	15-100%	0

P36*	Max. of cascade pump	Maximum PWM signal for cascade pump	15-100%	100%
P37*	Quantity of DHW boilers	Specifies the number of boilers operating on heating the domestic water	0 - 6	0
P38*	Antifreeze cascades - ON	Temperature on the cascade sensor to activate the antifreeze function	°C or °F	6
P39*	Antifreeze cascades - OFF	Temperature on the cascade sensor to the end of antifreeze function	°C or °F	15
P40*	Boiler switching delay	Minimum break time / operation of boiler in cascade	0-255s	20
P41*	Sampling time	PI regulation parameter		
P42*	Operation mode - OT	0-standard 1-SMILE	0 - 1	0
* Parameters recorded in the boiler display plate				
** It is recommended to leave unchanged				

Table 4.5.1 – Controller configuration parameters

No	Parameter	Unit	Description
P01	Ionization current	µA	
P02	CH supply temperature	°C	
P03	CH return temperature	°C	
P04	DW temperature	°C	
P05	Water pressure	Bar*10 ⁻¹	Pressure in CH installation
P06	Power level	%	Level of burner power
P07	Required fan speed	50 * rpm	Required fan speed
P08	Current fan speed	50 * rpm	Measured fan speed
P09	Flue gas temperature	°C	Inactive
P10*	Cascade supply temperature	°C	If the temperature sensor on the coupling is connected
P11*	Outside temperature	°C	Temperature measured by external sensor
P12*	Degree of cascade modulation	%	Current relative degree of cascade modulation
P13*	CH setting	°C	
P14*	DHW setting	°C	
P15*	Quantity of burners	---	Number of installed burners
P16*	Quantity of operating burners	---	Number of operating burners
P17*	Quantity of displays	---	Number of boiler modules
* Parameters recorded in the boiler display plate			

Table 4.5.1.1 – Boiler control parameters

5. STARTUP AND OPERATION OF THE BOILER

5.1. Initial startup of the boiler

Before turning on the boiler for use, please check

- hydraulic and flue installations are compatible with applicable law;
- ground connection has been made;
- expansion tank has sufficient capacity, appropriate to the content of water in the system;
- discharge pipe from the safety valve has been connected;
- type of gas corresponds to the gas to which the device was designed (→ name plate of the boiler);
- gas supply pressure conforms to the expected values.



After installing the boiler, checking the accuracy and tightness of its connections and preparing for operation in accordance to this instruction manual and applicable regulations, first commissioning and user training for boiler operation and safety devices may be done only by AUTHORISED FACTORY SERVICE.

Venting the system:

- Check whether the plug of boiler's automatic vent item 2.13 Fig 2.2.1.1 is loose, if not - loosen for half a turn.
- Open the valves on the supply and return from the CH system to the boiler.
- Close the gas valve at the boiler connection.
- Turn on the electrical boiler power.
- Check the system pressure (see section 4.5.1, P05 parameter). The pressure should be in the range of 1.2 ÷ 1.8bar. In case of too low

pressure, fill the installation with a filling valve mounted on the installation.

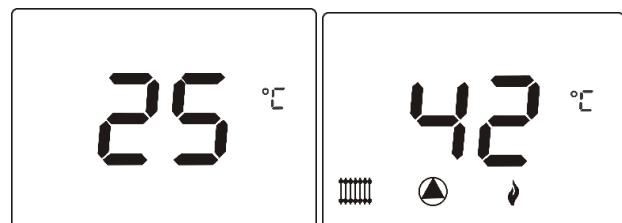
- Start the boiler in the TEST service mode, the boiler will start the circulation pump and start the ignition. Due to lack of gas after failure of ignition test, error "01" will be displayed, which will allow for continuous operation of the pump and removal of the incoming air. The boiler should remain in this state until the noise of removed air will disappear. Continue the procedure until vent the installation.
- Delete "01" error by using [B] button. Recheck the system pressure.

After venting the system:

- Check if flue pipe is not blocked and is properly connected to the flue system;
- Connect the boiler to a power source. Before starting operation, the boiler controller performs self-checking;
- Open gas valve,
- Using [E] and [D] buttons, set the required CH water temperature and accept with [B] button;
- After setting the required temperature on the display, after a few seconds the actual temperature of heating water will appear;
- If you run the boiler and still hear a noise in the installation, it is necessary to repeat priming steps in order to ensure complete elimination of air from the system;
- Check the pressure in installation, if it has been reduced - open the filling valve again until the display shows a value of 1.5 bar, and after completing the operation close the filling valve;
- Check the CO₂ value in flue gas. If the values does not correspond to the values indicated in the Table 4.3.1, the boiler should be adjusted in accordance with Section 4.3.

In the waiting state on demand the heat, the boiler displays on the screen the current temperature measured by the sensor on the power supply of the CH system, item 2.15, Fig. 2.2.1.1.

In the operating state, the display shows the current temperature on the supply with the corresponding symbols.



5.2. Operating modes

Startup mode – after turns on the power or after a manual reset of the boiler. In this mode, three-way valve and pump are supplied. If there is no require for heat within 12 hours, the boiler is reset. Such action is to prevent blocking of three-way valve and pump.

Standby mode – no heat demand.

TEST service mode – for a proper setting of the boiler, see section 4.3. In this mode, the fan speed is set between the minimum and maximum values defined by parameters P27 and P28. The three-way valve is set on CH. The burner starts at the startup power level defined by parameter P33 and then goes to the required power value. TEST mode can not be started if the controller signals an error.

Stand-by mode – mode in which the boiler is switched off, only safety functions operates:

- Antifreeze protection of the water in CH system, (the boiler switches on when the boiler water temperature drops below 6°C and heat the water until temperature reach 15°C), burner's power is set on the lowest lever,
- Antifreeze protection of the water in DHW system (the boiler switches on when the boiler water temperature – in DHW circuit – drops below 6°C and heat the water until temperature reach 15°C), burner's power is set on the lowest lever,

- Protection against possibility of blocking the pump and the three-way valve (pump and valve are switched on for about 20 seconds, at least once a daily).

CH mode – mode in which the boiler heats the CH system. Detailed described in section 2.4.1.

DHW mode – mode in which the boiler heats the DWH tank. Detailed described in section 2.4.3.

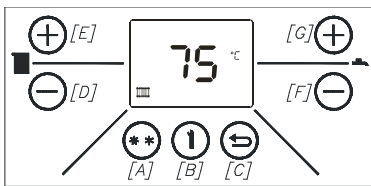
WINTER mode – the boiler performs the heat demand for both CH system and heating of domestic water. Priority is always DHW. In the boiler we can turn off the heating of domestic water function by pressing [C] button. In this mode, the boiler will ignore the heat demand from the DHW tank.

SUMMER mode – the boilers performs only heating of domestic water, and ignores the heat demand for heating in CH system.

The boiler is factory adapted for operation in CH system only, after installing to boiler the domestic hot water tank, the boiler can operate in heating the domestic water mode.

5.3. Settings

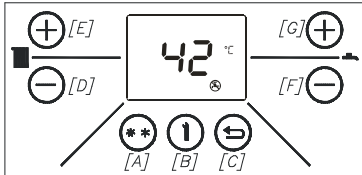
5.3.1. Change the setting of heating water



Use [D] or [E] buttons to change the heating water temperature of the CH system on the outlet from boiler. The display will flash the set temperature in degrees Celsius. The

selection must be accepted with [B] button. If the user does not accept, after about 10 sec you will leave the function without saving new value.

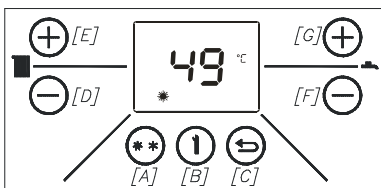
5.3.2. Change the setting of domestic water



Use [G] or [F] buttons to change the heating water temperature of the DHW system on the outlet from boiler. The display will flash the set temperature in degrees Celsius. The

selection must be accepted with [B] button. If the user does not accept, after about 10 sec you will leave the function without saving new value.

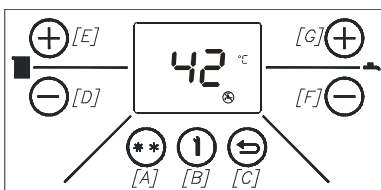
5.3.3. Switching the SUMMER / WINTER mode



Use [A] button to change WINTER mode to SUMMER mode. The symbol (W2) shown on the picture will appear on the screen. To revert to WINTER mode, use

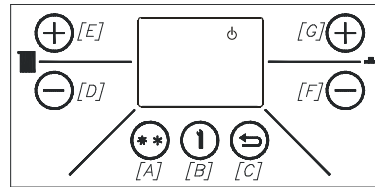
[A] button again.

5.3.4. Turn off the heating of domestic water



By using [C] button, you can turn on or turn off the heating function. Turning off the function is signaled by the symbol (W5) shown on the picture.

5.3.5. Stand-by mode



Use [A+C]_{3sec} buttons to activate this mode The symbol (W11) shown on the picture will appear on the screen. Press [B] button to activate the boiler.

5.4. Diagnosis

When the operation of the boiler will be incorrect the display shows the symbol "E" and the error number. When user intervention is required to remove the blockade of, there will be RESET displayed. If the boiler will continue to go into a blockade state an AUTHORISED SERVICE COMPANY needs to be called.

Error code	Error description	Reset required
01	No flame	R
02	Fake flame – signaling of disturbances in the flame control circuit	R
03	Activation of temperature limiter on boiler water system or activation of heat exchanger temperature limiters	R
04	-	-
05	No record of fan speed	R
06	-	-
07	Protection on exhaust outlet (2.2)	A
08	Flame control circuit error	A
09	Error of circuit of gas valve control	R
13	Remote reset error	W
15	Test of NTC sensors failed	R
16	Error of supply water NTC sensor (2.15)	R
17	Error of return water NTC sensor (2.14)	R
18	Damage of supply water NTC sensor (2.15) or return water NTC sensor (2.16)	R
21	ADC transducer error	A
25	Matching error	A
30	Closed SUPPLY CH NTC sensor (2.15)	R
31	Open SUPPLY CH NTC sensor (2.15)	R
32	Closed DHW NTC sensor	A
33	Open DHW NTC sensor	A
34	Low supply voltage	A
37	Low pressure of boiler water	A
41	Pressure transducer (2.8) – no communication	A
43	Closed RETURN CH NTC sensor (2.14)	R
44	Open RETURN CH NTC sensor (2.14)	R
45	-	-
46	-	-
47	Pressure transducer (2.8) – damaged or not connected	A
74	Temperature sensor of solar collector - closed	A
75	Temperature sensor of solar collector - open	A
76	-	-
77	-	-
78	-	-
79	-	-
80	Swapped NTC sensors of supply and return	R
81	NTC sensors error	see description
90	Internal error	
94	Internal error	see descr.
95	Error of cascade NTC sensor	see descr.
96	Error of ES outdoor temp. sensor	see descr.
97	Cascade system error	see descr.
98	Error of communication between boilers	see descr.
99	No communication CONSOLE / CONTROLLER	see descr.

Table 5.4.1 – Error codes

During displaying of each error code the pump is startup. The only exception is an error E37.

Error 01 description – Number of ignition attempts has been exhausted and no flame is detected during the safety time in any of the attempt.

The error may also indicate that the boiler water flow is too low - less than 20 dm³/min - or the water flow sensor is damaged (2.17).

Error 03 description – Heating water has reached 97°C or thermal protection of the heat exchanger (BW1) or (BW2) has been activated.

Error 07 description – Flue gas temperature is too high. Back to operation after about 10 minutes since the switching off. Check the thermal fuse. In case it is damaged - replace for new one. If not - check the wiring. Disconnect from the power supply to reset.

Error 13 description – Permissible number of faults reset has been exceeded (5 x within 15min). It is necessary to disconnect and turn on again the power again in order to remove the error.

Error 15 and 81 description – If, during standby the temperature difference on the supply temp. sensor (2.15) and return (2.14) is too high, an error E15 is displayed. If after 24 hours of error, temperature difference is still out of range, an error E81 is displayed.

Error 16 description – Each time the burner ignites, the value read by the sensor must change by at least $\pm 0.25^\circ\text{C}$. If the sensor did not read the change within 2 minutes, an E16 error is displayed.

Error 17 description – Within 24h the value of the read temperature must change by at least $\pm 0.25^\circ\text{C}$.

Error 18 description – In continuous mode, the temperature difference on each sensor is measured if there occurs a temperature change on any of the sensors above 30K/s, an error E18 is displayed. Sensors should be checked; defective one or both at once should be replaced.

Error 21 description – An internal control has identified an error of ADC transducer. Deleting a lockout will be possible if the internal tests do not show the error again. Probably, the transducer is damaged and the controller should be replaced.

Error 25 description – Software in the microprocessor and EEPROM memory are not the same. The controller should be replaced.

Error 34 description – The supply voltage has dropped below 157V (+/- 10V).

Error 37 description – It appears when the pressure in system read by the pressure sensor (2.8) is less than 0.5 bar. Check whether the system pressure is in the range of 1-1.5bar and complete the installation (if it is needed).

Error 80 description – Each time the boiler is started, the NTC supply and return sensor measures the temperature on both sensors at short intervals. If the return temperature is higher by 3°C, the time 180s is measured. If the return temperature remains higher during this time, an error E80 is displayed.

Error 94 description – The display in the control panel (2.6) has been damaged. Replace the display plate.

Error 95 description – For boilers connected in series, the temperature sensor in the supply collector (CS) is not connected or the sensor is damaged (closed/open). In the case of a single boiler, the control console does not receive a signal from the NTC supply sensor. Check the electrical connections.

Error 96 description – When the P14 parameter is set on a value other than zero, the controller does not detect the presence of the sensor (closed/open). Please check the sensor (ES) connection. If there is no sensor, change the value of P14 parameter to 0.

Error 97 description – The system of boilers connected in series in the cascade system has changed.

- The number of connected boilers has changed.
 - The sequence of boilers connection has been changed.
 - The last cascade configuration has failed.
- In order to remove the error, re-configure the cascade.

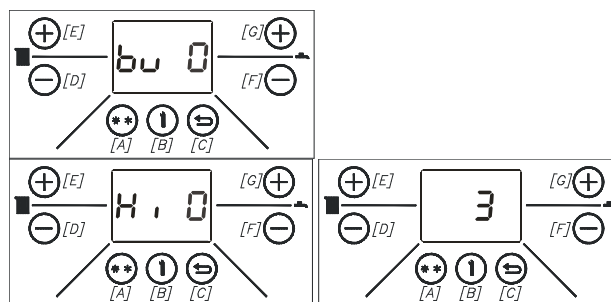
Error 98 description – Communication between boilers connected in series in the cascade system has been lost.

- The sequence of boilers connection has changed. Re-configure the cascade.
- The control system has been replaced in one of the cascade boilers. Re-configure the cascade.
- The wiring has been damaged. Check the wires for serial connection of boilers.
- There are problems with power supply of one of the boiler. Check the power supply and fuses in each boiler.
- The control console (2.6) has been damaged. Replace the display board in the control console (2.6).

Error 99 description – The display in the control console (2.6) can not communicate with the controller (2.7). Check the wiring. Replace the display board or the controller (2.7).

5.4.1. Errors history

Activation of History errors mode takes place after using **[C]_{3sec}** button. In this mode we have access to the last 8 faults. After turning on this mode, on the screen appears "bu 0" after 3 seconds. Move to the index selection screen takes place after 3 seconds or on demand with **[B]** button. The screen shows number "H i O" indicating the index of the last fault, fault indexes take values from 0 to 7. To switch between the indexes faults, use **[E]** and **[D]** buttons. The selected index after 1s. is replaced by an error code. Switch between the index and the value of the error code can be made using **[B]** button.



To complete the History errors mode use **[C]_{3sec}** button.

5.5. Antifreeze function

This function starts the pump when the temperature in CH circuit or DHW circuit drops below 8°C. If the water temperature drops to 6°C, the burner starts and heats the water until the temperature reaches 15°C. The burner's power is set at the lowest level.

5.6. Function to prevent blockage of pump and three-way valve

Pump and three-way valve are started at least once in 24 hours for about 20 seconds to eliminate the risk of blockage due to a long inactivity.

5.7. Break in operation of the boiler

- leave the boiler connected to the electricity mains;
- leave the gas valve and water valve of CH opened;
- start the Stand-by mode with **[A+C]_{3sek}** buttons.

If the boiler may stay unused for a longer period of time and the above protections will be turned off from operation you should:

- disconnect the boiler from the electric mains;
- drain the water system of the boiler and also CH system if there is possibility of freezing;
- close the valve on the water and the gas system.



In a winter time (due to the risk of freezing water in the system) the disconnection the boiler from electrical system is forbidden (if there is still water in the water system of the boiler).

Empty the boiler by means of a valve mounted inside the boiler (2.22).

6. MAINTENANCE, INSPECTIONS, CHECKING OF THE OPERATION

6.1. Inspection and maintenance



The boiler should be regularly serviced and subjected to maintenance. At least once a year it is recommended to perform a service and it should be reviewed before heating season. All service and maintenance works should be performed by an authorized person. Only original parts should be used for boiler repairs. At every service and maintenance works the tightness of the gas units and gas installation and correctness of the protective systems should be checked. The warranty does not cover above mentioned operations.

6.1.1. Preparing the boiler for service



Before each cleaning or replacement of components, ALWAYS disconnect the power supply as well as water and gas supply of boiler. The manufacturer is not liable for any damages caused by failure to follow the above recommendations.

For easier maintenance, it is recommended to remove the casing as follows.

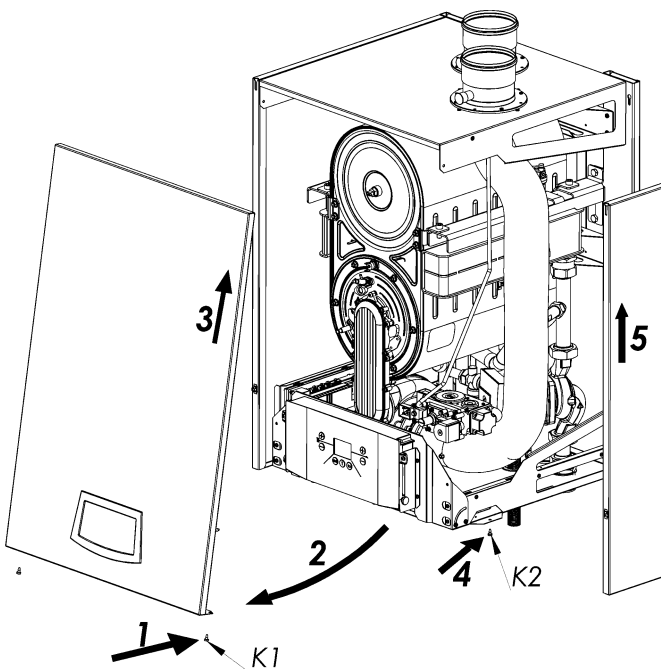


Fig. 6.1.1.1 – Removing the front cover

Dismantling the front cover:

1. Loosen the screws (K1),
2. Pull the cover behind its lower edge to release from the latches,
3. Move the cover up.

Dismantling the side cover:

4. Unscrew the screws K2.
5. Move the cover up.

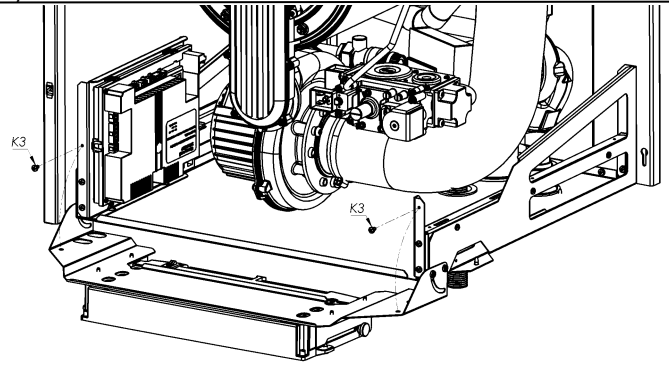


Fig. 6.1.1.2 – Deflecting the controller bracket

In order to facilitate access to the boiler's interior, the controller must be lowered together with the bracket on which it is mounted, for this purpose:

1. Unscrew the screws (K3),
2. Lower the bracket until locked.

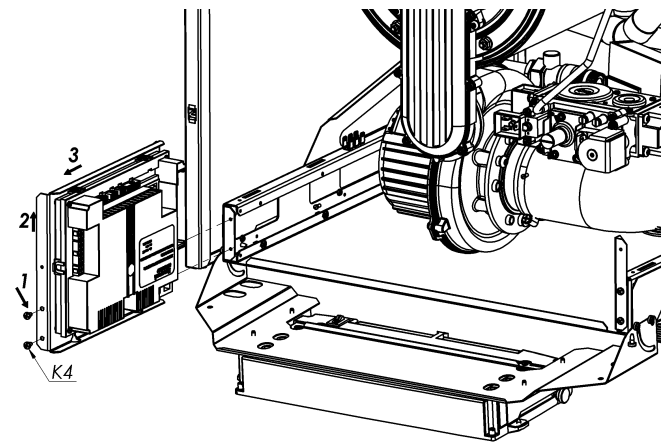


Fig. 6.1.1.3 – Dismantling of the controller

If it is necessary to remove the controller (2.7) after removing the front cover and deflecting the console, you must: Remove all wires connected to the controller.

1. Unscrew the screws (K4)
2. Move the controller up and then pull out of the boiler.

6.1.2. Maintenance of the combustion chamber, burner, ignition electrode and ionization electrode

The interior of the combustion chamber, burner surface and the electrodes should be checked by visual inspection:

- the contaminated burner and the interior of the combustion chamber may be cleaned with a brush made of plastic,
- visible on the surface of the burner gaps and deformations disqualify burner - replace the burner,
- clean the electrodes with a plastic brush,
- deformed electrodes should be replaced,
- check the condition of insulators of all electrodes,
- clean dirty insulators,
- insulators with visible damages disqualify the electrodes – to be replaced.



Dirty burner and the interior of combustion chamber mean that the boiler regulation must be done.

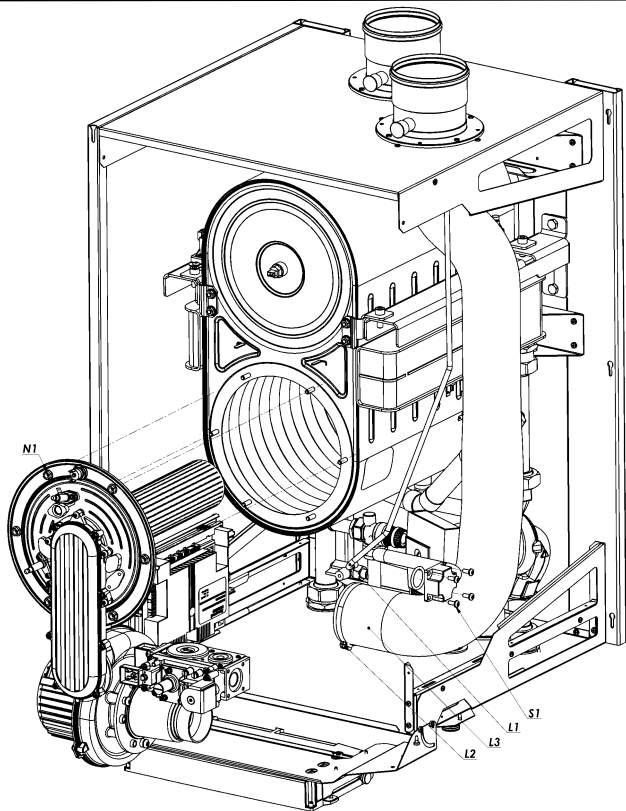


Fig. 6.1.2.1 – Deflecting the burner unit

Actions performed during the service of combustion chamber and heat exchanger:

- Stop the power supply and gas supply of boiler;
- Disconnect electrical connections of fan;
- Open the connection which connect gas valve;
- Disconnect the cables of the ignition electrode and flame control electrode;
- Loosen the band (L2) and take off the air suction pipe (L3) from the mixing unit;
- Unscrew the screws (S1) connecting the gas valve with supply piping;
- Unscrew 6 caps (N1) fixing the burner assembly to the combustion chamber;
- Remove the burner assembly being careful not to dismantle the cover of the bottom of exchanger which is made of ceramic fiber;
- Check that the burner is free of sediment and scale, and whether there has been no over-oxidation; check all holes of burner - if they are not blocked;
- Carefully clean the electrodes without changing their location in relation to the burner;
- Clean the burner cylinder with a brush (cannot be metal), being careful not to damage the ceramic fiber;
- Check the integrity of the seals (gaskets) on the lid of the burner;
- Clean the heat exchanger using domestic detergent designed for cleaning stainless steel. Spread the product with a brush on the rolls of the exchanger, taking care not to wet the coverings made of the ceramic fiber. After a few minutes, remove the sediment with a soft brush (not metal) and then remove residues with tap water;
- Remove the clamp ring, pull out the pipe to condensate drainage and wash it under running water;
- Loosen the siphon connection, remove it and continue washing under running water;
- After cleaning, reassemble the components in reverse order;
- Check that the boiler does not have any leaks causing loss of gas

6.1.3. Thermal protection of the heat exchanger

The heat exchanger is equipped with thermal protection (BW1) and (BW2) protecting against improper assembly of the exchanger. If the exchanger is mounted without ceramic thermal insulation, the protection will be activated. The limiters (BW1) and (BW2) are connected in series with the domestic water temperature limiter (2.16), in this case of activation - "E03" error occurs. Temperature of limiter activation (BW1) is 260°C. Limiter has the ability to manually reset at room temperature about 22°C. Before restarting, check the insulation on the burner collector. The fuse (BW2) will be burned at 318°C, after checking and removing the fault, replace the fuse with a new one.

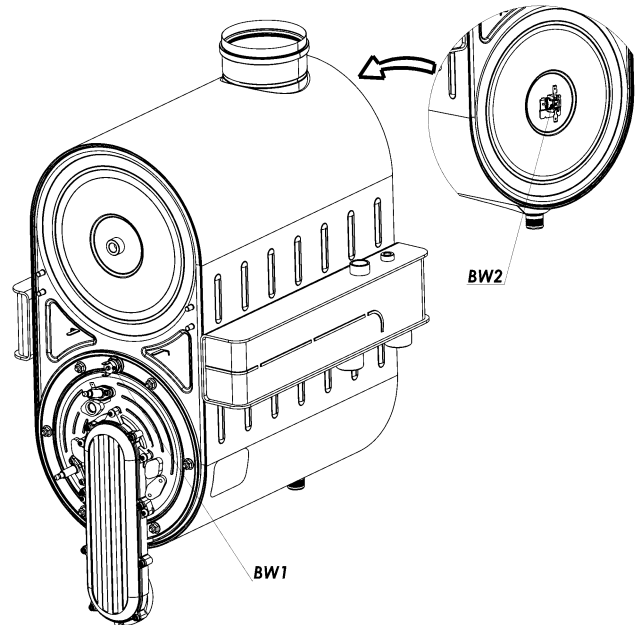


Fig. 6.1.3.1 – Temperature limiters of exchanger

6.1.4. Cleaning the condensate siphon

In order to clean the siphon:

- Unscrew the siphon (under bottom cover – see Fig. 3.7.1),
- Lifting the float, empty the siphon from remaining condensate;
- Inside the boiler, unscrew condensate drain from the siphon;
- Remove the hose connecting the siphon with heat exchanger;
- Remove the siphon set in bottom cover;
- Clean the siphon from any dirt;
- Mount the siphon;
- Check the patency of the siphon (e.g. blow the tube which drains the condensate).

To avoid the possibility of leakage of flue gas through a siphon until the condensation of the condensate in it (flooding) there is a possibility of flooding the siphon by pouring a little water.

6.2. Replacing a damaged control board in the control panel

If the control board need to be replaced follow the installation instructions attached to each board devoted as spare part.

6.2.1. Replacing the fuse in the controller

Remove the controller (2.7) according to Fig. 6.1.1.3. With the flat screwdriver, unscrew 6 catches on the controller housing, then remove the cover. There are two 3,15A fuses on the board. Find the damaged fuse and replace it with a new one. Replace the cover and mount the controller.

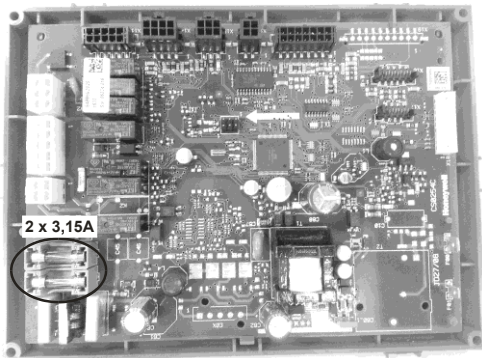


Fig. 6.2.1.1 Fuse assembly location



Inside the control console (2.6) according to Fig. 6.1.1.3, there are two additional 2.5A fuses or protecting boiler's pump.

6.3. The maintenance operations to be performed by user

User should:

- clean the water filter periodically, preferably before the heating season (should be replaced when used),
- clean the domestic water filter also in case of finding decreasing flow,
- refill the central heating system with water,
- vent the central heating system and the boiler,
- periodically clean the boiler cover with the water with detergent (avoid cleaners that cause scratches).

In order to maintain a continuous, efficient and safe operation, we recommend review of the device after each heating season by suitably qualified person.

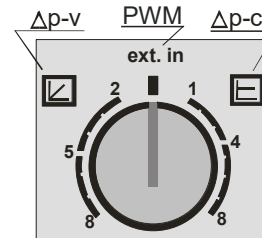
At least once a year is recommended to perform the following steps:

- checking the tightness of the gas installation, and if necessary – replacement of seals;
- checking the tightness and possible replacement of seals in the water system;
- visual inspection of the flame and the combustion chamber;
- check whether the burning is adjusted properly and eventual perform the following steps;
- take out and clean the burner from rust;
- check whether sealing of the combustion chamber is undamaged and correctly located;
- check the primary heat exchanger, and if it is necessary - clean it;
- check the condition and operation of ignition system and gas security system. If necessary - take out and clean the ignition electrode and flame control electrode from sediments, paying particular attention to maintaining appropriate distances from the burner during reassembling them;
- check the security systems of heating: safety thermostat as a protection against exceeding the limits of temperature, protection against exceeding the pressure limits;
- check whether vents are present with correct dimensions and operating according to the installed device. In this regard should be followed the provisions of appropriate standards and regulations;
- periodically check the flue system, to ensure safety and proper operation;
- check whether electrical connection is compatible with the connection described in the instruction manual;
- verify proper operation of condensate discharge installation, and equipment on the outside of the boiler, such as equipment for condensate discharge;

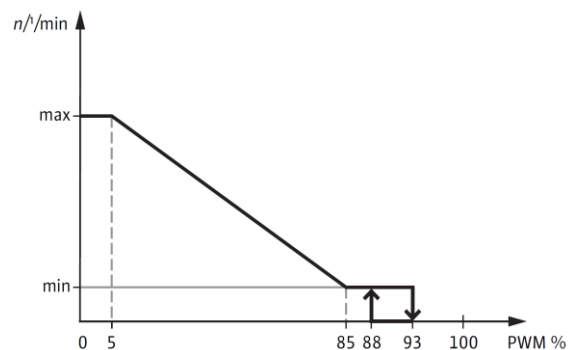
- check whether the liquid flow is not blocked and that the combustion products cannot return to internal installation.

6.4. Pump characteristic

Boiler circulation pump is factory set on PWM mode, which means that its operating characteristic is controlled by boiler's controller. Pump has also the ability to operate independently, and the operating mode selection is possible by knob in which it is equipped.



Setting in position marked as "ext.in" means that the pump is controlled by the boiler's controller with a PWM signal. Pump speed (depended on the value of the PWM signal) is shown on the below chart.



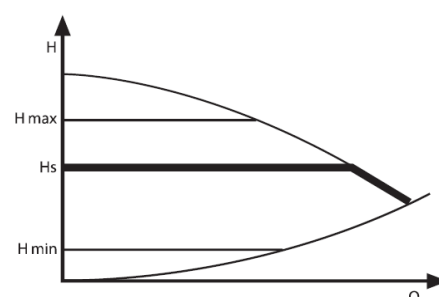
PWM signal for an external pump (from terminals marked as **CASC.PWM**) takes max value (100%) for the highest pump speed.

Depending on the mode in which boiler operates, the pump is controlled differently:

- TEST mode – max efficiency
- DHW mode – max efficiency
- Pump rundown – the last value of PWM signal
- CH mode – pump adjusts the flow rate to the heat demand by measuring the temperature difference on supply and return.

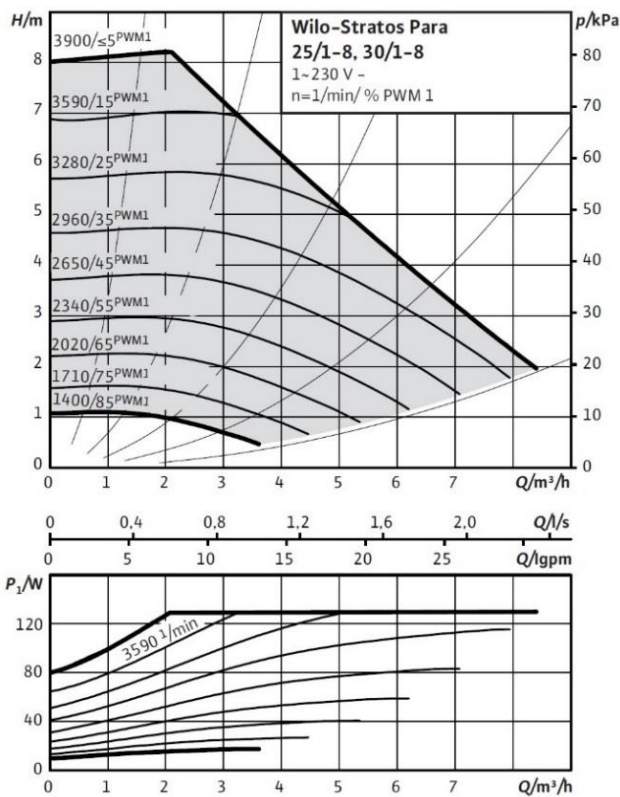
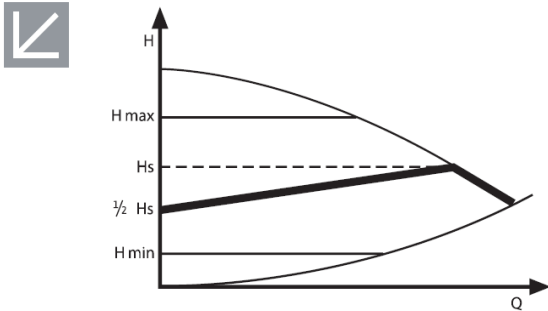
Δp-c adjustment mode

Means an autonomous operation of the pump uncontrolled by the boiler controller. Pump maintains a constant pressure difference depending on knob setting, between H_{min} and H_{max} values limited by the maximum pump characteristic.



Δp-v adjustment mode

Pump operation is not controlled by boiler’s controller, but pump’s electronics changes the differential pressure setting to be maintained linearly between HS and ½HS by the pump. The H differential pressure setting decreases or increases depending on the Q flow.



Characteristic of pump operation

6.5. Parameters of boiler components

Fan NG150, item 2.11

- Supply voltage from the controller 230V AC
- Nominal power 200 W
- Nominal current 1,3A

Pump STRATOS PARA 25-1-8, item 2.18

- Supply voltage from the controller 230V AC
- Power 8-130W
- Current 0.07-0.95A
- PWM control signal
- Frequency 100-5000Hz
- Amplitude 5V-15V

Gas unit, item 2.19

- Supply voltage from the controller 230V AC
- Nominal coil current EV1 = 45mA EV2=25mA

Pressure transducer for heating water, item 2.8

- Supply voltage from the controller 5V DC
- Output voltage 0,5 V do 2,5 V (0 bar - 4 bar)

Temperature limiter 95°C, item. 2.16

- Supply voltage from the controller SELV
- Contact

Thermal fuse, item 2.2

- Supply voltage from the controller SELV
- Activation temperature 115°C

Return NTC sensor, item 2.14 / Supply, item 2.15

- Supply voltage from the controller SELV
- 12K@25°C β=3635
9570-10130 Ω @ 30°C
2690-3030 Ω @ 65°C
1420-1680 Ω @ 85°C

Flow sensor, item 2.17

- Supply voltage from the controller 230V AC
- Current 20mA

Three-way valve (in option)

- Supply voltage from the controller 230V AC

Tank NTC sensor (in option)

- Supply voltage from the controller SELV
- 12K@25°C β=3635

Outside temperature NTC sensor (in option)

- Supply voltage from the controller SELV
- 10K@25°C β=3946

NTC sensor of temperature in supply collector

- Supply voltage from the controller SELV
- 12K@25°C β=3635

NTC sensor of temperature in collector (in option)

- Pt1000 sensor

Solar pump (in option)

- Supply voltage from the controller 230V AC

Safety valve by Caleffi, 311540 model

- PN10 nominal pressure
- Operation temperature 5÷110°C
- PED IV category
- Opening pressure 20%
- Closing pressure 20%

Diameter	Sluice Φ mm	Sluice surface cm ²	Set pressure (bar)	Opening pressure (bar)	Closing pressure (bar)	Outflow coefficient K	Sluice efficiency (W) kg/h	Max. device power kW
¾"	13	1,327	4	4,8	3,2	0,5	178,25	103,3

7. CASCADE SYSTEM

It is possible to connect boilers into cascade system. Within the cascade, up to 6 boilers can be connected. The first one functions as master (MASTER) and the rest are controlled as subordinate (SLAVE).

Integrated controller provides:

- cascade configuration
- detection of configuration and parameter settings
- control of cascade system and monitoring of boiler status
- check the additional information

7.1. Autodetection

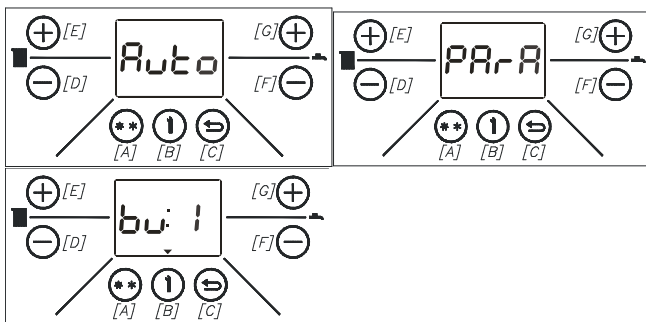
To ensure configuration of the controller and to allow the communication in network, each of the connected boilers must be subject to an autodetection process. It is started on the MASTER boiler, which sends an autodetection request to the other boilers. Make sure that the autodetection process (on each boiler) has been properly started-up, otherwise there may be some communication problems.

Autodetection should always be made when:

- The boiler is started for the first time
- The number of boilers in cascade system has changed
- The sequence of boilers connection has changed
- The parameters in MASTER boiler has been changed

The autodetection process can only be started when the boiler is in stand-by mode or error mode.

Press **[D]**_{3sec} button to start.



Flashing AUTO indicates that the autodetection process is in progress. PARa – data from the controller is read.

bu + number of burners – the number of burners is requested.

Confirm the number of burners by pressing **[B]** button.

If the autodetection process fails or an incorrect number of burners is detected within the cascade, check all connections and restart the autodetection process.

If the number of burners is not confirmed by the operator, an error F97 is displayed.

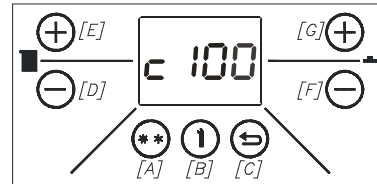
7.2. Cascade operation mode

If there is no request for heat, boilers enters a Stand-by mode. All burners are turned off, and a PWM signal with a value of 0% is sent to the cascade pump. To prevent pump blockage, the cascade pump is switched on every 24 hours for 3 seconds, and a PWM signal corresponding to [P35 parameter] is applied to the connector.

7.2.1. TEST mode for cascade

TEST mode within the cascade can be started locally for each boiler as described in section 4.3. or for the whole cascade. During the cascade TEST mode, if there is no error on any of the burners, all burners are started and the required power is divided between all the burners according to the cascade algorithm.

Use **[A+B]**_{3sec} buttons on the MASTER boiler control panel to activate TEST mode for the cascade.



The LCD display will show "c" and a value of 0..100 indicating on percentage level of boiler power in the range of min. - max.. You can change the power level with **[D]** and **[E]** buttons by 1%; use **[F]** button to set the min power, or **[G]** button to set the max power.

The PWM signal for the cascade pump is selected according to the operation algorithm of boiler controller. When the TEST mode is complete and there is no heat request is made, the countdown of pump rundown starts according to setting [Parameter P07].

To switch off the TEST mode press **[A+B]**_{3sec} button.

The mode is aborted if any error occurs.

7.2.2. Cascade operation in CH mode

Burners are started when a heat request is received from an external RT or OT controller which is connected to the control console of the MASTER boiler.

Power modulation in the cascade system is based on the value of the read temperature on the temperature sensor in a supply collector (CS) which is connected to the MASTER boiler. The CH supply temperature can be set on the MASTER boiler, via OpenTherm regulator; or in case of connecting an outdoor temperature sensor, the supply temperature is selected according to the heating curve, see section 2.4.2.

During operation, the cascade pump is controlled by PWM signal which is connected to the MASTER boiler. After heat request the pump starts, duration of pump rundown is set with [P07 Parameter]. When the temperature read by CS sensor in the supply collector is higher than the setting, boilers will not start despite heat request. If the temperature of CS sensor is lower than the set value and the heat is required, the burner of Master boiler is started and is maintained on min power for time set with [P05 Parameter]. After this time, temperature of CS sensor is the starting point for starting of power modulation according to a curve set with [P06 Parameter]. If the set value is exceeded by the hysteresis value [P03 Parameter], burners are switched off and countdown of break time in CH operation [P04 Parameter] starts.

7.2.3. Cascade operation in DHW mode

The function of DHW heating, antifreeze for domestic water and anti-legionella – are assigned to MASTER boiler.

DHW heating can be switched off via boiler panel, OpenTherm regulator (antifreeze and anti-legionella functions still active) or in case of damage the sensor in tank.

There are two possibilities of configuration the DHW heating in tank.

- Cascade – all boilers will operate on heating the DHW and CH. [P37 Parameter] should be set on 0.
- Divided – for purpose of heating the DHW will operate the selected boilers only. [P37 Parameter] determines the number of boilers that will operate on DHW heating, the rest will operate in CH system only.

7.2.3.1 Cascade configuration

All boilers connected in series into cascade can operate for purpose of DHW heating, and for purpose of performing the antifreeze function of domestic water or anti-legionella according to algorithm of cascade operation.

The tank temperature sensor (TS) must be connected to the MASTER boiler, which transmits information to the other boilers with heat demand for DHW. Boilers are modulated to obtain the set temperature for DHW.

To set the cascade configuration for heating DHW, set the value 0 for [P37 Parameter].

In DHW mode, the cascade pump is not started.

Setting the water heating setting depends on the operating mode:

- For anti-legionella function setting = $80 + [P25 \text{ Parameter}]$.
- For DHW heating in tank = setting set by user + [P25 Parameter].

In all cases the boiler is switched off after reaching 95°C.

Boilers are switched off after reaching a temperature higher by 5 degrees from set by user. Boilers will remain switched off as long as the temperature is higher than the set. To prevent frequent boiler starts-up during the first 60 seconds after first burner has been switched on, overheating temperature is increased by an additional 5 degrees. Time of 60 seconds can be extended by [P26 Parameter].

The following diagram shows connection of 3 boilers in a cascade configuration.

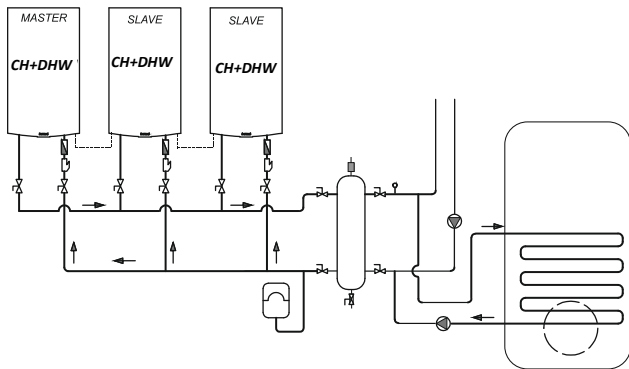


Fig. 7.2.3.1.1 – Diagram of connecting boilers for DHW needs in cascade configuration

7.2.3.2 Divided configuration

Only declared number of boilers operates in DHW heating mode and CH mode, the other boilers operate CH purpose only. The number of boilers available DHW purpose is defined by [37 Parameter]. Boilers operating in DHW system are the first boilers in serial connection, the countdown starts with MASTER boiler.

DHW heating, DHW antifreeze function and anti-legionella function are simultaneously performed by all boilers which are declared for DHW heating. In DHW heating mode, the boilers available for DHW are start-up at the same time and each of them is controlled independently of the set value that is declared. In case of anti-legionella function, all boilers receive the operate demand at the highest setting.

Each boiler individually controls the temperature (so as not to exceed the set), the pump and the three-way valve.

If only one three-way valve is used, it can be connected to any of the boilers which performs the DHW heating function. However, it is recommended to connect to the MASTER boiler.

Water heating mode in CH system can be interrupted by DHW heat request. After heating the DHW and the pump rundown, the boilers are ready for operation in CH system.

Diagram of connecting 3 boilers, two of which are intended for heating DHW. One three-way valve is used.

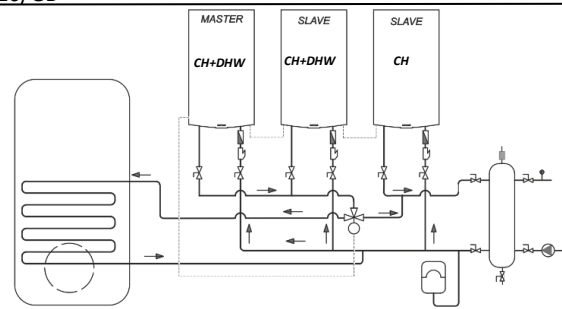


Fig. 7.2.3.2.1 – Diagram of connecting boilers for DHW needs in divided configuration with one three-way valve.

Diagram of connecting 4 boilers, two of which are intended for heating DHW. Each boiler is equipped with independent three-way valve.

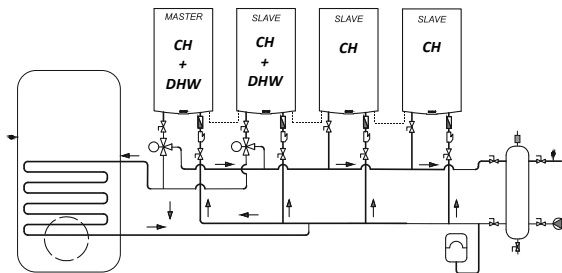


Fig. 7.2.3.2.2 – Diagram of connecting boilers for DHW needs in divided configuration with independent three-way valves.

7.3. Algorithm of cascade operation

Available power for the cascade system is contained between minimum power of 1 boiler and a boiler maximum power multiplied by the number of installed boilers.

The power for individual boilers is allocated in such way to use as many boilers as possible. Each boiler has the same maximum power determined by [P13 Parameter] and the same modulation level [P12 Parameter]. The number of active boilers is selected by dividing the demanded power by the minimum power set for a single boiler.

The number of boilers which can operate is limited by the number of available boilers. Boilers are available for operation if they do not have any faults and are not used for DHW heating in a divided system and their pumps have already completed the rundown. The power for individual boilers is evenly distributed and selected by dividing the required power by the number of boilers currently on.

To avoid the frequent switching of the boilers (on or off), [P40 Parameter] determines the time after which the boiler is switched on or off within the cascade.

In order to use each boiler in similar stages during the period of use, the cascade control performs rotation between the boilers that are activated as first. After each heat demand in the next boiler, another boiler will be started as the first one. If the heat demand lasts more than 24 hours, boilers will automatically rotate.

At the beginning the system checks the number of operating burners and compares them to the quantity that should be switched on.

When the power demand increases, the availability of boilers is checked. According to the clockwise rotation and to the principle of rotation right after the first burner, the individual boilers are checked. If the boiler is not turned on and is available, it is switched on; the process continues until the required number of boilers is started.

If the power demand decreases and boilers are switched off, the availability of boilers is checked counter-clockwise from the first boiler in accordance with the rotation principle.

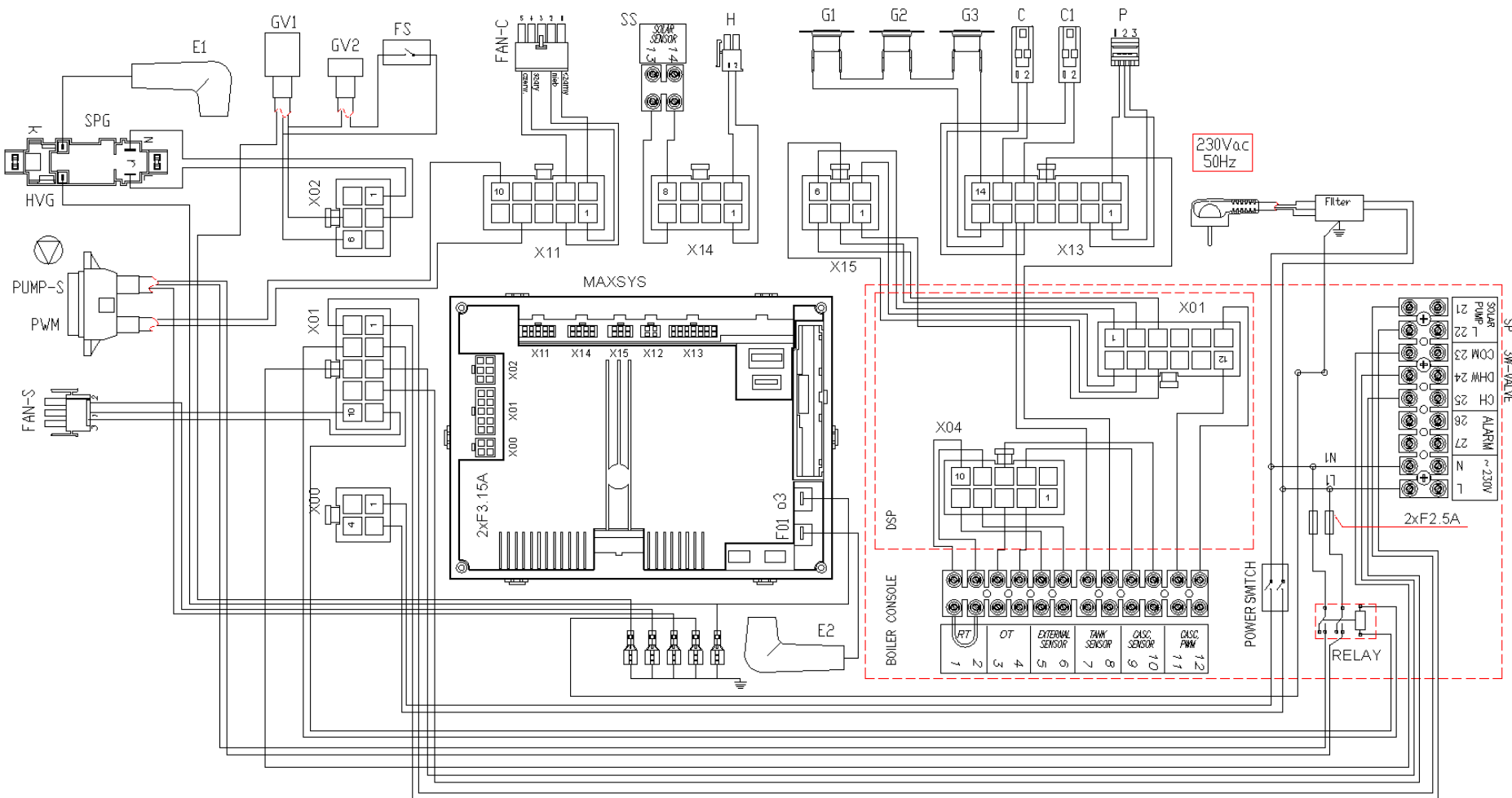
In case of an error in any boiler, the cascade system continues operate, but the boiler with an error is skipped to meet the heat demand. This applies to both slave and master boilers.

TECHNICAL DATA

Parameter	Unit	Ecocondens 100	Ecocondens 80
Energy parameters			
Nominal boiler thermal power at 80/60°C (modulated)	kW	17-100	17-80
Nominal boiler thermal power at 50/30°C (modulated)	kW	19 – 110	19-88
Nominal heat load	kW	18 – 103	18-82
The efficiency of the boiler at nominal load and average heating water temperature 70°C	%	97	
The efficiency of the boiler at partial load and return water temperature 30°C	%	107	
Modulation range	%	17 – 100	21 – 100
Gas category	---	II _{2E3P} ; II _{2E3B/P}	
Gas consumption ¹⁾			
natural gas : 2E-G20 – 20mbar	m ³ / h	6,5	5,6
natural gas: 2E-G20 – 13mbar	m ³ / h	6,5	5,6
liquefied gas : 3P-G31 – 37mbar	m ³ / h	2,5 (4,7)	2,2 (4,1)
liquefied gas : 3B/P-G30 – 30mbar	m ³ / h	1,9 (4,8)	1,6 (4,2)
¹⁾ Consumption of different types of gases are given for reference gases in the reference conditions (dry gas 15°C, pressure 1013 mbar) with 107% of the efficiency of the boiler and partial load (arithmetic mean of min and max load) at return water temperature of 30°C.			
Nominal kinetic pressure in front of the boiler for gas:			
2E-G20	Pa (mbar)	2000 (20)	
2E-G20		1300 (13)	
3P-G31		3700 (37)	
3B/P-G30		3000 (30)	
Max temperature (central heating)	°C	80	
Standard / reduced adjustable temperature	°C	20 ÷ 80	
Pump head (at flow = 0 m ³ /h)	kPa (bar)	80 (0,8)	
Environmental protection			
Emission of NO _x (natural gas)	Class	Class NO _x – 6	
Emissions of nitrogen oxides	mg/kWh	≤ 50	
The pH of the condensate (natural gas)		5	
Max. amount of condensate (natural gas)	l/h	15	12
Hydraulic parameters			
Hydraulic resistance of the boiler at the heating water flow rate 10 dm ³ /min	kPa (mbar)		
Operating pressure	MPa (bar)	0,4 (4)	
Amount of water in the boiler	l	10	
Electric parameters			
Type and supply voltage	V	~ 230 ±10%/ 50Hz	
Degree of protection		IPX4D	
Integrated fuse	A	3,15	
Power consumption	W	350	
Type of flame sensor		ionization	
Parameters of flue gas			
Type of flue gas-air installation (according to PN-EN 483)	---	B ₂₃ , C ₁₃ , C ₃₃ , C ₄₃ , C ₆₃	
Max. flue gas flow	kg/h	157	120
Min. flue gas flow	kg/h	32	
Max. flue gas temperature / limiter temperature	°C	85 / 115	
Min. flue gas temperature	°C	40	
Mounting dimensions			
Mounting dimensions	mm	Fig. 3.3.1	
Connection to the chimney duct	mm	ø 100	
Connection of heating water (CH) -- gas	inch	G5/4" -- G1"	
Dimensions (width x height x depth)	mm	540 x 810 x 545	
Boiler weight	kg	84	
Parameters required by Regulation 813/2013			
Efficiency:			
- η ₄	%	87	
- η ₁		95	
Sound power level L _{WA}	dB	65	62

The manufacturer reserves the right to make changes in the construction of the boiler, which are not mentioned herein and have no influence on the technical and functional characteristics of the product.

Diagram of the electrical connections



SPG – Spark generator
E1 – Ignition electrode
E2 – Ionization electrode
PUMP-S – Pump supply
PWM – PWM pump control
FAN-S – Fan supply
FAN-C – Fan control

GV1 – Gas valve coil
GV2 – Gas valve coil
FS – Water flow sensor in CH
H – Flue gas temperature limiter
G1 – Protection against heat exchanger overheating
G2 – Temperature limiter on the supply
G3 – Protection against heat exchanger overheating

c – NTC temperature sensor on the supply
c1 – NTC temperature sensor on the return
p – pressure transducer
RELAY – Relay of the pump (5A)
2xF2.5A – Fuses in control panel
2xF3.15A – Fuses in controller

External connections:
ESOLAR PUMP (SP) – solar pump
3W-VALVE – three-way valve
ALARM – Error information connector
RT – Temperature regulator
OT – OpenTherm regulator
EXTERNAL SENSOR – Outdoor temperature sensor
TANK SENSOR – Tank temperature sensor
CASC. SENSOR – Temperature sensor in the collector
CASC. PWM – PWM signal for cascade pump

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