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Manual for pyrolytic boiler

MAKAK

Dear customer,

Thank you for purchasing pyrolytic boiler MAKAK and the trust you have put in KOVARSON s.r.o.

The boiler you have purchased has been comprehensively tested by our development department and we believe that you will be satisfied with our product. To avoid any problems, we advise you to read carefully the installation manual of the boiler, before you start using it.

If you have any questions, please do not hesitate to contact our service engineers who will help you with your inquiries and always resolve your issue quickly.

Comfortable heating by

KOVARSON s.r.o.

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1) Boiler application and benefits

Czech boiler MAKAK is designed for economical and ecological heating of family houses, business premises and medium – sized objects, including the ability to heat the water.

2) Boiler description

2.1 Boiler construction

The boiler is based on the principle of two-stage combustion at a high temperature during a process is a wood gasification followed by combustion flue gases with an exhaust fan which exhausts gases from the boiler.

Boiler MAKAK is welded boiler plate of high quality. The upper internal part of the boiler consists of a fuel hopper, which is at the bottom equipped with a heatproof pipe fitting having an elongated hole for the passage of gases. In the space below the fitting is a burn-out area and below that is an ashtray. At the rear of the vertical flue gas heat exchanger which is in the upper part of the collecting channel through which cold gases coming into the chimney.

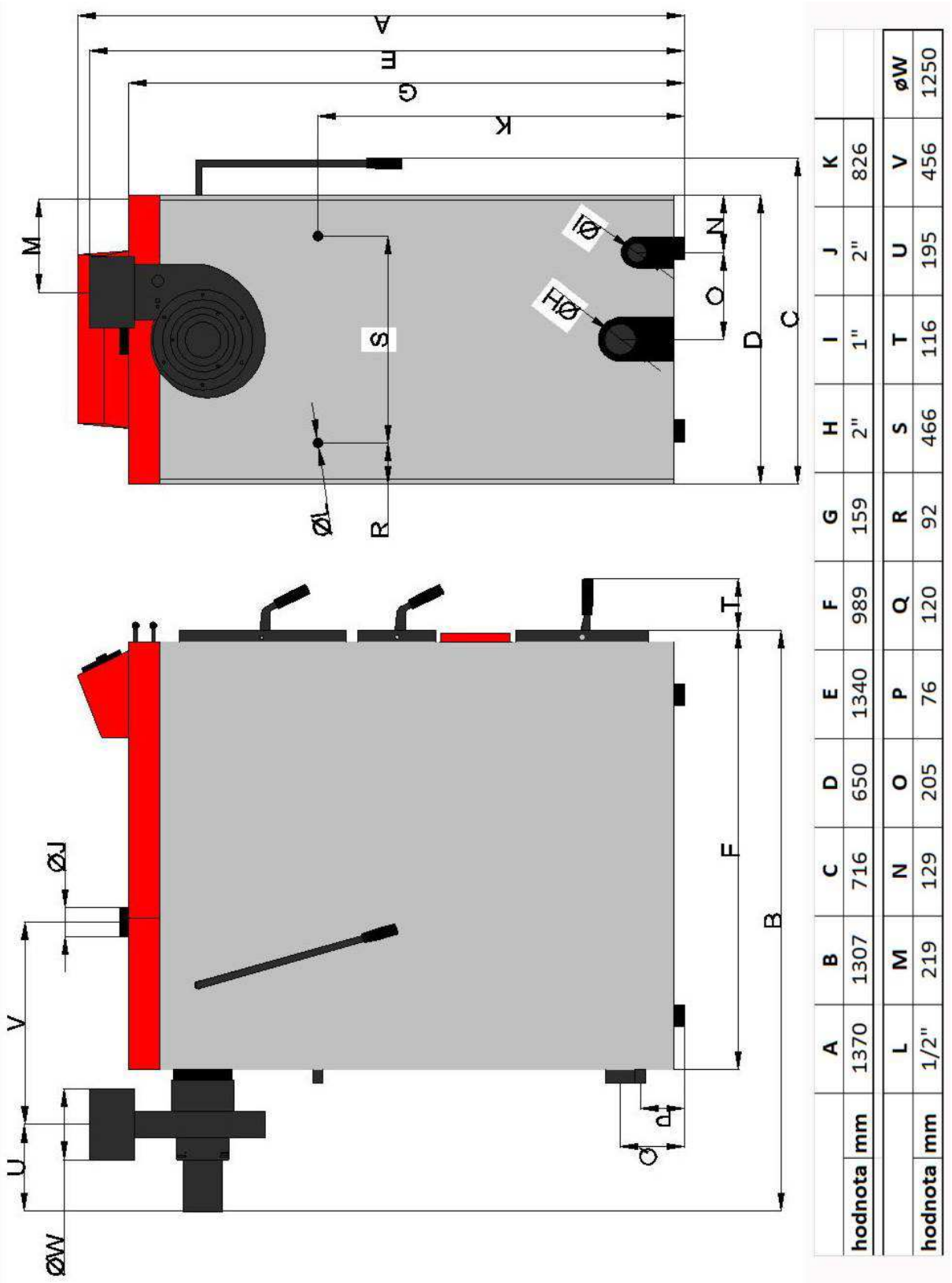
Most strongly stressed part of the boiler by a high temperature, corrosive gases, acids and condensates is the upper chamber, which is equipped with stainless steel inserts, which protects the combustion chamber of the boiler and increases the durability of the boiler.

The inner part of the boiler is made of sheet metal with a thickness of 6mm, flue gas heat exchanger at the back of the boiler is constructed by 5-exchanger tubes with inner diameter of 6mm. The boiler has double casing, the inner part is made of 6 mm high quality steel and any areas which might be in contact with the flame are reinforced by 8mm plate. The outer part of the boiler is made from metal sheet 4mm.

In front of the boiler are upper stoking door, middle cleaning (ignition) door and bottom door for the ash.

On the back of top boiler cover is a removable casing under which you will find cleaning access for flue gas chamber. On the side of the boiler is located a handle for cleaning turbulators.

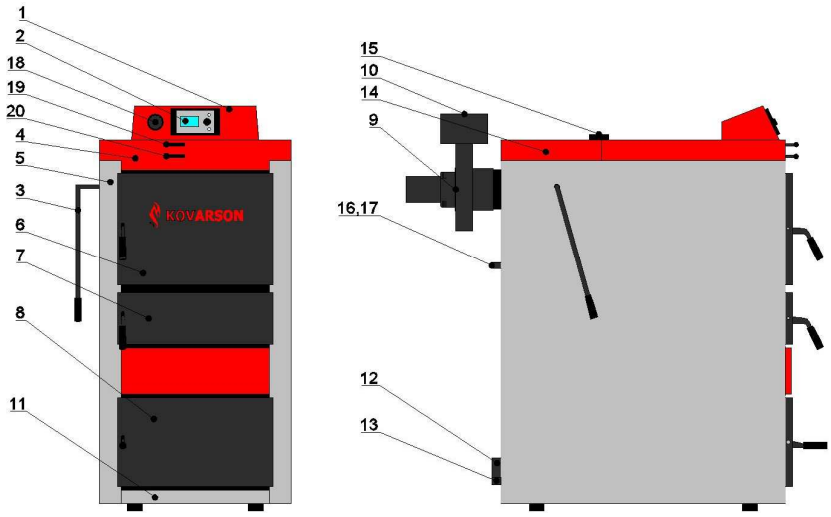
The body is insulated with mineral wool 40mm thick and cover by the metalling.



	A	B	C	D	E	F	G	H	I	J	K
hodnota mm	1370	1307	716	650	1340	989	159	2"	1"	2"	826

	L	M	N	O	P	Q	R	S	T	U	V	øW
hodnota mm	1/2"	219	129	205	76	120	92	466	116	195	456	1250

Pic. No.1 Main dimension of boiler



Pic.No.2 Main parts of boiler

1) panel for control unit
2) control unit
3) handle for cleaning
4) upper casing of boiler
5) side casing of boiler
6) stoking door
7) cleaning door
8) ash door
9) exhaust fan
10) flue outlet
11) back casing of the boiler
12) heating water inlet
13) drain valve
14) top cover for cleaning the exchanger
15) heating water output
16) cooling loop, connection to the water order
17) cooling loop, connection to waste
18) intake of primary and secondary air
19)regulation of primary air
20)regulation of secondary air

2.2 Function parts of boiler

Filling chamber – here is the primary combustion (gasification) process and it also serves as the fuel hopper.

Refractory concrete fitted with nozzle – intake of secondary air to the nozzle.

Post - combustion area – there is a secondary combustion process and area which serves for the collection of ash.

Main tube exchanger – transmitting the heat from the flue gases to heated water.

Fan – blows the air which is required for the combustion process, divided into:

a) **Primary –** air intake to the filling chamber supports the primary combustion.
b) **Secondary–** air intake into the nozzle is mixed with the woodgas.

Antismoke flap – system using a flap which draws smoke when you open the filling door.

Control unit – regulates the amount of air using the fan speed control, regulates the efficiency of the boiler on the basis of the output temperatures. Controls pump and mixing valve + it can also monitoring the storage tank.

Heatexchanger turbulators – additional device, which is located in the rear exchanger tubes. Turbulators increasing efficiency and simplify cleaning of the boiler.

Cooling loop – The loop should be permanently connected to a water order and to the waste. This system is monitoring a temperature using a bimetallic sensor to prevent overheating of the boiler. In case that the boiler is overheated system is able to cool him quickly.

2.3 Boiler accesories

The boiler is delivered with the following accessories:

Steel brush	1pc	Flange	2pc	Filling valve	1pc
Scraper	1pc	Manual for operating	1pc		
Exhaust fan	1pc	Manual SPARK	1pc		

3) Technical parameters

Chart, No.1 – Dimensions and technical parameters of the boiler

Boiler type		MAKAK 20	MAKAK 25	MAKAK 30	MAKAK 35	MAKAK 40
Wood efficiency	%	88,53	89,51	90,63	91,75	92,06
Weight	kg	450				
Water volume	l	120				
Flue diameter	mm	156				
Combustion chamber volume	dm^3	135,5				
Combustion chamber depth	mm	550				
Boilers dimensions	mm	See Figure 1				
Size of hopper loading window	mm	440x300				
EN 303-5 boiler class	-	4	5	5	5	5
Maximum operating excess water pressure	bar	2				
Tested operating excess water pressure tolerance	bar	2				
Recommended operating tem. of heating water	°C	50 - 85				
Recommended operating temp. of heating water	°C	70 - 90				
Minimum temperature of returning wate	°C	55				
Noise level	dB	< 60				
Chimney draft during the exhaust fan running at a rated power	Pa	20				
Boiler connections - water heating, return water	DN	G 2"				
Filling, Draining	DN	G 1"				
Cooling loop	DN	G 1/2"				
Supply voltage	V	230				
Electric load	W	60				
International protection	-	IP20				

Chart, No.2 Thermal technical parameters of the boiler (wood combustion)

Boiler model		**MAKAK 20**	**MAKAK 25**	**MAKAK 30**	**MAKAK 35**	**MAKAK 40**
Nominal output	kW	20	25	30	35	39
Minimum output	kW	-	-	-	-	-
Consumption of fuel at nominal outpu	$kg.h^{-1}$	5,575	6,648	7,879	9,110	9,446
Burning time at nominal output	h	2,17	2,16	2,16	2,15	2,15
Temperature of emissions	°C	86,6	111	135,4	160	159,7
Volume of emissions output at nominal level	$kg.s^{-1}$	0,0181	0,0201	0,0224	0,0246	0,0253

4) Recommended fuel

It is recommended to burn wood in maximum lengths according to the parameters of the boiler. It is neccesary to burn the wood with a maximal dampness up to 20%. When damp wood is burned it releases the water that condenses on the walls of a body and chimney. This combustion reduces the durability and performance of the boiler due to the formation of aggressive substances.

The vertical axis shows the calorific value of wood kWh \ kg and the horizontal axis shows percentually the water content in wood. Moreover the comparison between coniferous and deciduous trees.

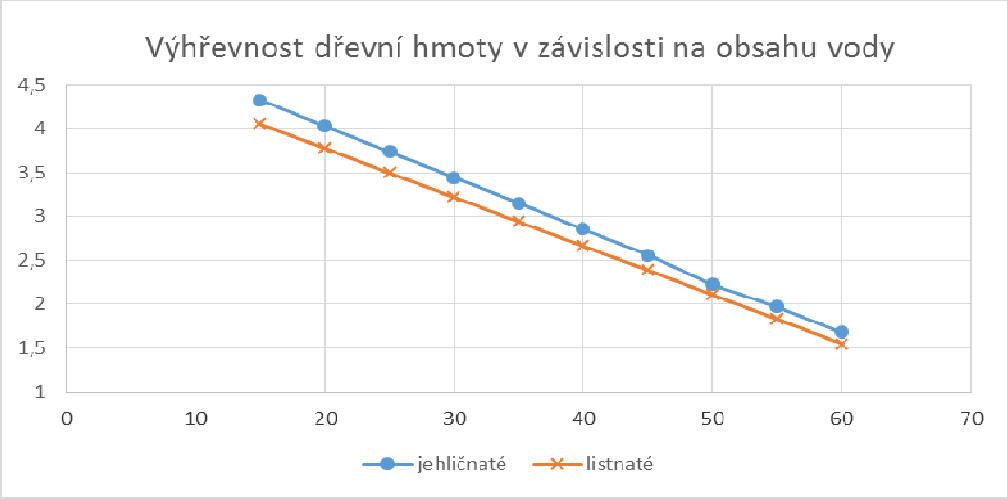


FIG. no 3 Calorific value of wood material in dependence on the water content

5) Boiler installation

When handling and storing of the product you must be careful to avoid any breaches of boiler.

The boiler has to be installed by heating specialists with a valid license for the installation and maintenance of such equipment. The installation project must be undertaken according to valid regulations. Before the installation, check the completeness and integrity of the boiler package, if they are correct with the data according to the product label.

Before commissioning a boiler, it meets the requirements of CSN. (e.g. chimney revision, approval of the boiler by chimney office, heating system project, heating test, etc.)

The main condition for boiler installation is the involvement of the mixing valve in the boiler circuit and wiring of the cooling loop. If there will be no cooling loop connected, it is necessary to ensure heat dissipation during a blackout which will block the pump and the mixing valve actuator.

Before the heating season it is necessary to check the water pressure and bleed the heating system.

The manufacturer is not responsible for demages of the boiler caused by errorneous installation!!!

5.1 Rules and Regulations

*The solid fuel boiler has to be installed by heating specialists with a valid license for the installation and maintenance of such equipment. The installation project must be undertaken according to valid.

The heating system must be filled with water which meets ČSN 07 7401 requirements and, in particular, its mineral content must not exceed the maximum parameters.

Doporučené hodnoty		
Hardness	mmol/l	1
Ca2+	mmol/l	0,3
Total Fe & Mn concetration	mg/l	(0,3)*

CAUTION!!! The manufacturer does not recommend the use of antifreeze.

a) About the heating system

ČSN 06 0310	Heating systems in buildings - Design and installation
ČSN 06 0830	Heating systems in buildings – Safety equipment
ČSN 07 7401	Water and steam for thermal energy equipment with working pressure up to 8 MPa.
ČSN EN 303-5	CH boilers – Part 5: CH boilers for solid fuel with manual or automatic delivery, nominal heat output of up to 300 kW – Terminology, requirements, testing and marking.

b) About the chimney

ČSN 73 4201	Designing chimneys and flues.

c) Due to fire regulations

ČSN 06 1008	Fire safety for heating equipment.
ČSN 73 0802	Fire safety in building – nonproductive – objects.
ČSN 73 0823	Technical fire properties of materials. Flammability rank of building materials.

d) The power supply

ČSN 33 0165	Electrical regulations. Marking of wires with colours or numbers. The implementing regulations.
ČSN 33 1500	Electro-technical regulations. Testing of electrical devices.
ČSN 33 2000-3	Electro-technical regulations. Electrical devices. Part 3: Declaration of the basic characteristics.
ČSN 33 2000-4-41	Electrical devices: Part 4: Safety Section 41: Protection against electric shock.
ČSN 33 2000-5-51	Electro-technical regulations. Construction of electrical devices.
ČSN 33 2130	Electro-technical regulations. Indoor electrical wiring.
ČSN 33 2180	Electro-technical regulations. Connection of electrical devices and appliances.
ČSN 34 0350	Electro-technical regulations. Regulations for mobile connections and cable placement.
ČSN EN 60 079-10	Electro-technical regulations. Regulations for electrical equipment in potentially explosive areas with flammable gases and vapours.
ČSN EN 60 079-14	Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines).
ČSN EN 60 252-1	AC motor capacitors - Part 1: General - Performance, testing and rating - Safety requirements - Guide for installation and operation.
ČSN EN 60 335-12	Electric appliances for household and similar purposes - Safety - Part 1: General requirements.
ČSN EN 60 335-2-102:	Electric appliances for household and similar purposes Safety - Part 2-102: Specific requirements for appliances burning gas, oil and solid fuel and containing electrical connections.
ČSN EN 60 445	Basic and safety principles for man-machine interface, marking and identification.
ČSN EN 60 446	Basic and safety principles for man-machine systems – Identification of conductors by colours or numbers.

ČSN EN 61000 – 6 – 3 EMC Part 6-3: Generic standards - Emission - for residential,

commercial and light industry.
ČSN EN 61000 -3 – 2 EMC - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16).
ČSN EN 61000 – 3 –3 EMC – Part 3 - Limits - Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for devices with nominal current <16A.

e) About the DHW heating system

ČSN 06 0320 Heating systems inside buildings – DHW set-up – Design and planning.
ČSN 06 0830 Heating systems inside buildings – Safety equipment.
ČSN 73 6660 Indoor water systems

5.2 Placement options

The boiler can be installed and operated in a simple environment AA5/AB5 according to CSN 33 2000-3. The boiler is equipped with a portable power cable and plug. The boiler must be in compliance with EN 60 335-1 ed. 2 Article 7.12.4, positioned so that the plug is accessible.

The installation and use of the boiler must comply with all ČSN 06 1008 requirements.

Location of the boiler in conformance to fire regulations:

1. Positioning on a floor made of non-combustible material:

- The boiler has to be set on a non-combustible insulating mat exceeding the dimensions of the boiler by 20 mm on all sides.
- If the boiler is located in the basement, it is recommended to placed the boiler on a base at least 50 mm high. The boiler must be established at horizontally level; any unevenness in the subsctructure is eliminated using the screws under the fuel hopper.

2. Safe distance from combustible materials:

- When installing and operating the boiler, keep a safety distance of 200 mm from combustible materials
- For easily flammable materials that burn quickly and by themselves even after removal of the ignition source (such as paper, cardboard, asphalt and tar paper, wood and fibreboard, plastics, floor coverings) the safe distance is doubled to 400 mm
- The safety distance must be doubled to 400 mm also when the reaction to fire is not proven

Boiler positioning with regard to the necessary handling space:

- In the front of the boiler must be left minimally 1000 mm space for handling.
- The minimum distance between the rear of the boiler and the wall is 400 mm.
- The minimum distance from the side wall of the boiler is 100 mm.
- Above the boiler minimally 450 mm.

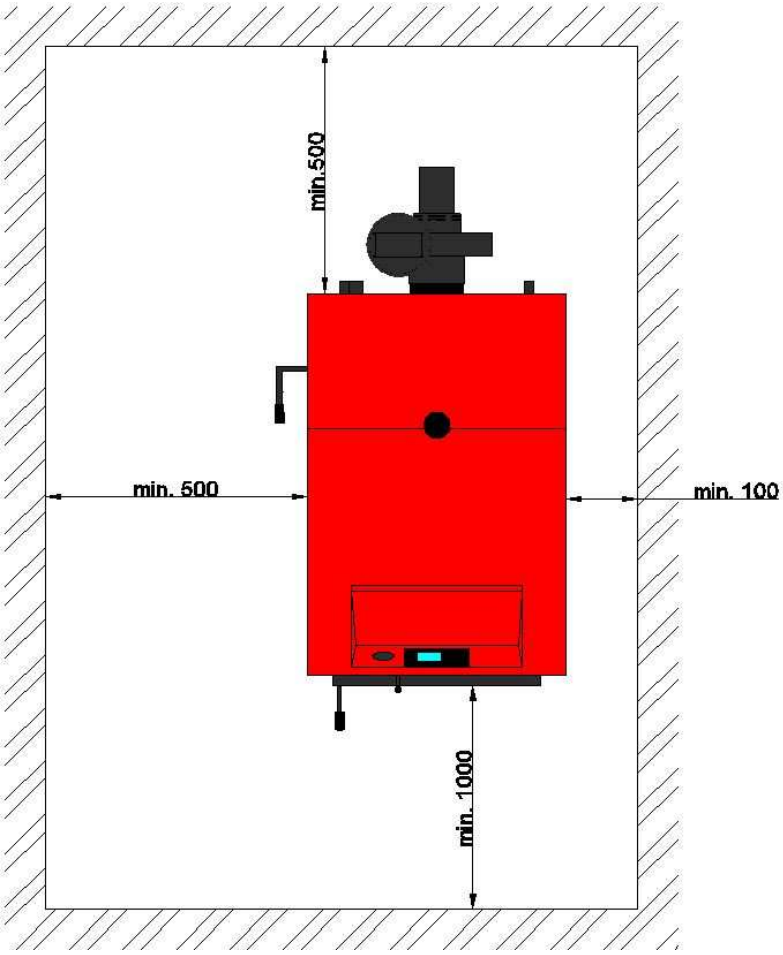
Boiler positioning with respect to the mains:

- The boiler must be positioned so that the plug in the socket (230 V/50 Hz) is always accessible

Location of fuel:

- For proper combustion, it is necessary to use dry fuel. Manufacturer recommended fuel stored in cellars or at least sheltered
- It is impossible to store fuel for the boiler or next to the boiler at a distance of less than 400 mm
- The manufacturer recommends to keep the distance between the boiler and fuel minimaly 1000 mm or store the fuel in a different room than the installed boiler

Connecting to the heating system must be made by a heating specialist with a valid license.



Pic. n.4 Location of the boiler

5.3 Connecting the boiler to the chimney and outlet of combustion products

The flue must lead to a chimney flue with a minimal possible lenght. The flue must rise towards the vent, in no case shall fall. The flue must be mechanically strong, tight passes and the accessible for cleaning. The inner diameter of the flue shall not be greater than the diameter of the flue and it is forbidden to narrows the flue toward the chimney. The use of large quantities of knees is not recommended.

Methods of implementation flues are given in ČSN 06 1008.

The chimney must be designed so that the chimney flue develop a sufficient draft (referred to the technical parameters of the boiler) and led the flue gases into the atmosphere. The manufacturer recommends the chimney inset.

If the chimney draft is big or small it is necessary to install the draft regulator.

5.4 Air supply to the boiler

In the room where the boiler is installed, it must be ensured continuous supply of air for combustion and ventilation. If it is not provided, it is necessary to ensure air vent from the outside according to the standards.

5.5 Connecting the boiler to the heating system

The boiler is connected to heating system with 2" mouthpiece. For the filling and draining of the boiler there is located an inlet (drain) valve beneath the return water. Filling and draining should be performed using a hose. The heating system must be filled with water that meets the requirements of ČSN 07 7401.

The boiler must be connected to the circuit so the temperature of the return water was above 55°C. This can be achieved by mechanical or controlled mixing valve, which is controlled by the control unit. If the minimum temperature of the return water is not reached, manufacturer can not guarantee the required service life of the boiler.

Boiler construction allows the connection of the boiler with a maximum pressure according to the technical parameters of the boiler.

Connection the cooling loop as it is described in chapter 5.6

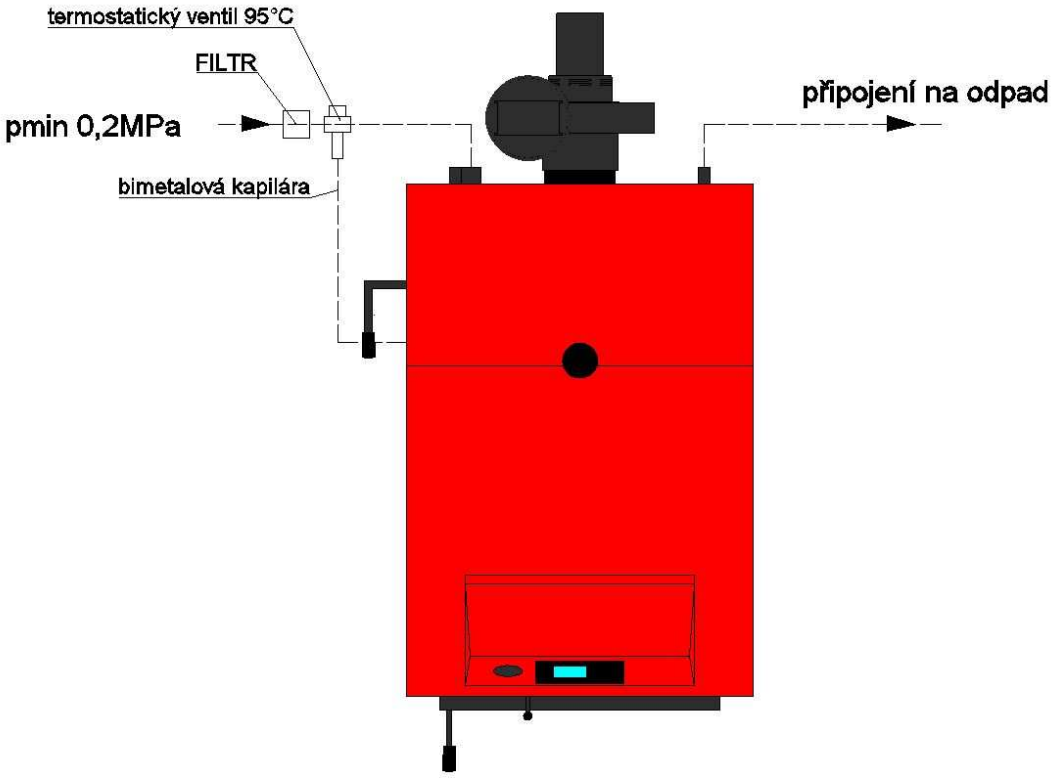
5.6 The cooling loop connection

*Connection of the cooling loop (unless otherwise stated) is performed according to pic. n.5. On one of two 1/2" outlet serves for the water main connect and the other one 1/2" outlet serves for joining runoff into drains.

In case the boiler is overheated (temperature above 95°C) the thermostatic valve will automatically open. This valve is installed on cold water supply pipe. When the overheating alarm turns on, the fan will stop and boiler remains in stable heat mode. Bimetallic sensor which senses temperature is placed in the boiler sump. After the end of the cooling proces, is the boiler temperature lower by 15°C then water flow will stop automatically.

This protection system only works reliably provided a constant supply of pressurized water from the water main. Due to a mechanical protection which serves mainly for situations as a power failure. It is necessary to be careful while connecting it to a water system!

Connect the cooling loop is the only condition for safe operation of the boiler. Connections must be performed only by authorized personnel.



Pic. No. 5 Cooling loop

5.7 Connection to the mains

The power supply 230 V / 50 Hz with boiler attached by a cord and plug. The plugging must comply with CSN. The plug must always be in reach. Unauthorized intervention in the electrical installation of the boiler will cause damage and can also cause fatal injuries.

5.8 Installation of boiler parts

Situated the boiler on the substructure (pad) into a horizontal position.

5.8.1 Montáž opláštění kotle

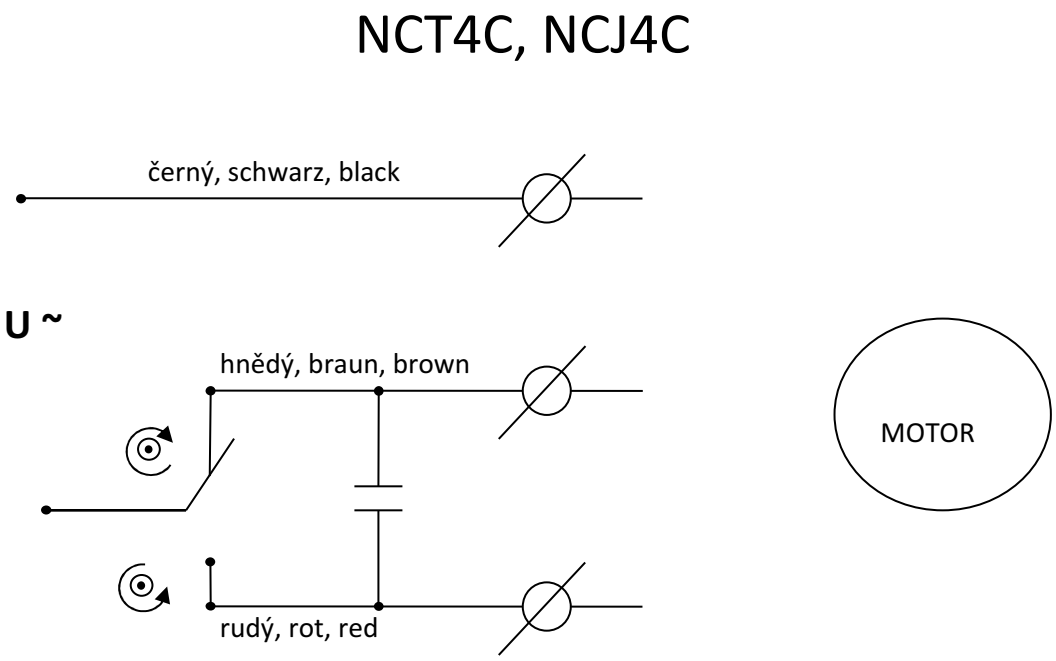
Kotlové těleso je dodáváno již originálně oplechováno. Pokud je potřeba opláštění kotle sundat, tak postupovat dle následujícího postupu:

1. sundat oba vrchní kryty – nasazen na sponkách, jen vycvaknout
2. odšroubovat zadní část oplechování
3. Odmontovat oplechování levé a pravé strany – každé opláštění připevněno 4ks šroubu.

5.8.2 Montáž odtahového ventilátoru

Na vývod kouřovodu kotlového tělesa se nanese kamnářský tmel a poté se nasadí odtahový ventilátor. Vývod kouřovodu směřovat směrem nahoru! Po usazení ventilátoru přitáhnout šroub na odtahovém ventilátoru a obtmelit prstem dokola, tak aby nedocházelo k přisávání vzduchu.

Připojíme kondenzátor dle schématu zapojení kondenzátoru.



Obr. č. 6 – schéma zapojení kondenzátoru

6) Operation of the boiler by user

The boiler must be operated according to the manufacturer's instructions to avoid any problem caused by the user, so it is highly recommended to read instructions manual for the boiler and control unit SPARK.

This appliance can not be used by younger children than 8 years old and persons with reduced physical, sensory or mental disorders or by users without sufficient experience. They are able to operate wit the boiler only if they are under the supervision or receiving the instructions from the specialist and they understand the dangers that they come into contact. Children should not play with the appliance. Cleaning and maintenance of the boiler can not be perform by the kids.

Once in every 14 days period is needed to check the water pressure in the heating system. If the pressure is low it is necessary to replenish the water. If the boiler in the winter period is not operated, it is recommended to drain the water from the system due to freezing. The discharged of the water is not recommended only when it is necessary and for the shortest

period of time. At the end of the heating season, it is necessary to thoroughly clean the boiler and check the boiler for any damages that might be caused by the operation.

It is recommended to clean the impeller and an air chamber of the exhaust fan twice in a year.

6.1 Verification activities before usage of the boiler

Before the commissioning of the boiler it must be checked:

a) Heating system water level

The mineral content (hardness) of the water used inthe boiler must comply with ČSN 07 7401 standards and it is essential that, if the mineral content is not in compliance, the water must be softened – this is covered in Section 05.01. Heating systems with open expansion tanks allow direct contact between the water and air in the environment. During the heating season the expanding water in the tank absorbs oxygen, which hastens the effects of corrosion while allowing significant water evaporation. If more water is added, it must be treated according to ČSN 07 7401 standards.

The heating system must be thoroughly rinsed out in order to eliminate all impurities. During the heating period a constant volume of water in the heating system must be maintained. When adding water to heating system, It must be ensured that no air is drawn into the system. Water from the boiler and heating system must never be discharged or removed except in cases of emergency such as repairs etc. Draining the water and replenishing it increases the risk of corrosion and scaling. If it becomes necessary to add water to the heating system, do soonly when the boiler is cold to avoid cracking.

b) A tight heating system

c) Connecting the flue – The flue must be approved by a chimney inspector

d) Burner tightness

You must connect the flexible cord with a plug into a standard socket 230 V/50 Hz/10A.

6.2 Firing

Please note that making fire is strictly forbidden to use flammable substances.

- Check the settings in the boiler control, operating control SPARK.
- Check the amount of water in the heating system by looking at the gauge.
- Open the shut-off valves between the boiler and the heating system.
- Check the operation of pumps (mechanical spinning)
- Clean the boiler (if it is not the first firing). The ash door must be permanently closed during the fire making and operation.
- Primary air slider control set to the open position.
- At the bottom of the filling chamber make fire using the small chips, sawdust or shavings.
- Put a few pieces of small wood in to the filling chamber, close the filling door.
- Ignite the wood throught the middle door.
- Start the control unit, using the fan we will support combustion in the chamber, which create a hot layer in order to fill up the filling chamber with the wood.
- If we follow the correct procedure we should be able to stoke a wood to the chamber in about 10 – 15 minutes.
- Stable combustion indicates that we can set the boiler to the desired performance and reduce the amount of primary and secondary air.

The shape of the flame gives us information about the correct settings for the nominal rating. When checking the shape of the flame, make sure that the boiler is set at nominal power.

6.3 Stoking

Hopper lasts for about 8 to 12 hours operation at medium power. In energy saving mode, the boiler should last up to 24 hours.

a) Slightly ajar the top door, in order to exhaust the woodgas from the filling chamber.
b) Completly open the upper stoking door.
c) Make sure that the basic layer is burning.
d) Fill up the filling chamber with the fuel.
e) Closed the upper stoking door.

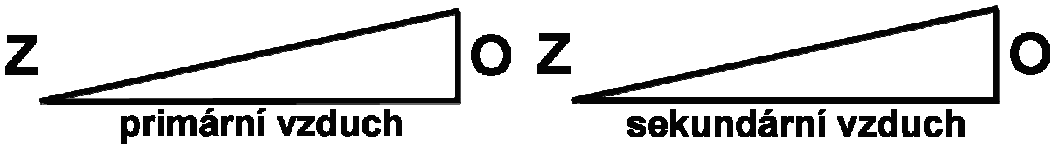
6.4 Combustion control

During the operation of the boiler it is necessary,to ensure the burning was carried out as perfectly as possible for efficiency reasons and to minimize the harmful substances such as hydrocarbons and tar which could clogged the boiler and flue. Combustion quality determines the types and moisture of the material, according to pic. no. 3. Further combustion affects the way of stoking the filling chamber and self regulation of the boiler.

In warmer seasons it is imperative to firing and stoking to the boiler, so boiler will work in rated power without an outage at least 2 hours. Therefore the dose of fuel in the warmer spring and autumn days should be smaller. See chapter 6.3.

Combustion can also be affected by the amount of primary and secondary air. It could be regulated by the rod on the left side of the boiler. The burning of harder wood, briquettes and small materials need a higher levels of secondary air.

Recommended settings of primary and secondary air can be seen on pic. 6



Pic. No. 6 – Regulation of primary and secondary air from 0 to 10

6.5 Power setting and regulation

Power control is governed by the exhaust fan speed. When firing up the boiler, boiler circuit reaches the desired minimum temperature. Then begins the venturing excess heat energy to the heating circuit. If the heating circuit is heating up, so the control unit switches off the fan and boiler passes into the so-called attenuation mode. If the water temperature drops, the boiler will go back into operation.

The boiler can be connected to a room thermostat which is superior to whole heating system and boiler goes into decline based on achieving the desired temperature in the room. When is the temperature in the room lower, the boiler starts heating again.

Chart. No. 6 Control unit settings for the wood at nominal power

Označení kotle	**MAKAK 20**	**MAKAK 25**	**MAKAK 30**	**MAKAK 35**	**MAKAK 40**
Otáčky odtahového ventilátoru	40	55	70	85	100
Primární vzduch	6	7	8	9	10
Sekundární vzduch	3	3-4	4	4-5	6

6.6 Removal of ash

The ash is collected in the middle door. When is the coating thickness of the ash is about 5-7 cm. We take the ash throught the middle door or we can use the nozzle for collecting the ash in the post combustion area using a ash door.

The bottom door mainly serves for taking off the ash.

6.7 Cleaning of the boiler

Main boiler cleaning is performed by using the lever on the left (right) side of the boiler. Cleaning is done by using the turbulators which are located in the main heat exchanger.

Manufacturer is recommending to clean the heat exchanger walls atleast once a month.

6.8 Maintenance and inspection of the boiler

During the operation of the boiler it is necessary to pay attention if there are any leaking tar or contamination to the air vents. Air valves must open and close smoothly.

Primary and secondary air flap is an important element of the boiler and must be checked frequently and even the air ducts must be kept clean. If something prevented

complete opening or closing the valve, it should be cleaned immediately. This may lead to the achievement of the desired output of the boiler.

Never take the ceramic bricks outside of the boiler and check them visually after the cleaning. There must be no clogging. The bricks might be demaged during the operation due to temperature cycles. The changing of the brick is recommended after the worse operation of the boiler overall.

Check the sealing cord on the door, if necessary it is needed to replace it.

It is recommended to periodically perform a visual inspection of the boiler.

7) Control unit SPARK

Pic. No. 7 Control unit SPARK

7.1 Control unit SPARK description

Boiler regulator SPARK is a modern electronic device intended to control solid fuel boiler:

-It automatically maintains desired temperature of the boiler by controlling the combustion process

-It is controlling the exhaust fan speed

- Automatically maintains the set temperature of HUW.

- It automatically maintains preset temperature of several independent mixer heating cycles up to maximal number of 5.

The preset temperature of heating cycles and boiler can be set on the basis of a weather sensor readouts. Possibility of cooperation with room thermostats, separate for each heating cycles facilitates maintaining comfortable temperature in the heated rooms. Moreover, if need arises, the device enables a reserve boiler (gas or oil-fired). Regulator can cooperate with an additional control panel situated in living quarters and with additional modul with the lambda-probe. The device is operated in an easy and intuitive way.

7.2 Operation of the controller

The simular manual for operating of control unit is incluaded in package. To avoid any problems, we advise you to read carefully the installation manual, before you start using it.

7.3 Installation of temperature sensors

CH temperature sensor

This sensor detects the current water temperature in the boiler. This temperature is shown on the red LCD control panel. Operating modes are set according to this value. The sensor is connected to the boiler output to have the best possible contact and heat transfer. It is either installed in a reservoir or it is taped to pipe. The brass part should have the best contact. The wire must never come into direct contact with any element of heating system!

To ensure the accurate measurement of temperature, it is recommended to use thermal grease.Oil must not be used as it can damage the sensor!

DHW temperature sensor

This sensor reads water temperature in the DHW tank. DHW pump start-ups and shut-offs are initiated according to this sensor's readings. It is either installed in a reservoir or it is taped toa pipe. This sensor is set to OFF in the factory settings so, it must be set in the main menu for use.

Emergency thermostat – thermocouple sensor

The independent thermocouple sensor protects the system against overheating. It operates independently of the control unit and, when it detects temperatures above 90°C, it will immediately shut the fan and the feeder down to prevent the burner from heating up any further. The alarm will switch the control unit to OFF mode!After checking the system, the user can press to switch the system to HEAT mode.

The first sensor is installed on the boiler's hot water output. It is placed in the reservoir or taped onto the tube with insulation. For the best results, remember that the wire must not be in direct contact with the tubes!

The sensor is installed with the CH sensor!

Pic. No. 8 – Thermal sensor installation

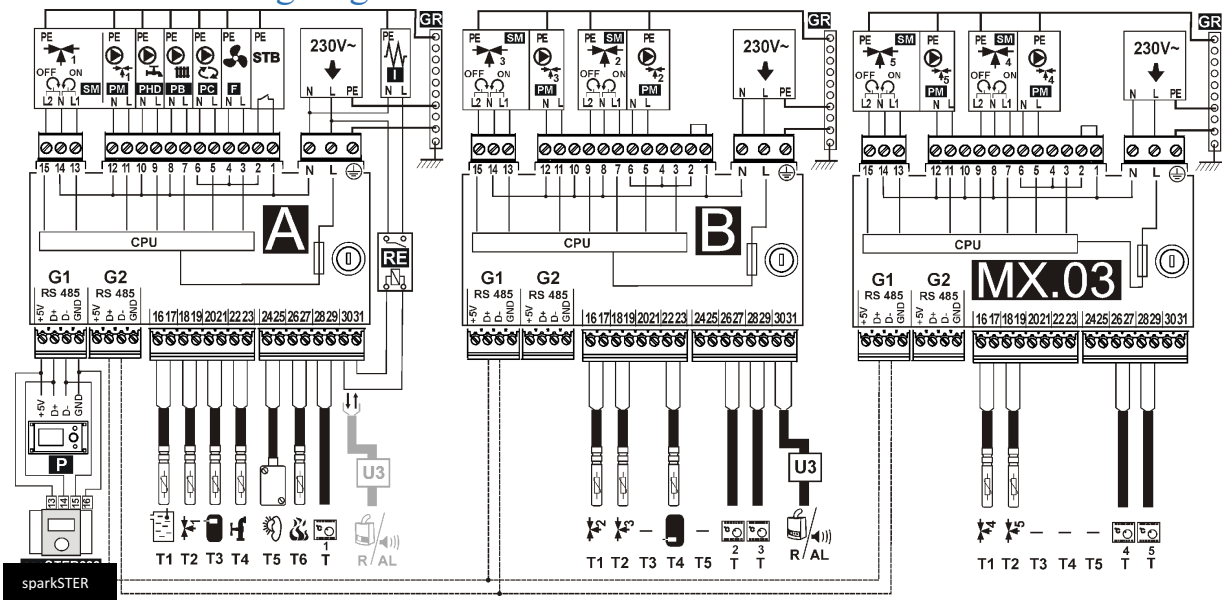
CAUTION:

- The sensors must not be immersed in liquids such including water, oil, etc.
- During assembly and operation, the sensor cables must not come into contact with hot pipes or other elements of the heating systém.

7.4 Technical data

Power supply	230V~; 50Hz;
Current consumption by the regulator	I = 0,02 A
Max. rated current	6 (6) A
IP rating of the regulator	IP20, IP00
Ambient temperature	0...50 °C
Storage temperature	0...65°C
Relative humidity	5 - 85%, without steam condensation
Temperature measurement range of sensors CT4	0...100 °C
Temperature measurement range of sensors CT4-P	-35...40 °C
Accuracy of temperature measurement using sensors	2°C
Connectors	Screw terminals at supply voltage side – 2.5mm^2 Screw terminals at control voltage side - 1.5mm^2
Graphical display	128x64
Overall dimensions	Control panel: 164x90x40 mm Operating unit: 140x90x65 mm
Total weight	0,5 kg
Standarts	PN-EN 60730-2-9 PN-EN 60730-1
Software class	A
Protection class	Suitable to bulit-into classI devices
Pollution degree	2nd pollution degree

7.5 A wiring diagram of the contoller



7.6 Commissioning

Control unit SPARK can be put into the operation only by a specialist with a valid license. The regulator should be put into operation according a manufacturer instructions..

8) Important alerts

- The boiler must only be used for the purposes of the use to which it is intended.
- The boiler can only be operated by adults who are familiar with the operating instructions. Leaving the children unattended near by a boiler in operation is prohibited.
- Children should be supervised to ensure that they do not play with the appliance.
- If there is a potencional risk of penetration of flammable vapors or gases into the boiler room or at work, during which a temporary fire or explosion (bonding floor coverings, painting with flammable paints, etc.), the boiler must be switched off before the works.
- The firing the boiler MAKAK is forbidden to use flammable liquids (gasoline, alcohol, etc.)
- During the operation of boiler MAKAK is forbidden any way to overheat it.
- The boiler and closer than the safe distance allowed is not possible to store any flammable objects.
- When you are removing the ash from the boiler there must be a minimum distance of 1500 mm from the boiler for storing flammable substances. The ashes must be disposed of non-combustible container with a lid. Wear protective equipment.
- • After the heating season is necessary to clean the boiler and flue. Boiler room must be kept clean and dry.
- It is forbidden to interfere with the construction and installation of electric boilers.
- The system must be equipped with a relief valve with a maximum pressure of 2.5 bar, its dimensions must correspond to the rated boiler output. In case of any questions, please contact the contract assembly companies and service organizations.
- Poor fuel quality can significantly affect the performance and emission characteristics of the boiler.
- During assembly, installation and operation of the appliance it is necessary to comply with the standards which apply in the specific country. If these conditions are not fulfilled it is not possible to claim any warranty repairs.
- According to Government Regulation 91/2010 Coll. - The conditions of fire safety during the operation of chimneys, flues and fuel appliances, operator is obliged to carry out regular cleaning and inspection of flueways.

9) Disposal of the product after its service life

Manufacturer recommended to liquidate of packaging according the following manners:

- plastic foil, cardboard packaging, use the junk
- metal strapping tape, use the junk
- wooden base is intended for single use and can not be used as a product for further usage. dřevěný podklad, je určen pro jedno použití a nelze jej jako výrobek dále využívat. The subject disposal according to Act 94/2004 Coll. and 185/2001 Coll. as amended. The product is made of common metal materials which manufacturer recommends to dispose as follows:
- cast iron – use the junk
- pipe distributions, casing, use the junk
- other metal parts, use the junk

10) Warranty and liability for defects

Manufacturer warranty:

The boiler warranty is 24 months from the date of issuing an invoice.

For possible complaint of supply, the customer must submit the boiler casing packaging label. It is located on the carton in which the casing is shipped.

The user must have a professional assembly service company put the boiler into operation and service the equipment, otherwise proper functioning can not be guaranteed. A completed „certification of quality and completeness of the TIGER boiler“ document can be used as a „Certificate of warranty“. The user is obliged to have the boiler undergo regular maintance.

Defects should be reported immediately after detection in writing and by telephone.

Failure to follow these instructions will void the manufacturer’s warranty.

The manufacturer reserves the right to make changes related to product innovations that may not be included in this manual.

11) The warranty does not cover:

- defects caused by improper assembly, improper handling or defects caused by improper maintenance (more in Section 8)
- product damaged during transport or other mechanical damage
- defects caused by improper storage
- defects caused by failure to observe water quality guidelines for the heating system (more in Section 5.1 and 7.2) or through the use of anti-freeze
- defects caused by not following the instructions provided in this manual
- failures caused by operating the boiler on non-warrantied fuel (see Tab. 3 and 4)

12) Trouble shooting

Issue	Possible cause	Resulotion
Control unit cannot be turned on	- no voltage in the network	- check the power network
	- plug incorrectly inserted in the wall socket	- check the socket connection
	- defective control unit	- replace the unit
	- LED indicators do not light up	- replace demaged fuse
Boiler does not reach the required parameters	- low water level in the heating system	- refill
	- pump output too high	- adjust the flow rate and pump switching
	- power output too low for the system	- poorly prepared project
	- wood moisture above 15%, wrong dimensional of wood	- use the fuel with maximum moisture up to 15%, dimensions which corresponding to manufacturer requirements
	- clogged nozzle	- clean and remove objects which stucked in a crevice nozzle or in the suction holes.
	- demaged nozzle	- replace of nozzle. - manufacturer highly recommends to use an authorized service!
	- insufficient draft	- new chimney, or correct improper connection
	- excess flue draft	- install a damper in the flue
	- inadequately cleaned boiler	- clean the combustion chamber , the nozzle, post-combustion area, ashtrail and main heatexchanger
	- closed primary air flap	- clean and free the flap
	- closed secondary air flap	- clean and free the flap
Door leaks smoke	- improperly adjusted door hinges	- tighten the hinge screws
	- faulty sealing cord	- replace the cord
Fan wobbles or is noisy	- overheated boiler – temperature limiter activation (an emergency thermostat)	- wait until temperature drops to approximately 70°C, then press the temperature limiter placed on control unit
	- inoperable motor	- replace the motor
	- demaged to the power cord	- replace the cord
	- fan is switched off due to safety system. The boiler is overheated – temperature higher than 95°C.	It is neccesary to cool the system. Afterwards, the fan will turn on automaticaly.
The boiler is overheating and hardly regulatable	- the water in the boiler is not circulating or in the heating system	- check water level in the heating system, pump status and its functionality - clean the pump filter
	- safety thermostat demaged – the boiler (fan) is operating even in higher temperature than 95°	- **replaced by an authorized service!**
	- closed, barely opened mixing valve	- check the functionality of mixing valve
	- overlarge boiler output	-make an adjustment of the heating system - recommended to use the storage tanks

13) Recommended connection of the boiler

The manufacturer recommends the connecting the boiler with a storage tank. Size of the storage tank selected according to the required boiler output which means 55 liters per 1 kW. If it is a 20kW boiler it should be used a tank size of at least 20 kW x 55 liters = 1,100 liter storage tank.

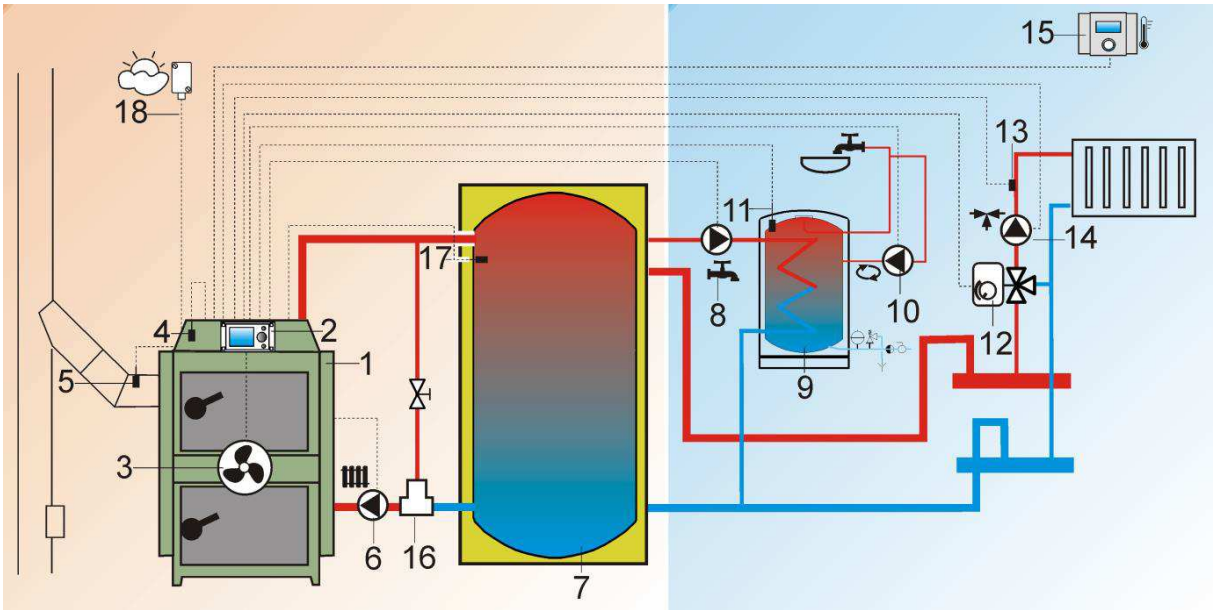


Diagram with the storage tank – without an additional moduls: 1 - boiler, 2 – control unit SPARK, 3 – fan, 4 – boiler temperature sensor, 5 – flue temperature sensor, 6 – boiler pump, 7 – storage tank, 8 – HUW pump, 9 – HUW tank, 10 – HUW circuit pump, 11 – HUW sensor, 12 – mixer servo, 13 – mixer temperature sensor, 14 – mixer pump, 15 – thermostat SPARKSTER control panel, 16 – thermostatic, mixing valve for protecting the return water, or Ladomatt, 17 – upper sensor for storage tank, 18 – temperature (weather) sensor

ES PROHLÁŠENÍ O SHODĚ

(původní)

Výrobce: KOVARSON s.r.o., Lhota u Vsetína 4, 755 01 Vsetín
IČ: 29220327, DIČ: CZ29220327

tímto prohlašujeme,
že následně označené zařízení na základě jeho koncepce a konstrukce, stejně jako námi do oběhu uvedené provedení, odpovídá příslušným základním bezpečnostním požadavkům nařízení vlády. Při námi neodsouhlasených změnách zařízení ztrácí toto prohlášení svou platnost.

Identifikační údaje o zařízení:

Název:	Zplyňovací kotel
Typ:	MAKAK 20 – 40 kW
Výr. č:	2040xxxx, 2540xxxx, 3040xxxx, 3540xxxx, 4040xxxx

Příslušné směrnice – ES/EÚ:

Směrnice Evropského parlamentu a Rady 2006/42/EC o strojních zařízeních
Směrnice Evropského parlamentu a Rady 2006/95/EC o nízkém napětí
Směrnice Evropského parlamentu a Rady 2004/108/EC o elektromagnetické kompatibilitě

Použité harmonizované normy při posuzování shody:
ČSN EN ISO 12100:2011 (EN ISO 12100:2010)
ČSN EN 303-5:2013 (EN 303-5:2012)
ČSN EN 60335-1 ed. 3:2012 (EN 60335-1:2012)
ČSN EN 60335-2-102:2007/A1:2010 (EN 60335-2-102:2006/A1:2010)
ČSN EN 55014-1 ed. 3:2007/A1:2010/A2:2012 (EN 55014-1:2006/A1:209/A2:2011)
ČSN EN 55014-2:1998/A1:202/A2:2009/Z1:2008 (EN 55014-2:1997/A1:2001/IS1:2007/A2:2008)

Doklady vydané certifikačním orgánem:
Certifikát shody č. 141299021 ze dne 30.01.2014, vydaný Technickým skúšobným ústavom Piešťany, š.p. Krajinská cesta 2929/9, 921 01 Piešťany, IČO: 00 057 380

Výrobek je za podmínek obvyklého a určeného použití bezpečný.

Při posuzování shody bylo postupováno podle § 12, odst. 7 zákona č. 264/1999 Z.z.. v platném znění.

Ve Vsetíně dne 30.01.2014

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