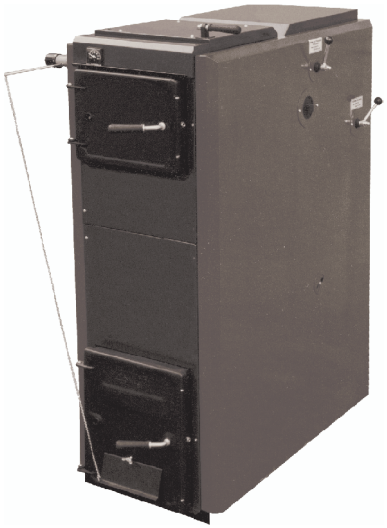
KALVIS®

CENTRAL HEATING BOILER ON SOLID FUEL

KALVIS-2-20, 2-25, 2-30, 2-40



USER‘S INSTALLATION AND OPERATION MANUAL

AE71

LST EN 303-5 ГОСТ 9817-95
ĮST 144948958.13:2004

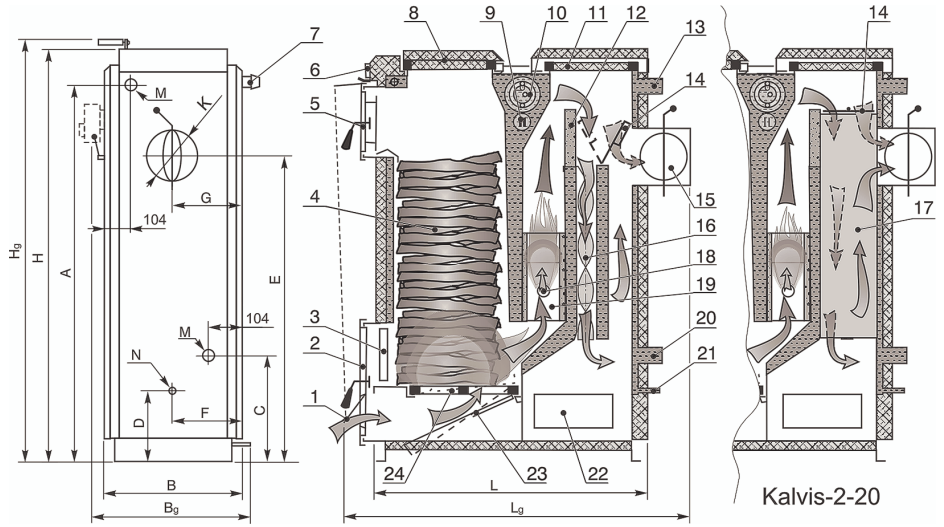
Attention !

Get acquainted with this technical certificate before installing the boiler.It will allow you to install the boiler correctly and to run it as efficiently as possible.

1. Technical data.

Central heating boiler "Kalvis-2-…" (hereinafter referred to as the boiler) is used for heating of various premises where central heating system with natural or forced circulation is arranged.

Boiler has a socket for mounting 3x1,5…3x2 kW electric heating devices (with 2“ thread) with temperature control and emergency thermostats or without them (devices not included).



1 fig.

1.Air supply damper. 2.Combustion chamber doors. 3.Cast iron doors. 4.Combusiton chamber. 5.Fuel loading doors. 6.Thermomanometer. 7.Draught adjuster. 8.Top loading cover. 9.Electric heating device socket. 10.Cooling loop installation socket**. 11.Service cover. 12.Chamotte brick. 13.Hot water tube. 14.Ignition damper. 15.Draught damper. 16.Turbulators. 17.Screen (only for **Kalvis-2-20**). 18.Secondary air openings. 19.Ctalyst plates. 20.Return water tube. 21.Drain tube. 22.Ash removal cover. 23.Fire grate mover. 24.Movable fire grate.*

Measures designated by letters are included in “main technical data” table.

** The reaction time and accuracy of the installed thermomanometer (120°C, 0-4bar) are adequate to the measuring function that it performs*

***After removing the cover form the shield and removing the cooling loop socket cover cooling loop (not included) may be installed.*

Main technical data:

Boiler type	**K-2-20**	**K-2-25**	**K-2-30**	**K-2-40**
Nominal output, kW	20	25	31,5	40
Minimal ouptu, kW	10	13	16	20
Heated area, when the quotient of the thermal resistance of the premises is no less than 2,5	140…250	180…300	220…380	300…480
Fuel used	Wood, waste wood, peat and saw dust briquettes, coal			
Wood size L x Ø, up to, cm	40 x 15	35 x 15	35 x 15	45 x 15
Wood position in combustion chamber	across	along	across or along	across
Fuel load, dm^3 (l)	100	120	175	220
Combustion duration*	4 … 8			
Approximate fuel consumption during heating season, m^3	10 - 15	16 - 20	18 - 28	25 - 35
Efficiency not less than, %	82			
Boiler grade according to EN 303-5	3			
Water volume in the boiler, l	81	84	102	116
Water pressure in the boiler, not greater than, MPa (kgf/cm^2)	0,15 (1,5)			
Maximum permitted water temperature °C	100			
Minimum return water temperature during operation °C	57			
Temperature adjuster operation range, °C	65 … 90			
Parameters for cold water used to dissipate excessive heat** Pressure, bar/temperature, °C	≥ 2,0 and ≤ 15**			
Minimal chimney draught, Pa	14	14	15	16
Exhaust temperature, °C when operating at - nominal output - minimum output	 223 161	 225 164	 226 166	 225 171
Loading opening dimensions, mm — from top	238 x 408	288 x 292	288 x 492	288 x 592
Loading opening dimensions, mm — from front	230 x 292	230 x 292	230 x 292	230 x 292
Overall dimensions, mm: H_g / H B_g / B L_g / L	 1335 / 1300 660 / 600 1027 / 800	 1467 / 1420 550 / 490 1206 / 960	 1465 / 1420 730 / 590 1207 / 970	 1465 / 1420 780 / 690 1182 / 970
Branching dimensions: K, mm M, G	 Ø157 G1½-B	 Ø177 G2-B		

N, G	G½-B	G½-B		
Cooling loop type	AAG6		AAG9	
Other dimensions, mm:				
E / G	980 / 195	1050 / 300	1050 / 350	1050 / 400
A / C	1180 / 330	1305 / 270	1305 / 270	1305 / 270
D / F	242 / 325	240 / 300	240 / 350	240 / 400
Mass not greater than, kg	435	435	490	535

* *18-20 % moist content birch wood.*
Firing boiler with wood that has more than 30% moist content is not recommended.

** *For boilers with an emergency cooling system installed*

2. Design description

Due to constant development of design, minor deviations from this manual are possible.

Boiler frame, welded from special sheet steel has, water cavities, where water is heated (see 1 fig.). Internal boiler frame is made of 6 mm thick steel, external – 3 mm. Exterior of the boiler is covered with insulating shields. Front side of the boiler has draught adjuster (p.7), which controls air supply damper (p.1), thermomanometer (p.6), doors (p.2), behind which there are cast iron doors (p.3). Combustion chamber is closed with doors (p.5). In the boiler there is an ignition damper (p.10) and ignition damper (p.14), which allows direct smoke flow into the chimney, ignition damper is used when fuel is ignited or when extra fuel is added. Combustion air is supplied through the fire grate (p.24) and secondary air openings (p.18). Combustion chamber has chamotte bricks (p.19) that maintain high temperature of combustion. Beneath the shields there is a service cover (p.11) for cleaning the internal surfaces of the boiler.

On the sides of the boiler there are secondary air control dampers.

Rear side of the boiler has drain tube (p.21), return (p.20) and hot water (p.13) tubes, smoke outlet with draught damper (p.15).

On the side of the boiler there is a flanged tube which serves as a socket for cooling loop installation.

Boiler heat exchanger (except Kalvis-2-20) has turbulators (p.16) that ensure better heat transfer.

If there is an insufficient draught it is recommended to remove turbulators.

Electric heating devices are automatically switched on when boiler runs out of fuel and temperature drops beneath the preset stand by mode temperature.

3. Transportation and storage.

Boilers are stored and transported on a wooden pallet wrapped in a plastic film, unless otherwise specified in delivery conditions.

Boilers are only to be transported in vertical position by all means of covered transport. During dry weather it is permitted to transport boilers by open transport. Use extra measures to prevent boilers from scratch, falling over. It is prohibited to throw or hit boilers during transportation or loading-unloading operation.

Boilers should only be stored in dry covered premises, where there are no chemically active vapors.

Note: After unpacking boiler, use wooden pallet for fuel and dispose of the plastic film.

4. Mounting

Boiler is to be mounted in a kitchen or another well ventilated room that complies with relevant national requirements in the place of installation.

It is recommended to mount a smoke collecting cover above boiler. Boiler should be mounted vertically or with forward inclination not exceeding 1^{o}.

Consider cleaning and maintenance functional accessibility prior to connecting the boiler to the heating system and chimney.

Necessary minimal dimensions to walls are given in fig. 2

4.1 Fire precautions:

- Boiler should be placed on an incombustible base;
- If boiler is connected to the chimney by metal pipes, pipes should be not thinner than 1,5mm and they have to be covered by thermal insulation

Attention !

When chimney's draught is too great and sawdust or other fines are used for fuel, sparks may fly out through the chimney when poking or adding fuel.

It is prohibited to use such fuel, if the distance between chimney and flammable roof or other flammable structures, fuel storage or construction materials is less than 20 m.

Fig. 2 Recommended distances to incombustible partitions

Heat proof ceiling (lubos), heat proof walls

Central heating boilers

Boiler type

* if the cooling loop or electric heating will be installed in the system, distance "a" has to be no less than 500mm.

4.2. Requirements for chimney

Chimney design and boiler connections into it are shown on fig. 3.

- Chimney draught may not be less than specified in main technical data table;
- Chimney hole's cross section should be no less than 120x270 mm;
- Boiler needs a separate hole for the chimney connection. No other connections through that hole are allowed

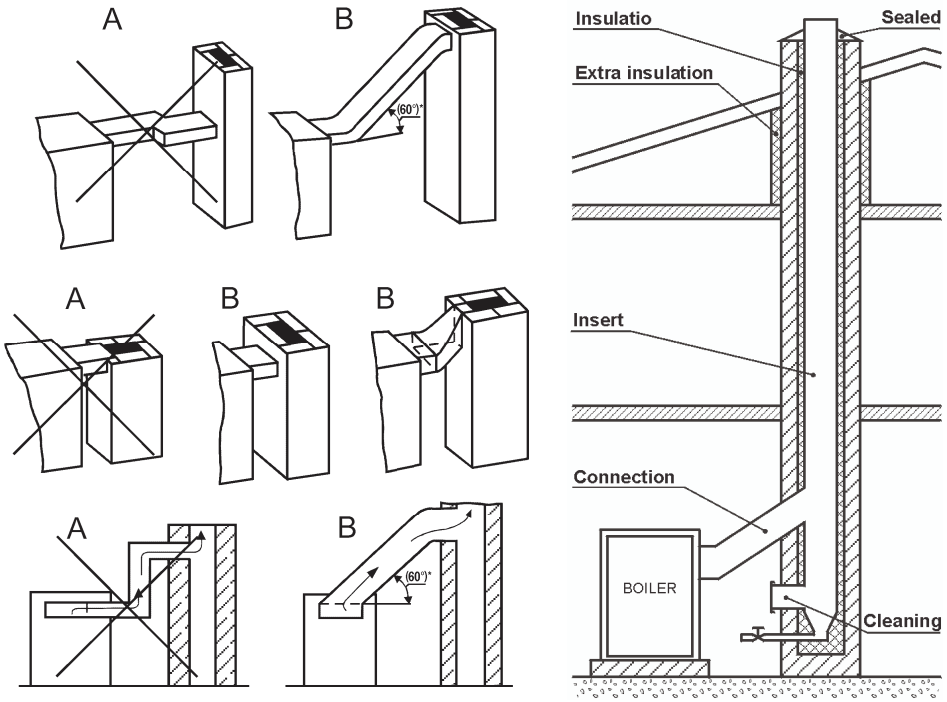


Fig. 3

- If chimney is connected with additional elbow, it's cross section has to be not less than that of the boiler smoke outlet, and bending radii not less than 100mm;
- Pipe from the smoke outlet to chimney has to be not longer than 1,5 m and lean upwards toward chimney;
- Joints have to be well sealed;
- Chimney has to be periodically cleaned.

<u>Necessary to know that:</u>

- Smoke continues to cool in the chimney, smoke vapour condenses on the chimney walls, especially in the unheated loft and on the exterior of chimney;
- Condensate acids and erosion may destroy the chimney in a few years;
- Not cleaned soot in the chimney may self-combust and become the cause of fire.

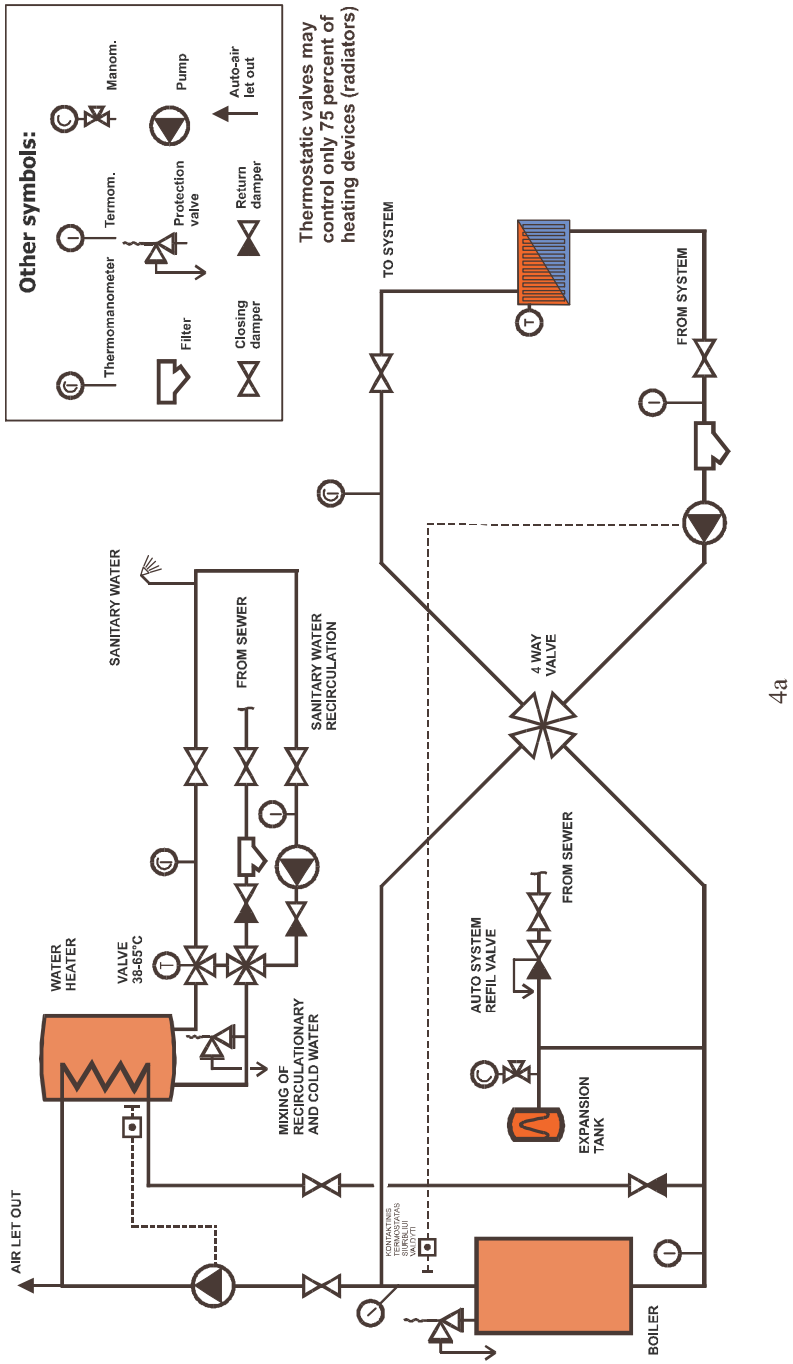
Recommended:

- Mount a stainless or ceramic insert into the chimney. Well mounted insert protects chimney from condensate and improves draught;
- Insert should not significantly decrease the cross section of the chimney;
- Insert parts should be well joined together (no soldering);
- Condensate collector and drain should be arranged in the bottom;
- An incombustible material should insulate the cavity between the insert and chimney. Top slit should be hermetically sealed;
- Chimney should be insulated by an incombustible material should in an unheated loft;
- If fire starts in a chimney, close the air supply to the boiler and call the emergency line
- Make holes in easily accessible places on the chimney connection for periodic soot cleaning (once a month).
- Have a qualified chimney maintenance supervisor check your chimney once a year.

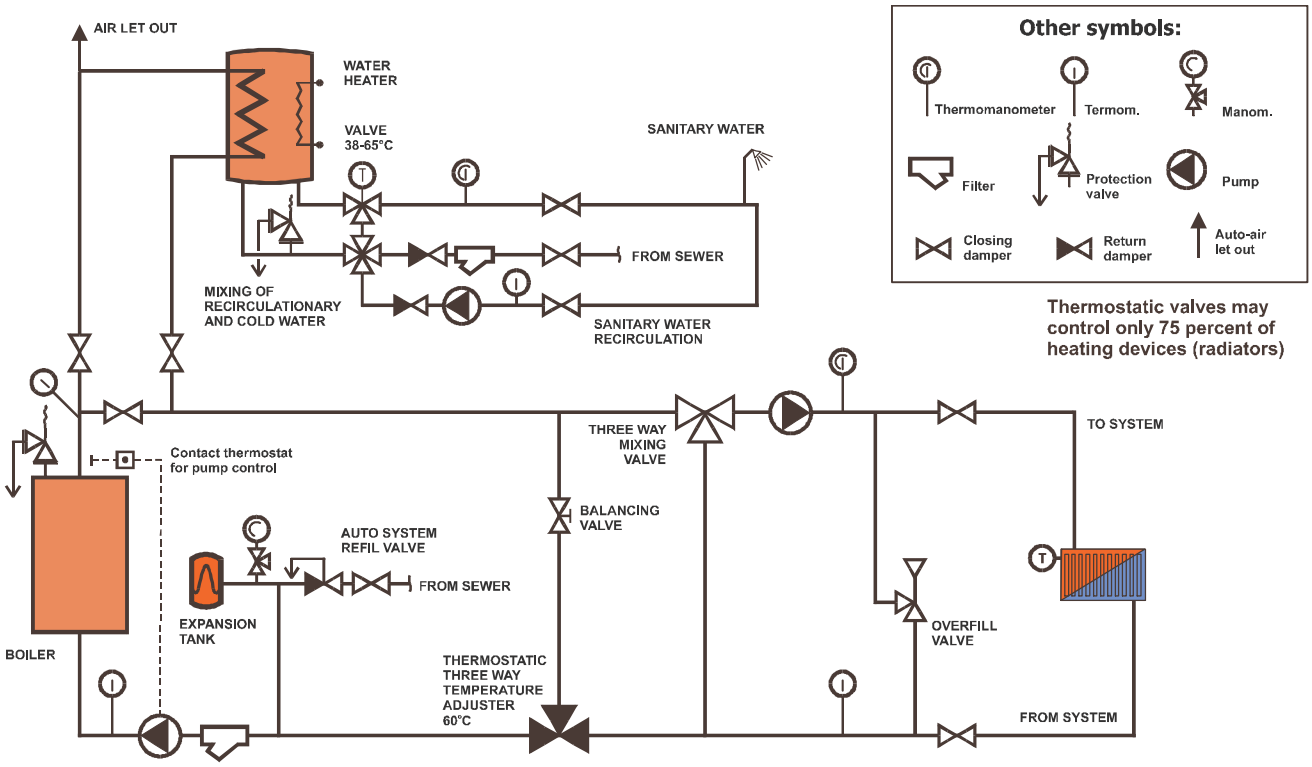
4.3. Requirements for the connection to the heating system:

Requirements for connection:

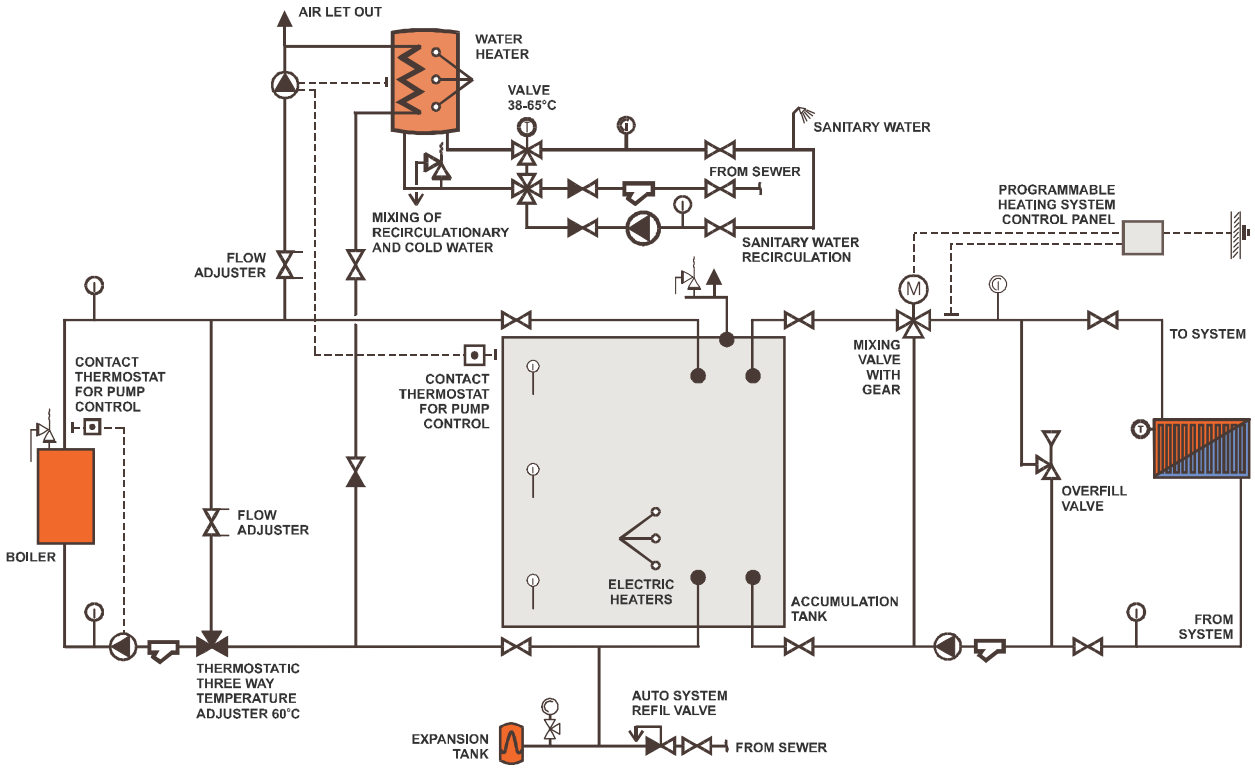
- Boiler may be connected to the heating system according to the project prepared by heating equipment specialists or works may be performed by a well qualified plumbing welder who is well acquainted with this manual and boiler design



4a


AIR LET OUT
WATER HEATER
VALVE 38-65°C
SANITARY WATER
FROM SEWER
MIXING OF RECIRCULATIONARY AND COLD WATER
SANITARY WATER RECIRCULATION
Other symbols:
Thermomanometer
Termom.
Manom.
Filter
Protection valve
Pump
Closing damper
Return damper
Auto-air let out
Thermostatic valves may control only 75 percent of heating devices (radiators)
Contact thermostat for pump control
THREE WAY MIXING VALVE
TO SYSTEM
BALANCING VALVE
AUTO SYSTEM REFIL VALVE
FROM SEWER
EXPANSION TANK
BOILER
OVERFILL VALVE
THERMOSTATIC THREE WAY TEMPERATURE ADJUSTER 60°C
FROM SYSTEM

4b


AIR LET OUT
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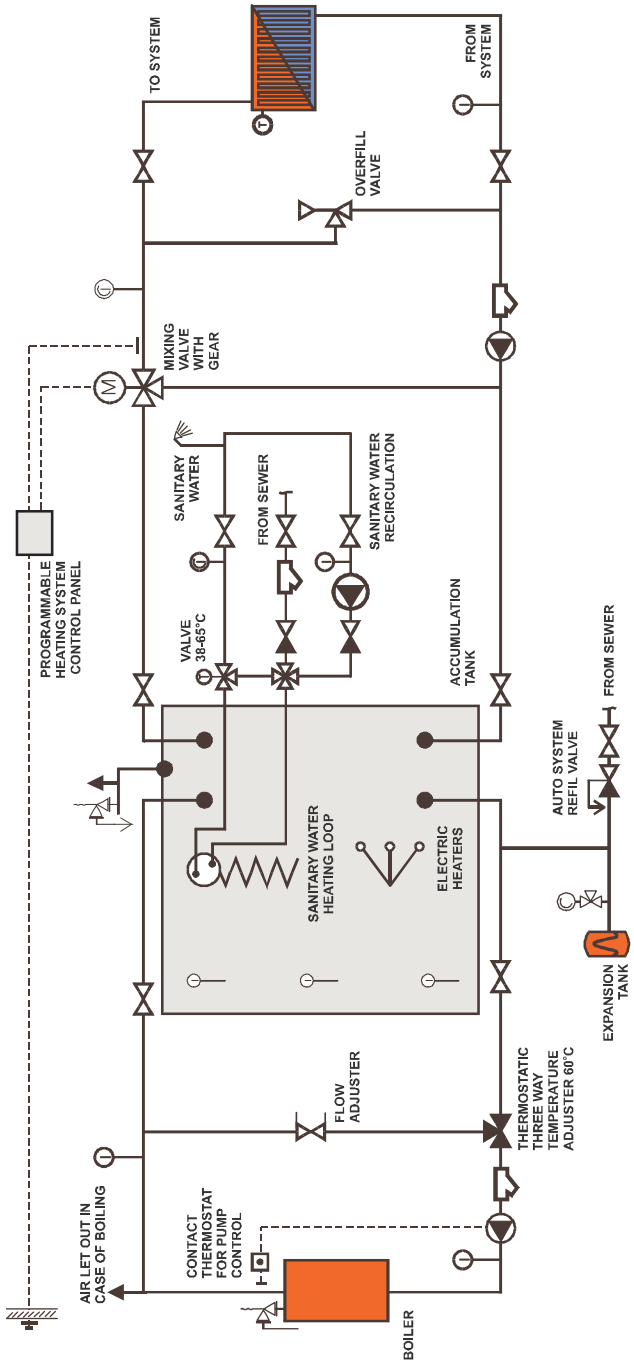
PROGRAMMABLE HEATING SYSTEM CONTROL PANEL
FLOW ADJUSTER
CONTACT THERMOSTAT FOR PUMP CONTROL
MIXING VALVE WITH GEAR
TO SYSTEM
OVERFILL VALVE
BOILER
FLOW ADJUSTER
ELECTRIC HEATERS
ACCUMULATION TANK
FROM SYSTEM
THERMOSTATIC THREE WAY TEMPERATURE ADJUSTER 60°C
AUTO SYSTEM REFIL VALVE
EXPANSION TANK
FROM SEWER

4c



4d

- If system pipes have valves, that disconnect boiler from the system, they have to be fully opened. To avoid break down due to inadvertence, valve handles should be removed.
- Heating system may be of an open type. In such case an expansion tank may be installed instead of a pressure expansion vessel.
- In order to avoid condensation, which may reduce boilers service life several times it is necessary to install a four way mixing or three way thermostatic valve that will maintain the temperature of return water above 57°C.
- It is necessary to mount the protection valve that keeps the operating pressure in the system not greater than 0,15 MPa (1,5 kgf/cm^2). It is necessary t5o check the operation of the valve by turning it's handle each time before ignition.
- It is permissible to connect the boiler to the heating system (with an expansion tank that backs up the protection valve as a safeguard against overpressure) with working pressure not exceeding 0,15 MPa (1,5 kgf/cm^2);
- It is recommended that the boiler is inspected by a qualified boiler inspector once a year.
- Drain pipe is used to drain pipe from boiler and system if there is a freezing risk.

Recommended connection schemes are given in Fig. 4a-4d

If boiler is operated at less than nominal output, boiler's efficiency and environmental parameters decrease. It is recommended to use connection schemes with accumulation tanks (4c, 4d). Accumulation tank volume is calculated according to the formula given in fig. 4d.

4.4. Connection of Boiler Cooling System

In accordance with the requirements set forth in par. 4.1.5.11.3 of EN 303-5 standard applied for boiler operation, devices for excessive heat dissipation are to be installed if due to any reasons normal heat exchange is interrupted in the heating system in order not to exceed the maximum permitted water temperature in the boiler.

In order to protect boiler from overheating, there is an option to install emergency cooling loop into the frame. When boiler water heats over 95°C, temperature valve opens and cold water from water mains runs into the cooling loop and cools the boiler. Used water is discharged to sewage by tubes no thinner than coil water outlet (water should easily flow into sewage).

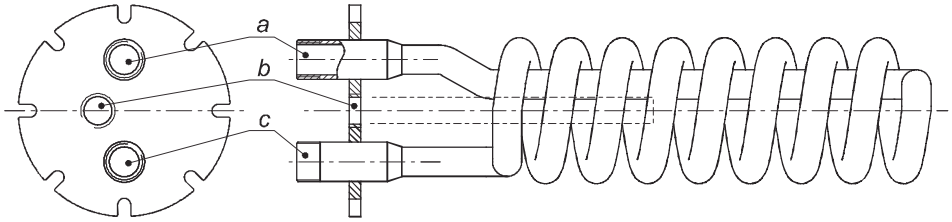
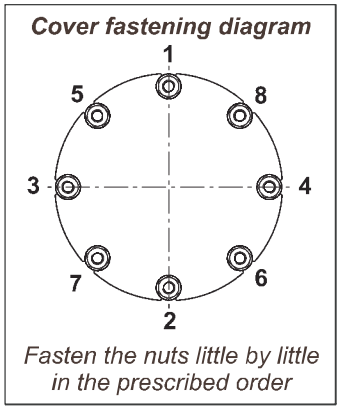


Fig. 5

*a) Cooling water outlet branch (G ¾)**
b) Temperature sensor socket (G ½)
*c) Cooling water inlet branch (G ¾)**
** a and c can be interchanged*

To install cooling coil:

- Remove cover from shield.
- Unscrew flange.
- Change sealing ring.
- Insert and fasten cooling loop (as shown in the figure).



Connect „Honeywell TS 130“, or similar temperature valve to the cooling coil (see recommended boiler connection diagram).

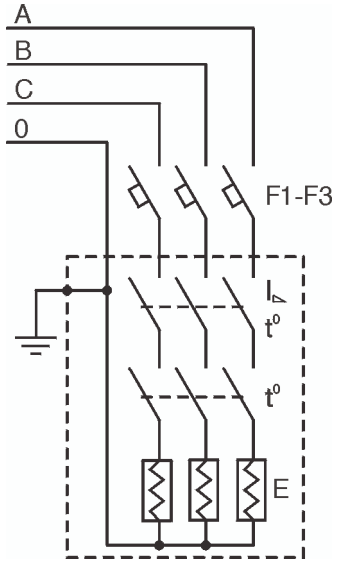
In the case of power failure in the house with local water supply system (water supplied by hydrophore), boiler can overheat (due to system circulation pumps stop), therefore it is necessary to have extra water supply to the cooling system. Recommended cooling system connection diagrams are shown in fig. 4a – 4d.

Boiler cooling loop can be used for warm water preparation in small amounts. During tests it was established that when water temperature in the boiler is 75ºC, water temperature in the cooling loop is 15ºC, and running water volume is 2,2 l/min, the running water heats up to 42ºC. However, if we increase volume of the water running through the cooling loop up to 5 l/min, temperature of the water leaving the cooling loop is 32ºC. In order to use the loop for warm water preparation, the following has to be taken into consideration:

- Boiler water temperature
- Temperature of the water getting into the coil and volume of warm water used.

4.5. Requirements for the electric connections:

If electric heating devices are installed



Pos.	Name	q-ty	
F1-F3	Switch	3	16A
E	Heating device thread G2B L=400)	1	3x1,5 kW 3x2 kW

6 fig..

Recommended connection for electric heating

- Only persons with necessary qualification are allowed to perform installation works;
- It is recommended to install electric heating if boiler is connected to the heating system according to scheme shown in Fig. 4a.
- Installation works should be performed according to the prepared project (if relevant when taking into account the output of mains);

5. Boiler operation

Adults that are well acquainted with the design and users manual may operate the boiler.

Attention! When firing boiler with humid fuel or saw dust the condensate reacts with the combustible gases and forms aggressive acids that reduce the service life time of the boiler several times.

It is prohibited to fire fine pieces of waste wood (dust) due to a risk of explosion or discharge of the fine unburned fuel bits from the chimney.

5.1. System preparation for heating

Fill system with desalinated water and let the air out. Check if valves disconnecting boiler from the heating system are fully opened and remove their handles.

5.2. Firing the boiler (refer to fig. 1)

When boiler with an oven (K-4AB) is fired for the first time or after long pause in firing (after summer season), it is necessary to preheat the heat proof concrete parts. It is done in order to remove the moisture that may rupture the parts when turning into steam. Place some wood on the fire grate and ignite it. The volume of the fuel should be such that it would burn down in 20-30 minutes. Repeat the process in 2 hours. Do it three times.

Open draught damper (p.15) prior to fuel ignition, ignition damper (p.14), place some dry wood waste through doors (p.3) and ignite it. Secondary air dampers (p.18) have to be closed. Dampres are adjusted when water temperature in the boiler reaches 60 degrees.

Upon fuel ignition chamber may be filled with fuel (wood or coal). Finer fuel increases boiler capacity.

When firing coal 5 - 10 kg of firewood should be covered by a 10 cm layer of coal. Coal should be added in layers depending on the quality and the required heat amount.

When adding fuel:

- Open ignition damper (p.14);
- Open doors (p.2) and check if the ash allows air inflow through the fire grate openings. Poke the bottom layer of fuel
- Close the door damper (p.1) with draught adjuster (p.7);
- Slightly open fuel loading door (p.5), fully open them in 5-10 seconds and add fuel;
- Close fuel loading doors and dampers tightly;
- Open damper (p.1) with draught adjuster.

Check the smoke colour out of chimney. Smoke should be thin of a light grey colour. If smoke is thick and black it means incomplete combustion, not enough secondary air. Open secondary air supply dampers. Combustion quality may be adjusted by a gas analyzer or visually, depending on the smoke colour, when temperature of water in the boiler reaches 80 degrees.

Ash is formed as a part of combustion process. It blocks the openings in fire grate, reducing boiler output and combustion

intensity. Fuel has to be poked. Poke the fuel and ash by pressing the pedal of the fire grate mover. Excess of ash in an ashtray blocks primary air supply and has to be removed periodically. Bottom doors of K-2-30 and K-2-40 have two primary air dampers. Top damper allows air flow even when ash blocks fire grate openings.

Unless there is a necessity it is not recommended to open fuel loading doors (p.5 and p.8) during combustion.

Boiler premises have to be well ventilated.

Recommended fuel humidity: not greater than 15-22 %.

Note: At the start of operation water condenses on the internal walls of the boiler which may give an impression that boiler is not water tight. Water condensation disappears when the water temperature in the boiler reaches 70-80 degrees by setting the 4 way valve. It is recommended to keep water temperature in the boiler as high as possible. When the return water temperature is lower than 57 degrees, water vapor condenses on internal wall of the boiler, forms aggressive acids and decreases the service life time of the boiler several times.

To make sure that boiler is water tight user should intensively burn fuel for a few hours and then stop. If the amount of condensate does not increase it means that boiler is water tight.

Attention! When operating the boiler in breach of this manual, firing bad fuel or when the chimney draught is too little boiler dampers may get stuck. Open and close the dampers several times during operation.

5.3. Installing and adjusting the draught adjuster

Draught adjusters manufactured by Swedish ESBE C20/25 with protection from boiler overheating or without it are used. Screw adjuster is into a socket, use sealing tape, attach chain to air supply damper.

When boiler heats up to 70°C, set adjusters knob (marked 1 to 6) to position "4" and shorten the chain so that air supply damper is closed when chain is strained. Turning adjuster to the correspondent position sets desired temperature. Position "6" corresponds to 90°C. Temperature increment between positions is 10°C.

5.4.Boiler cleaning.

Ash collected under the fire grate may block air flow into combustion chamber, so the ash has to be removed from the ash tray and ash pit at least once every two days.

To ensure better operation soot has to be periodically cleaned form the internal boiler surfaces. Periods between cleaning depend on fuel quality (especially humidity), combustion intensity, draught strength and many other factors. It is recommended to clean boiler at least 2-3 times per month removing ash and sooth or when the residual layer of soot on the heat exchanger surfaces and combustion chamber reaches 3 mm thickness. Remove covers (p. 8, 11) and clean internal surfaces with a scraper.

Use special chemicals for hardened solids cleaning. Use Swedish „Fasch 300“ or similar.

Clean chimney at least once a year.

Note: When firing up the boiler for the first time or after a long pause in operation smoke may be blocked in a chimney. To remedy the situation open up the cleaning cover of the chimney and carefully stick a piece of burning paper inside. Close the doors when paper has burned down. Draught should improve.

5.8. Risk analysis and remedies

Boiler is protected from the negative impact of over pressure by a protection valve and/or expansion tank.

Error	Reason	Remedy
Boiler overheats	Combustion too intense Power out (for systems with enforced circulation)	Close the air supply, observe water temperature. When temperature falls down return to a normal mode of operation
Power out		Call an electrician. During winter with a prolonged power outage and a risk of freezing drain the water form the system
Boiler does not reach nominal output	Bad fuel Bad draught	Use dry fuel, open ignition damper Check chimney draught
Boiler „weeps“	Bad fuel Return water temperature too low (<57^{o}C!) Bad draught	Use dry fuel Adjust the mixing valve Check chimney draught
Overpressure in the boiler	Boiler overheats, protection valve malfunctioned Expansion pressure vessel tank does not operate in the closed system	Close the air supply. Observe boiler water temperature. Check and replace the protection valve Check expansion vessel

6. Safety precautions

Prohibited to

- to connect the boiler in to the closed system without protection valve, which maintains the pressure in the system not greater than 0,15MPa (1,5 kgf/cm^2);
- Operate boiler without filling the system with water. Water must not freeze in the boiler or the heating system
- to close feed or return line’s valves, when boiler is running;
- to dry fuel or flammable items close to or on the boiler;
- to ignite fuel by flammable liquids (gasoline, kerosene and other);
- to fire boiler with open doors and covers;
- to pour out not extinguished coal and ashes close to living or other premises;
- to entrust the boiler‘s operation to children;
- to operate the boiler without grounding the frame.

Necessary:

- to constantly check that the grounding is good.

7. Consumables

Doors, cast iron doors, glass fiber sealing gaskets, fire grate, rings and heat resistant concrete may wear, burn out or crack.

These parts may be purchased from the manufacturer.

Use only manufacturer’s parts.

8. Fuel types and properties

Combustion heat of absolutely dry wood does not depend on the kind of wood and equals 4510 kcal/kg. So in order to compare

different kinds of wood we need to assume their relative weight. 1m^3 weighs:

- oak wood - 500 kg;
- birch wood - 450 kg;
- fir wood - 330 kg;
- asp wood - 330 kg.

The higher wood humidity the less calorific value it contains. Decrease in calorific value of humid wood in comparison to 20% humidity wood:

- 30 % humidity - 10 ÷ 15 %;
- 50 % humidity - 35 ÷ 40 %.

Fresh cut tree has about 35 ÷ 60 % water. Wood cut in the beginning of winter or hard wood has least water.

Peat and wood calorific value is similar.

1 kg of coal gives 2 ÷ 3 times more heat than 1 kg of wood.

Combustion of 1 kg of wood requires 4 ÷ 5 m3 of air, coal – around 10 m^3.

The more ash is left – the worse fuel is.

Energy radiation from combusting 1 dm3 of wood of 20 % humidity:

Wood type	Kcal	Kwh	Comparison to oak %
Oak, maple	2520	2,93	100 %
Ash	2460	2,86	98 %
Birch	2270	2,64	90 %
Alder	1900	2,21	75 %
Pine	1850	2,15	73 %
Asp	1810	2,10	72 %
Polar	1680	1,95	67 %
Fir	1610	1,87	64 %

Average coal caloric value 6500 kcal/kg (7,56 kWh/kg).

9. Acceptance certificate

Central heating boiler "Kalvis-2-____" factory No._____ conforms to technical documentation, EN303-5 and IST 144948958.13:2004 requirements and is ready for operation.

Boiler tested at 0.4MPA pressure

Manufacturing date_____

Quality manager_____

10. Complement

1. Boiler "Kalvis-2-_____"	1 pc.
2. Draught adjusterC20/25	1 pc.
3. Scraper	1 pc.
4. Ash scoop	1 pc.
5. Poker	1 pc.
6. Manual	1 pc.
7. Wooden pallet	1 pc.

Electric heating device and cooling loop are not included.

11. Product guarantee

* Manufacturer guarantees that boiler conforms to manufacturing drawings, provisions and regulations of ĮST144948958.13:2004, and LST EN 303-5.

* Manufacturer applies the following guarantee servicing terms from the date of sales:

- Boiler frame – 24 months.
- Complement – 12 months.
- Consumables (para 7) – 6 months.

Manufacturer is obliged to remedy all malfunctions that appear due to manufacturer‘s fault if the user has not violated the requirements for transportation, storage, installation or operation.

- In case of malfunction fill in the application and send it to the manufacturer or manufacturer‘s official distributor. In case of an emergency make a call and give an application to manufacturer‘s representatives on arrival.

Note: If boiler has been connected and operated in breach of the requirements set in this manual, purchaser loses his rights to a guarantee service.

I am acquanited with rules of installation and servicing and guarantee policy.

Purchaser: _____
(name, last name, signature)

Sold by:
Company_____
Sales date: _____
Address _____
Phone _____

Installed by:
Company_____
Address_____
Phone _____
Foreman _____
(name, last name, signature)

In case of a malfunction contact
Company _____
Address _____
Phone _____

Manufacturer UAB "Kalvis"
Pramonės 15, LT-78137 Šiauliai, Lithuania
Phone: (+370 41) 540556
E-mail: info@kalvis.lt

F-02/IN-04

To _____

Guarantee servicing request

Having acquainted with fireplace‘s “Kalvis_____” user‘s manual (Products No._____) and having installed it as required I have following claims:

1. _____

_____

_____

I consider it a manufacturing error and I ask you to send your representatives to inspect the fireplace, determine the defects and remove them.

If the aforementioned defects are due to wrong installation and operation of the fireplace I shall cover the arrival costs of your representatives (_____) and the time spent for travel and on site at _____/hour for each representative including the driver.

My address _____ Phone number. _____

_____

Name Sumame Signature

Notice: Request should be sent by a registered mail to the address specified in this passport, in case of emergency call specified phone number.

Barcode