

# ELECTRICAL BOILERS ECOTERMAL

## 1. INTRODUCTION

The flow-through electric boiler ECOTERMAL – MRE is a modern ecological source of heat designated for story and central heating of small and average size houses and production facilities. The main advantages of heating with electric power are mostly cost effectiveness, high efficiency, environmental friendliness and compactness. Electric boiler can be used in every system of central or story (local) heating in a direct, accumulating or hybrid system. It can be integrated also in existing heating systems, in parallel with solid fuel boiler (exemplary diagrams are shown on Fig. 1 and 2, page 16). It is recommended for safer operation the electric boilers to be mounted in systems operating with a pump securing enforced circulation of the heat medium.

## 2. TECHNICAL DESCRIPTION OF THE BOILER

The electric boiler consists of heat insulated boiler body, electric control unit, circulation pump GRUNDFOS UPS/WILO, placed in metal hull, which is fixed to the wall. The boiler hull and the boiler body are electrostatic painted, which makes them extremely corrosion resistant. All models are equipped with boiler water filter, safety valve, boiler and emergency thermal controllers, with inbuilt weekly program timer, with water level sensor in the boiler body and pressure gauge.

## 3. ELECTRONIC CONTROL SYSTEM

### 3.1. Technical description.

Present technical description is reviewing the operation principle and the characteristics of the control system of electric boiler with rated heaters' power of 60 kW. The system is carrying out the complex control of the local electrical water heating components in accordance with the ambient conditions – the boiler body in a set up regime, which is prolonging the life of the components and increasing the reliability.

### 3.2. Control and signaling devices.

Indicator panel – (Fig. 3).

- Digital LED two-stage indication (pos. 2). It shows the actual water temperature or the preset temperature of the selected boiler controller. The readings are in degrees Centigrade.
- Digital liquid crystal indication (pos. 1). It shows – day, hour, as well as the preset program.
- AUTO/OFF button (pos. 8). It is switching the system to heating mode defined by the prior selected program or prolonged stay.
- Light indicator for the circulation pump condition (pos. 3). It lights on when the circulation pump is on.
- Button PRESET/ACTUAL (W/X) temperature (pos. 10). It shows the preset or the actual water temperature.
- Light indicator low level (pos. 4). It lights on when the water level in the boiler body is lower than the admissible one for safe operation of the heaters.
- Light indicator overheating (pos. 5). It lights on when the blocking temperature controller has been triggered because of emergency high temperature of the water in the boiler body.
- Six or eight-stage light indication for the number of switched on heater sections (pos. 13). It shows the operating power percentage.
- Device for determination of the desired boiler water temperature to be maintained (pos. 11).
- Timer preset button (pos. 6, 7, 9, 12, 14 and 15).

- Jumper J1, accessible from the back side of the indicator panel under the button PRESET/ACTUAL (W/X) (pos. 10). It is designated to operate with weekly timer or without weekly timer. Operation with weekly timer. Operation without weekly timer J1.

### **3.3. Indoor temperature controller.**

- Digital LED two-stage indication. It shows the actual or the preset air temperature at the place, where the indoor controller has been mounted. The readings are in degrees Centigrade.

- Button PRESET/ACTUAL temperature. It shows the preset temperature, which the system is attempting to maintain in the premises or the actual temperature in the premises. Device for determination of desired preset temperature.

### **3.4. Operating mode and functions**

**3.4.1. INDOOR TEMPERATURE CONTROLLER.** The electric boiler operation is regulated proportionally and automatically by the indoor temperature controller in accordance of the temperature in the premises, where it is located.

**3.4.2. BOILER TEMPERATURE CONTROLLER.** The electric boiler operation is regulated proportionally and automatically by the boiler temperature controller on the grounds of the heat medium temperature, and the room temperature is regulated through radiator thermal valve on each radiator.

**3.4.3. EQUITHERMAL TEMPERATURE CONTROLLER.** The electric boiler operation is regulated proportionally and automatically by the equithermal temperature controller, which, on the grounds of the ambient temperature, is selecting the operative heat medium temperature. The equithermal temperature controller is mounted on the northern wall of the building without possibility to be lit by the sun and nothing should affect it by changing the ambient temperature.

**3.4.4. WEEKLY TIMER.** The weekly timer is regulating automatically in **ON/OFF** mode the electric boiler operation and it can be combined with any of the above controls.

**3.5. OFF mode.** It is used during prolonged stay of the boiler. It is selected by the **AUTO/OFF** button on the indicator panel. In **OFF** mode, the boiler regulator is preset to 9°C and the heaters are off. It is performing daily switch on of the circulation pump for about 10 minutes in order to prevent its blocking by water deposits and to update the information on the heat medium temperature at all points of the installation. The **OFF** mode is suitable for all cases, when necessary to stop the heating for a longer period, even in winter. In this case, there is no risk of freezing water because all protections are activated.

**3.6. AUTO mode.** Normal operation of the heating. It is selected by the **AUTO/OFF** button on the indicator panel. The heaters operation is determined by the preset program of the weekly timer and the signals of the indoor temperature controller, the equithermal temperature controller and the boiler temperature controller depending on the operative mode.

**3.7. PUMP.** The pump switches on any time when at least one heater section is on. After stopping all heaters, the pump continues to work for 10 more minutes in order to disperse the energy accumulated in the boiler body to the radiators. Upon drop of the boiler temperature below 15°C, the pump is compulsory switched on in order the entire water quantity to pass through the boiler temperature sensor.

**3.8. HEATERS.** The maximum number of heating sections is 12. Consecutive switching on or off the sections is done in such a way that each subsequent one is connected to a neighboring phase of the power supply network in view of symmetric loading. If simultaneous switching of more than one section is needed, it is done consecutively and each coming is switched with 2 seconds delay towards the preceding one. This results in smooth loading or unloading of the power supply network, electric shocks are avoided and high noise resistance of the system is achieved.

**3.9. REGULATION.** Adjustment of the heating power is done according to the signal of the indoor controller, the boiler controller and the equithermal controller. Upon

approaching of the actual temperature to the preset boiler temperature, greater number of sections are switched off, the boiler selecting such power for maximum approach to the preset temperature without catching up with and exceeding it.

### **3.10. Protections and blockings**

- PROTECTION thermal emergency of the boiler body. In is carried out by an electromechanical blocking thermostat. Boundary temperature – fixed, cannot be adjusted.
- REACTION. Upon exceeding the boundary temperature, all heaters are immediately compulsory switched off. The pump continues to work for 10 more minutes, after which it switches off. Signal OVERHEATING is lit on the indicator panel. The protection is not self-recovering. It is unblocked manually only after removal of the reason for tripping on and drop of the temperature.
- PROTECTION from lowering the level of water in the boiler body. Because of various reasons (evaporation, leakage), the quantity of water in the pipes and radiators may decrease and the water level in the boiler body may drop under the one admissible for their safe operation.
- REACTION. All heaters and the pump are immediately compulsory switched off. Signal LOW LEVEL is lit on the indicator panel. Upon recovery of the level, the protection is waiting for 40 seconds, after which the heaters are smoothly switched on to the needed number.
- PROTECTION against water freezing in the boiler body, pipes and radiators.
- REACTION. Upon drop of the temperature of water in the boiler body below 15°C, the circulation pump is switched on compulsory to constant operation. If in such status temperature lower than 6°C should be measured, all heaters are smoothly switched on (100% power). This shall continue until raise of the temperature above 8.5°C. Then the heating is switched off again smoothly, but the pump is continuing to work while the temperature is staying below 15°C. Upon triggering the overheating protection, the action of the protection against freezing is blocked.

## **4. CONDITIONS OF COMMISSIONING AND UNDERTAKING GUARANTEE MAINTENANCE – GENERAL TERMS:**

**The electric boiler is mounted with the help of consoles only on a wall that can bear its weight. The boiler location should be selected in a manner to secure access – technological tolerance from its all four sides is shown on Fig. 12 and 13, page 23, the distances being different for the various rated powers.**

1. Boiler should be mounted at a place suitable for servicing (free access thereto) and possibility of opening the front lid.
2. Minimum free space should be secured at the right and at the lefts side of the boiler in order the side lid to be able to open for work on the heaters heads.
3. Boiler should be mounted suspended on the wall at minimum height of 1 m off the floor.
4. Boiler safety valve should be assembled without mounting any shut off devices between it and the boiler.
5. Water filter should be mounted at the cold water intake before the pump by observing the direction marked on the filter itself (boiler fixture), in accordance with the attached manufacturer's instructions.
6. Automatic air bleeder should be mounted on the boiler.
7. The boiler should not be contaminated with building materials.
8. Banjo fitting connections should be mounted on the boiler intake and the outlet.
9. Hydraulic test should be carried out at an index of 1.25 above the operating pressure.
10. Upon assembly, it is necessary the adjustments of the boiler and the blocking thermostats to be checked up. The actual control is done during the warm test.

11. The guarantee shall be effective as from the commissioning date, but not later than six months as from the date of the purchase.

### Method of connecting the system to a solid fuel boiler

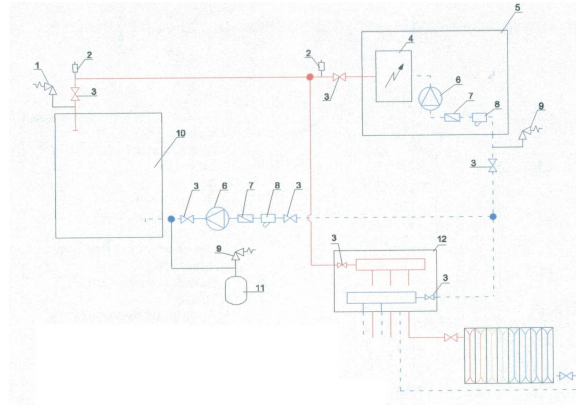


Fig. 1

- |                                |                             |
|--------------------------------|-----------------------------|
| 1. Safety valve by temperature | 7. Return valve             |
| 2. Air bleeder                 | 8. Water filter             |
| 3. Shut off valve              | 9. Safety valve by pressure |
| 4. Electric heater             | 10. Solid fuel boiler       |
| 5. Electric boiler             | 11. Expansion vessel        |
| 6. Circulation pump            | 12. Manifold Box            |

### Method of connecting of story (local) heating

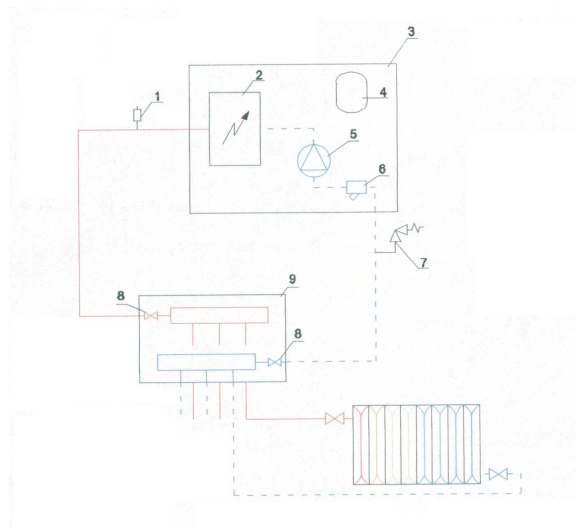


Fig. 2

- |                     |                   |
|---------------------|-------------------|
| 1. Air bleeder      | 7. Safety valve   |
| 2. Electric heater  | 8. Shut off valve |
| 3. Electric boiler  | 9. Manifold Box   |
| 4. Expansion vessel |                   |
| 5. Circulation pump |                   |
| 6. Water filter     |                   |

## INDICATOR PANEL

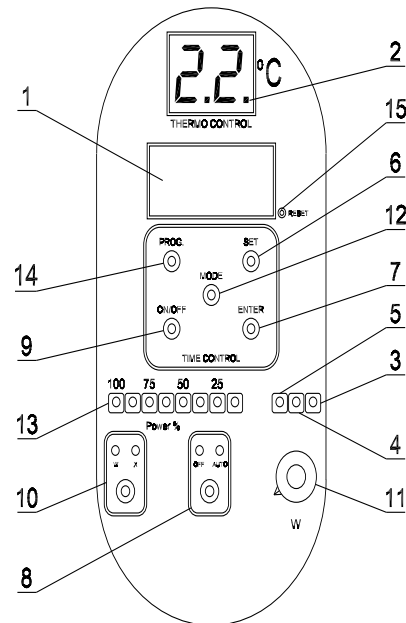


Fig. 3

## OPERATING MODES WITH WEEKLY PROGRAMMER

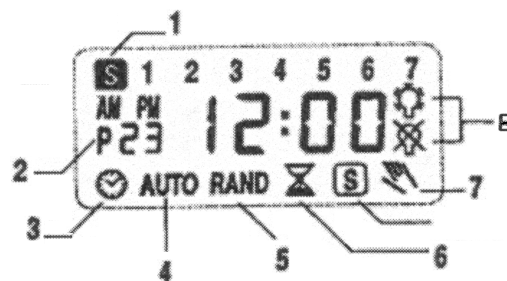
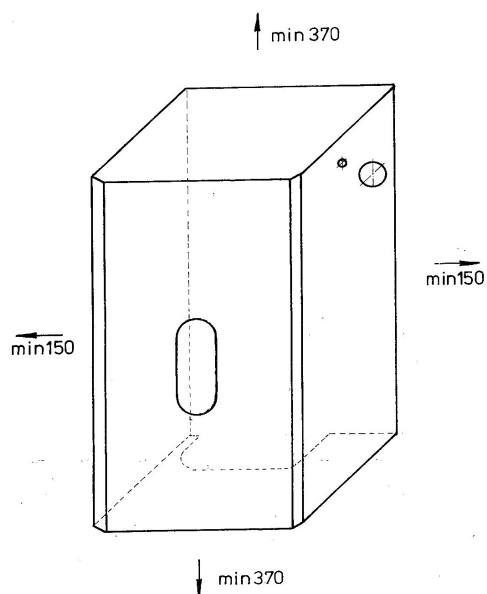


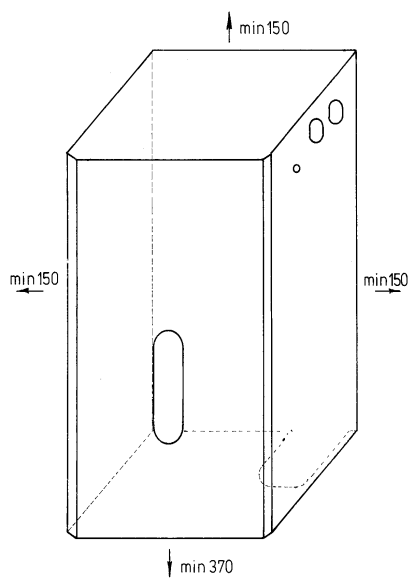
Fig. 9

1. summer daylight saving time
2. programming mode
3. set time mode
4. AUTO mode
5. random on/off mode
6. counting mode
7. manual on/off mode
8. outlet status: on/off

**ELECTRIC BOILER WITH ELECTRONIC CONTROL MRE/MODULE FROM 6 - 30 kW**



**ELECTRIC BOILER WITH ELECTRONIC CONTROL MXE/MODULE FROM 36-60 kW**



### Dimensions of electric boilers/module with electronic control

<b>Electrical Boiler MRE 6 - 30</b>	<b>kW</b>	<b>6 - 30</b>
height	mm.	700
length	mm.	385
width	mm.	260
<b>MODULE 6 – 30</b>	<b>kW</b>	<b>6 - 30</b>
height	mm.	645
length	mm.	315
width	mm.	270
<b>Electrical Boiler MXE/MODULE 36 - 60</b>	<b>kW</b>	<b>36 - 60</b>
height	mm.	780
length	mm.	500
width	mm.	295

Table 1

### Technical characteristics of electric boilers/module with electronic control

Maximum power	<b>kW</b>	<b>6,8</b>	<b>10,12</b>	<b>15,18</b>	<b>22,24</b>	<b>36,42,48</b>	<b>54,60</b>
Commutation degree	number	6	6	9	12,12,15	18,21,24	25
Boiler body volume	dm <sup>3</sup>	4.7	5.7	15	15	26	26
Supply voltage	V	240/400	240/400	400	400	400	400

Table 1.1

### Technical characteristics of electric boilers MRE/Module – new design

Maximum operating pressure	MPa	0.25
Test pressure	MoA	0.40
Regulation of heat medium temperature	°C	30-90
Room temperature control	°C	5-30
Connection pipes dimensions	G	1"
Efficiency index	%	99.30

Table 2

### Cross-section of power supply cables to electric network

<b>P [kW]</b>	<b>I<sub>heater</sub> [A]</b>	<b>Cross-section [mm<sup>2</sup>]</b>	<b>I<sub>fuse</sub> [A]</b>
6	8.7	5 x 2.5	10
8	11.6	5 x 2.5	16
10	14.5	(3 x 2.5 + 1.5) + 1 x 4	20
12	17.4	(3 x 4 + 2.5) + 1 x 4	25
15	21.8	(3 x 4 + 2.5) + 1 x 6	32
18	26.1	(3 x 6 + 4) + 1 x 6	40
24	34.8	(3 x 6 + 4) + 1 x 10	50
30	43,5	(3 x 10 + 6) + 1 x 10	63
36	52,2	(3 x 10 + 6) + 1 x 16	2 x 40
42	60,9	(3 x 10 + 6) + 1 x 16	1 x 40 / 1 x 50
48	69,6	(3 x 10 + 6) + 1 x 16	2 x 50
54	78,3	(3 x 10 + 6) + 1 x 16	1 x 50 / 1 x 63
60	87,0	(3 x 10 + 6) + 1 x 25	2 x 63

Table 3