ENTROPIE
INDUSTRIAL BOILERS

CONTROL SYSTEM ENTROMATIC 503

Installation and Operation Manual

Contents

INTRODUCTION **02**
1 TECHNICAL DESCRIPTION **02**
1.1 General Appearance and Purpose 02
1.2 Indication and Control 03
2 FUNCTIONAL DESCRIPTION **04**
2.1 Burner Unit Control 04
2.2 Safety System 05
2.3 Continuous Blowdown System (Salt Content Monitoring) 07
2.4 Discontinuous Blowdown System 08
2.5 Make-up System 09
3 ECC503 CASCADE CONTROL MODULE **11**
3.1 Generating a request for burner actuation in cascade control mode 13
4 EDC503 DEAERATOR LEVEL CONTROL BLOCK **14**
5 MAINTENANCE **15**
APPENDIX 1. OVERALL DIMENSIONS, MOUNTING HOLES **16**
APPENDIX 2. COMPLETE SET LIST OF CS ENTROMATIC EBC503 ..... **17**
APPENDIX 3. LIST OF PROGRAMMED PARAMETERS FOR REGULATOR 2TPM1 ..... **18**
APPENDIX 4. CIRCUIT DIAGRAM OPTIONS OF EXTERNAL CONNECTIONS FOR BURNER AND CCM ECC503 ..... **19**

INTRODUCTION

The Installation and Operating Manual (OM) determines the key installation requirements, adjustment and maintenance requirements for steam boiler control system ENTROMATIC 503 (hereinafter referred to as CS EBC503).

Only persons at least 18 years old who have passed medical examination, have been trained and have the certificate authorizing them to do this work shall be admitted for above work.

This OM serves to be used for installation, design planning, operation and maintenance of the whole package of CS EBC503. The following materials must be used in addition to this OM: technical descriptions of the sensors used, actuators and burner unit.

1 TECHNICAL DESCRIPTION

1.1 General Appearance and Purpose

CS Entromatic EBC503 is designed to ensure safety and control for all the necessary systems of small and medium capacity steam boilers (up to 5 tons of steam per hour inclusively).

Functions:

- remote control of the main steam valve (MSV);
- control of make-up pumps/make-up valve by water level in the boiler;
- control of boiler continuous blowdown system (salt content control);
- control of boiler discontinuous blowdown system (sludge removal);
- monitoring of minimum water level in the boiler;
- monitoring of maximum water level in the boiler;
- monitoring of maximum water pressure in the boiler;
- burner unit interlock;
- light signals of emergency situations;
- alarm of top level automation interlock;
- alarm in the event of dispatcher system emergency.

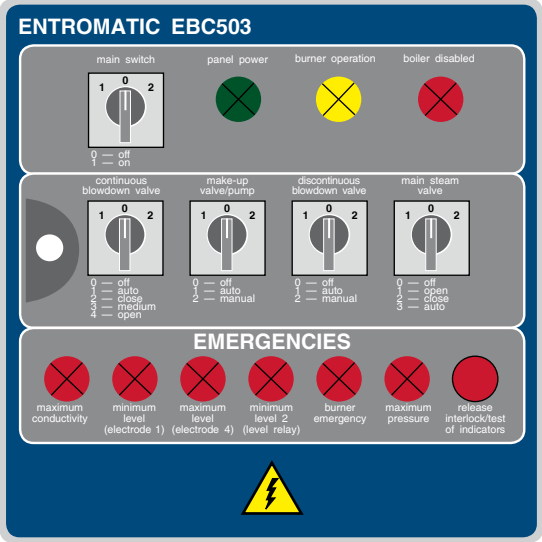


Fig. 1 Appearance

Important general instructions on use

CS is to be used according to its purpose only. Maintenance and repairs must be carried out by authorized qualified personnel only. The unit shall be used with components and spare parts recommended in this operating manual only. Other components and fast wearing parts can be used in expressly designated cases only, when they do not affect operating characteristics and comply with safe operation requirements.

We reserve the right to make technical modifications!

Due to continuous technical improvement of the equipment, insignificant changes in appearance, in functional solutions and technical parameters are possible.

1.2 Indication and Control

On the front panel of CS there are system status indicators and controls divided into three logic groups.

Status Block (Block 1)

- The main switch powers on/off CS.
- “Panel Power” Indicator shows that there is power after the SC main switch has been closed.
- “Burner Operation” Indicator shows the controlled burning of the flare in the boiler furnace.
- “Boiler Disabled” Indicator shows that there is a break in the boiler safety circuit. The interlock is activated if there is an emergency situation specified in the indication block. The interlock is released manually by pressing “interlock release”* button after the emergency cause clearing.

Block of Mode Switches (Block 2)

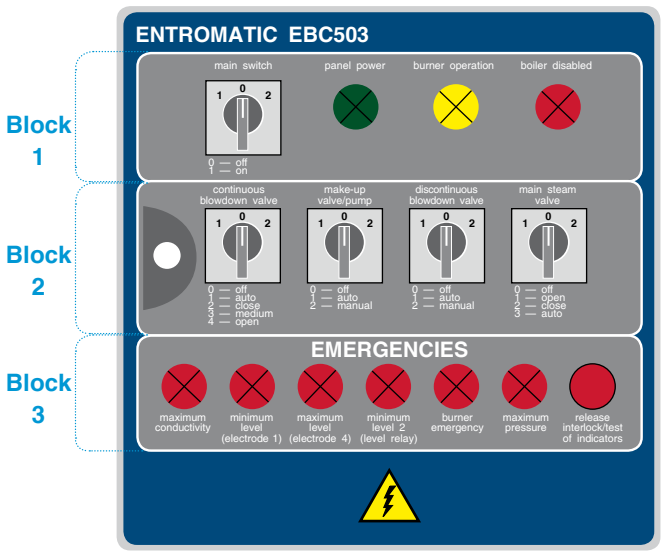


Fig. 2

Table 1.
Block of Mode Switches

Actuator	Function	Modes	
Continuous blowdown valve	Keeping pre-set salt content in the boiler	0 — OFF	There is no control
		1 — AUTO	Automatic control of the Regulator
		2 — CLOSE	Always closed
		3 — MEDIUM	Always in medium position
		4 — OPEN	Always opened
Make-up valve/pump	Keeping pre-set water level in the boiler	0 — OFF	There is no control
		1 — AUTO	Automatic control of the Regulator
		2 — MANUAL	Always on
Bottom blowdown valve	Discontinuous sludge removal from boiler bottom	0 — OFF	There is no control
		1 — AUTO	Timer based control
		2 — MANUAL	Always on
Steam cutoff valve	Boiler disconnection from the steam line	0 — OFF	There is no control
		1 — OPEN	Always opened
		2 — CLOSE	Always closed
		3 — AUTO	Automatic control of the cascade regulator

Block for Emergency Conditions Indication (Block 3)

Table 2.
Block for emergency conditions indication

Indicator	Initiator sensor	Reason
Maximum pressure	Maximum pressure switch	Pressure in the boiler exceeded the set set-point of the pressure switch
Minimum level 1	Minimum level sensor	Level in the boiler is below the sensor electrode
Minimum level 2	Combined level sensor (electrode 1)	Level in the boiler is below electrode 1 of combined level sensor
Maximum level	Combined level sensor (electrode 4)	Level in the boiler is above electrode 4 of combined level sensor
Burner emergency	Burner unit	See Operating Manual for burner unit
High electrical conductivity	Electrode for measuring electrical conductivity	Electrical conductivity of the boiler water exceeded the pre-determined set-point

* “Interlock release/Indicators testing” button — when pressed it acknowledges the safety circuit interlock and check operation of the CS indicators.

2 FUNCTIONAL DESCRIPTION

2.1 Burner Unit Control

The control system EBC503 is not active during the process of capacity regulation of the burner unit. It is implied that the burner operates from its own (builtin or external) capacity regulator (CR), as a rule, in accordance with the PID law. The setting for the CR of the burner is the signal from the steam boiler pressure sensor. When adjusting, it is required to configure the burning manager for operation by the pressure sensor installed on the boiler.

The burner CR maintains the set pressure in the boiler by means of the PID regulator and the burner capacity modulation system. In the event that the consumed power is less than the minimum burner capacity, the burner automatically turns off/on based on the set hysteresis.

To set the burner manager operation in the mode of control by pressure sensor use the OM for the burner.

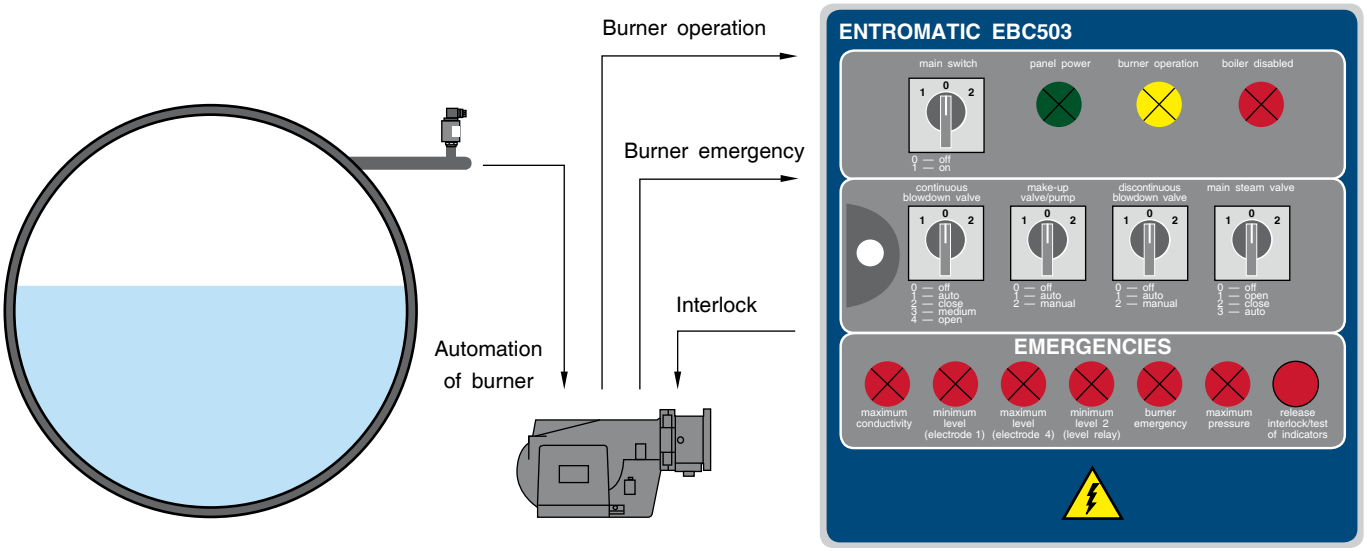


Fig. 3. External control links for a single boiler system

To ensure safe operation and shutdown of fuel supply to the burner unit in the case of emergency situation arising the burner safety circuit needs to incorporate a normally opened (NO) interlock contact of CS EBC503.

The interlock contact will be opened in the following emergency situations:

- automation accident;
- maximum pressure in the boiler;
- minimum level in the boiler;
- maximum level in the boiler;
- electrical conductivity of the boiler water;
- no power supply.

The required condition for boiler automation operation is availability of the two potential signals (220 V) from the burner unit:

- burner emergency;
- burner operation.

When connecting, make sure that the burner automationand CS EBC503 are powered from the same phase.

Should it is necessary to organize cascade control of two boilers unit, it is recommended to use ECC503* cascade regulator.

Connection of the cascade regulator is made as follows**:

- when there is no main steam cutoff valve (MSCV) theconnection is made when the burner startup circuit is broken (signals T1–T2);
- when MSCV is installed the connection is made directly to EBC503 automation.

Note

*** — See Operating Manual on ENTROMATIC ECC503 Cascade Regulator.**

**** — See section CASCADE CONTROL.**

2.2 Safety System

EBC503 safety system is designed to ensure safe operation of the steam boilers and to disable the burner operation (disconnection of fuel supply to the burner unit) in the following emergency situations:

- automation accident;
- maximum pressure;
- minimum level in the boiler;
- maximum level in the boiler;
- electrical conductivity of the boiler water;
- no power supply.

If necessary, provision is made for connection to the safety circuit terminals of the supplementary (external) safety systems, and in that case the jumper wire is removed from these terminals.

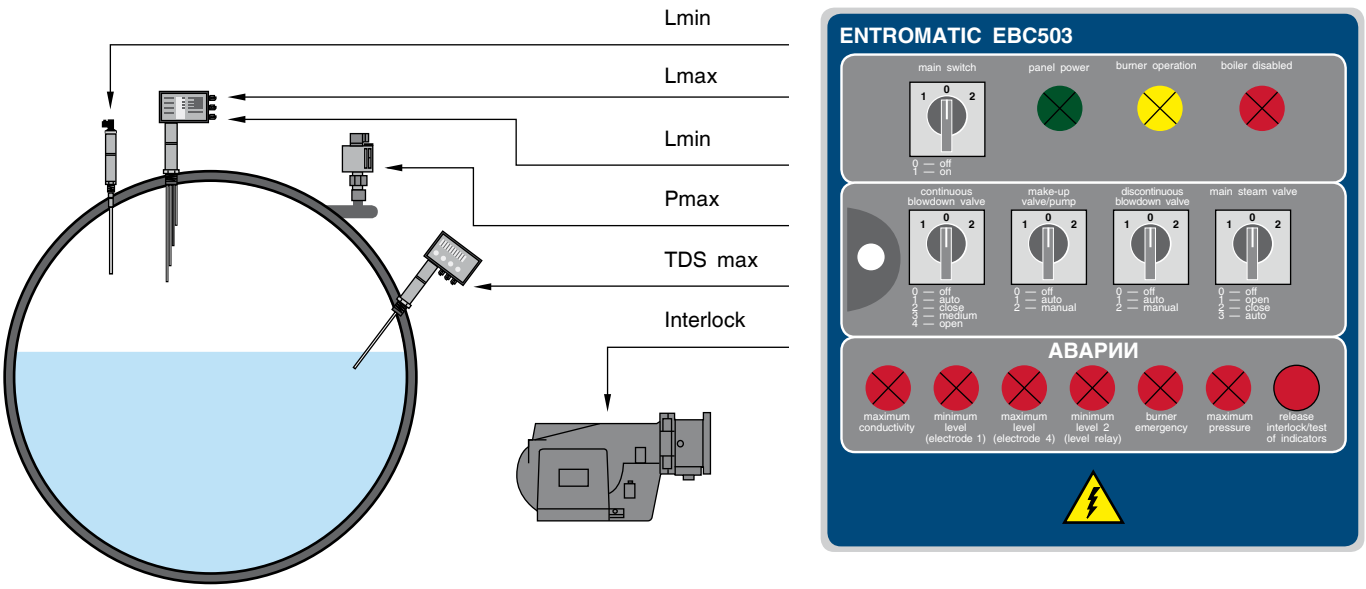


Fig. 4. Safety System

Maximum pressure switch

DSA switch installed on the safety group header controls maximum pressure. When the pressure in the boiler goes up above the permissible level, the CS safety circuit opens with a signal issued to the indication panel.

Sensor is set by rotating the regulation screw. The sensor set-point shall not exceed the permissible pressure stated in the boiler passport.

Electrode for measuring electrical conductivity of the boiler water

Setting is made in accordance with the operating manual for this sensor. The following values are set in this case:

- measurement range is 100–10000 or 0.5–100000 depending on the electrode type;
- maximum value, at which the emergency signal is generated, shall be set with a slight exceedance of the set-point but not exceeding the value specified in the OM for the steam boiler.

Emergency caused by exceedance of the permissible conductivity (salt content) is serious enough and indicates that one of the controlled boiler water quality indicators exceeded the acceptable readings.

Minimum level*

Minimum level is monitored by two independent sensors (NRGS 15-1 (electrode 1) and NRG 16-50). When the water level goes below one of the sensors, the CS safety circuits opens with signal issuing to the indication panel.

Maximum level

Maximum level is monitored by one sensor NRGS 15-1 (electrode 4). When the water level goes above the set level of the electrode, the CS safety circuit opens with signal issuing to the indication panel.

The length of the electrodes of the minimum and maximum level sensors is set by cutting them to required length stated in the boiler passport or to the level specified on the boiler nameplate.

Before the NRGS sensor use set the DIP switches as per the Figure.

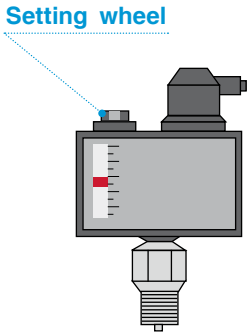


Fig. 5. DSA maximum pressure switch

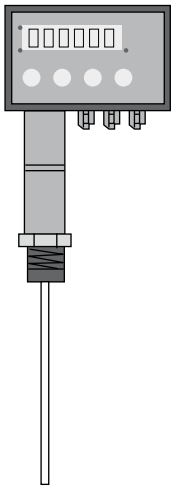


Fig. 6. Conductivity meter LRGS 15-1

Installation procedure:*

- cut off the electrodes of the minimum and maximum level sensors according to the water level in the water gage glass;
- install the sensors in the nozzles specially designated for these purposes (shown in the boiler drawing);
- connect the electrodes to the boiler automation cabinet;
- turn on automation, make sure that both minimum level sensors were activated;
- start the boiler filling up with water;
- upon reaching the minimum level, simultaneously check that the emergency signal is removed from both sensors;
- make check marking for minimum level on the water gage glass for visual monitoring;
- continue the boiler filling up with water until the signal of the maximum level achieved;
- make check marking for maximum level on the water gage glass for visual monitoring.

The procedure of setting and commissioning of the level regulator is described in the Operating Manual for NRGS15-1.

* If the steam boiler has nameplate specifying the minimum level, then the procedure of the sensors setting is reverse. First, the boiler is filled up with water and then according to actual state the sensors are cut off.

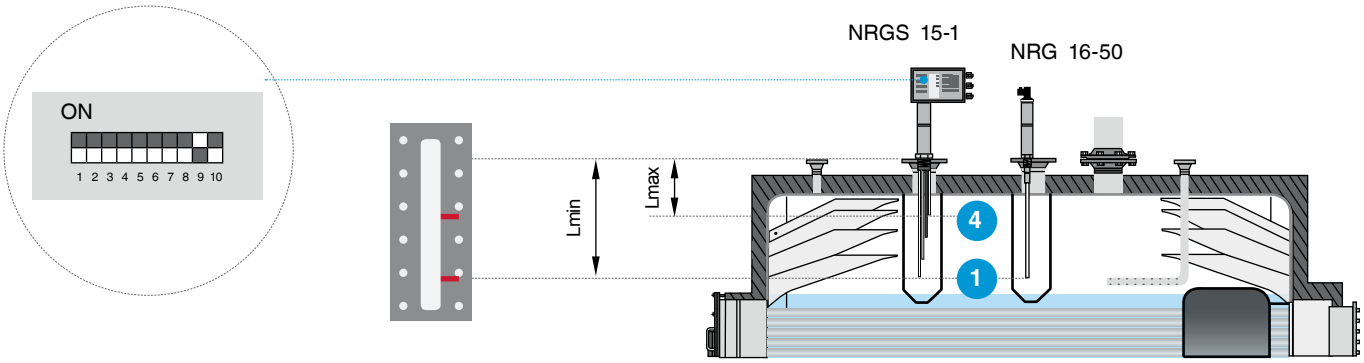


Fig. 7. Safety System

2.3 Continuous Blowdown System (Salt Content Monitoring)

The continuous blowdown system shall ensure removal of dissolved salts accumulating in the boiler water to prevent deposits from building up and to maintain normal water chemistry of the boiler.

The upper blowdown valve is controlled in automatic mode based on the signals received from electrical conductivity meter LRGS 15-1. The valve operation mode is selected with a selector switch on the front panel of CS EBC503.

The system starts operating when the “operation” signal from the burner appears. The “operation” signal is potential signal 220 V, initiated by the burner unit after ignition and flame control procedure.

When the burner turns off, the valve automatically closes.

When setting the sensor, the following shall be set:

- valve full opening set-point;
- maximum (emergency) value;
- determine correction coefficient for operation without temperature sensor;
- determine temperature coefficient for operation with temperature sensor.

The procedure of setting and commissioning of the salt content regulator is described in the Operating Manual for LRGS15-1.

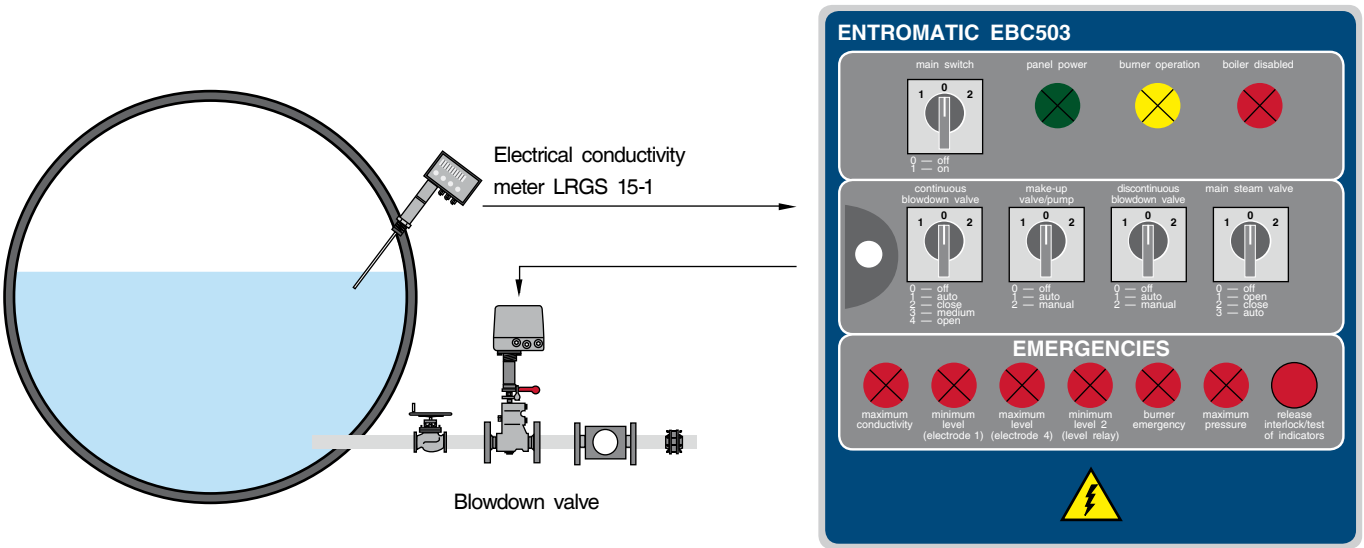


Fig. 8. Continuous blowdown system

2.4 Discontinuous Blowdown System

System which ensures sludge removal with some water by short-term opening of the discontinuous blowdown valve. The valve operation mode is selected with a selector switch on the front panel of CS EBC503.

Calculation of blowdown valve opening time

For the purpose of determining the water flow rate for discontinuous blowdown, the following formula can be used

$$A = \frac{Q \times S}{K - S},$$

where:

A — blowdown value (kg/h);
Q — boiler capacity (kg/h);
S — feed water conductivity (µS);
K — allowable conductivity of boiler water (µS).

EXAMPLE:

Boiler capacity 2000 kg/h,
operating pressure 8 bars,
feed water conductivity 22 µS,
allowable conductivity of boiler water 4000 µS.

$$A = \frac{2000 \times 22}{4000 - 22} = 11.06 \text{ kg/h}$$

According to graph 1 of throughput capacity of the blowdown valve (specified in the OM for the valve) the throughput capacity of the valve at pressure of 8 bars corresponds to 5.7 kg/s. Based on the results obtained, we set the pulse generator, the valve opening to 2 s after each hour.

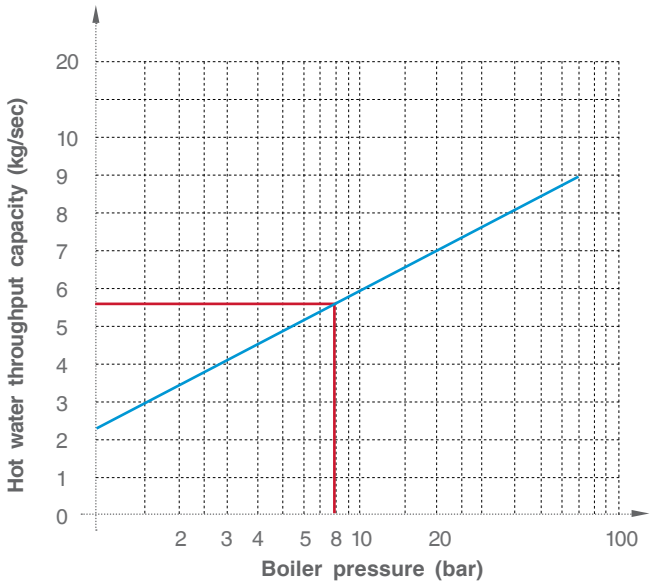
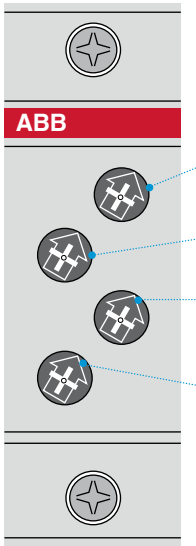


Diagram 1. Example of throughput diagram of discontinuous blowdown valve

The pulse generator for discontinuous (bottom) blowdown purging in automatic mode is actuated when the “operation” signal comes from the burner. The “operation” signal is potential signal 220 V, initiated by the burner unit after ignition and flame control procedure. Once the burner tuns off, the pulse generator tuns off, too.

The pulse generator is located inside the cabinet. To set it, it is required to set the configurators located on it in the required position.



“Puls on” Pulse time. We set it to position “2”

“Range” Maximum range of pulse time. We set it to position “10s”

“Puls off” Down time. We set it to position “6”

“Range” Maximum range of down time. We set it to position “100m”

Therefore, we have configured the pulse generator with the following parameters: opening every 60 minutes for 2 seconds.

Fig. 9. Setting made for this example

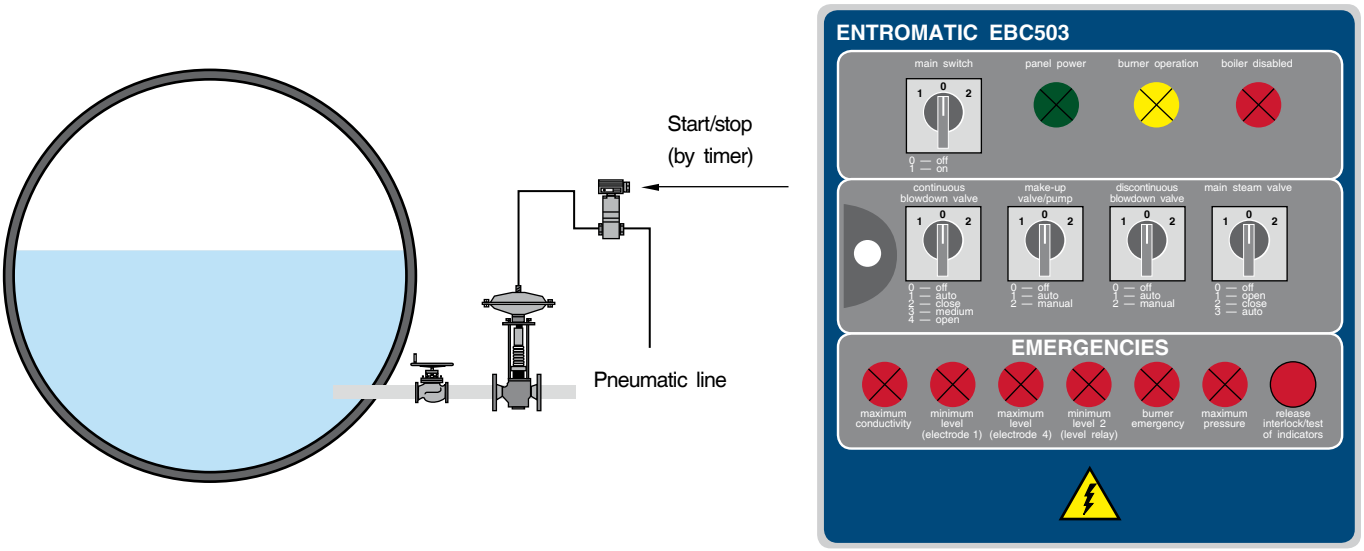


Fig. 10. Discontinuous blowdown system

2.5 Make-up System

The make-up system is designed to maintain the water level in the steam boiler within preset allowable range.

The boiler make-up is controlled in automatic mode based on the signals received from NRGS 15-1 level switch. Make-up operation mode is selected with a changeover switch on the front panel of CS EBC503.

Procedure of level sensor installation*

Cut off the electrodes for the pump/valve turning on/off to establish the boiler make-up working zone.

As a rule, the pump is started at 40–60 mm to the low level and stopped at 40 mm to the high level.** Monitoring is performed using water gage glasses.

1. Install the level sensor in the special nozzle.
2. Make electrical connection of the sensor and automation.
3. Drain water from the boiler until the make-up signal is issued.
4. Make control marking on the gauge glasses to identify beginning of the working zone.
5. Make-up the boiler until the make-up signal clearing.
6. Make marking on the gauge glass to identify end of the working zone.

NOTE

* If the steam boiler has nameplate specifying the minimum level, then the procedure of the sensors setting is reverse. First, the boiler is filled up with water, and then the sensors are cut off in the field.

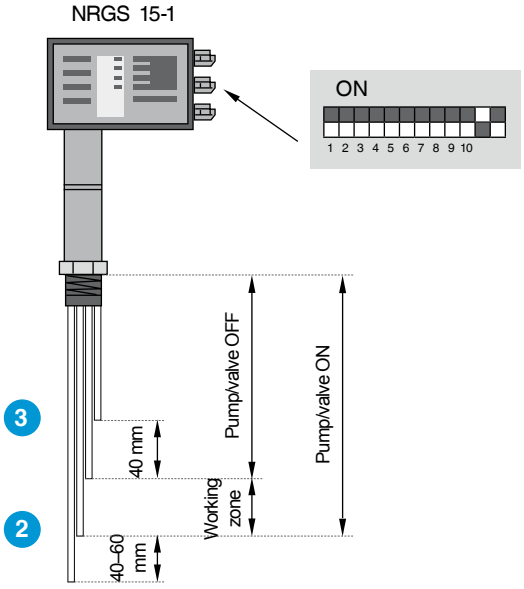


Fig. 11. Cutting off the level electrodes

** The working zone is determined subject to 60% of permissible range (distance between the maximum and minimum level). The working zone, as a rule, is determined by a pre-commissioning organization based on the boiler's operating mode. Periodically re-occurring triggering of the minimum or maximum level protection indicates that the working zone needs correction.

As part of CS EBC503 use two options for boiler make-up diagrams are proposed which are selected depending on this boiler capacity.

OPTION 1. MAKE-UP SYSTEM FOR BOILERS WITH CAPACITY UP TO 2 T/H INCLUSIVELY

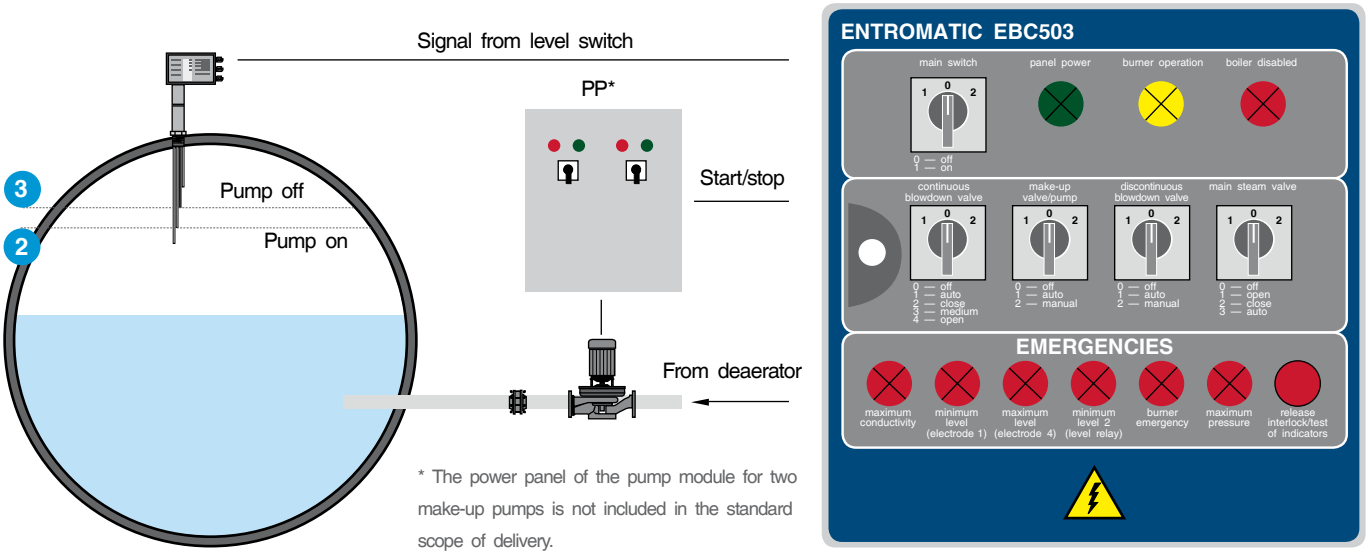


Fig. 12. Make-up system for boilers capacity up to 12 t/h inclusively

When the water level in boiler drops below the electrode 2 of level sensor, a signal is issued to CS EBC503 to notify of the need to start the pump. In this case, CS EBC503 sends to the power panel (PP) of the pump module the potential signal 220 V which is signal requesting the pump start-up. Request for pump operation is removed when water reaches the level of electrode 3.

OPTION 2. MAKE-UP SYSTEM FOR BOILERS WITH CAPACITY UP TO 5 T/H INCLUSIVELY

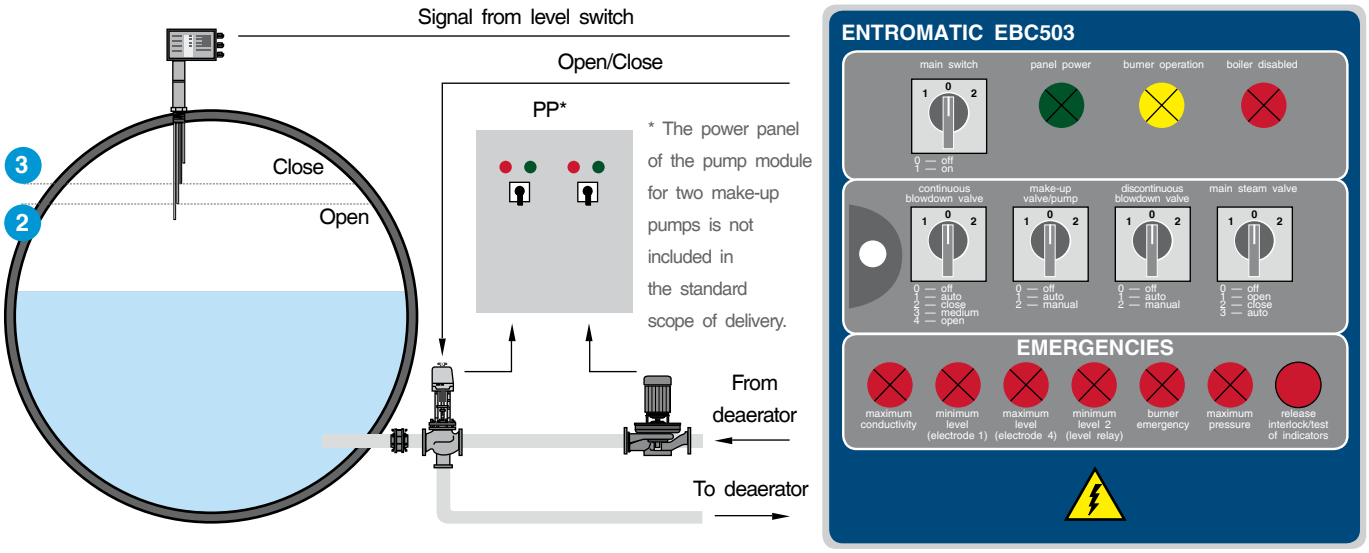


Fig. 13. Make-up system for boilers with capacity up to 5 t/h inclusively

When the water level in boiler drops below the electrode 2 of level sensor, a signal is issued to CS EBC503 to notify of the need to make up the boiler. Besides, CS EBC503 issues 220 V potential signal to open the make-up valve.

The signal to close the valve is generated when the water in the boiler reaches the level of electrode 3 of level sensor. When the main passage of the valve fully closes, water recirculates via the discharge line. The signal to turn on/off the pump is generated by the limit switch of the make-up valve.

Recommendations for the diagram:

To automatically turn off the make-up pump, it is recommended to use the limit switch contacts of the valve “CLOSED position”. When the signal of the valve full closure reaches the power panel, the pump can be turned off with time delay. The value of the delay between the command arrival about full closure of the valve and the pump shutdown is determined during pre-commissioning.

Note that delay between the turn-on/off signal from CS EBC503 and the full opening of the valve relates to its run-down time which shall nbe considered when cutting off the electrodes in norder to exclude the possibility of the minimum or maximum level interlock triggering.

3 ECC503 CASCADE CONTROL MODULE

The cascade control module (CCM) ECC503 allows cascade operation of two steam boilers to be organized (burners with their own capacity regulator (CR)).

Actuation/de-actuation of the slave boiler takes place based on the steam mass flow rate in the common header.

As input signal for mass flow rate the signal 4-20 mA from the steam meter (accounting unit corrector) installed on the common header is used.

Cascade regulator functions:

- cascade connection of the slave boiler for operation;
- automatic actuation of the slave boiler in the case of the master boiler failure;
- setting the cascade sequence by means of changeover switch located on the front panel (see Fig. 14).

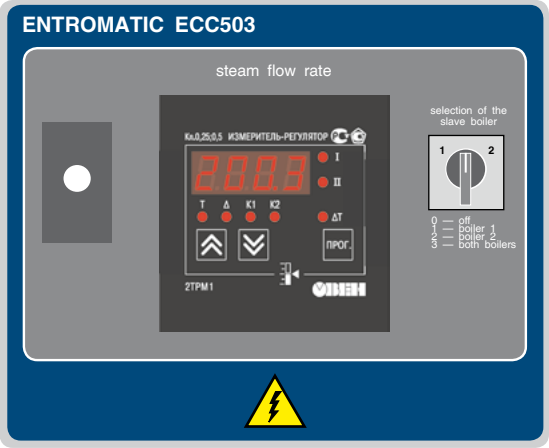


Fig. 14. Appearance of CCM ECC503

In CCM ECC503 it is possible to implement two cascade control circuits, i.e. using the main steam valves on the boilers and without such valves.

CASCADE CONTROL USING THE MAIN STEAM VALVE

When using the circuit with the MSV (Fig. 15), control signal from CCM ECC503 to turn on the slave boiler comes to CS EBC503 of this boiler. In this case, CS EBC503 of the slave boiler opens MSV, which, in its turn, reduces the pressure in the boiler, and, as a consequence, turn on the burner. As the mass flow rate of the steam on the user decreases, the pressure in the boilers rises, and the cascade regulator sends signal causing closing of the MSV of the slave boiler. Let us draw your attention to the fact that the slave boiler is always in operation because its MSV is always opened.

This diagram allows the non-operating boiler disconnection from the common steam header.

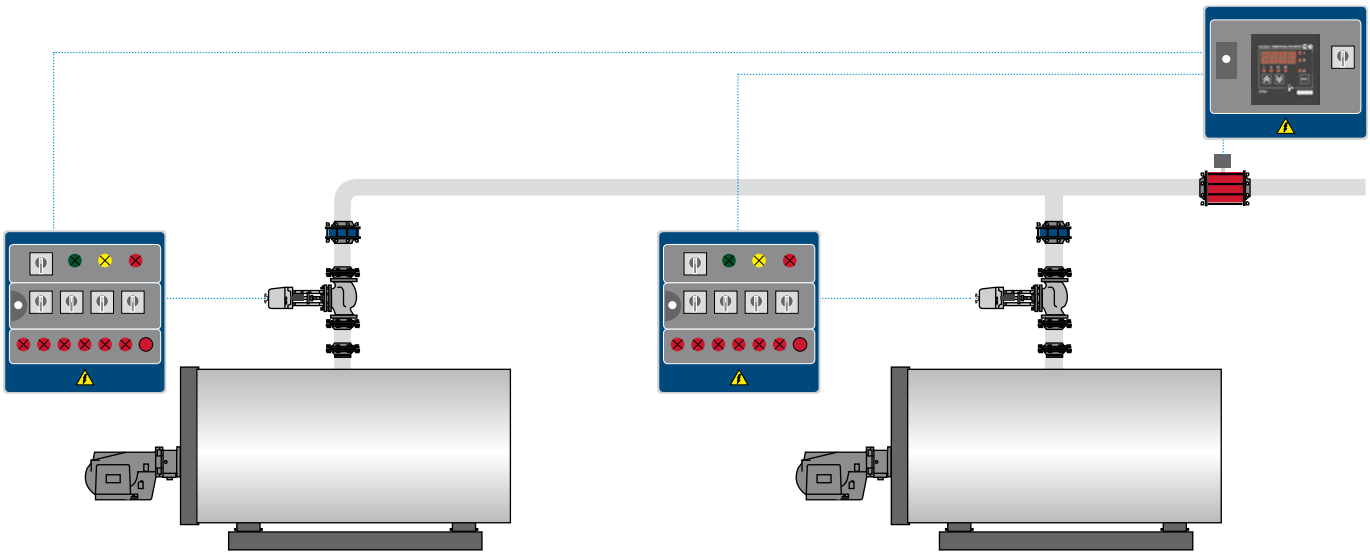


Fig. 15. Cascade control by means of main steam valve

CASCADE CONTROL WITHOUT USING THE MAIN STEAM VALVE (MSV)

When the circuit without the MSV is used (Fig. 17), the control signal (contact) from MCC ECC503 shall be incorporated in the startup circuit of the burner first stage. Closure of the startup circuit contact (generating the signal requesting actuation) causes the burner turning on and visa versa.

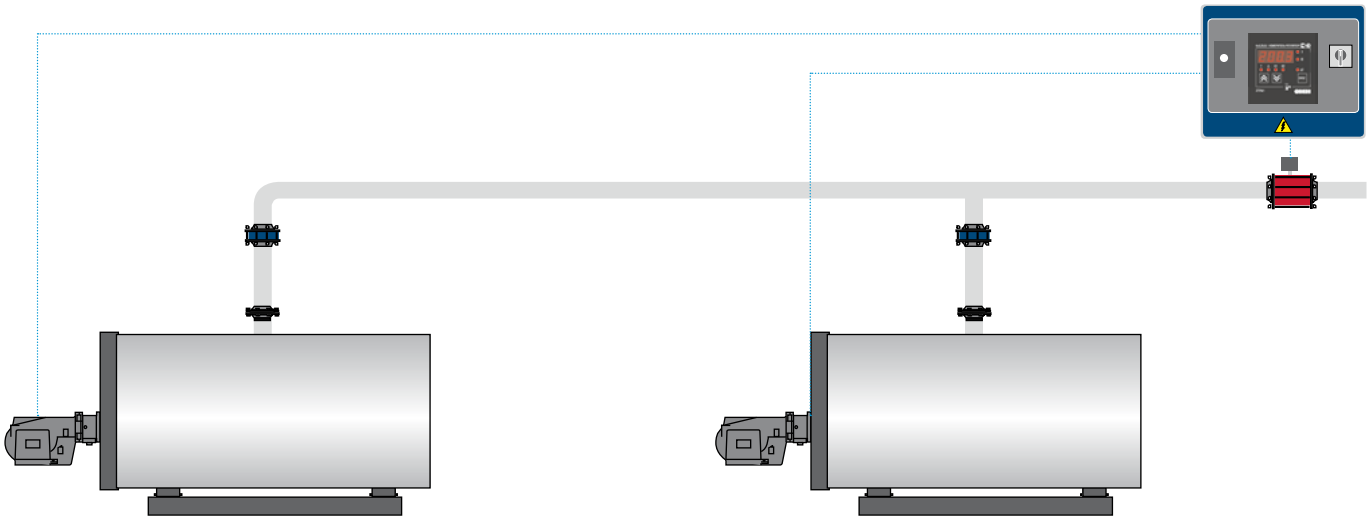
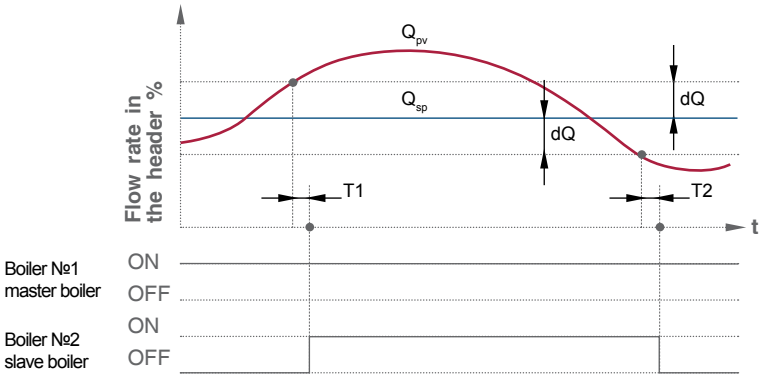


Fig. 16. Cascade control by means of main steam valve

2TPM1 REGULATOR

The design of MCC ECC503 includes the 2TPM1 regulator manufactured by the Company OVEN (Russia) whichprovides the cascading of a two boilers steam system. More details about the settings and operation of this device can be found in the documentation for this device. The regulator's operating principle is visually demonstrated in the Figure below.

In the event that the 4-20 mA mass flow rate signal is interrupted, all the boilers are turned on, and the emergency signal is generated from the CCM.



Q_{pv} — current mass flow rate, set in %;

Q_{sp} — mass flow rate set-point at which cascading takes place, %;

dQ — hysteresis which determines the working regulation field;

T1 — actuation delay time;

T2 — de-actuation delay time.

Diagram 2. Diagram of cascade control principle

3.1 Generating a request for burner actuation in cascade control mode

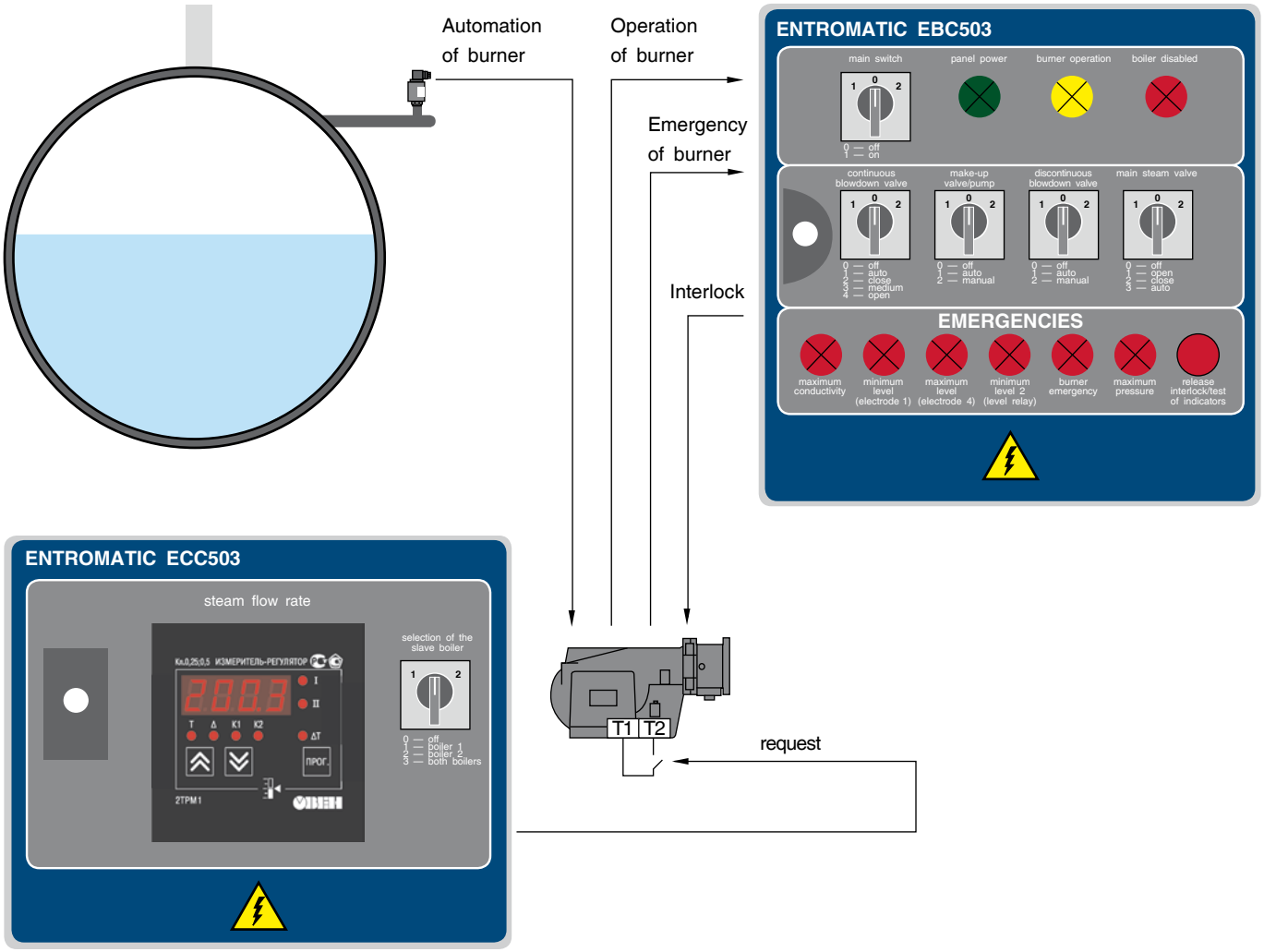


Fig. 17. Request for burner actuation from the cascade control module

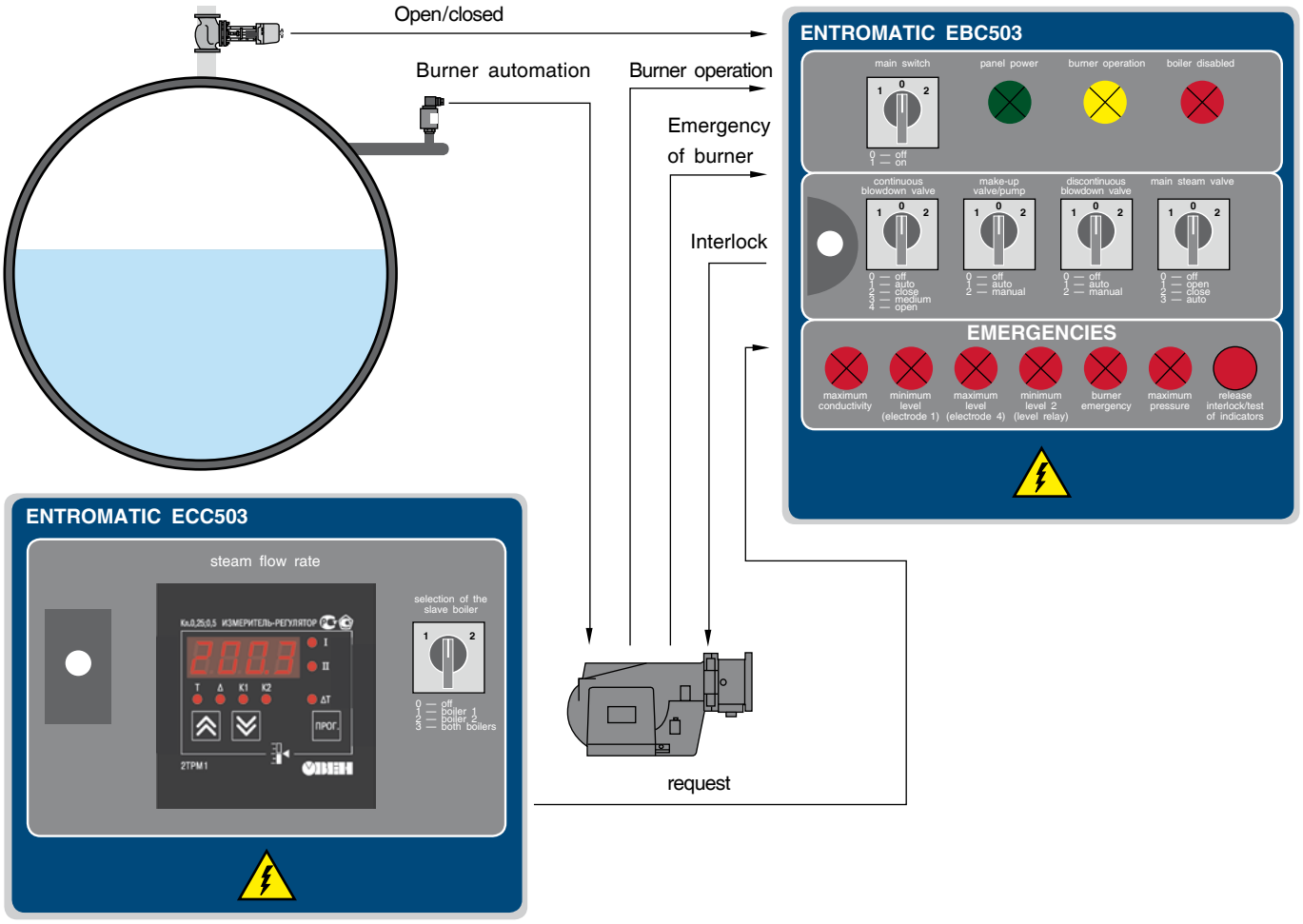


Fig. 18. Request for MSV opening from cascade control

4 EDC503 DEAERATOR LEVEL CONTROL BLOCK

EDC503 deaerator level control block is designed to control water level in the deaerator by means of four level electrodes installed in the deaerator.

The electrodes are installed and cut off in accordance with the deaerator documentation.

Table 3.
Operating modes of make-up valve (pump)

Actuator	Modes	
Deaerator make-up valve (pump)	0 — OFF	There is no control
	1 — OPEN/ON	Always opened (on)
	2 — CLOSE/OFF	Always closed (off)
	3 — AUTO	Automatic control

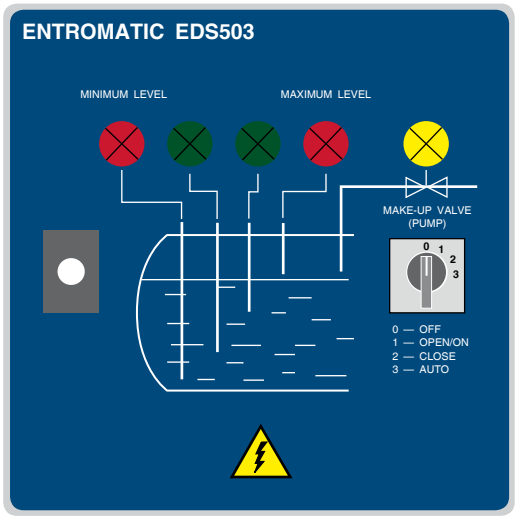


Fig. 19. Appearance of EDS503

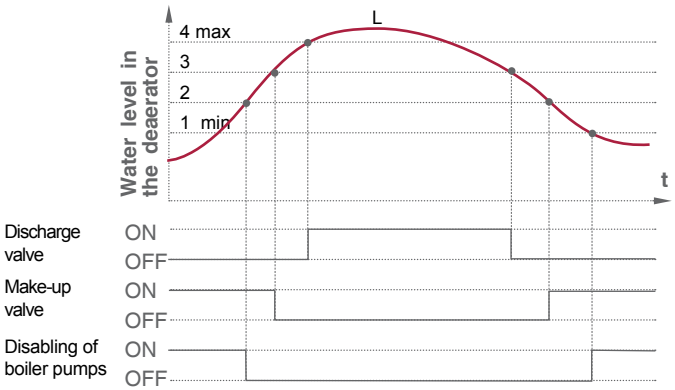


Diagram 3. Cascade control diagram

Table 4.
Purpose of the electrodes

№	Electrode	Function	Outlet
1	Minimum level	Disabling of boiler make-up pumps	Switch contacts
2	Enabling make-up	Opening the make-up valve (pump actuation)	Switch contacts
3	Disabling make-up	Closing the make-up valve (pump de-actuation)	Switch contacts
4	Maximum level	Discharge valve opening	Switch contacts

5 MAINTENANCE

For the purpose of ensuring that the automation package of CS Entromatic EBC503, MCC ECC503 and EDC503 operates correctly, the service personnel shall undergo industrial training at the workplace. In the course of training the personnel shall be made familiar with the purpose, technical specifications, operation and design of the package, with the procedure of preparing and commissioning automation and other requirements of this manual.

To ensure normal operation, it is recommended that the following measures are carried out within the prescribed due dates.

DURING THE SETTING

Check if the package functions correctly as part of control facilities using the readings of the instrumentation displaying the progress of controlled processes.

WEEKLY

When CS operates under increased dust contamination conditions, blow the dust off the terminal blocks with dry air.

MONTHLY

Blow the dust off from CS terminal blocks with dry air. Check if the external electrical connection are secured properly.

Maintenance of the package shall be carried out in compliance with the requirements of the existing “Rules of Technical Operation of Electric Installations of Consumers” (PTE), “Safety Rules for Operation of Customers’’ Electrical Installations” (PTB), “Electrical Installation Regulations” (PUE) and other territorial normative documents.

- It is required to ensure reliable attachment of the CS.
- Any connections as well as maintenance shall be carried out with power off only.
- It is not permitted to operate automation with the cover opened.
- It is not permitted for moisture ingress onto the contacts of the terminal boxes and inside the instruments.
- CS operation is not allowed when there is no grounding.
- All the signal cables (sensor connection) shall be shielded. Routing the power and signal cables together is prohibited.

APPENDIX 1. OVERALL DIMENSIONS, MOUNTING HOLES

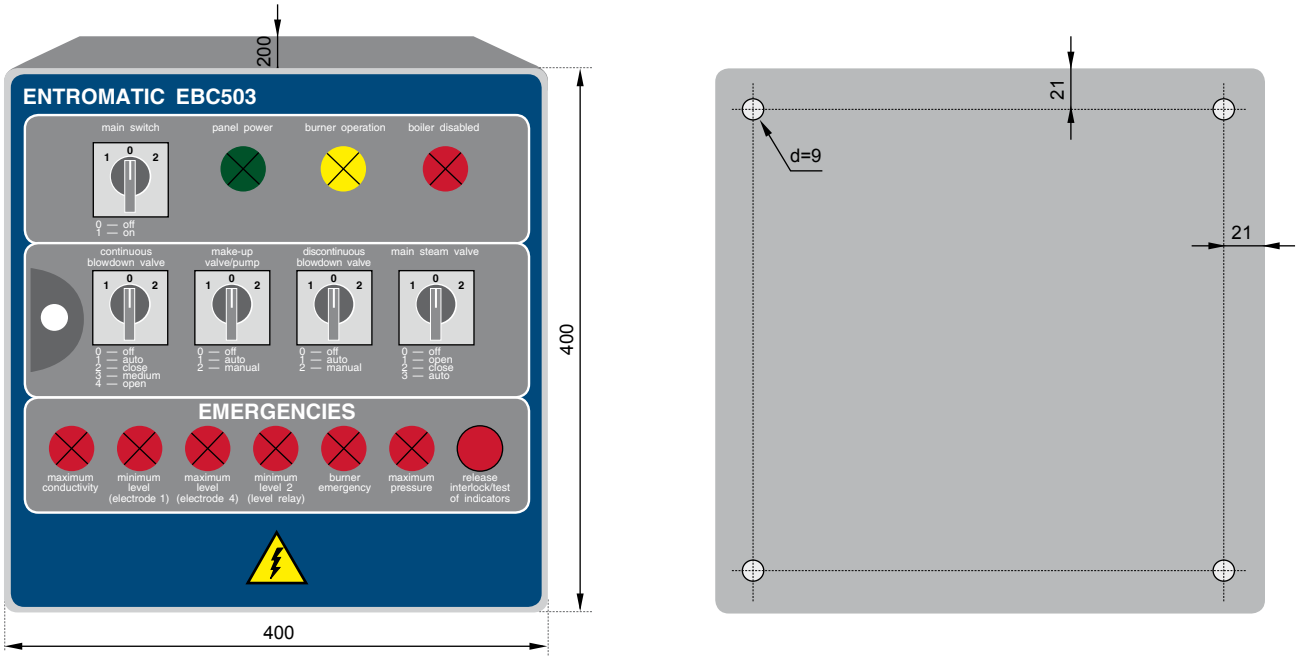


Fig. 20. Overall Dimensions, mounting holes of EBC503

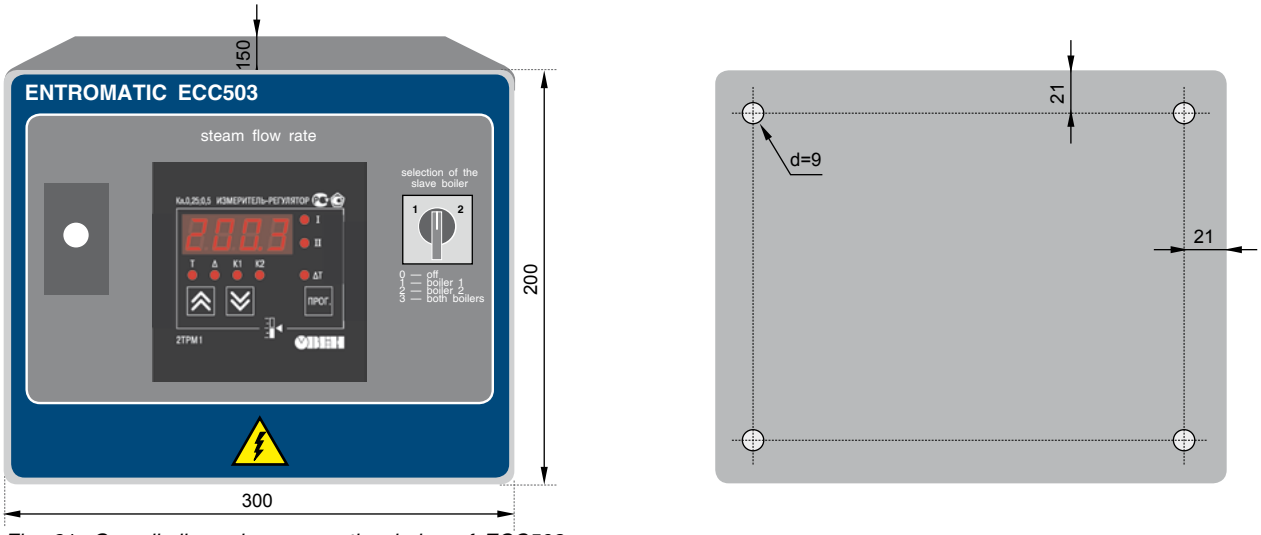


Fig. 21. Overall dimensions, mounting holes of ECC503

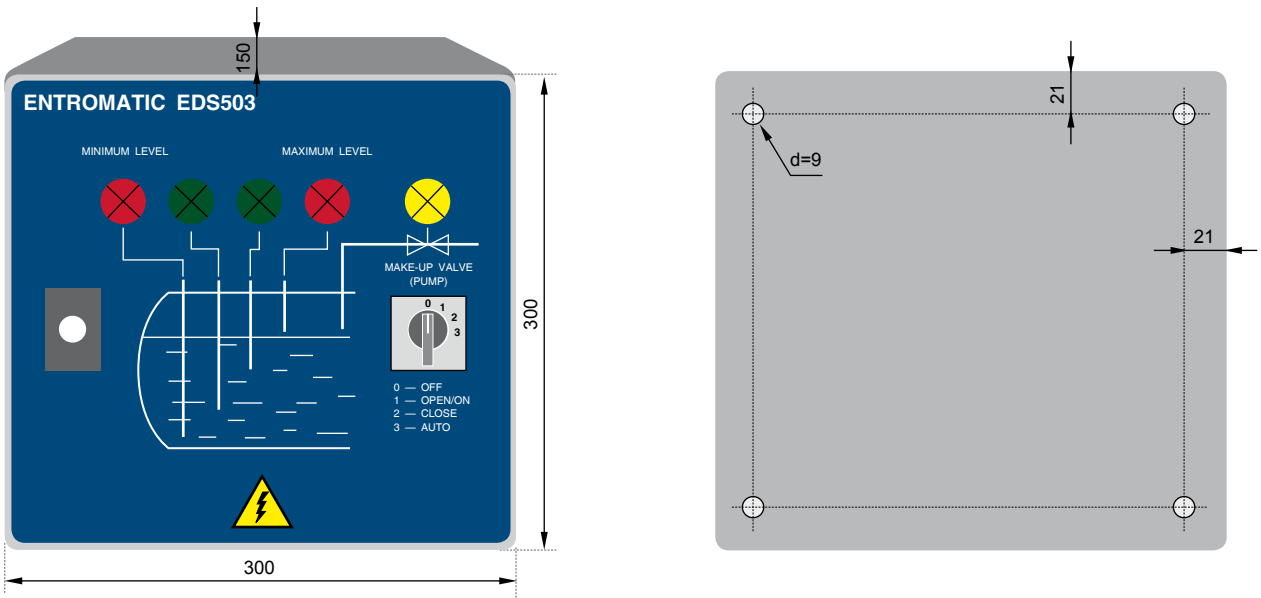


Fig. 22. Overall Dimensions, mounting holes of EDC503

APPENDIX 2. COMPLETE SET LIST OF CS ENTROMATIC EBC503

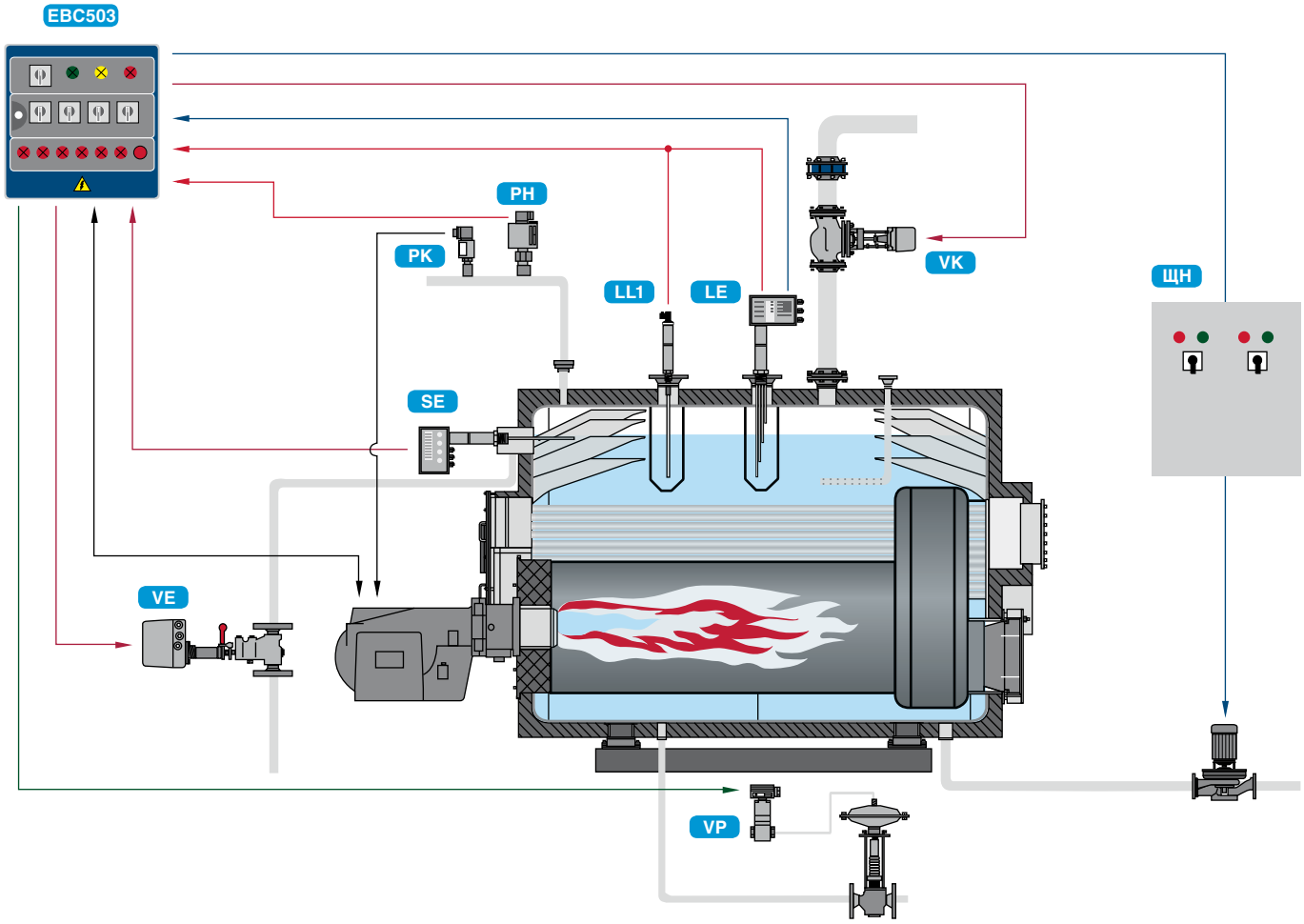


Fig. 23. Complete set list of CS Entromatic EBC503

Table 5

Basic delivery		
EBC	Control system EBC503	1
PH	Maximum pressure sensor	1
LL1	Minimum level sensor	1
LE	Combined level sensor (min., max., 2-position pump/valve control)	1
SE	Salt content sensor	1
VE	Continuous blowdown electric valve	1
VP	Control electric valve + discontinuous blowdown pneumatic valve	1
Additionally		
ЩН	Power panel of the pump module	
VK	Main steam cutoff valve	
PK	Pressure sensor 4–20 mA	

APPENDIX 3. LIST OF PROGRAMMED PARAMETERS FOR REGULATOR 2TPM1

For the example, the Table is prepared for two boilers, capacity 4 t/h. The parameters in bold font are mandatory.

Table 6

Parameter		Permissible values	Unit of measurement	Setting value	Comments
Designation	Name				
$T_{set.1}$	Setting for regulated value of channel 1	-999...9999	%	45	Setting for actuation/de-actuation of slave boiler
Δ1	Hysteresis of comparator 1 or proportional band of P-regulator 1	0...9999	%	2	At 47% command is generated to turn on the slave boiler; at 43%, command is issued to turn off.
A1-1	Operation mode of Logic Device 1	01...07		02	Comparison device: reverse hysteresis (for cooler)
A1-2	Signal at input to Logic Device 1	01...03		01	Signal from input 1, T1
A1-3	Low registration limit from input 1	-999...9999	%	0	Output value on mass flowmeter for 4 mA, expressed in %
A1-4	High registration limit from input 1	-999...9999*	%	120	Output value of mass flowmeter for 20 mA, expressed in %, where capacity of both boilers is assumed for 100% (for the case where the parameter value of meter output signal cannot be changed).
A1-5	Actuation delay of Input Device 1	0...99	сек	60	Value of delay time for slave boiler turning on
A1-6	De-actuation delay of Input Device 1	0...99	сек	60	Value of delay time for the slave boiler turning off
A1-7	Minimum time of Input Device 1 being in On condition	0...1000	сек	0	
A1-8	Minimum time of Input Device 1 being in Off condition	0...1000	сек	0	
A1-9	Status of Logic Device 1 in the case of fault	on / off		off	
A2-1	Operation mode of Logic Device 2	01...07		off	
A1-9	Status of Logic Device 2 in the case of fault	on / off		on	
b1-0	Type code of the sensor operating in the first channel	00...39		10	Corresponds to input 4-20 mA
b1-5	Instrument reading for the low limit of the unified input signal T1	-999...9999	%	0	At 4 mA the panel displays 0 %
b1-6	Instrument indication for the high limit of the unified input signal T1	-999...9999	%	120	At 20 mA the panel displays 120 %
b1-7	Position of the decimal point during parameters indication of the first channel	0...3		0	

APPENDIX 4. CIRCUIT DIAGRAM OPTIONS OF EXTERNAL CONNECTIONS FOR BURNER AND CCM ECC503

OPTION 1. WITHOUT USING MSV WITH CUB UNIGAS BURNERS

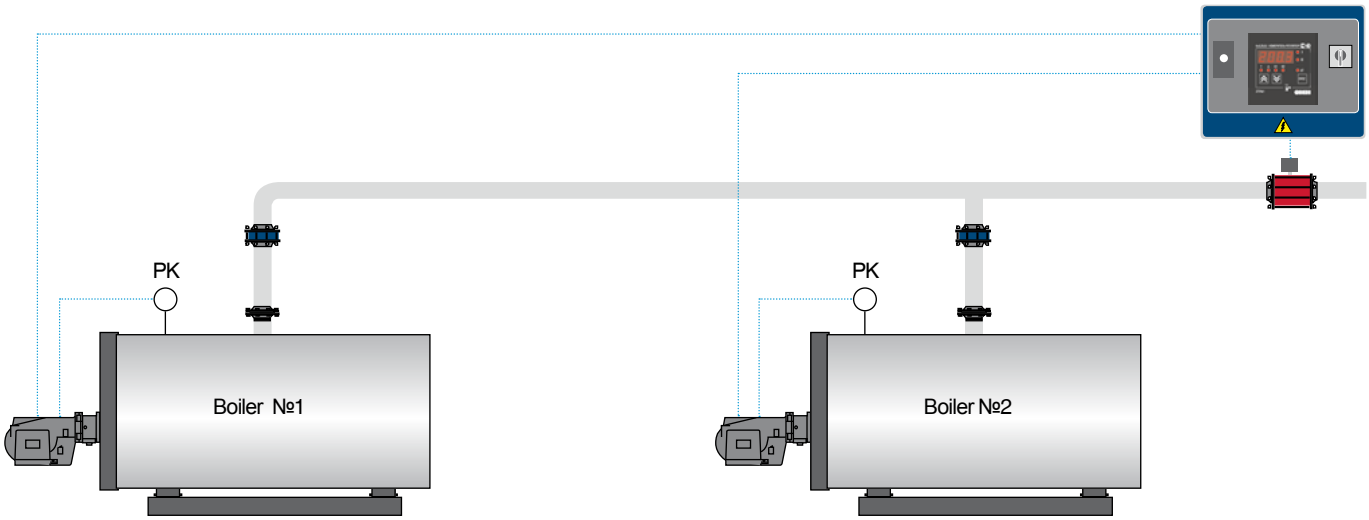


Fig. 24

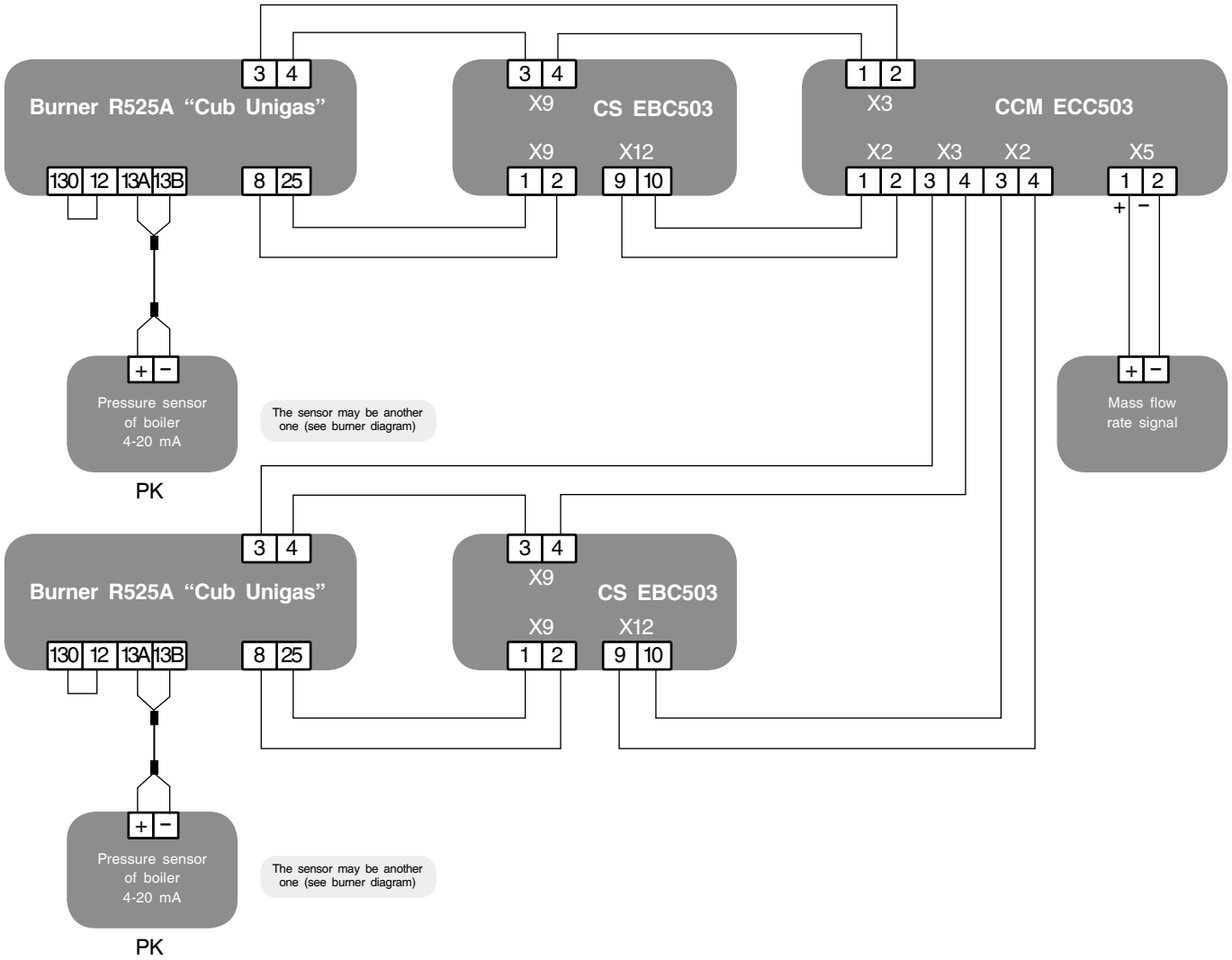


Fig. 25

OPTION 1. WITHOUT MSV WITH "OILON" BURNERS

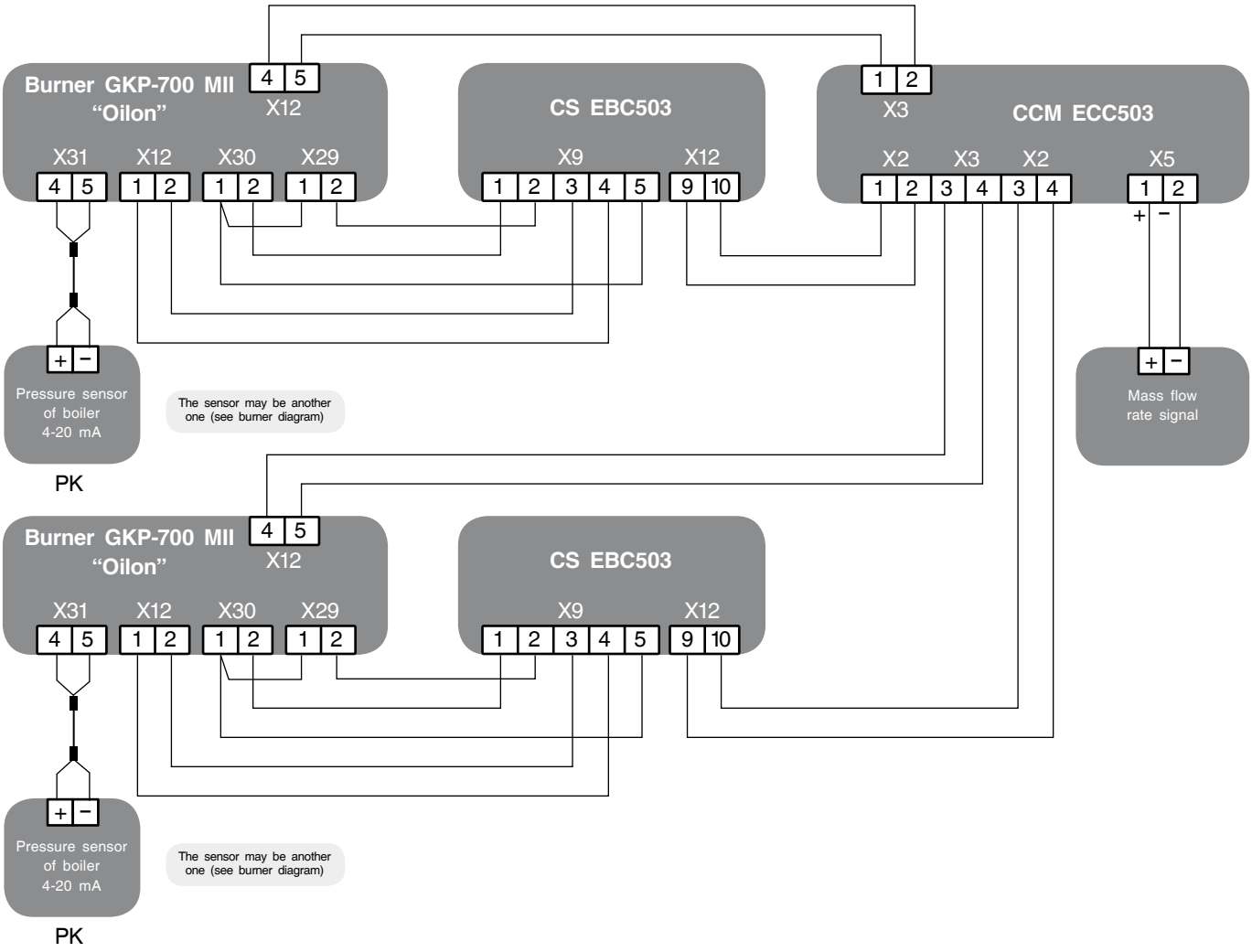


Fig. 26

OPTION 2. USING MSV WITH CUB UNIGAS BURNERS

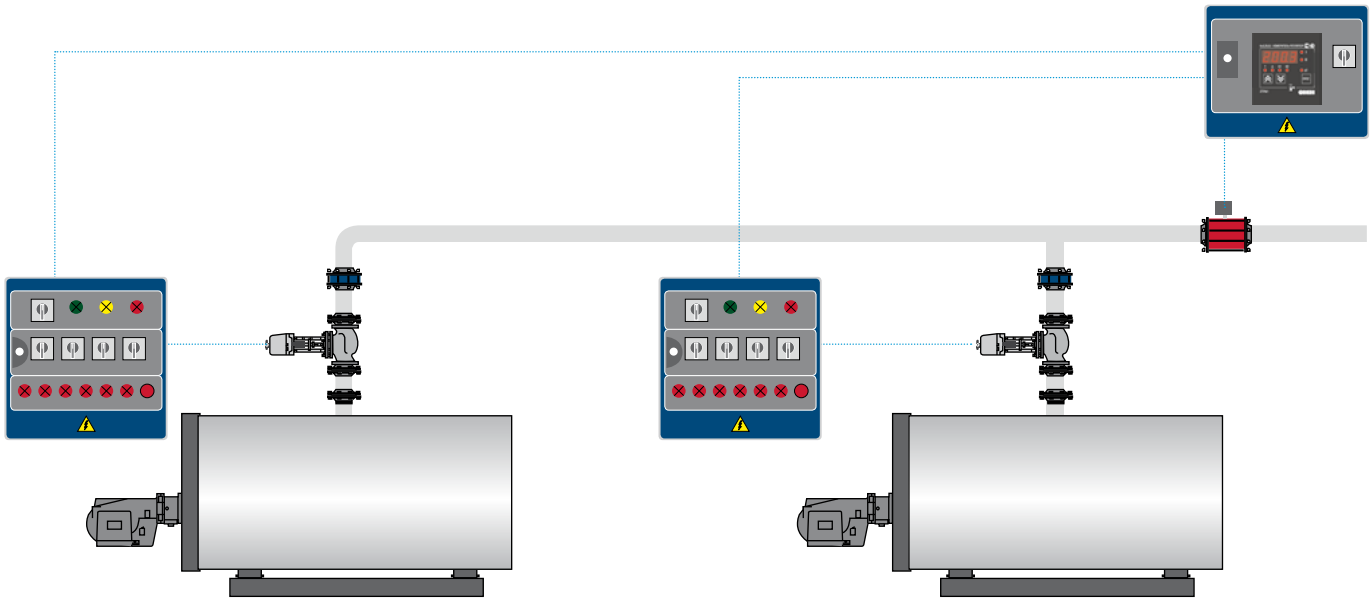


Fig. 27

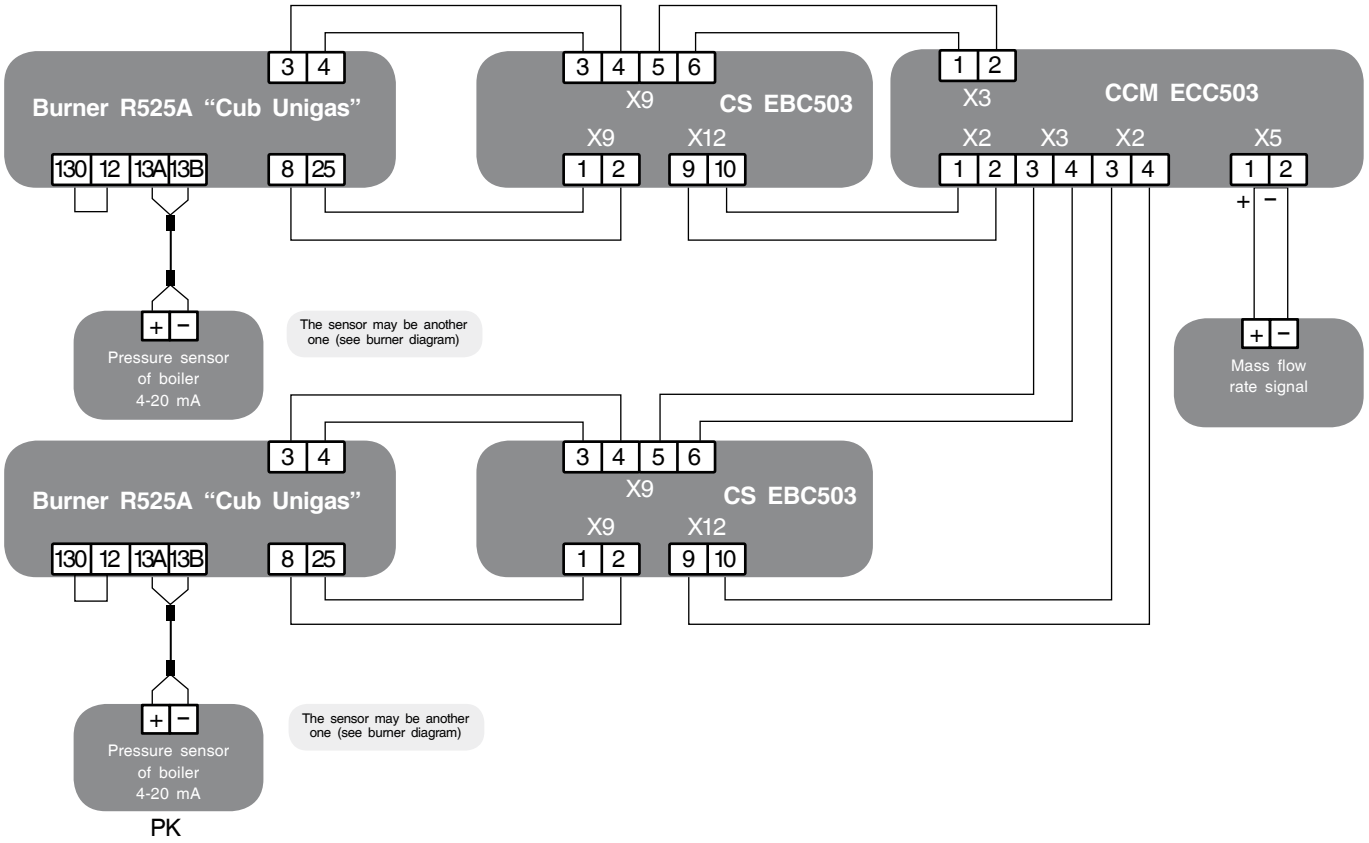


Fig. 28

OPTION 2. USING MSV WITH OILON BURNERS

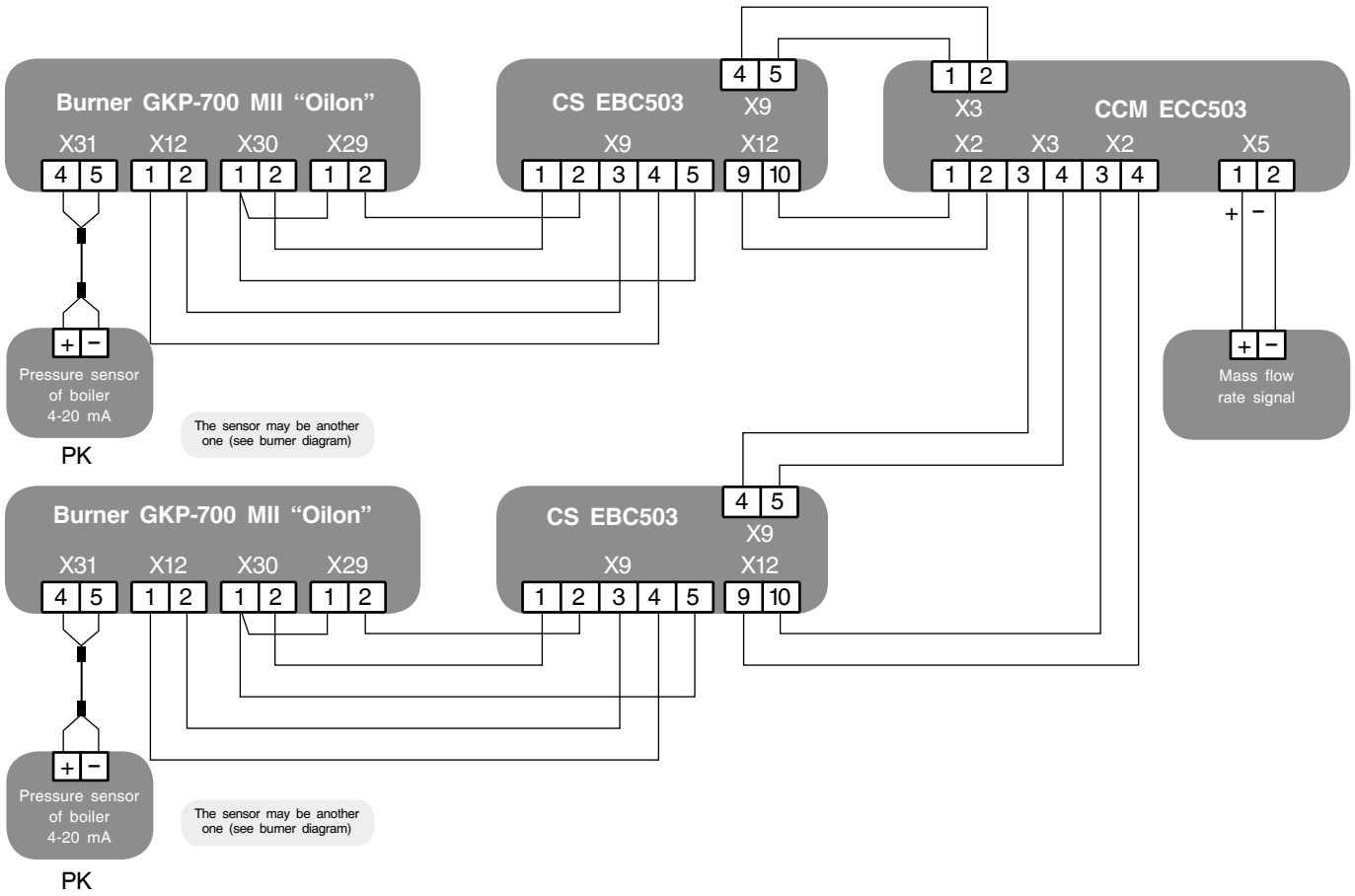
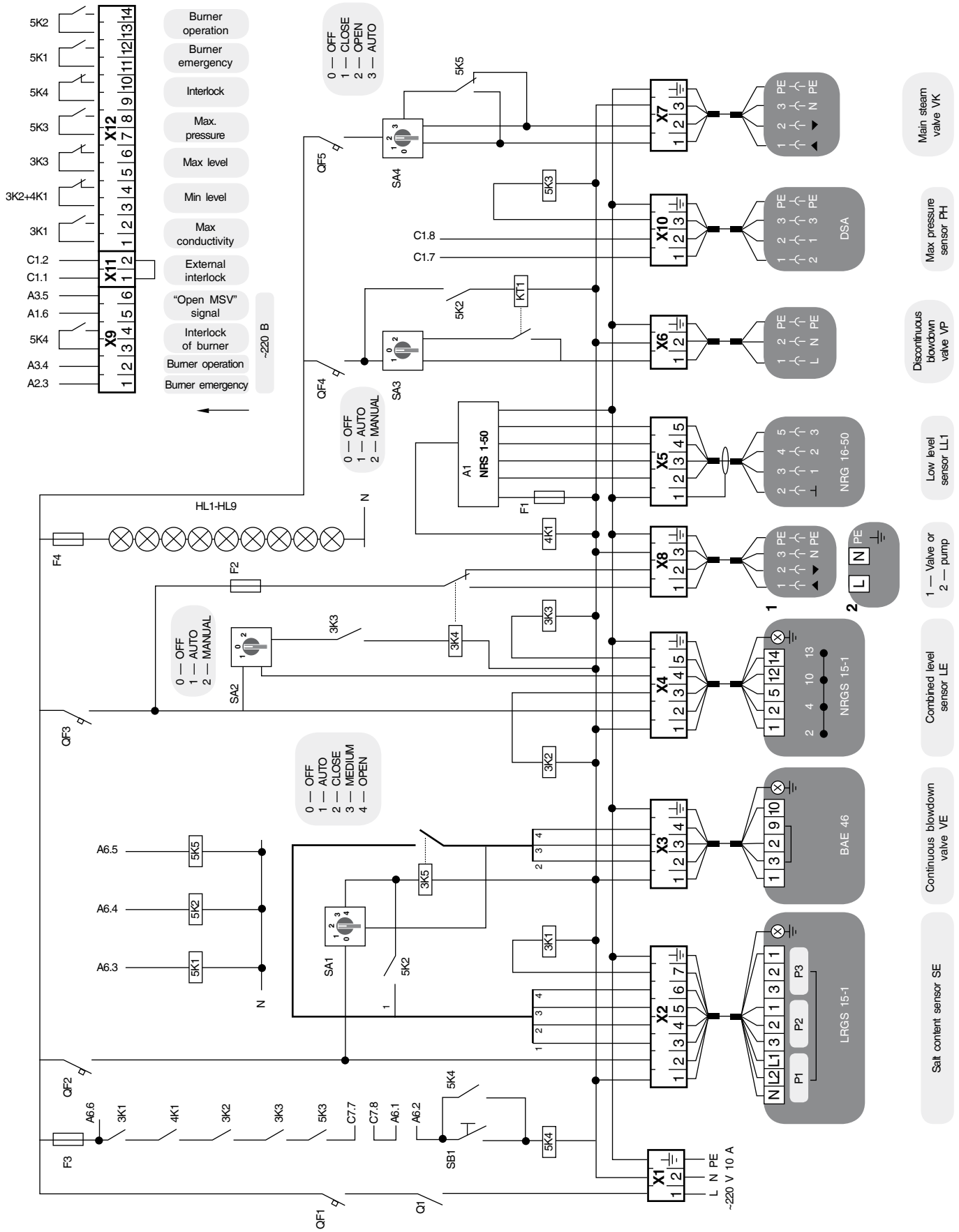
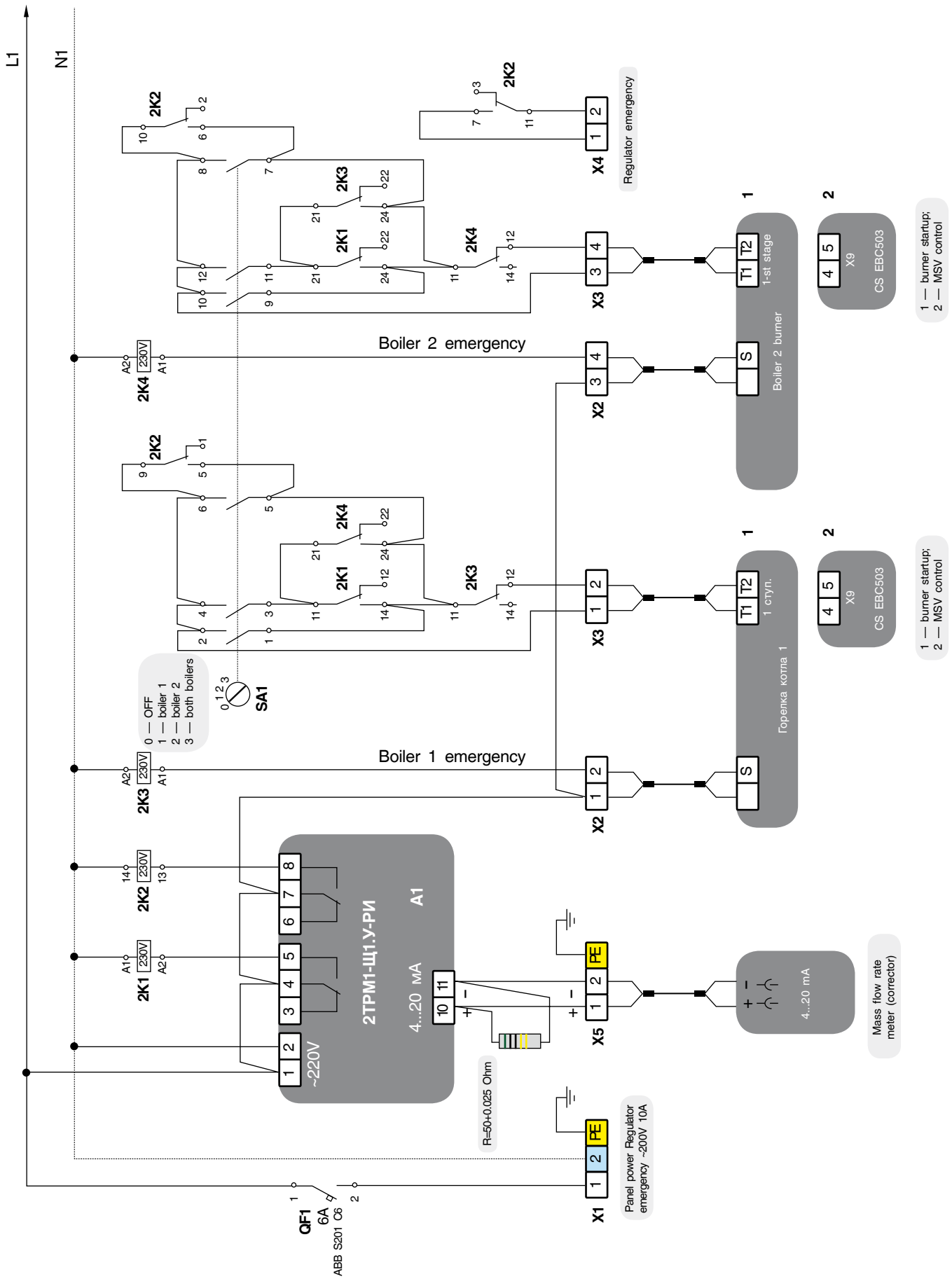


Fig. 29

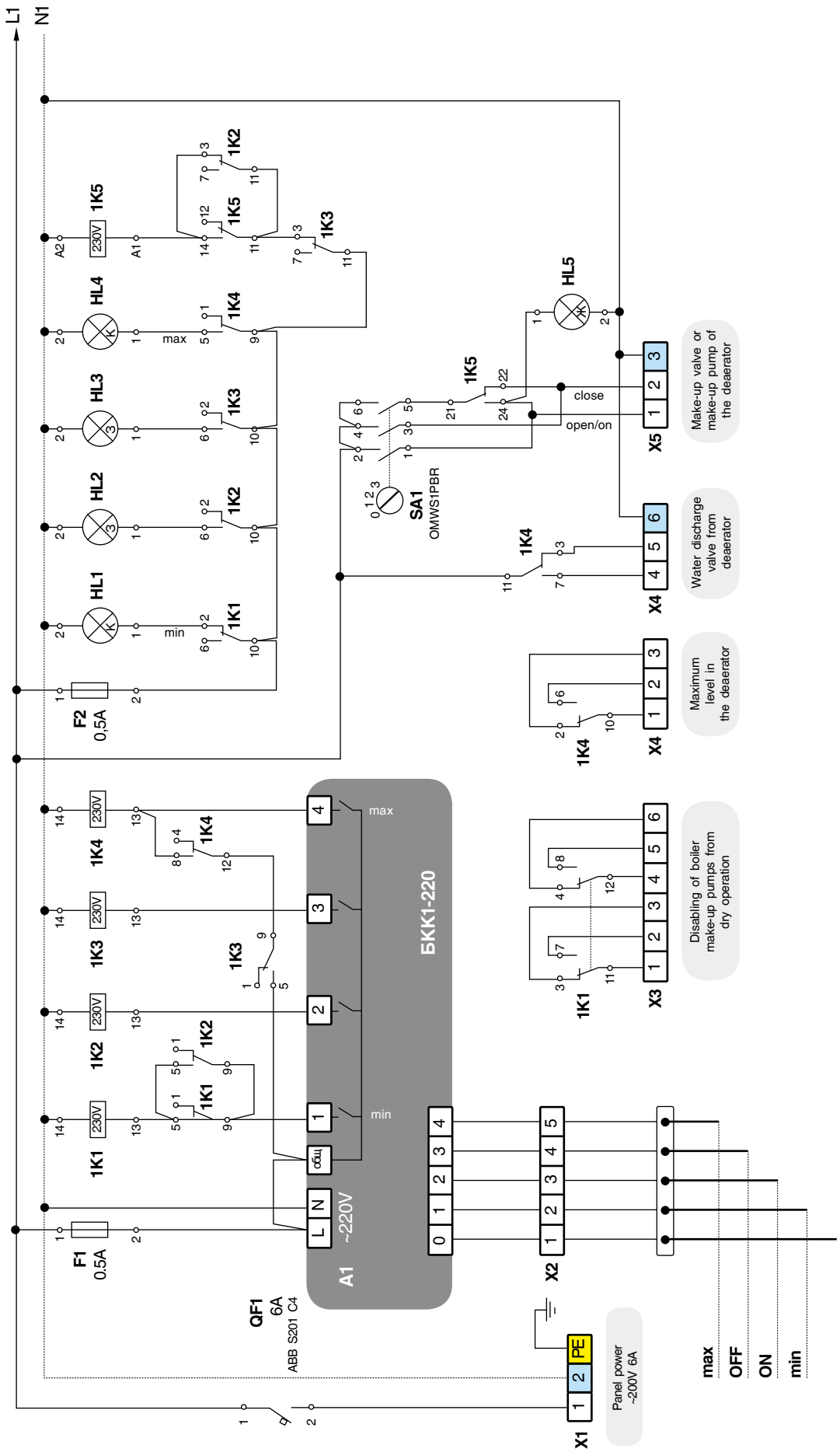
CONTROL SYSTEM EBC 503



ECC503 CASCADE CONTROL MODULE



DEAERATOR CONTROL BLOCK EDC503



ENTROPIE
Heizungssysteme GmbH
Helene-Mayer-Ring 31
80809 Munich, Germany

Phone: +49 (89) 559 699 83
Fax: +49 (89) 559 697 25
Email: info@entropie.de
Web: www.entropie.de