

Operating instructions and manual

Compact electrolytic water treatment plant
type KEUV Mini, 01, 02, 03

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1. Introduction

The compact electrolytic water treatment plant serves to remove undesired admixtures from the source water that can be further used as drinking water or industrial water. The equipment consists of a steel frame, of a distribution board, of an electrode system, of filtration sand or of any other filtration material. The operation of the water treatment plant is fully automated.

The function of the equipment can be described as follows: The water to be treated flows first through the pipe of the electrolyser (the electrode area) from where it follows through an opening in the upper part of the equipment into the reaction area with filtration sand and after passing the filter filling placed on the lower intermediate floor with the filtration nozzles it gets out of the lower part of the equipment. While the filling gets washed the water flows in the opposite direction, i.e. it is first driven into the area under the nozzle bottom, then the water flows from below upwards and the wash water leaves through the manifolds into the sewage.

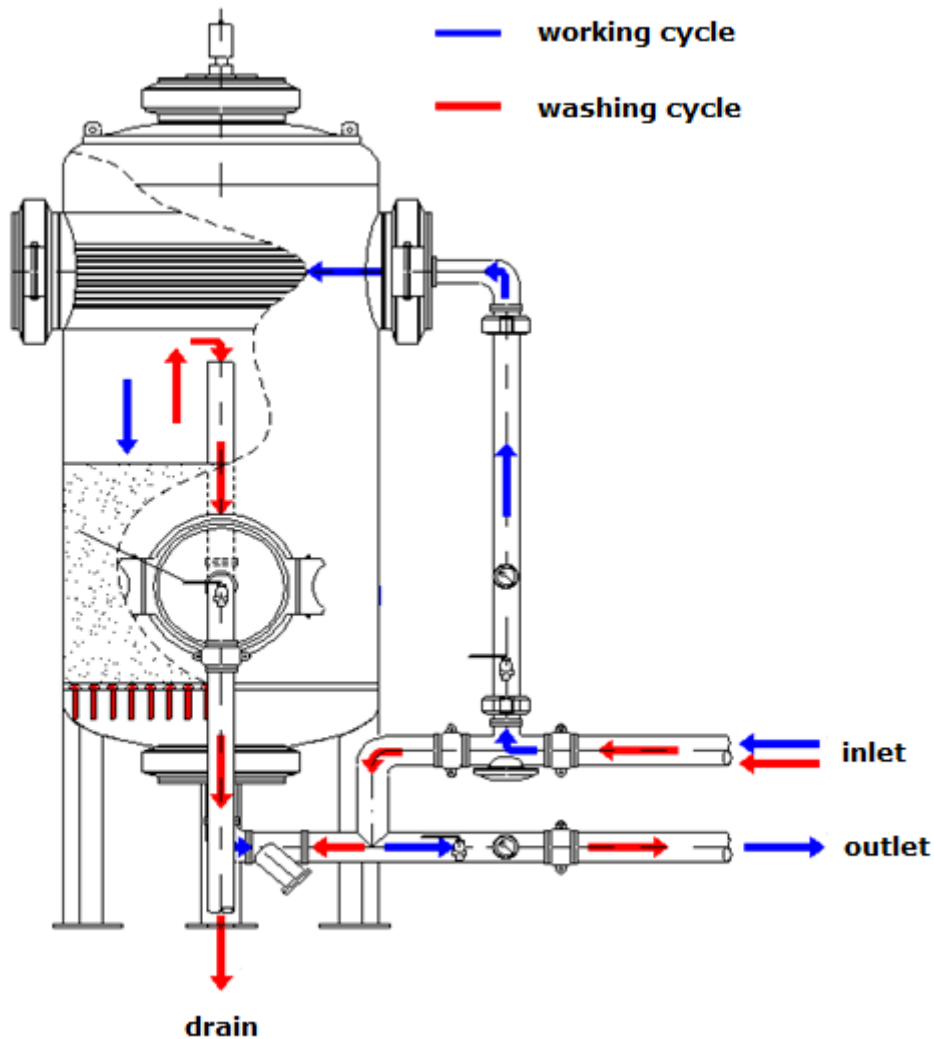


Figure 1 Operating scheme

2. Technical description

Model	KEUV MINI	KEUV 01	KEUV 02	KEUV 03
Max. flow rate (m ³ /h)	3,5	6	14	25
Diameter (mm)	300	400	600	800
Inlet / Outlet	DN 40	DN 50	DN 50	DN 80
Voltage on electrodes (V)	2 – 12	2 - 12	2 - 12	2 - 12
Current min. – max. (A)	0,5 – 5	0,5 – 5	0,5 – 5	0,5 – 5
Input power (W)	10 – 15	10 - 30	10 - 60	10 - 100
Pressure loss (bar)	0,1 – 0,3	0,1 – 0,3	0,1 – 0,3	0,1 – 0,3
Max. working pressure (bar)	10	10	10	10
Min. working temperature (°C)	5	5	5	5
Max. working temperature (°C)	60 / 100	60 / 100	60 / 100	60 / 100
Weight (kg)	80	120	230	400
Total height (mm)	1380	1450	1830	1940
Filter media volume (kg)	25	50	150	350

Table 1 Machine parameters

2.1. Operation conditions

It is the electric distribution board that ensures the control of the compact electrolytic water treatment plant; this switchboard by means of solenoids controls the activity of 3-way and 2-way valves. These valves change the activity mode of the equipment: operation – washing. Furthermore, the distribution board controls the intensity and the polarity of the current conducted into electrodes including the time lapse in the direct current supply into electrode system and it is the source of the direct current voltage for the control of solenoid valves.

Output voltage for solenoids	24 V DC
Output voltage for electrodes	max. 12 V DC
Output current for electrodes	max. 5 A DC
Protection rating (for distribution box)	IP 54 / 20
The protection against the dangerous contact	Yes, see the note
Enhanced protection	connecting
Environment	basic
Operation water pressure	max. 1 MPa
Pressure for the pressure test	1,5 MPa
Working environment temperature range	0 °C to +40 °C
Operation water temperature	max. 60 °C / 100 °C

Table 2 Operation conditions

Note:

The protection against the dangerous contact voltage on parts that are not live is ensured by the automated disconnection of the source power and by low voltage SELV in control elements and control circuits. The protection against the dangerous contact voltage on live parts is provided by covering and insulation.

2.2. Material

The case of the frame of the water treatment plant including handholes, flanges and connecting piping are made from steel of the category 11 (by ČSN standard). The accurate names of the material the individual parts were made of are mentioned in the drawing documentation. The internal surface of the steel frame is protected against corrosion with a burned paint.

2.3. Compliance with the requirements of the relevant standards

- 1/ Electrical installation complies with the ČSN standards that are in force, especially with the standards ČSN 332000-4-41 and ČSN 332000-5-54.
- 2/ Electric power supply is not a part of the equipment delivery. It has to be carried out in accordance with the corresponding ČSN standard. In the lower part of the distribution board there have been made preparations for connection.
- 3/ Substitutability for wearing parts is guaranteed.
- 4/ Protection – the equipment with its construction meets the requirements with regard to work safety and health protection at work.
- 5/ Product labelling – the equipment has a label placed on the frame of the container; this label contains:

The business name and the seat of the producer

Type designation

Serial number

Max. operation overpressure

Max. operation temperature

The year of construction

6/ Testing: - the equipment gets tested with a pressure test according to the standard ČSN 736612. The testing overpressure is set to the amount of 1.5 multiple of the operation overpressure, i.e. 1.5 MPa.

- The electric part of the water treatment plant has to go through a short-term functional testing. Moreover, a testing in accordance with the standard ČSN 332200 Article 13 has to be performed. Tests of material are not carried out.

- The equipment has to undergo an output control of electric device according to the standard ČSN 343800/67 Article 61 already in the production plant. Furthermore, it is subject to periodic inspections of electric equipment according to the standard ČSN 343800 Art. 21 within the given periods.

7/ Acceptance and delivery

- The transport is provided in compliance with the agreement between the producer and the customer.

- Installation and handover of the installed equipment to the user is carried out by the specialists from the company EuroClean s.r.o. After the installation or after the trial operation a handover protocol has to be drawn up.

- There is a guarantee period of 2 years for the equipment. The specialists from the company EuroClean s.r.o. perform guarantee and post-guarantee repairs.

3. Transport and handling

The steel frame of the water treatment plant including the fittings and the connecting pipes should be transported on a wooden pallet with strap handles. It has to be transported to the place of assembly in accordance with the local circumstances either on a forklift or manually. For placing the equipment on the spot there are two normalized loops on the opposite sides fixed on the upper part of the frame that are meant for attachment of fastenings of the lifting equipment. The hanging on the suspension hook of the lifting equipment shall be carried out by means of suitable fastenings attached to the normalized loops. The individual strands of fastenings may form an angle of maximum 90°.

The distribution board of the water treatment plant including the solenoid valves has to be transported in a cardboard box filled with impact protection mass, usually by means of the company assembly car. The distribution board has to be mounted on the designed grips of the steel frame of the water treatment plant with screws.

The electrode system of the water treatment plant including the relief valve is transported in a similar way as the distribution board, most often in the company assembly car. The electrode system has to be mounted by means of screws with plastic bushings into the electrode pipe of the steel frame. Filtration sand or any other filtration material is transported in bags weighing 25 kg each, either on a wooden pallet fixed with shrink wrap or in the company assembly car. The filtration part of the water treatment plant is fed through the upper opening while using the hopper. Before any potential transport of the compact electrolytic water treatment plant to another place it is necessary to take out the filtration material and transport it separately.

4. Installation conditions

4.1. Requirements for the fastening of the water treatment plant

The compact electrolytic water treatment plant is equipped with three stems with flat ending for adjustment into horizontal position. In accordance with the local circumstances the water treatment plant can be anchored, however, the placement of stems and the weight distribution are already arranged in a way that the equipment itself is completely stable.

Usually it is not necessary to set foundations for stems, since a concrete floor with sufficient load capacity is already enough. The anchoring of the water treatment plant can be solved by means of expansion shield anchor bolts that are placed into the prepared holes in the floor. The actual fastening of the water treatment plant is carried out with lock nuts, propped inside against the stem bracing. If necessary it will suffice to anchor just one stem of the water treatment plant.

4.2. Assembly and setting conditions

The assembly and setting of the compact electrolytic water treatment plant is carried out by the company EuroClean s.r.o. or by an authorized company under the supervision of a specialist from the company EuroClean s.r.o. A short-term downtime of the existing equipment is necessary for the installation of the bypass piping and the branch pipes for the water treatment plant (inlet and outlet). Another necessary issue is to ensure the power supply, drainage of the wash water into the sewerage system and piping away of the exhaust air from the equipment into the air.

4.3. Space requirements for usage and maintenance

The compact electrolytic water treatment plant is solved in a way so that a person standing on the floor can carry out all activities connected with setting and maintenance. There must be an area that is kept free around the equipment, which makes it possible that the filtration filling can be replaced and electrical elements of the distribution board can be adjusted. The minimum distance from other equipment is 600 mm; the free space required in front of the distribution board is at least 800 mm.

4.4. Permissible environment conditions

ČSN EN 60204-1 (the Czech National Standard) establishes the environment conditions for the electric equipment:

Environment temperature:	+ 5 up to + 40°C
Humidity:	max. 50% at + 40°C
Height above sea level (altitude):	max. 1000 m above sea level

The distribution board withstands external influences in accordance with the standards ČSN 33 2000-3 and ČSN 33 2000-5-51. All other external influences are considered normal in compliance with the article 512.2.4. of the standard ČSN 33 2000-5-51. The distribution board cannot be exposed to direct sunshine.

4.5. Connection to the power source (electricity)

The distribution board is connected to the socket circuit 230 V, 50 Hz with a circuit breaker, usually 16 A. The requirements for permissible voltage and frequency fluctuation are mentioned in the ČSN EN 60204-1.

Voltage: steady-state voltage 0.9 up to 1.1 of the rated voltage
Frequency: 0.99 to 1.01 of the nominal frequency permanently
0.98 to 1.02 in short-term

Securing and dimensioning of conductors must be in conformity with the ČSN 33 2000-5-523 so that in case of a failure the conditions were met for the protection by means of automated switching off the source due to the given environment in conformity with the ČSN 33-2000-4-41. While installing the electric equipment it is necessary to advance in conformity with the ČSN 33 2000-1 and related standards.



During the initial revision the electronic components that are powered from the secondary part of with SELV must be switched off due to potential damage by induced voltage!

4.6. Information about removal and waste disposal

There is generated gaseous, fluid and solid waste during the operation of a compact electrolytic water treatment.

Gaseous waste is the exhaust air from the equipment that goes into the air. During operation, the exhaust air has an average content of 0.05 mg CO₂/m³, other gases like Cl₂, ClO₂, H₂, H₂O₂ and O₃ are beyond the detection limit.

Fluid waste is the washing water that is piped away into the sewerage. It contains on the average 30 mg/l of undissolved substances (predominantly ferric hydroxide, calcium carbonate and other inorganic and organic substances).

The used filtration filling (usually siliceous sand) is solid waste. The company EuroClean s.r.o. carries out the replacement or this activity can be performed by an authorized organization that secures the disposal of the filling (usually by means of taking it to the dump site for other waste – waste category "O").

5. Lifetime of the KEUV, removal from the service and disposal

The lifetime of the water treatment plant is high and this for the reason that the equipment is protected against corrosion partly thanks to the protecting paint inside the equipment, partly thanks to the passive anodic protection. The lifetime of the electrode system depends on the purpose the equipment is used for and on the properties of the water to be treated, it usually is two years. Only the service technician of the company EuroClean s.r.o. can carry out the replacement of the electrode system.

The lifetime of the filtration filling depends on the type of filling and on the purpose of the equipment use. The lifetime of siliceous sand is about four years. When sand loses angularity, it is a sign that sand should be replaced.

After the lifetime of the water treatment plant has expired, the equipment has to be disposed of in the following way:

- The steel frame should be taken to the scrap yard.
- The control distribution board should be environment-friendly processed by a specialized company, rare earth metals used for coating of joints and contacts should be separated.
- The electrode system is recycled and after activation and overhaul it is repeatedly used, this is taken care of by the company EuroClean s.r.o.
- As for the filter fill it depends on its composition – it is either taken to the dump site or incinerated.

6. Operating instructions for the equipment

6.1. Description how the KEUV functions

The KEUV consists of the steel frame where there is at the right angle to the vertical axis in a removable way integrated the electrolyser pipe that is equipped with the electrode system. The lower part of the frame is equipped with stems. Internal surface of the frame was painted with a colour applied on the blasted surface electrostatically and subsequently it was burned out in a furnace. The electrolyser pipe and all joining piping is attached to the frame by means of expansion joints, the type Victaulic. There is a relief valve installed in the upper part of the frame.

The electrolyser pipe is equipped with an inlet piping for the water to be treated and in the upper part of the frame has a discharge outlet into the reaction area of the pressure filter. There are filtration nozzles placed on the internal screen of the frame; the filtration filling is kept on those nozzles. Moreover, the frame is equipped with the distribution board that besides the supply of the direct current into the electrodes also controls the individual fittings. There is a filter installed on the outlet piping, a pressure gauge and a tap for taking samples.

The electrode system is composed of a set of anodes and cathodes that is fixed to the cover of the electrolyser pipe; lugs for electrodes, power supplies and plastic fittings.

During the operation of the water treatment plant, the water to be treated flows through the electrolyser pipe (through the electrode area), then it continues through the opening in the upper part and it gets to the reaction area of the pressure filter and after passing through the filter filling placed on the lower intermediate bottom with filtration nozzles the water gets drained from the lower part of the equipment. When the filling gets washed, the water flows the other way round, i.e. it first gets to the area under the bottom with nozzles, it is driven from below upwards through the filter filling and, finally, through the manifolds for the wash water it leaves into the sewage.

These changes in the process can be achieved by means of the system of two-way or three-way valves that are hydraulically controlled by the pressure of the material to be treated. The impulses for controlling the fittings come from the solenoid valves that are controlled by the computer. This one is located in the control distribution board.



Figure 2 Distribution board

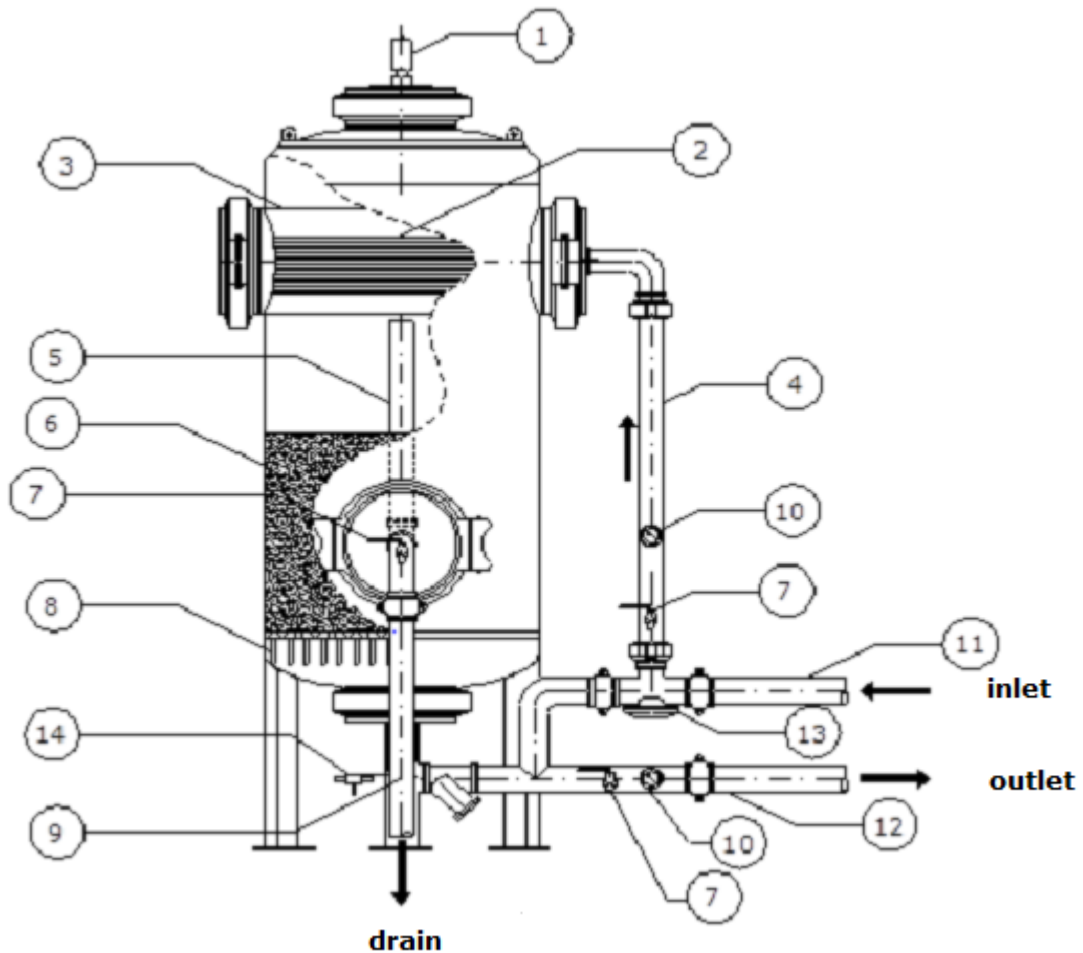


Figure 3 KEUV scheme

- | | |
|------------------------|------------------------------|
| 1. Relief valve | 8. Filter nozzles |
| 2. Electrolyser | 9. Drain outlet |
| 3. Electrode system | 10. Manometer |
| 4. Water inlet | 11. Inlet water connection |
| 5. Drain tube | 12. Treated water connection |
| 6. Filter media (sand) | 13. 3-way valve |
| 7. Sampling tap | 14. Solenoid valves |

6.2. Controlling distribution board functioning

The installation and the operation of the controlling distribution board can be performed solely by a person with the relevant electrotechnical qualification according to the law.

The control distribution board is equipped with a transformer, a main switch, a circuit breaker and with a programmable PC.

All components are placed in the plastic distribution board in the category II, with the enclosure IP 54 (of a switch cabinet). The controlling elements of the PC are placed in the front part of the distribution board under a plastic transparent cover. When the cover of the distribution cabinet is open, there is the enclosure IP 20.

The distribution board is supplied from the line voltage 230 V/+N+PE, 50 Hz, TN-S system. Before every handling it is necessary to carry out a safe switching off the equipment from the power supply and to make sure it will not accidentally switch on. The control distribution board is made in the category II and it is necessary to control the prepended securing and to check the impedance of insulation resistance. The control distribution board gets connected by a conductor HOVV-F 2A x 1.5 mm² to the fixed distribution of low voltage.

The control distribution board gets switched on and off with the main switch placed under a plastic transparent cover. For this external cover enclosure IP 54 is used.

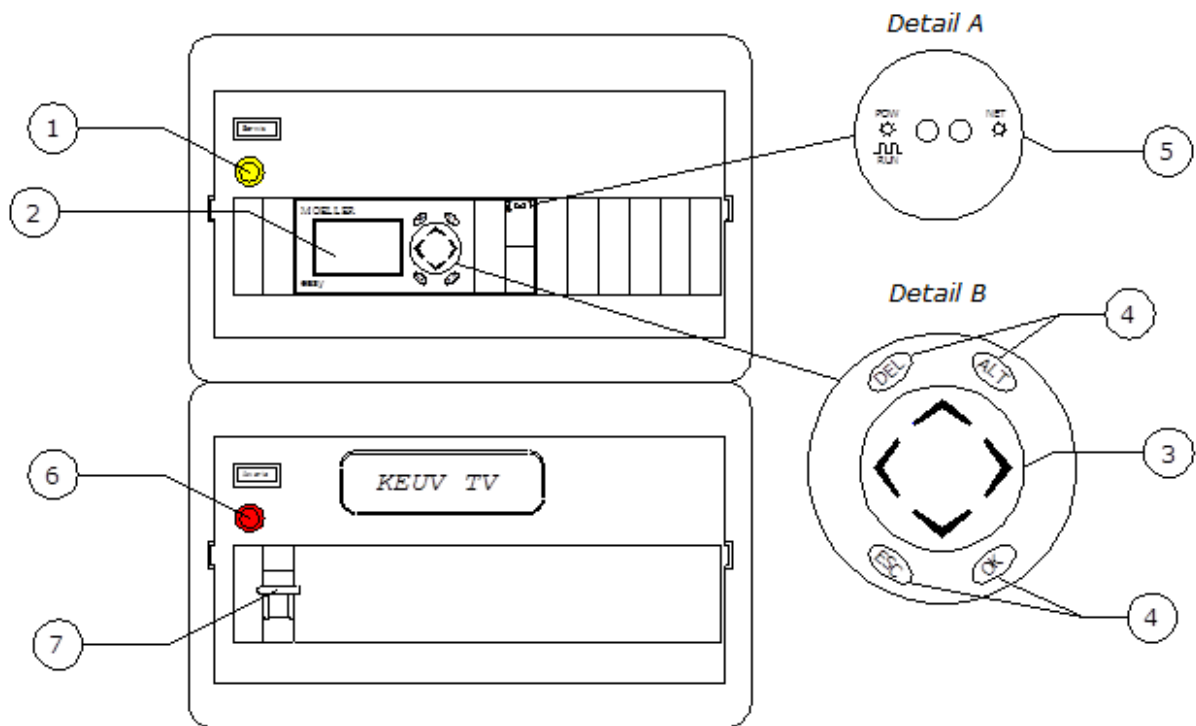


Figure 4 Distribution board scheme

- | | |
|---------------------------------------|-------------------------------|
| 1. Yellow pilot lamp („need service“) | 5. Informative LED's |
| 2. PC display | 6. Red pilot lamp („failure“) |
| 3. Main button controls | 7. Main switch |
| 4. Auxilliary button controls | |

The red pilot lamp indicates a failure of the control distribution board (the fuse P1 has blown).

The yellow pilot lamp signals a breakdown of the electrode system (the current running through the electrode system is higher than 0.5 A).

The circuit breaker in the electrode circuit reduces the current flowing into the electrode system to 5 A.

There appears the set current and the actual current in the electrode system on the PC display after switching on the equipment.



Figure 5 PC Display



The setting of the parameters of the water treatment plant KEUV on the PC can be carried out only by the repair shop of the company EuroClean s.r.o. or by its contractual partner. In case of a failure, call the producer immediately.



On the grounds of proper functioning, it is necessary to replace the electrode system approximately every two years of operation and the filtration material in the filter every four years of operation in the compact electrolytic water treatment of type KEUV. The replacement of the electrode system and of the filtration material can be effected exclusively by the producer.

6.3. Potential risks of the operation of KEUV



The water treatment plant is designed for a continuous water flow. If there for any reason the flow of water or that of aqueous solution through the equipment gets interrupted for a longer time period, the equipment has to be switched off.



The operation of the equipment without the minimum water flow can result in the increase of gas concentration in exhaust air outgoing from the equipment, the increase of chlorine in water and the increase of medium temperature.



Before a long-term shutdown of the water treatment plant it is by all means necessary to wash the filtration medium and ensure that the filtration filling remains submerged in water. If the filter has to be discharged, it can be done so only for a short time period only. A water discharge from the filter for a long time period can result in formation of "sandstone" in the filter. Such sediment then has to be broken up either mechanically or chemically.

6.4. Prohibited use of the KEUV

The water treatment plant cannot be used where the environmental conditions do not comply with the IP Code of the control distribution board (IP 54/20), and this especially:

- In areas with a danger of explosion or fire.
- In areas where explosive material is used, processed or produced.
- In underground closed areas where there is a risk of accumulation of exhaust air from the equipment.
- In operation facilities with an enhanced aggressive environment.
- In areas where temperature, humidity or above sea level of the environment are beyond the permissible range according to the standard ČSN EN 60204-1.
- In areas where through use of the equipment substances with risk of explosion or fire could be created.
- In areas where due to use of the equipment dangerous ecotoxic substances or substance with subsequent toxicity could be created etc.



The water treatment plant cannot be put out of operation for a time period longer than two days, and this in particular after the water is discharged from the water treatment plant for a longer than two-day period. It can result in a situation when the filtration medium gets blocked. In case such downtime appears necessary contact the producer without undue delay.

7. Maintenance

The basic set-up of the KEUV is carried out by the service specialist from the company EuroClean s.r.o., or by its contractual partner, all this on the basis of the envisaged purpose for the equipment use and on the ground of the water analysis.

Approximately one month after the equipment was put to operation the setting of the control distribution board has to be adjusted in accordance due to the operation experience of the user, or due to the analysis results.

The service work during the guarantee and lifetime period has to be carried out by service specialists from the company EuroClean s.r.o. or an organization that was authorized and trained by the company EuroClean s.r.o. for such tasks. Each individual service intervention is described in the service sheet that is stored in the control distribution board.

The control distribution board has to be inspected in conformity with the standards ČSN 331500 and ČSN EN 33-2000-6-61 in intervals according to the protocol on the environment determination. In general, this inspection has to be performed every two years.

7.1. Maintenance activities

The staff authorized to carry out inspection patrols has to control the proper functioning of the water treatment plant by means of the light signalling device. Moreover, they have to control the leak tightness of the individual joints, functionality and fitting tightness in in the whole equipment, etc. The maintenance workers are eligible to repair joints or fitting only, provided that they use spare parts from the equipment supplier. Only a person who is authorized and has the required special technical qualification can perform repair jobs in the control distribution board. The warranty and after-warranty service can be performed by the company EuroClean s.r.o. or an organization that was authorized or trained in such activity.

8. Emergency situations

8.1. Failure of power supply

In case of a failure of the power supply the automatic mode of the equipment gets interrupted and all fittings automatically return to the basic safe position and when the power supply resumes the fittings automatically start the operation of the KEUV.

8.2. Failure of circulating pumps

In case of a short-term interruption of water flow through the water treatment plant (usually in minutes), the equipment does not have to be switched off. In case of a longer interruption it is necessary that the water treatment plant gets switched off and it is essential to prevent the filtration medium from hardening.

8.3. Failure of the equipment

If an unrecoverable failure of the equipment occurs, the water treatment plant has to be switched off, the fittings both on the water input and output have to be shut down and the bypass piping of the equipment has to be opened.

8.4. Fire in the control distribution board

Should fire occur in the distribution board the power supply to the distribution board must be switched off either by means of the circuit breaker or by pulling the plug from the socket. Only powder or snow fire extinguishers can be used for fire-fighting.

8.5. Closing of the ventilation system

Gases that are produced during the operation of the equipment are vented either directly to the air outside or to the surrounding area if those areas are ventilated to the atmosphere.

If the vents taking the gases to the free atmosphere are closed, it could result in the accumulation of gases in the closed space above the permissible limit from the hygienic point of view. If the equipment operates for a long-term period in a space that is hermetically sealed, the lower limit for risk of explosion may be exceeded and this situation may result in a subsequent explosion.



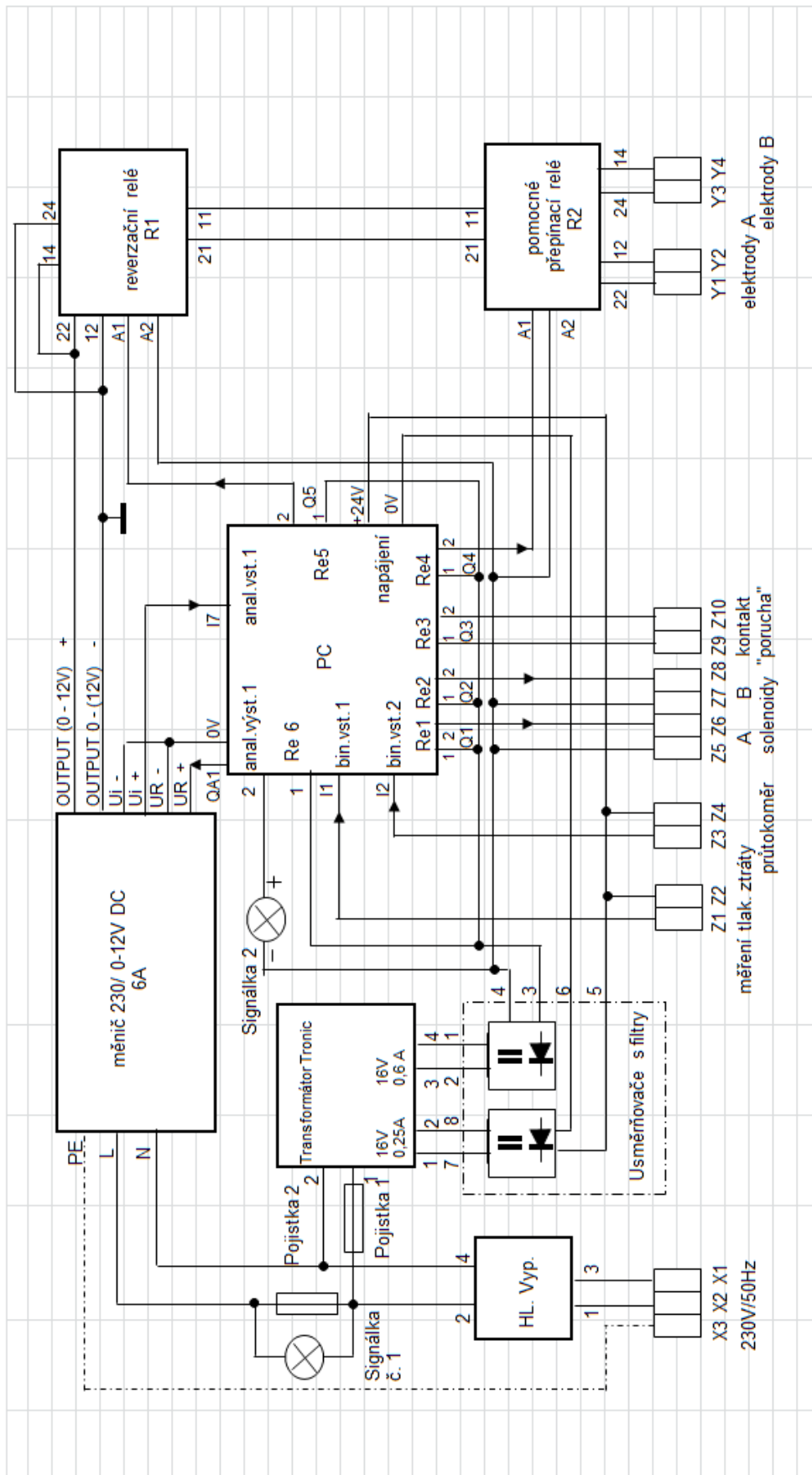
At least the minimum ventilation of the surrounding area must be provided during the operation of the compact electrolytic water treatment plant at all events!

9. Sample taking

It is advised to take samples of the water after treatment in a way that the tap for taking samples is opened for a short period of time before the actual sample taking in order to wash away rust and other sediments from the piping. Subsequently, the water flow has to be adjusted in a way that running water forms a continuous beam approximately 0.5 cm strong. Then after about half a minute the actual sample can be taken. Furthermore, it is necessary to make sure that the sample container is washed out several times with sampling water. After that the sample container can be filled with water according to the laboratory instructions.

Note: This documentation has been processed in compliance with the regulations and standards ČSN EN 292-2 "The Machinery Safety" from November 1994. This national standard is identical with the standard EN 292-2: 1991.91.

10. Wiring diagram



analogový vstup	analog input
analogový výstup	analog output
binární vstup	binary input
elektroda	electrode
hlavní vypínač	main switch
kontakt "porucha"	contact "failure"
měníč	transformer
měření tlakové ztráty	measurement of the pressure loss
napájení	power supply
pojistka	fuse
pomocné přepínací relé	auxiliary relay
průtokoměr	flowmeter
reverzační relé	reversing relay
signálka	pilot lamp
solenoidy	solenoids
transformátor	transformer
usměřovače s filtry	rectifiers with filters

Changes to technical data and illustrations reserved.

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