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POLNA

ELECTRIC DISTILLER

Type DE 5

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

CONTENTS

Designation	
Rated voltage	230 V AC
Rated power	..... kW
Protection class	**I**
Serial no./year of manuf.	**.....**

CE

QC mark
.....

Note: Prior to installation and operation, read this manual carefully.

13. DISTILLER WATER/STEAM SYSTEM DIAGRAM

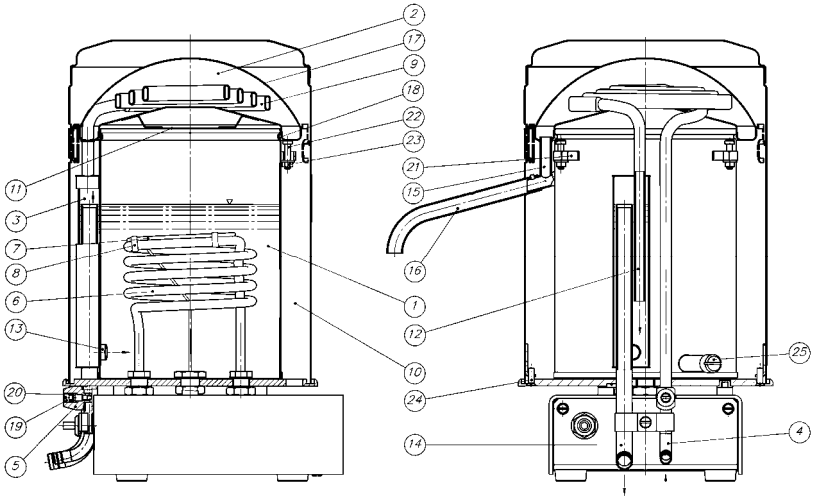


Fig. 2.

14. DISTILLER ELECTRICAL SYSTEM DIAGRAM

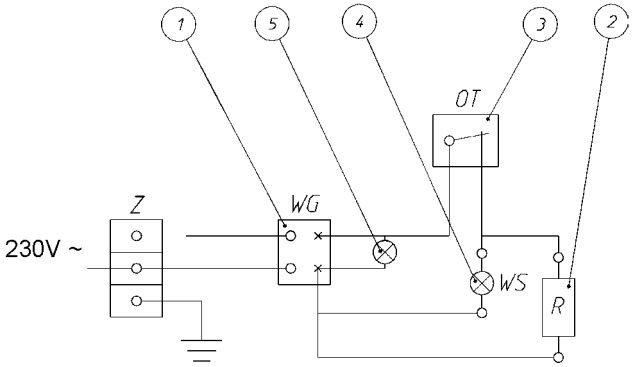
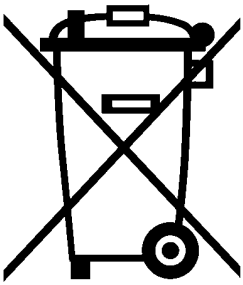


Fig. 3.

R	- Resistive heater
WG	- Main power switch
OT	- Temperature limiter
WS	- Indicator light
Z	- Threaded coupling

11. PRODUCT DISPOSAL

When the service life of the distiller ends, it shall be dismantled and its parts must be separated by material, into metal parts (non-ferrous and ferrous metals), rubber and plastic parts (feet, cable glands, insulating sleeves, and seals), electrical wires and other electrical components (main power switch, indicator light, connector, and temperature limiter).
The recycling of these materials shall conform to the waste management regulations applicable.
The product does not contain materials whose disposal is harmful for the environment.



12. LIST OF SPARE PARTS

Resistive heater	6501869000
Temperature limiter	6002601000
Cooler	6702014000
Switch	6002941000
Voltage indicator light (green)	6002953000
Heater light (yellow)	6002954000
Pin	6002513000
Sealing ring, 153x3.55	841463005
Sealing ring, 3.3x2.4	871111000

1. OVERALL DIMENSIONS OF THE DISTILLER

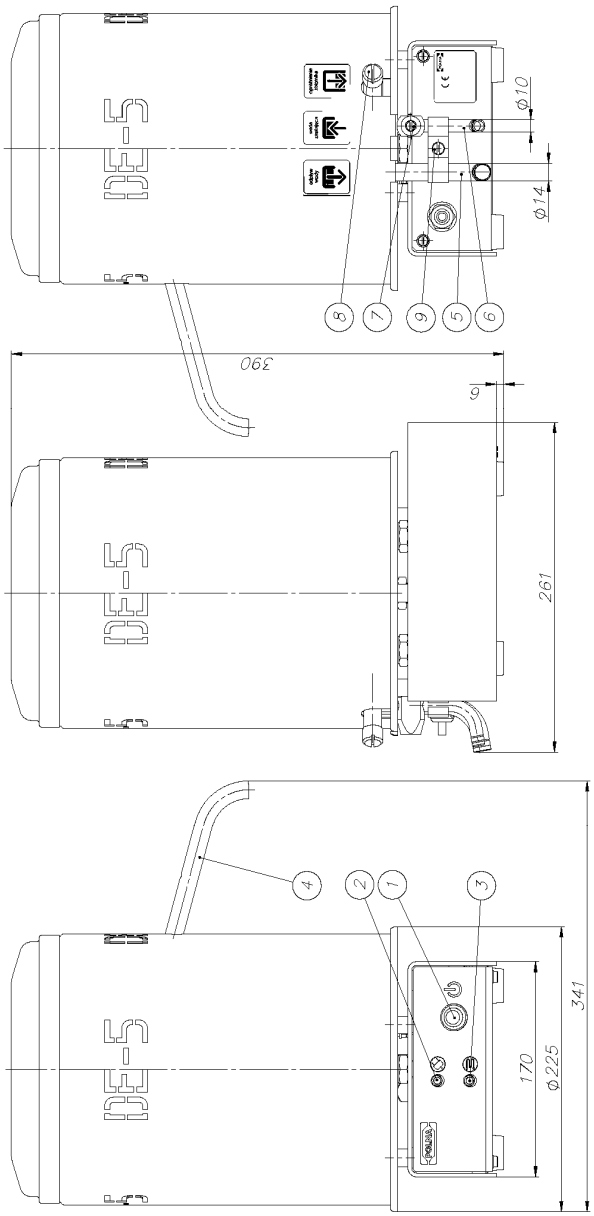


Fig. 1.

2. INTENDED USE

The electric distiller treats water to remove dissolved mineral salts and gases by distillation. It is intended for chemical and pharmaceutical laboratories. The distiller produces water of the quality conforming with Polish Pharmacopoeia V.

3. ACCESSORIES

The distiller has a removable distillate drain (spout) and a sealing ring, see Fig. 2-18.

4. TECHNICAL SPECIFICATIONS

Protection class	I
Distillate production output	ca. 4 dm^3/h
Water consumption rate	ca. 50 dm^3/h
Electrical power input	3 kW
Rated voltage	230 V AC
Weight	8 kg
Overall dimensions	ref. Fig.

5. DESIGN AND OPERATION

The electric distiller comprises a water/steam system (Fig. 2) and an electrical system (Fig. 3).
The water/steam system comprises a boiler (Fig. 2-1), a cooler (Fig. 2-2), an overflow unit (Fig. 2-3) and a flow controller (Fig. 2-5). The cooler is attached to the boiler by three bolts (Fig. 2-22) and nuts (Fig. 2-23) through brackets located on the side of the boiler, with the cooler sealed by a ring. There is a resistive heater in the boiler (Fig. 2-6) with a temperature controller sensor (Fig. 2-7) attached to the upper coil of the heater with fasteners (Fig. 2-8). The cooler consists of a coil (Fig. 2-9), a cooler end, a cover (Fig. 2-17) and a partial condenser (Fig. 2-11). The flow regulator used in the distiller (Fig. 2-5) allows the minimum water supply to the distiller to be set at the nominal distillate production output. The electrical system has two circuits: a heating circuit and a control and feedback circuit.

10. OPERATING SAFETY CONDITIONS

The following principles shall be complied with to ensure operating safety:

- The distiller must be connected to protective earth using a protective conductor connected to the power plug socket;
- The power supply service requires a current protection rated at least at 16A;
- Do not attempt to dismantle the distiller components before the power supply and water supply are isolated;
- During maintenance checks, inspect electrical wiring connections for loose and corroded wires;
- Other operating hazards are indicated with the character "**!**" in this document.

It is only recommended to inspect and retighten loose electrical wiring connections. When reinstalling the cooler after maintenance, inspect the condition of the cooler sealing ring (Fig. 2-18).
Replace the ring that is cracked, has missing pieces, is deformed, or has an irregular cross-section with a new one.

CAUTION!
Removal of the distiller's cover and casing to carry out the foregoing servicing operations does not void the manufacturer's warranty.
Maintenance can be provided by the manufacturer's technical service for a charge not under the warranty.

Warranty repairs are not provided to remove failure of this unit or poor distilled water quality caused by abnormal scale ("lime muck", sand, etc.).

9. REPAIRS

The table below lists the possible malfunctions and their remedies. Have the unit repaired by an authorised maintenance service. Do not attempt any repairs before isolating the power and water supply.

Symptoms	Cause	Remedy
Poor performance.	Low mains voltage.	Troubleshoot the overload and voltage drops in the electrical power system.
	Resistive heater failure or loose wiring connection.	Replace the failed resistive heater or rectify the wiring connection.
	Water scale on the resistive heater or pipe coil.	Remove the scale as recommended in Section 8.
The distillate drain vents steam.	Insufficient cooling due to an excessive water pressure drop.	Increase the pressure of the water supply to the unit.
Water leaking from the casing.	Cooler-to-boiler connection leak.	Replace the sealing ring or improve alignment.
	Leaking cooler.	Reseal by soldering (service repair)
	Leaking boiler.	
The resistive heater fails to turn off for more than 60 s despite the boiler water level being too low or the water supply missing.	Temperature limiter failure.	Replace the temperature limiter.
Water leaking from the flow regulator.	Sealing ring failure.	Replace the ring with a new one.

Operation of the water/steam system (Fig. 2)
The water is supplied through a supply line to the inlet port (4) and flows through the flow regulator (5) and the pipe coil (9).
Once the condensing steam heat output is taken off inside the cooler (2), the water leaves through a tube (12) to the overflow unit (3) and down the port (13) to supply the boiler (1) up to a predefined boiler water level; excess water is drained to the outside via the drain port (14). The steam generated in the boiler, after passing through the partial condenser (11) where it loses the water condensate, condenses in the cooler and leaves it as the distillate through the distillate tube (15) and distillate drain (16).

Operation of the electrical system (Fig. 3)
The distiller is turned on using the main power switch (1) on the front panel. When turned on, the voltage indicator light (green) (5) and the heater indicator light (yellow) (4) come on; the resistive heater (2) is energized with the power supply voltage. This step initiates the distillation process. The resistive heater (2) is protected by the temperature limiter (3) against burning out if the boiler water level is insufficient. When the resistive heater (2) heats up to approx. 115°C, the temperature limiter (3) trips to isolate voltage from the heater. When this happens, the electric heater light indicator (yellow) goes off (4). When the water supply is stopped, the drain port profusely discharges the cooling water while the distillate drain dumps the distillate in large volumes, followed by steam; this continues until the resistive heater is turned off (usually within 60 seconds). Once the boiler is refilled with water and the resistive heater has cooled down, the temperature limiter switches the supply voltage to the resistor and the distillation process continues.

6. PREPARING THE UNIT FOR OPERATION

The installation location of the unit requires electrical power and water service. The distiller can be powered by 230V AC.
The electrical supply is wired via an OWY 3x1.5 cable terminated with a plug which has a protective earth pin.
The distiller must be connected to protective earth using a protective conductor connected to the power plug socket (⏚).
The power supply service wired to the distiller should be provided with a current breaker, as the distiller features no protection fuses or breakers. The minimum current breaker rating shall be 16A. The water supply service shall be provided with a hose fitting and a drain gully connected to the site drainage system.
Install the distiller above the drain gully, as close to it as possible.
Provide the drain port stub (Fig. 1-5) labelled “WATER DRAIN” with the shortest possible length of a 14 mm I.D. rubber house rated for hot and cold water applications and put its other end to the drain gully without kinking. Obstructed or failed drainage will result in water flooding and damage to the distiller. !
Connect the inlet port stub (Fig. 1-6) labelled “WATER SUPPLY” to the water supply service using a 10 mm I.D. 10 mm and secure the connection with a hose clamp.

The last step before commissioning the unit for operation is to attach the distillate drain (spout) (Fig. 2-16) to the distillate tube (Fig. 2-15) labelled “DISTILLATE DRAIN”, on the distiller casing. Insert the distillate drain fitting into the opening on the distiller casing (Fig. 2-10) so that the distillate tube (Fig. 2-15) is inserted into the distillate drain port. The installation location shall ensure trueness of the distiller unit to the plumb.

7. COMMISSIONING AND OPERATION

Once the steps specified in Section 6 are complete, the unit is ready for operation.
Start the unit by opening the water supply valve of the water service to the distiller and connect the power cable plug to a suitable power supply service outlet with a PE pin.
When water starts to flow out of the drain port (Fig. 1-5), turn on the main power switch (Fig. 1-1); the voltage indicator light (Fig. 1-2) and the electric heater indicator light (Fig. 1-3) should come on. This step initiates the distillation process.
Approximately 5 minutes after filling the boiler with water, the distillate will start to come out of the distillate drain.
During this time, adjust the water flow rate by operating the water supply valve the temperature of the cooling water leaving the “WATER DRAIN” port (Fig. 1-5) is between 50 and 60°C. The flow regulator (Fig. 2-5) can be used for finer adjustment.
Turning the pin (Fig. 2-19) in or out reduces or increases the cooling water flow rate.
If the distiller sees daily operation, it is recommended to establish (and mark out) the correct opening ration of the water supply service valve to reduce the start-up time.
The distillate produced during the first few hours of operation should be rejected before proceeding with regular operation. Once this has been done, the distiller can be used if the distilled water output meets the pharmacopoeia specifications that apply. **Use pretreated mains water or a water service with tap water parameters specified in Dz.U 2007.61.417 (as amended) and Dz. U. 2001. 72.747 (as amended) (or equivalent potable water purity specifications).**

Tap water parameters									
Specification	Turbidity	Colour	pH	Iron	Manganese	Chlorides	Hardness	Aqueous chlorine	E.Coli count
Units	mg/dm^3 SiO_2	mg/dm^3 Pt	pH	mg/dm^3 Fe	mg/dm^3 Mn	mg/dm^3 Cl	mg/dm^3 $CaCO_3$	mg/dm^3 Cl	g/dm^3 $CaCO_3$
TLV	< 1	< 15	6,509.50	0.2	0.05	250	60 to 500	0.3	0

To achieve the specification parameters listed in Section 4, the pressure of the water service for the distiller should be within 0.05 to 0.15 MPa.
A pressure lower than 0.05 MPa will increase the temperature of the distillate and cooling water.

See the table below for indicative dependencies of the distiller's performance vs. water supply pressure.

Pressure [MPa]	0.05	0.1	0.2
Output [dm^3/h]	4.5	4	3.7
Water consumption rate [dm^3/h]	32.5	49.8	73.2
Distillate temperature [°C]	88	87	82
Cooling water temperature [°C]	68	57	45

A high distillate temperature is good for the pH level of the produced distilled water.
NOTE: During operation, the unit's cover heats up to approx. 70°C

8. TECHNICAL INSPECTION AND MAINTENANCE

Maintenance comprises periodic draining of the boiler and cleaning the water system. During the distillation process, scale and other contaminants are separated from the water, and their amount and form depend on the concentration and type of mineral salts dissolved in the supplied water. Scale can flake off and sediment or adhere permanently to scaled surfaces; heavy sediments restrict the heat transfer, causing the resistive heater to overheat and the distiller efficiency to decrease. Sediments also clog the water system piping.
The maintenance and cleaning intervals should be established according when the actual efficiency of the distiller falls below 75% or other symptoms are manifested, like water drainage through the overflow unit. Before attempting maintenance of the distiller, isolate it from the power service by unplugging the power cable, close the water supply service valve and disconnect the water supply hose from the inlet port. Next, drain the boiler by removing the plug (Fig. 2-25) at the "TANK DRAIN" port. Maintenance procedures require the cooler to be dismantled.
To do this, first disconnect the distillate drain (Fig. 2-16), remove the fastening screws (Fig. 2-24) and remove the cover (Fig. 2-10). Next, remove the 3 nuts (Fig. 2-23) on the side of the boiler and the fastening screw (Fig. 1-9); remove the cooler core from the boiler taking care not to damage the surface of the bottom of the cooler which mates with the sealing ring (Fig. 2-18).
With access to the boiler, you may proceed with maintenance. Remove all deposits and scale stuck to the resistive heater by tapping, scraping with a wooden spatula and brushing with a hard bristle brush, taking care not to damage the galvanic protective coating, the sensor and the temperature limiter capillary (Fig. 2-7); do not disturb the fasteners (Fig. 2-8). The temperature limiter sensor (Fig. 2-7) must fit snugly against the resistive heater (Fig. 2-6). Remove the scale flakes accumulated in the boiler after cleaning by hand and flush the boiler thoroughly, making sure the inlet port (Fig. 2-13) of the boiler is clear of obstruction. Remove all deposits found. Clean the cooler by turning it with the partial condenser up; next, fill the pipe coil with a 5% water solution of sodium lye using a hose (do not allow the solution to overfill, as it will compromise the tin coating). Leave the solution to dwell for about 10 hours. Connect the hose to the water supply service valve and flush out the coil clean with a strong flow of water. Electrical components require no routine maintenance.