HYDROGEN GENERATOR

USER MANUAL

214.4.464.014UM

PRODUCTS P/N: 451-01XX

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This User Manual (UM) intended for studying the device and operation principle of the hydrogen generator (further – the generator), with directions for its proper operation and maintenance.

The list of manufactured generators is specified in Passport 214.4.464.014PS.

Before using the equipment accurately read the present User Manual.

Two marking types of parts are used in this and accompanied documents:

XXX-XXXX – Part number or Cat. Number referred to ordering documents;

214.X.XXX.XXX(-XX) or simplified X.XXX.XXX(-XX) – Cross ID referred to internal manufacturer documents.

Both can be used for ordering parts.

1 Introduction

This User Manual (UM) is intended to familiarize you with the design and operating principle of the hydrogen generator (hereinafter referred to as the generator), with instructions for its correct operation and maintenance.

Instructions marked with this box must be followed to avoid injury or damage to the equipment. Information that requires special attention is also highlighted in this way.

2 Description and operation

2.1 Purpose

The generator is intended for hydrogen supply of chromatograph's flame detectors.

Besides, the generator can be used as a source of carrier gas. For this purpose, it's recommended to use the generators under mark "HPM" (high purity model).

Operation of the generator is carried out in closed laboratory premises if combustible gases and highly inflammable liquids may be present in volume insufficient for creation of explosive– or fire hazardous mix.

Environmental conditions:

- air temperature from 10 to 35 °C;
- relative humidity not more than 80 %;
- atmospheric pressure from 84 to 107 kPa (from 630 to 800 mm Hg);
- impurity content in premises air shall be normal, regulated by GOST 12.1.005.

As for climate performance, generator is referred to cold-temperate category 4.2 according to GOST 15150-69.

Generator electric power supply is carried out from alternating-current mains with voltage (220±22) V, frequency (50±1) Hz.

The generator complies with GOST IEC 61010-1-2014 for electrical safety. The method and degree of protection against electric shock are CLASS I according to GOST R 58698-2019 (developed and based on IEC 61140:2016 standard).

In terms of electromagnetic compatibility, the generator complies with the requirements of GOST R IEC 61326-1-2014.

2.2 Technical specifications and delivery set

Technical specifications and delivery set is according to Passport 214.4.464.014PS.

2.3 Precious metals content

Data on precious metals content in electrolysis module are specified in The Passport of electrolysis module attached to the Passport of the hydrogen generator.

2.4 Construction and operation

Distinctive features of generators construction:

- Hydro-pneumatic principal drawing for generators are shown below: model 10.600 (Figure 2.1), model 10.600HPM (Figure 2.3), 16.600, 25.600 (Model 2.2), 16.600HPM, 25.600HPM (Figure 2.4). Signs specified in figure are commented on page 10. All models have two output lines: "2.0 kg/cm^2" and "6 kg/cm^2".
- Mechanical pressure controller MPC1 (Figure 2.1 – Figure 2.4) is intended for stabilizing pressure rate of hydrogen flow at its outlet "2.0 kg/cm^2". This line is recommended to use for flame detectors supply.
- Model 10.600HPM (Figure 2.3) has additional catalytic oxygen trap in the construction.
- Models 16.600 and 25.600 (Figure 2.2) have a cooler in the construction.
- Models 16.600HPM and 25.600HPM (Figure 2.4) have a cooler and additional catalytic oxygen trap in the construction.

In the generators of mod 10.600; 10.600HPM electrolysis modules have anodic feed water scheme. In the generators of mod. 16.600, 16.600HPM, 25.600; 25.600HPM electrolysis modules have mixed feed water scheme.

Hydrogen production in generator is based on electrochemical water decomposition into hydrogen and oxygen. Water is loaded in reservoir R1 (Figure 2.1 – Figure 2.4), decomposition takes place in electrolysis module E1 under effect of direct electric current.

Gaseous hydrogen generated by electrolysis module (E1), and mixed with some water drops passes into separator S (where separation of bulk moisture occurs), then goes through mechanical pressure controller MPC2, filters F1 (also F3 for mod. 16.600, 25.600, 16.600HPM, 25.600HPM), F2 removing moisture traces and filter FI1 (moisture indicator).

At output, high pressure hydrogen flow passes to consuming device through the outlet ft3 "6 kg/cm^2" (6 Bar) for model 10.600 (Figure 2.1), model 10.600HPM (Figure 2.3), 16.600, 25.600 (Model 2.2), 16.600HPM, 25.600HPM (Figure 2.4).

At output, low pressure hydrogen flow passes through the manual pressure controller MPC1 and fitting ft4 "2.0 kg/cm^2" (2 Bar) for all models.

In models 10.600 HPM; 16.600 HPM; 25.600 HPM hydrogen also passes through a catalytic oxygen trap A5 (Figure 2.3, Figure 2.4).

Water passes from separator S1 through the valve V1 into reservoir R1 (besides in models 16.600, 16.600HPM, 25.600, 25.600HPM some water eliminated from separator flows back to electrolysis module through hydrogen tube). Oxygen exiting from electrolysis module with some water goes to reservoir R1 and vents into atmosphere through the hole in reservoir R1.

The appropriate level of hydrogen pressure is kept by means of semiconducting pressure sensor PS1 (Figure 2.1 – Figure 2.4). Once hydrogen pressure reaches set value, current feeding electrolysis module smoothly goes down. While pressure decreasing, current goes up smoothly.

Mechanical pressure controller MPC2 provides minimal level of pressure in separator S1 to let flowing water from separator into reservoir R1 at Hydrogen switching on (with no pressure in lines). To control hydrogen pressure in pneumatic system visually, there is manometer M1 built-in front panel.

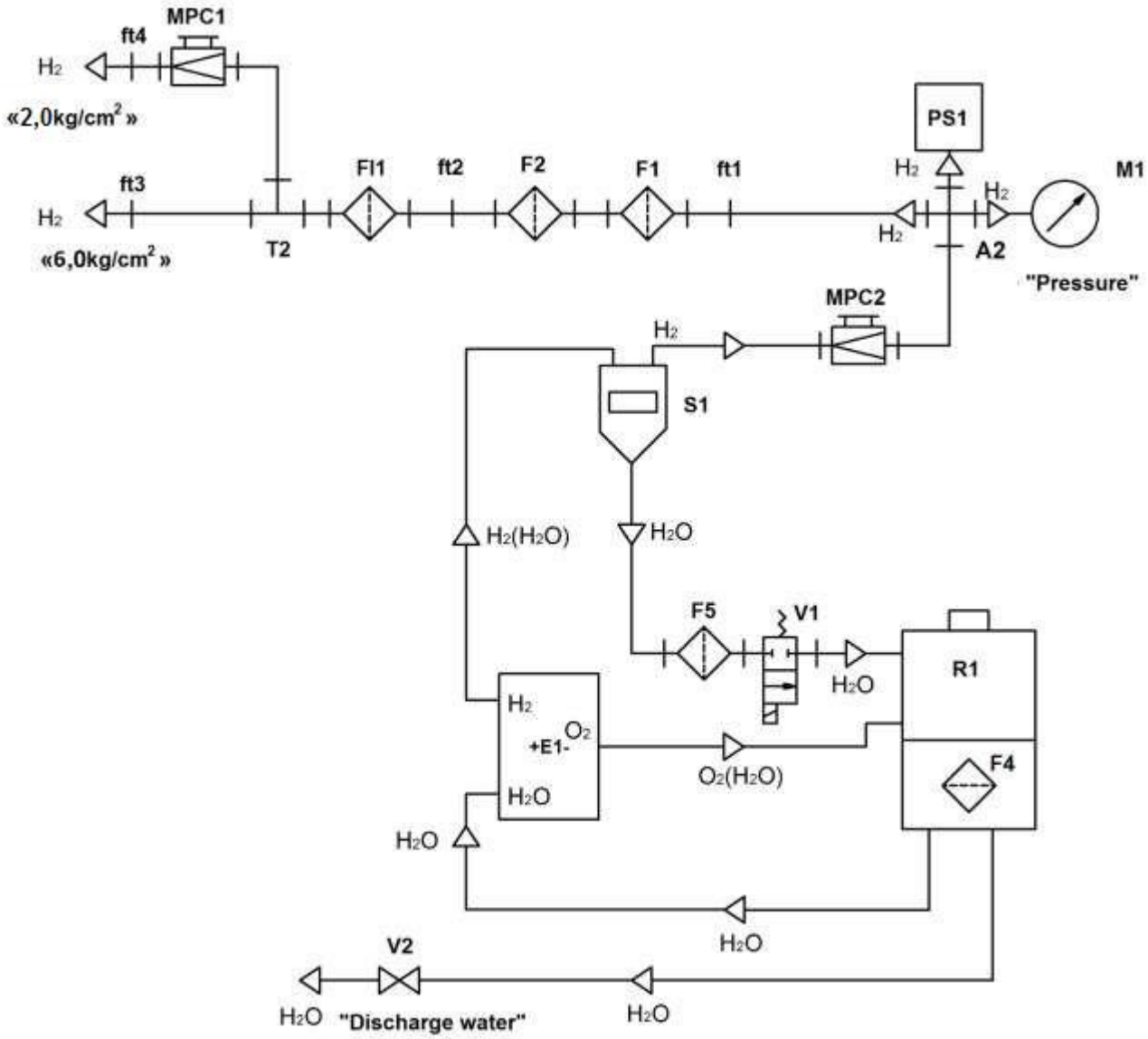


Figure 2.1 – Hydro-pneumatic principal drawing for generators mod. 10.600

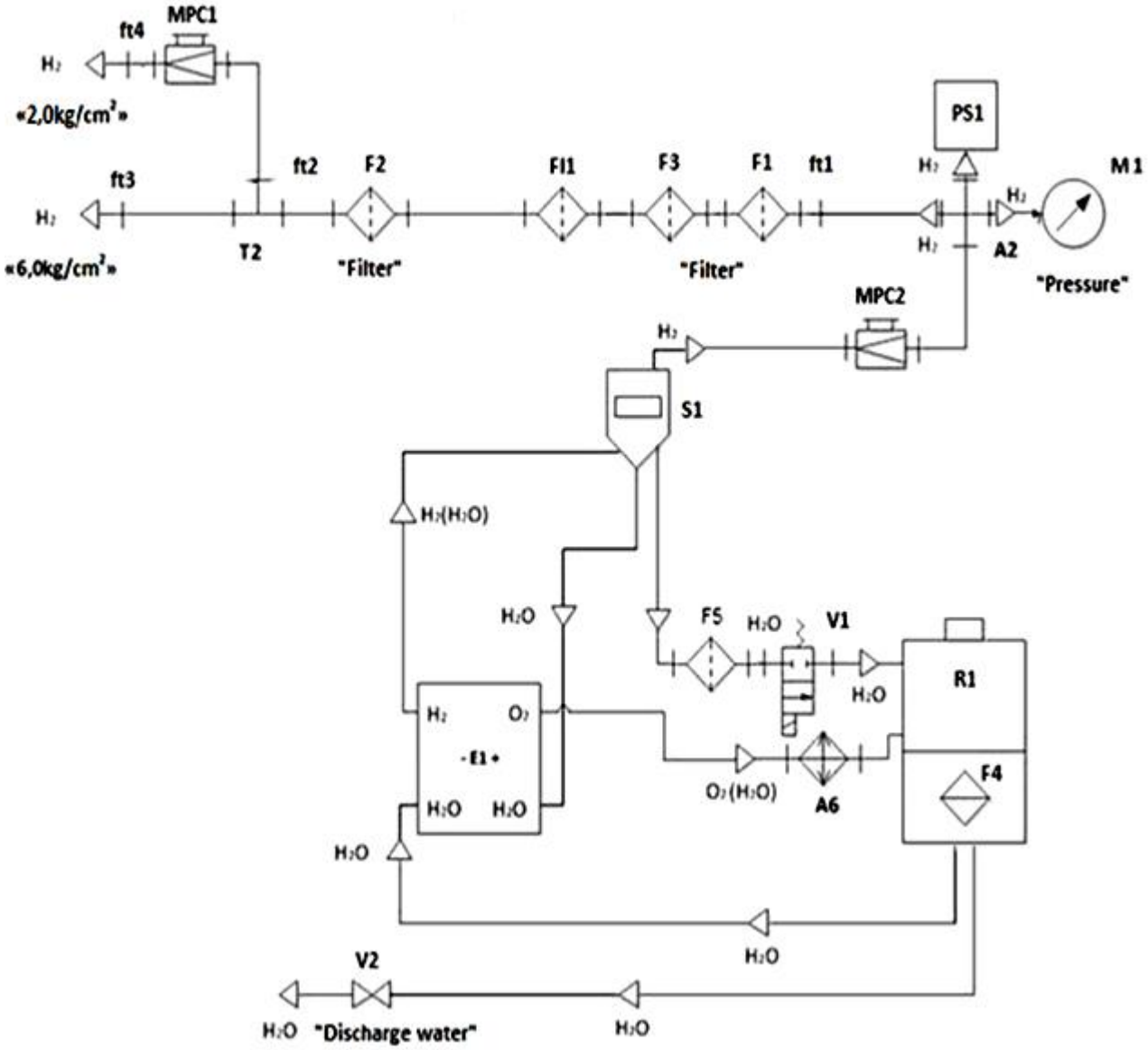


Figure 2.2 – Hydro-pneumatic principal drawing for generators mod. 16.600, 25.600

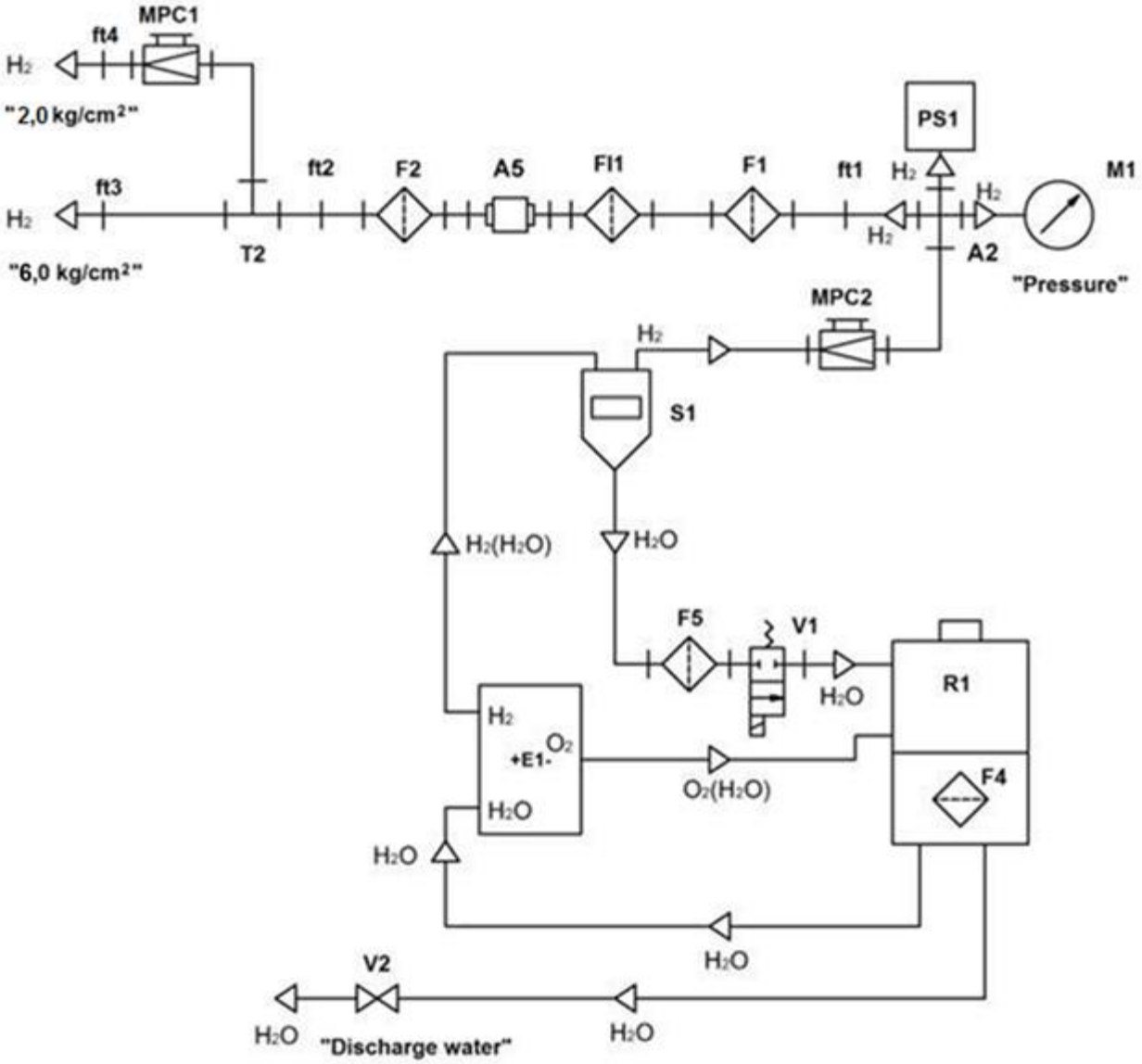


Figure 2.3 – Hydro-pneumatic principal drawing for generators mod. 10.600HPM

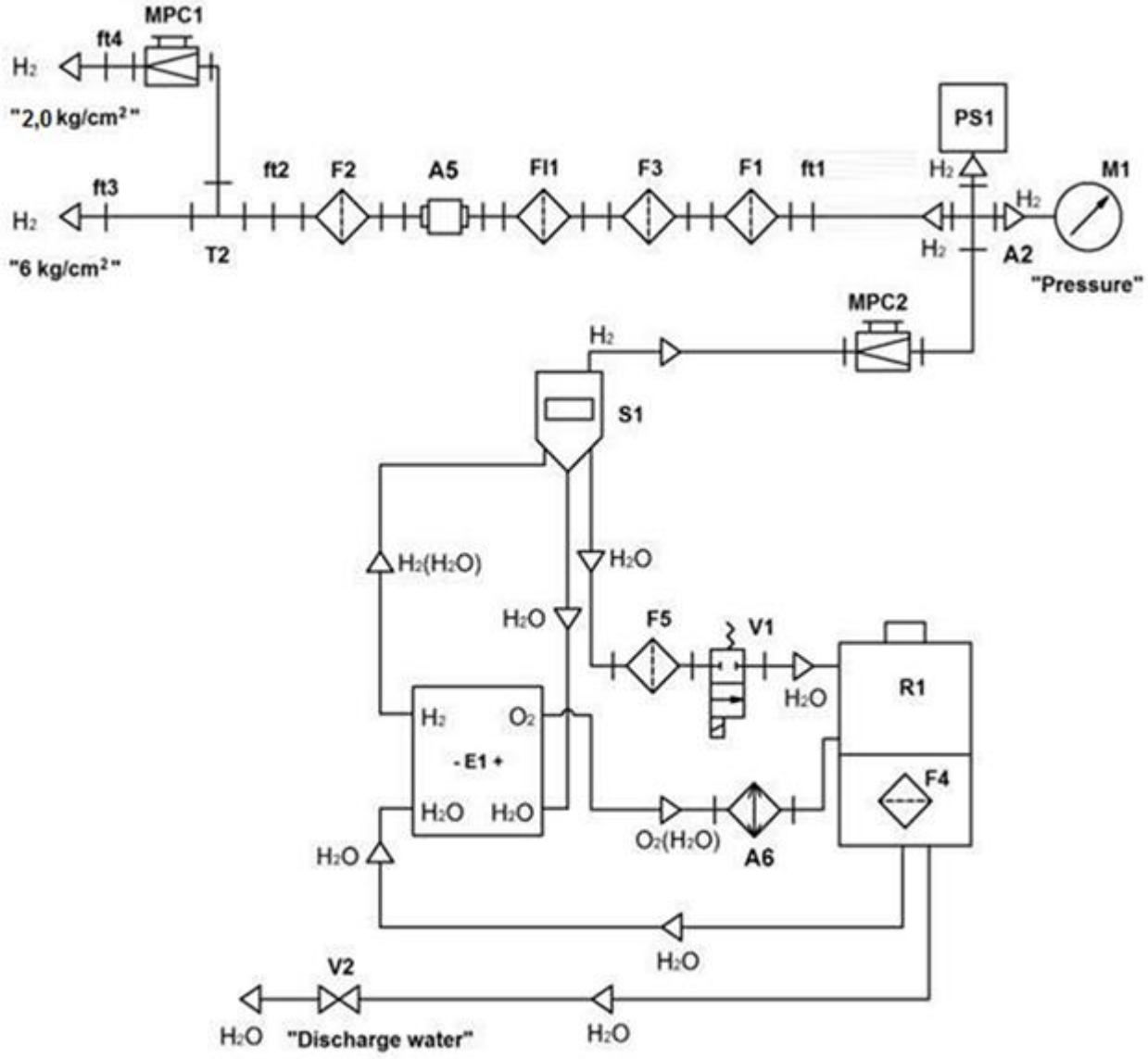


Figure 2.4 – Hydro-pneumatic principal drawing for generators mod. 16.600 HPM, 25.600HPM

Signs in figures:

R1 – reservoir 5.887.040;

PS1 – pressure sensor (type 26PCFFH6G for all models);

M1 – manometer (scale 10 kg/cm^2);

MPC1 – manual pressure controller 5.157.003,

MPC2 – manual pressure controller 5.157.007;

T2 –tee-joint 6.453.016;

V1 – solenoid valve 5.890.042-01;

F1, F2, F3 –filter 5.884.041 (mol. sieve trap);

F4 – ionite filter 6.112.004;

F5 – filter 5.884.085

FI1 – filter (moisture indicator) 5.884.080;

ft1 – Fitting 8.652.487 (for all models); ft2-ft4 – Fitting 8.652.487;

S1 – separator 5.887.039 (for models 16.600, 25.600, 16.600HPM, 25.600HPM), separator 5.887.042 (for the rest models);

E1 – electrolysis module (for models 10.600, 10.600HPM – electrolysis module with anodic feed water scheme; for models 16.600, 25.600, 16.600HPM, 25.600HPM – electrolysis module with mixed feed water scheme);

V2 – on/off valve 6.451.010 (manual);

A2 – X-connector 6.453.090;

A3 – X-connector 6.453.090-01;

A5 – catalytic oxygen trap 5.863.220;

A6 – cooler 6.452.041

Drying filters F1, F2 and F3 are filled with molecular sieve for trapping moisture. Filter F4 contains ion exchange resin, which neutralize acidity of water arising at generator operation. Filter F5 is designed to protect valve V1 from ingress of mechanical particles.

Admissible water level in separator S1 is maintained as follows:

- At reaching maximum water level in separator (controlled by level sensor) valve V1 opens in pulse mode, water flows from separator into reservoir R1.
- If by any reason (valve clogging, low pressure level in the system), water overflows permissible level, overflowing protection alarms in order to prevent water entrance into gas lines. In this emergency state red LED indicator lights continuously and periodic beep sounds, the generator stops producing hydrogen.

Water level in reservoir R1 is controlled as follows.

- Once water level in reservoir approaches minimum permissible value, short beep starts sounding (three short beeps then break). On the front panel Yellow LED indicator lights, which indicates need to add water into reservoir. At this state, the generator continues operating.
- When running without loading water, after a while the generator water deficiency protection system responses; at this state red LED indicator lights continuously and periodic beep sounds. The generator stops producing hydrogen.

Generator overviews:

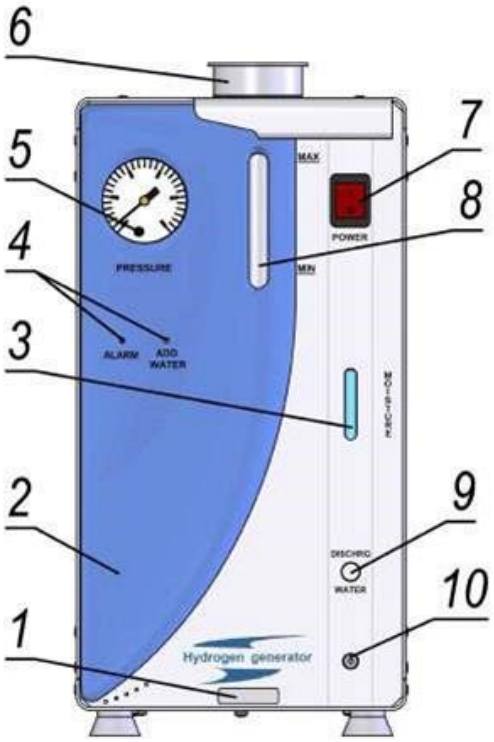
- Figure 2.5 – front view (for all models);
- Figure 2.6 – right view;
- Figure 2.7 and Figure 2.8 – rear view for different models,

Reservoir R1 pos.6 has a neck for filling with water (Figure 2.5, pos.6); level visual control is performed through translucent wall pos.8 on the front panel of the generator. Reservoir water level should be not higher graduation mark "MAX" and not lower graduation mark "MIN". Once water

run out, close the valve V2. To drain the water, open the valve V2 "DISCHARGE WATER". After the water stops flowing out of the drain nipple, close the valve V2.

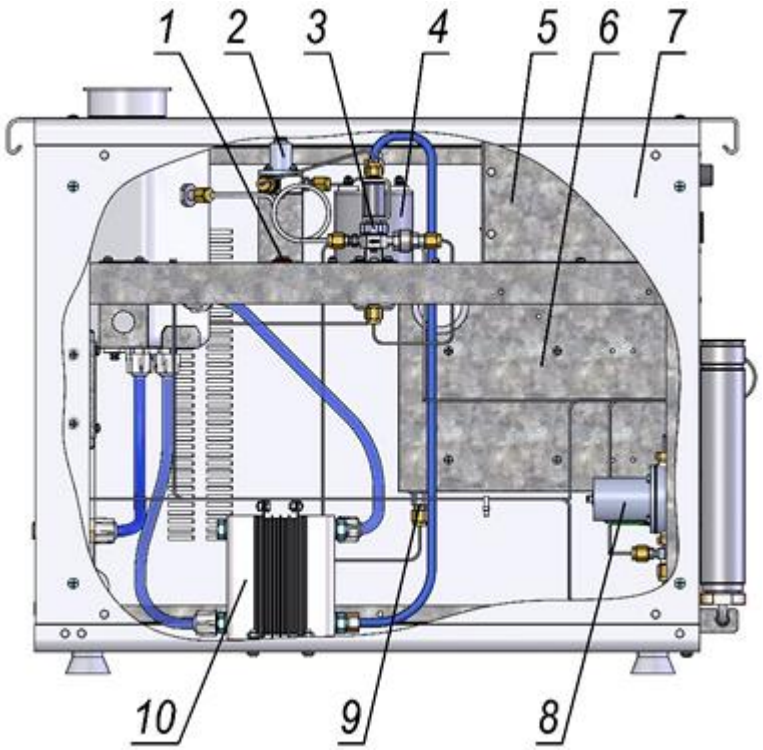
For convenient emptying reservoir it's recommended to attach fitting 6.454.104 with PVC tube from Shipping kit to fitting "Discharge water".

On the front panel of the generator there is filter FI1 (moisture indicator) at its outlet of produced hydrogen (pos. 3, Figure 2.5).

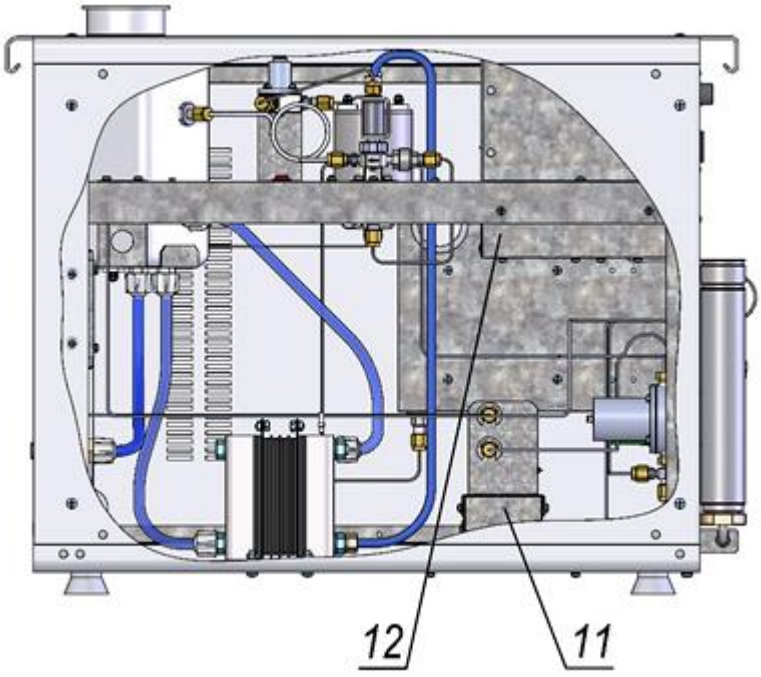


1 – Marking of generator model; 2 – front panel; 3 – filter FI1 (moisture indicator); 4 – LED indicators "Alarm", "Add water"; 5 – Manometer M1; 6 – reservoir R1; 7 – key POWER (switching on/off); 8 – reservoir water level; 9 – on/off valve V2 "Discharge water"; 10 – discharge fitting.

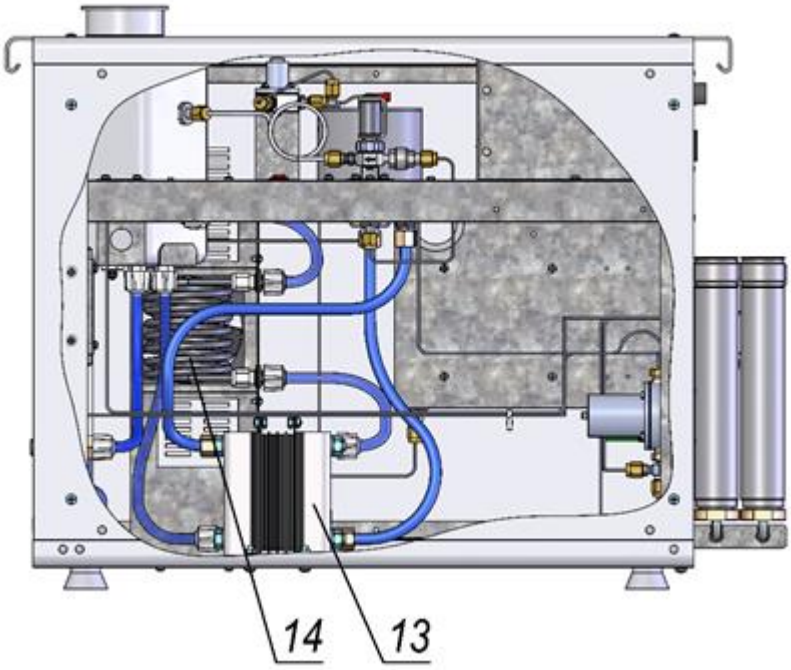
Figure 2.5 – Hydrogen generator. Front view



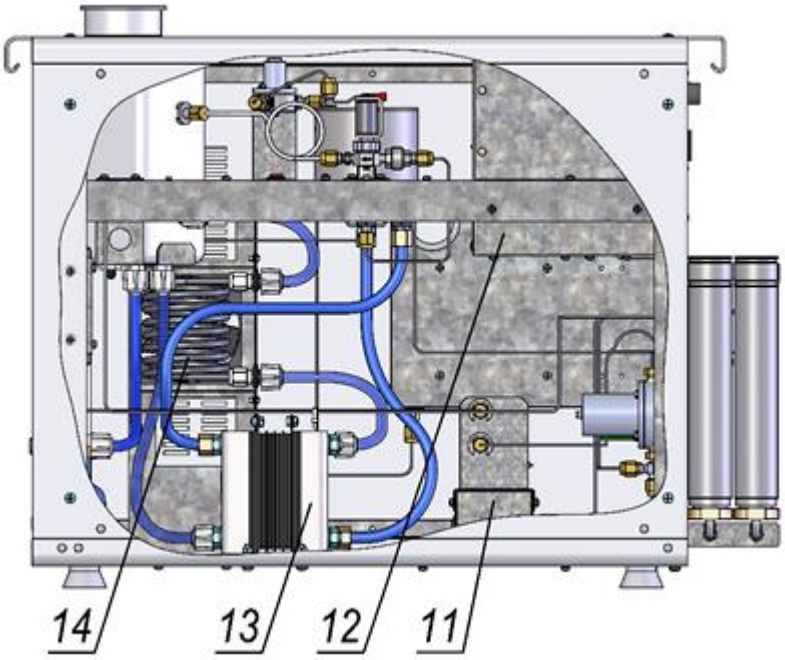
a) model 10.600



b) model 10.600 HPM



c) models 16.600 and 25.600

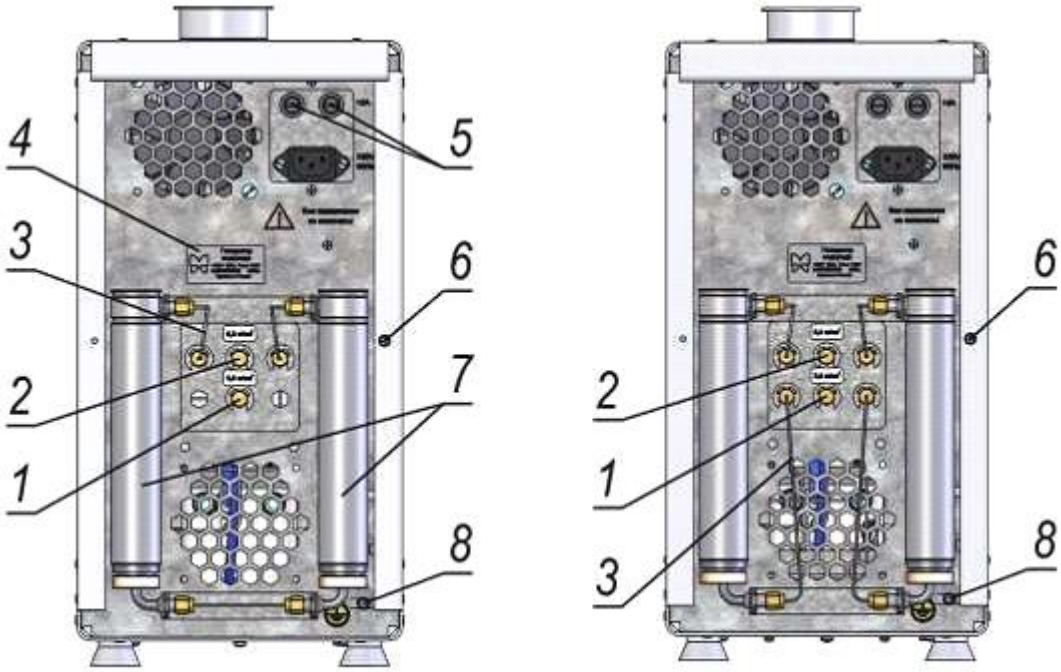


d) models 16.600 HPM and 25.600 HPM

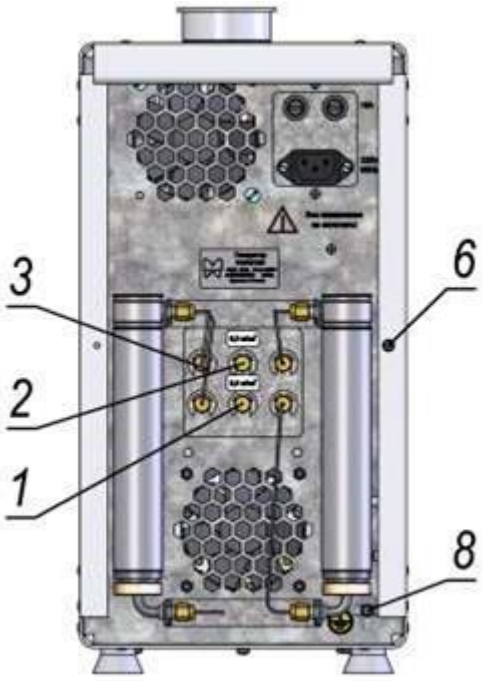
1 – button for forced emptying separator; 2 – mechanical pressure controller MPC2; 3 – solenoid valve V1; 4 – separator S1; 5 – power unit; 6 – electronic unit; 7 – side cover; 8 – pressure controller MPC1; 9 – pressure sensor PS1; 10 – electrolysis module (anodic feed water scheme) E1; 11 – catalytic oxygen trap A5. 12 – power unit for catalytic oxygen trap A5; 13 – electrolysis module E1 (mixed feeding scheme); 14 – cooler A6.

Figure 2.6 – Hydrogen generator. Right view

Unused outlets are plugged with caps 6.432.002 (Figure 2.7).



a) model 10.600, b) model 10.600 HPM

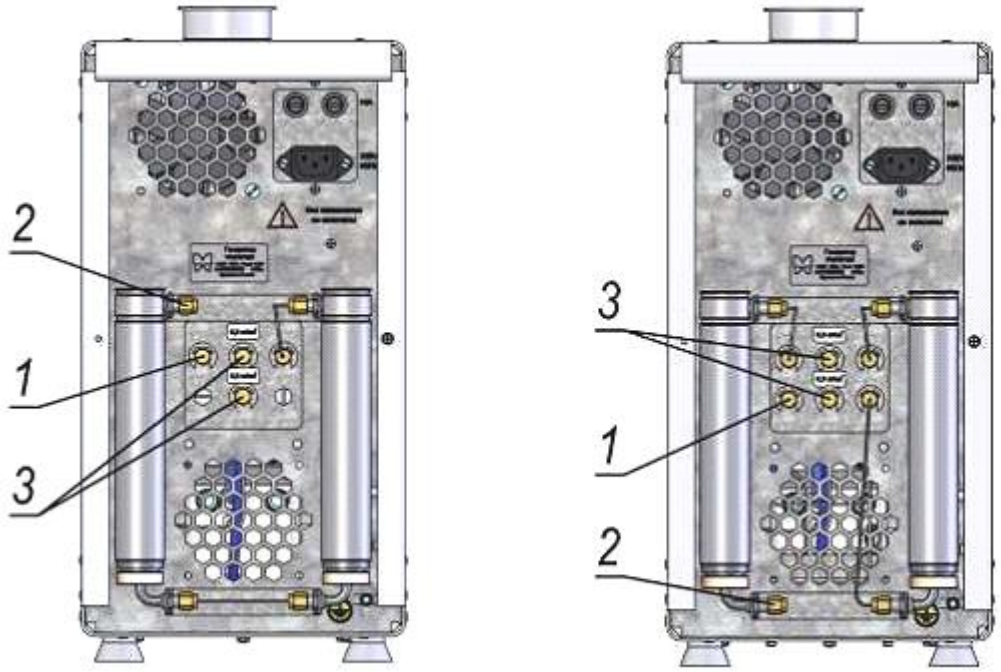


c) models 16.600, 25.600, 16.600 HPM and 25.600 HPM

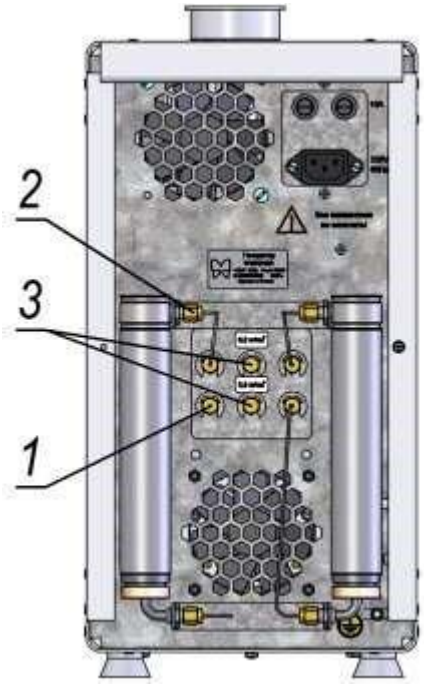
1 – outlet "2.0 kg/cm^2"; 2 – outlet "6.0 kg/cm^2"; 3 – tube (taken from mounting kit of the generator); 4 – Serial number tag; 5 – fuses (2 ea); 6 – seal; 7 – filters F1, F2, F3; 8 – ground terminal.

Figure 2.7 – Hydrogen generator. Rear view (operating state)

The tube connecting filter F1 and fitting ft1 (from the left) is demounted and placed in the mounting kit of the generator for transportation purpose (Figure 2.8).



a) model 10.600, b) model 10.600 HPM



c) model 16.600, 25.600, 16.600 HPM and 25.600 HPM

1 – cap 6.432.002 (attached on the fitting ft1); 2 – cap 6.432.002 (attached on the filter F1); 3 – cap 6.432.002 (attached on unused outlets of the generator).

Figure 2.8 – Hydrogen generator. Rear view (transporting state)

3 Usage

3.1 Operation limitations

Generator operation without ionite filter is strongly forbidden, except maintenance when it is washed with hot water.

At operation and storage without water, the generator breaks down. The electrolysis module must always be filled with water.

Generator operation to the atmosphere (external restrictor absence) is undesirable, because it increases water vapor content in produced hydrogen which saturates filters and filter indicator.

Long storage (more than a month) of water prepared for generator is inadmissible considering its parameters deterioration.

Generator storage and transportation is not admissible at temperatures lower than +5°C. (Except generators specially prepared for transportation at negative temperatures).

The generator specially prepared for transportation at negative temperatures as allowed for transporting (but not for storage) at temperatures as low as minus 45 °C.

Mark about special preparation (or not preparation) of the generator for transportation at negative temperatures is made in section 3 of the Passport.

Hydrogen in the generator is produced by electrolysis module with solid polymer electrolyte in which catalytic decomposition of the deionized water takes place. Solid polymer electrolyte is ion-exchange membrane which has enhanced sorption ability that causes special demands to water quality.

The membrane "poisoned" with ions Fe^{2+}, Fe^{3+}, Ca^{2+}, Ni^{2+}, thus its resistance increases, the electrolysis current and productivity on hydrogen drops. As a result, the sell gradually gets out of operation. Therefore, application of double-triple distillation with preliminary water treating with polypropylene filters or application of distillation with following clearing by ion-exchange resin is advisable.

For feeding the generator use only deionized water with resistivity not less than $1x10^6$ Ohm x cm). Using water of insufficient purity will lead to electrolysis module breakage, it is not warranty case.

Ingress of oils, organic solvents, etc. in water for loading is inadmissible.

Water for the generator should be stored in tightly closed, clean glassware. Using of plastic or metal utensils is not allowed.

The generator is to be installed on horizontal place. Slope at more than 10 degrees is not forbidden.

It is forbidden to lay foreign objects on the generator.

The generator is repairable, renewable product.

Repair of electrolysis module is performed by manufacturer only.

Transportation **(but not storage!)** of the generator at temperatures below freezing point (down to minus 45°C) is allowed, if it had been specially prepared for transportation at negative temperatures according to Directions 214.4.171.041I.

On packaging of generator which passed preparation to transportation at negative temperatures, there is a label of following content:

Hydrogen generator

Model _____

S/N _ _____

Contract N_____

Power cord	☐
User manual	☐
Shipping kit	☐

Do not turn over!

Top is here

Caution!!!

Fragile

On packaging of generator which did not pass this preparation, label looks like following:

Hydrogen generator

Model _____

S/N _ _____

Contract N_____

Power cord	☐
User manual	☐
Shipping kit	☐

Do not turn over!

Top is here

Caution!!!

Fragile

Do not tilt more than 20°!

Do not cool lower +5 °C!

3.2 Safety measures

Do not operate the generator without first reading the safety instructions outlined in this section.

Do not operate the generator without first reading the generator user manual.

Repair and maintenance of the generator must be performed with the electrical power disconnected and the gas lines shut off (except when power is essential).

Sources of danger in hydrogen generator are:

- Hydrogen being produced by electrolysis module and passed through output fittings of the generator (Figure 2.7, pos. 1, 2);
- Oxygen being produced by electrolysis module and passed into reservoir R1 (Figure 2.5, pos.6);
- Voltage of power supply of power unit (Figure 2.7, pos.5).

For safety operation and preventing trauma when working with hydrogen generator, it's necessary to follow directions specified this section.

Gaseous hydrogen is hazard.

Contact of oxygen with oil can lead to the explosion.

Voltage of power supply may cause electrical shock.

When generator operating fire-prevention safety measures according to GOST 12.1.004-91 should be observed.

Persons who studied this manual are allowed to generator operation.

The area in which the generator works, should meet the requirements:

- Should be equipped with a plenum-exhaust ventilation;
- Should be equipped with firefighting means;
- The presence of acids and oils vapors indoor is not allowed.

The generator should be grounded. Grounding is carried out with the help of power plug and additional grounding. Contact "⊥" power outlet for connection of the generator and terminal of additional grounding (position 9 in figure 3) should be connected to external grounding loop with the help of copper wires cross-section not less than 1.5 mm^2. Cable 6.644.056 of Shipping kit is used for additional grounding.

Do not turn generator on without grounding!

Before each removal of external covers, it is **OBLIGATORY** to release pressure in hydrogen line to null (switch off the generator and disconnect it from device-consumer).

It is forbidden:

At non-compliance with section 3.2 Measurement requirements of User Manual, to leave the generator running without permanent supervision.

Operate if water level in reservoir is above line "MAX".

Fill reservoir with water at running generator and removed cover. Untrained personal to repair generator themselves.

Personnel who have not studied this manual should not perform repair work on their own.

At complete fulfillment of requirements specified in this section operation of the generator may be carried out without permanent supervision.

3.3 Preparation for operation and operation procedures

Power supply (single-phase alternating current mains with voltage 220 V, frequency 50) and external grounding loop should be brought to the place of generator installation.

Install the generator on a table with front panel to operator on distance not more than 1.5 m from the power outlet.

For preparation to operation follow actions:

- Turn cap from reservoir neck, load newly prepared deionized water;
- open a cap of the reservoir of the generator, place an ionite filter bag in the reservoir, having previously released it from the polyethylene packaging (from the mounting kit);
- screw the cap onto the reservoir neck;
- Using cable 6.644.056 connect additional grounding. With the help of power cord connect the generator to power;
- Remove cap (Figure 2.8, pos.1) from the fitting ft1.
- Switch on the generator (press the POWER button on front panel) and keep running the generator during 30 min to atmosphere in order to remove possible water remains from internal gas lines;
- Switch off the generator.

For 16 and 25 L/h hydrogen generators (with upgraded control boards, released after July 2025), a depressurization protection (depressurization alarm) is triggered after 10 minutes of generator operation at atmospheric pressure.

To restart the generator at atmospheric pressure for 10 minutes (e.g., to purge filters), turn the generator off and on again.

To restart the generator at atmospheric pressure for a longer period, install a pneumatic resistance at the generator outlet sufficient to build up pressure and turn the generator off and on again.

To prevent electrostatic discharge and, consequently, hydrogen ignition, avoid touching the generator outlet with your hands or any other objects while it is operating at atmospheric pressure. There are no other hazards when operating hydrogen generators at atmospheric pressure with 16 and 25 l/h capacity.

Check internal lines for leaks as follows:

- Attach a cap on the fitting ft1 (Figure 2.8, pos.1);
- Remove a right-side cover of the generator;
- Switch on the generator;
- After pressure rose up to working value switch off generator. Then waiting for 2 min, check pressure decrease on manometer. Pressure decreasing is not allowed. Besides it's necessary to make sure visually that there are no water leaks in the generator;
- Fit back the right-side cover of the generator.

Switch tubes from transport to working position (connect filters into gas lines), thereto:

- Remove a cap from the fitting ft1 (Figure 2.8, pos.1);
- Remove a cap from the filter F1 (Figure 2.8, pos.2). Connect the filter F1 and fitting ft1 with tube from the mounting kit (Figure 2.7, pos.3);
- Remove a cap from output fitting expected to be used (Figure 2.8, pos.3);
- Connect generator output fitting to consuming device using tube from Shipping kit;
- Check for leaks as it described above, but with connected filters.

3.4 Troubleshooting

Possible malfunctions and recommended recovery procedure are given in table 1.

Table 1 – Troubleshooting procedures

Malfunction signs	**Possible cause**	**Recommendation**
The generator doesn't run at switching on.		
"Power" lamp and moisture filter lighting LED on the front panel do not shine. Coolers on the rear wall do not fan.	Faulty contact between the generator and power supply source	Check that power supply is on, check power supply cord, correct electrical connections, "Power" button, fuses
	Power unit is broken down	Apply to manufacturer (or its representative)
The generator fails to reach operating pressure level when outlets are sealed		
	There is no water in reservoir	Add water

Malfunction signs	Possible cause	Recommendation
Indicator “Alarm” lights constantly, the generator utters short beeps. Hydrogen is not produced: when right cover is removed, there are no seen gas bubbles going along in tubes from electrolysis module to reservoir and separator.	Valve V1 is broken down (water is not over flowed from separator into reservoir).	Turn off and then turn on the generator. Check valve operability: valve switching snaps must be heard at pressing button 4 (see appendix A). Check electric connection in circuit of valve. Blow the valve with air (nitrogen) or replace the valve. Apply to manufacturer (or its representative).
	Level sensors in separator are contaminated and closed to the ground (no water in the separator, valve switching snaps are heard at pressing button 4, see appendix A).	Wash separator, follow procedure described in appendix A.
	Pressure controller after separator MPC2 is broken down. (water flow from separator is too slow, valve switching snaps are heard at pressing button 4, see appendix A).	Adjust pressure regulator. Apply to manufacturer (or its representative).
Pressure level = 0. When right cover is removed, there are no seen gas bubbles going along in tubes from electrolysis module to reservoir and separator.	Electrolysis module is not supplied by power.	Check electrical connections on current sensor board. Apply to manufacturer (or its representative).
	Pressure and flow setting board is not adjusted correctly.	Adjust pressure and flow setting board. Apply to manufacturer (or its representative).
	Pressure sensor is broken down	Apply to manufacturer (or its representative).
Pressure level = 0. When right cover is removed, there are seen gas bubbles going along in tubes from electrolysis	There is a leak in gas lines	Spot leak point with soap foam, recover leak-tight connections. Wipe carefully soaping places.

Malfunction signs	Possible cause	Recommendation
module to reservoir and separator.	Manometer is broken down	Check pressure level with any external manometer (use 10 bar max scale). Replace manometer. Apply to manufacturer (or its representative).
Pressure level goes up, but fail to reach required operating level	Valve V1 is contaminated (valve is opened constantly, can not to be closed; produced hydrogen flow wastes into reservoir).	Blow the valve with air (nitrogen) or replace the valve. Apply to manufacturer (or its representative).
	There is a leak in gas lines	Spot leak point with soap foam, recover leak-tight connections. Wipe carefully soaping places.
	There is a leak in electrolysis module (oxygen bubbles in tube from electrolysis module are much more than hydrogen bubbles in another tube).	Apply to manufacturer (or its representative).
Pressure level goes up dramatically exceeding operating level	Pressure sensor is broken down.	It's forbidden to run the generator in order to prevent it from breakage. Apply to manufacturer (or its representative).
Generator productivity is too low		
Flow controller with connected tube from generators outlet shows hydrogen flow below than required maximum productivity, though it is set more than maximum productivity value.	There is a leak in gas lines	Spot leak point with soap foam, recover leak-tight connections. Wipe carefully soaping places.

Malfunction signs	Possible cause	Recommendation
Voltage value in electrolysis module section exceeds 3.2 (3.8) V and (or) below 2V in one of sections	Deterioration of electrolysis module parameters (due to contamination or aging).	Apply to manufacturer (or its representative).
Detector background and fluctuation noise increase		
Filter FI is rose-colored or colorless	Filters F1, F2, F3 are saturated with water moisture	Carry out regeneration of sorbent in filters F1, F2, F3
Unstable operation: beeps sound at normal operation		
Hydrogen is being produced. The generator utters short beeps (three short beeps then break). Yellow indicator “Add water” shines.	Water level in reservoir below "MIN"	Add water into reservoir
Hydrogen is being produced. Sometimes red indicator “Alarm” shines or blinks, the generator utters short beeps.	Purity of water is not sufficient.	Discharge water. Wash reservoir. Load reservoir with new water.
	Operation without ionite filter. Ionite filter is used up	Replace ionite filter
Hydrogen is being produced. Red indicator “Alarm” shines constantly. Valve switching snaps are heard.	Top level sensor in the separator is contaminated and closed to the ground	Wash separator, follow procedure described in appendix A.
	Level sensor wires are confused between each other	Change wire connections between each other

4 Maintenance

For the generator two types of maintenance are foreseen:

- current maintenance;
- periodic maintenance.

Maintenance may be carried out by persons who studied this manual.

4.1 Current maintenance

Table 2 – Current maintenance operations

Operation	**Periodicity**
Cleanness check of the generator	Daily
Pressure check	Daily
Moisture check of the produced hydrogen	Daily
Sorbent regeneration (in filters F1, F2 and F3	Depending on state of moisture indicator. At increasing of detectors noise level
Water level check	Daily

Cleanness check of the generator

Cleanness check means visual observation of the generator. Especially prevent the generator from staining generators covers with oils.

Hydrogen pressure check

Hydrogen pressure value by manometer on the front panel must be within range from 5.75 to 6.25 kg/cm^2 (for all the models of the generator).

Manometers located on front panel of the generator are just means of indication and cannot be exposed to verification procedure.

Hydrogen moisture check

The generator has a moisture filter (indicator), which colored blue at normal moisture. At normal hydrogen humidity moisture filter is dark-blue colored. Once hydrogen flow gets humid, the filter change color into pink.

At changing color of moisture indicator into pink, it's necessary to remove filters F1, F2, F3, unscrew caps of the filters, then eliminate sorbent from filters, place it into a container for baking. Bake sorbent (molecular sieve) at (350-400) °C during (4-6) hours. It's recommended to put sorbent into filters being warm (50-60) °C. Long contact of sorbent with ambient air **is not allowable**.

Recommended filters blowing procedure for HPM models:

- Connect filters F1 and F3 (F1 only for mod. 10.600 HPM), keep blowing during 15 minutes.
- Connect wet trap and catalytic oxygen trap (for mod. 16.600 HPM and 25.600 HPM) and keep blowing during 15 minutes. Connect filter F2.

It is not recommended dismounting moisture indicator and baking sorbent in it!

At passing through the filter indicator of dry hydrogen the sorbent in it restores original color. For recovery of normal sorbent moisture in filter indicator it is necessary to switch on the generator for 30 minutes "to atmosphere".

Water level check

When water level approached to minimum admissible level short beeps sound, yellow indicator "Add water" lights on the front panel. At this state the generator goes operating.

Filling with water can be carried out without both switching off the generator and interrupting analyses, at dropping water level down to minimum admissible level.

4.2 Periodic maintenance

Table 3 – Periodic maintenance operations

Operation	**Periodicity**
Water replacement	1 week At breakage in operation more than a week
Reservoir washing	1.5 year, or at arising film-like deposit on its walls
Separator washing	1.5 year and at reservoir washing
Ionite filters replacement	1.5 year (if water quality is insufficient, earlier replacement may be required)

Water replacement

To drain water into vessel, open on/off valve V2 "Discharge water". At running out water from the draining fitting, close valve V2.

For convenient emptying reservoir it's recommended to attach fitting 6.454.104 with PVC tube from Shipping kit to fitting "Discharge water".

Unscrew a cap of the reservoir. Load fresh water up to the level "MAX". Close the cap by rotating.

For filling the generator use only deionized water with resistivity not less than $1x10^6$ Ohmxcm).

Once a week is a recommended periodicity of water changing. This is indicated on the top cover of the generator next to the neck.

At changing water, check presence of film-like deposit on reservoir's walls. If necessary, wash the reservoir. If any coating observed, especially check quality of water.

Washing reservoir

Washing reservoir is to be carried out once in 1.5 year, and also at arising film like deposit on its walls. For this purpose:

- open reservoir's cap;
- remove ionite filter from reservoir;
- drain water from reservoir;
- wash out reservoir with distilled water twice. If necessary, remove film-like deposit by wiping with lint-free cloth;
- wash out reservoir with distilled water;
- place ionite filter into reservoir, fill with water and close the cap.

The instruction on separator washing is given in the appendix A.

After servicing it is necessary to check water and gas lines for leaks, see section 3.3.

At servicing it is necessary to monitor water filling of electrolysis module. Do not allow water draining! This disables the module.

Ionite filter replacement

Ionite filter replacement is to be carried out in each 1.5 year (if water quality is insufficient, earlier replacement may be required).

- Open reservoir's cap.
- Remove ionite filter from reservoir.
- Place new one.

Ionite filter is available from manufacturer.

Voltage checks on sections of electrolysis module

Data on voltages on electrolysis module sections and generator productivity are recorded in Passport of the generator and filled by the manufacturer at generator output. Voltage value can be different for various manufacturers of electrolysis module.

Voltage checking procedure:

- remove non-sealed side cover of the generator;
- switch on the generator;
- Using multimeter at 20V of direct current range, measure voltage value in each section from the left to the right as it is shown in Figure 4.1;
- Fit non-sealed side cover of the generator back.

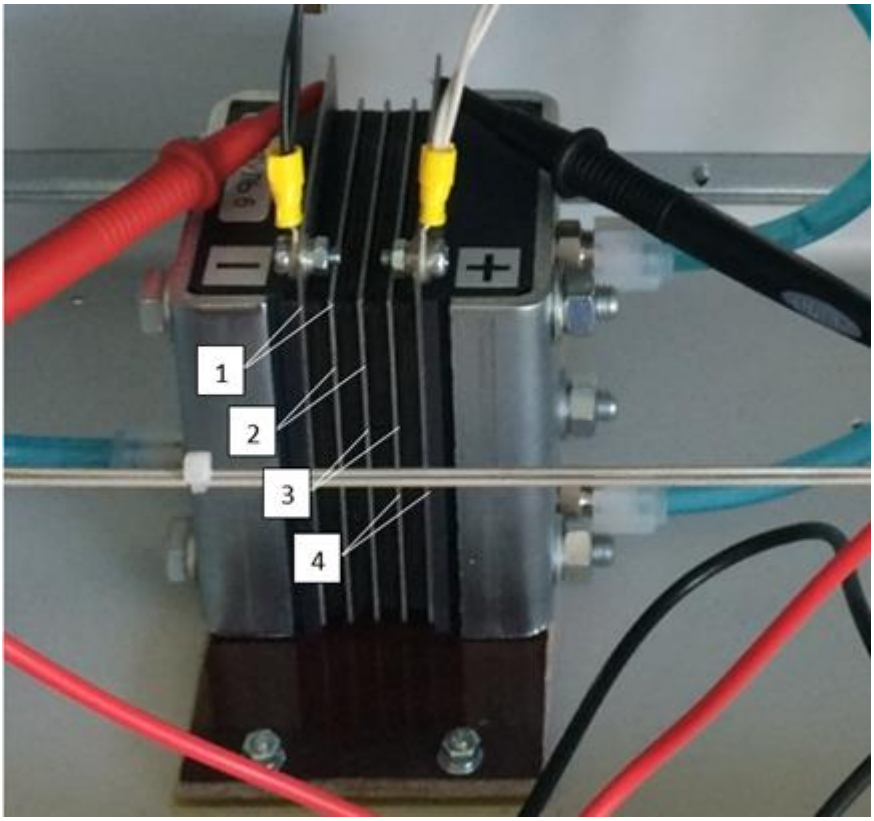


Figure 4.1 – Checking voltage on the electrolysis module (numbers indicate section numbers)

5 Conservation and reconservation

Generator conservation is executed on option of time corrosion protection B3-10 in accordance with GOST 9.014.

Reconservation of electrolysis module (keeping operating condition of electrolysis module at long storage) is in fact washing of electrolysis module per each 3 months.

The reconservation can be provided by persons who studied present User Manual.

When long storage and at breaks in operation of the generator, reconservation of electrolysis module is to be performed **every three months**.

Reconservation of electrolysis module is required in order to save parameters in productivity of the generator.

For conducting electrolysis module reconservation it is necessary:

- Open reservoir's cap, fill reservoir with fresh deionized water;
- If the generator was in transporting state, remove sticky tape closing hole in the cap of reservoir, screw the cap;
- Using cable 6.644.056, connect additional grounding. With the help of power cord connect the generator to power;
- If the generator was in transporting state, remove cap (Figure 2.8, pos.1) from the fitting ft1.
- If the generator was in operating state, remove tube connecting the Filter F1 and the fitting ft1 (from the left) (Figure 2.7, pos.3);
- Drain water from the generator if it was in operating state;
- Remove ionite filter from the reservoir and put it in any other vessel filled with deionized water. Load into reservoir fresh deionized water heated up to (90-95) °C beforehand, then switch the generator on;
- Keep service running of the generator during 15 minutes, then switch it off and drain water;

In order to prevent electrostatic discharge and as effect hydrogen ignitions should be avoid ed contacts of hands or any subjects to output generator fitting at it operation to "atmosphere".

- fill into reservoir fresh deionized water heated up to (90-95) °C beforehand, keep the generator running during 15 minutes;
- Finally drain water, fill the reservoir with deionized water of ambient temperature (23±5) °C. Place ionite filter into reservoir. Switch the generator on, then pass service running for 30 min.

Make sure that ionite filter does not touch water level sensors in reservoir.

- Control of voltage on sections of electrolysis module. Remove not sealed side cover of the generator switch the generator on and after running during 60 minutes measure voltage on sections of electrolysis module using digital multimeter. The module is considered suitable for operation if drop of voltage on each section doesn't exceed a value specified in the Passport of the generator;
- Drain water from the generator down to "MIN" mark;
- Make a record in the Passport of the generator.

6 Transportation and storage

The generator should be transported in the shipping container during seasons when the ambient air temperature is not lower + 5 °C by any transport, except for not hermetically sealed compartments of the airplane and open decks of a water-carriage. At transportation should be provided the protection of the shipping container from atmospheric precipitations.

Transfer the generator from operating state into transporting state as follows:

- Drain water from reservoir completely. Attach fitting 6.454.104 with PVC tube from Shipping kit to fitting “Discharge water”, open the valve “Draining water”. Once water run out from the fitting, close the valve.
- Remove tube connecting Filter F1 and fitting ft1 (from the left) (Figure 2.7, pos.3), place it into mounting kit.
- Close fitting ft1 with cap (Figure 2.8, pos.1).
- Put the cap on the Filter (Figure 2.8, pos.2).
- Disconnect hydrogen tube to consuming device, put it into Shipping kit of the generator.
- Put the caps on output fittings of the generator (Figure 2.8, pos. 3).
- Close a hole in the cap of reservoir with sticky tape.

Transportation and storage of the hydrogen generator is forbidden at temperature lower than + 5 ^{O}C.

It’s forbidden laying the generator sideways or turning it over, since there is a water inside.

Transportation **(but not storage!)** of the generator at negative temperatures and its inclinations are admissible, if the generator had passed special preparation (see sections 3.1).

The method of placing boxes in a transport vehicle should prevent their movement. During loading and unloading operations, boxes should not be subjected to sudden impacts or exposure to precipitation.

The packed generator should be stored in dry heated location at temperature not lower 5 °C and relative humidity no more than 80 %. Presence in air of dust, acids vapors, alkalis and other aggressive admixtures is inadmissible.

Stocking – no more than three tiers.

After unpacking in cold season, the generator should be kept at normal condition during at least 2 hours.

Packaging should be kept until before guarantee period expiry.

7 Claims

In case of the generator failure within warranty period it is necessary to:

- draw up a technically reasoned act of defects concerning its incompliance with technical specifications, listed in the Passport;
- make abstracts from section "Acceptance Certificate";
- specify date and the organization that performed putting into operation; specify performed maintenance procedures.

It's allowable sending copies of sections "Acceptance Certificate" and "Maintenance registration" witnessed by head of customer's organization.

The claim should be sent to the address:

Special Design Office "Chromatec", 94 Stroiteley Str., Yoshkar-Ola, Russian Federation 424000; or at Correspondence address: Central post office, P.O. box 84, Yoshkar-Ola, Mari-El republic, Russian Federation 424000.

424000 г. Йошкар-Ола, ул. Строителей 94, СКБ "Хроматэк" или 424000, г.Йошкар-Ола, Главпочтамп, а/я 84.

Fax: +7.8362.685916, E-mail: mail@chromatec.ru

Service support department

Tel.+7.8362.685919, +78362.685932, fax. +7.8362.685987, E-mail: service@chromatec.ru

Sales department

Tel.+7.8362.685968, +78362.685969, fax. +78362.685970,

E-mail: sales@chromatec.ru

8 Appendix A

Procedure on separator's washing

This procedure covers all models of hydrogen generator.

Technological washing of the separator is carried out in the following cases:

- upon expiration of the warranty period;
- after 6 months of storing the generator in a preserved state;
- arising film-like deposit on the walls of reservoir.;
- when an alarm is triggered by separator level sensors.

The procedure is to be carried out by degreased hands or with medical gloves being put on.

Use deionized water only for separators washing.

Preliminary procedures to be performed before washing:

- Transfer the generator into transport state. On the fitting ft1 attach cap from the Shipping kit.
- Remove right-side cover (Figure 2.8, pos.1);
- Switch on the generator. When pressure rate exceeds 1 kg/cm^2 (100 kPa) drain water from the separator. For this press the button (see Figure A1 pos.3; Figure A3 pos.3). At pressing on/off valve opens and water flows out from the separator (see Figure A1 pos.1 and Figure A3 pos.1) into reservoir via tubes. Keep the button pressed down until water is not run out completely from the separator into reservoir;
- Switch off the generator, release the rest pressure in pneumatic system opening cap on the fitting ft1 (Figure 2.8, pos.1). Manometers pointer on the front panel must drop down to zero;
- Place any plate or other glassware beneath the separator for water collection. Unscrew nuts of level sensors (see Figure A1 pos.2; Figure A3 pos.10), remove terminals attach the nuts back to their seats;
- Disconnect tubes from the separator unscrewing nuts (see Figure A1 pos.4, 5; Figure A3 pos.4, 5);
- Unscrew nut (see Figure A1 pos.6; Figure A3 pos.6) which fixes the separator on brackets (see Figure A1 pos.7. Figure A3 pos.7) Take out the separator from the generator.

Perform washing procedure as follows:

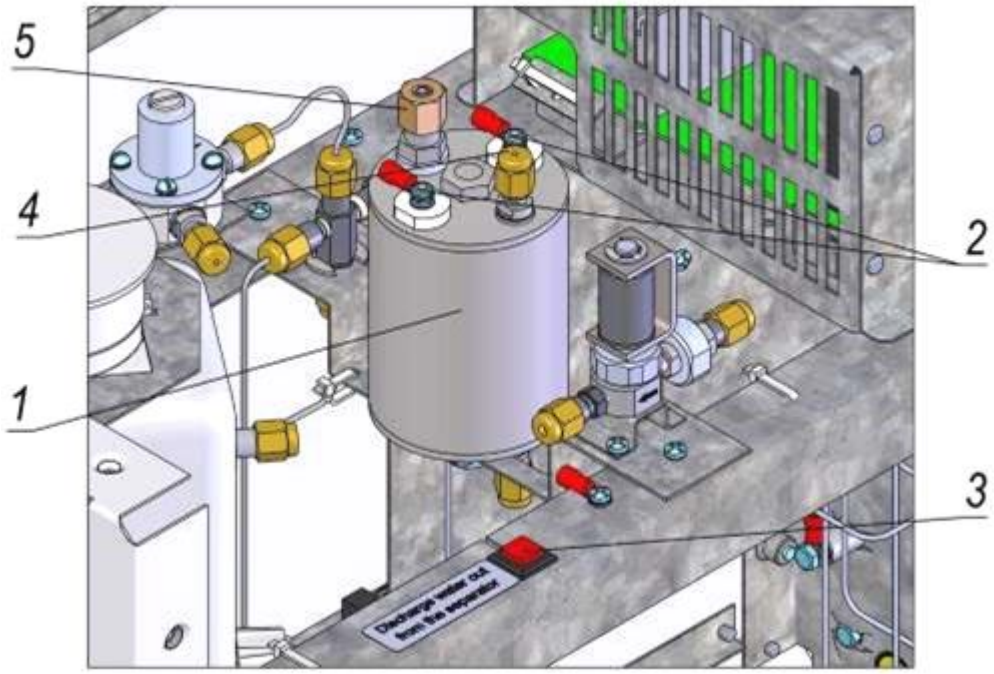
1. Unscrew water level sensors (see Figure A2 pos.3; Figure A4 pos.5), fittings on the separator (see Figure A2 pos.4, 6, 10; Figure A4 pos.3, 12, 15, 16);
2. disconnect flanges (see Figure A2 pos.7, 8; Figure A4 pos.6, 11) from the separators body, for this unscrew nuts (see Figure A2 pos. 5, 9; Figure A4 pos.4, 13) from the stud (see Figure A2 pos. 2; Figure A4 pos.10);
3. collect sealing rings and gaskets, place into separate cuvette for washing;
4. stainless steel parts are to be placed into another cuvette;

5. wash the parts in hot water (60 – 80 °C) using clean sponge. Washing time is 2 minutes. Drain water from cuvette;
6. add cold water into cuvette, rinse the parts for 1 minute;
7. eliminate water from cuvette and control its quality by conductometric method. Resistivity should be from 0.9 to 1.0 MOhmxcm. At unsatisfactory quality washing should be performed again;
8. wipe stainless steel parts surfaces with lint-free cloth;
9. place the parts into perforated tank in row and keep them until complete drying. The parts should not touch each to other;
10. assemble the separator in reverse order, install it in the generator;
11. check the generator for leaks according to section 3.3.

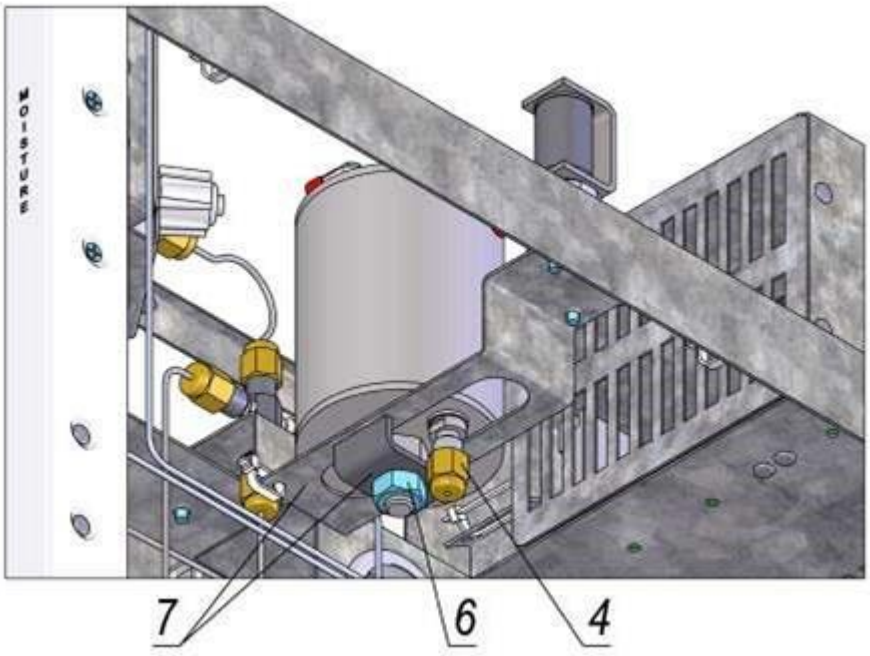
Make sure in correct connection of level sensors wires to the separator:

Wire marked “1” is to be connected to the "short" sensor;

Wire marked “2” is to be connected to the "long" sensor.



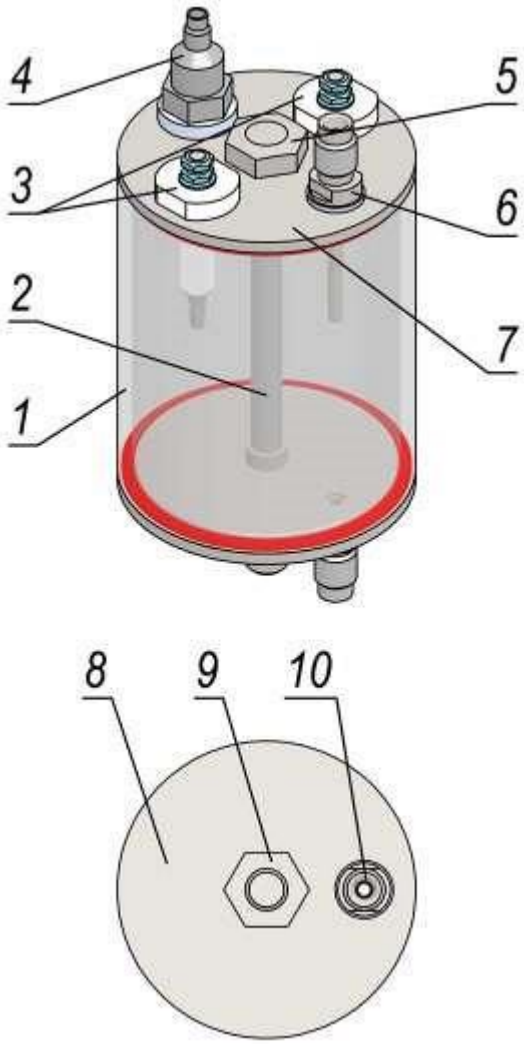
Top view



Bottom view

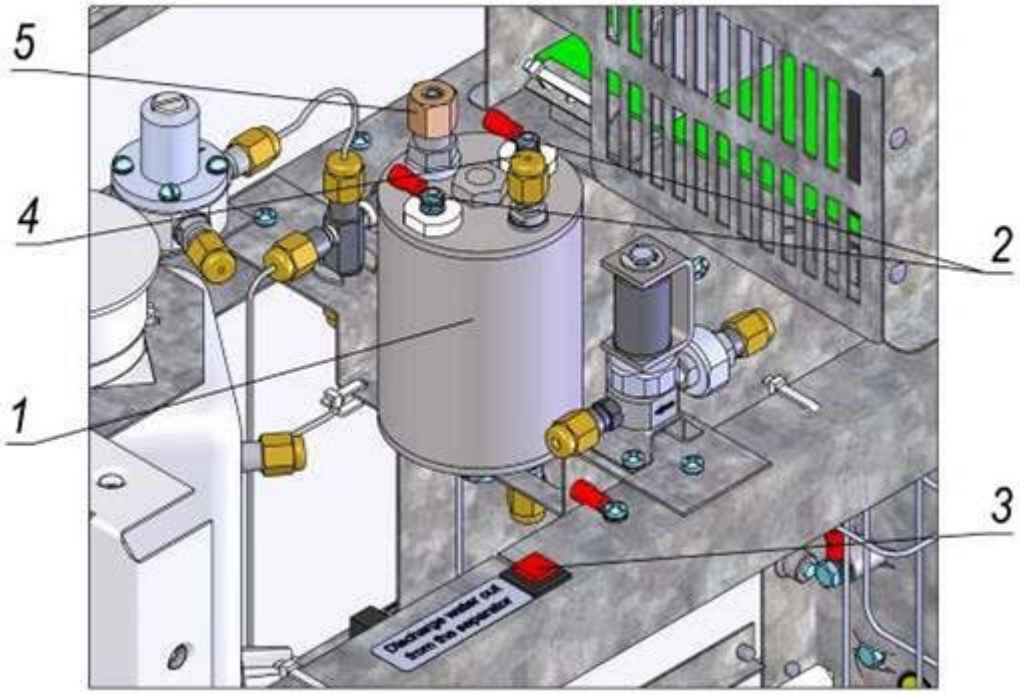
1 – separator; 2 – nuts fixing wires of level sensors; 3 – button for forced draining water from separator; 4, 5 – tubing connection nuts; 6 – nut fixing separator; 7 – brackets.

Figure A1 – Separator. Top and bottom views (for mod. 10.600; 10.600HPM)

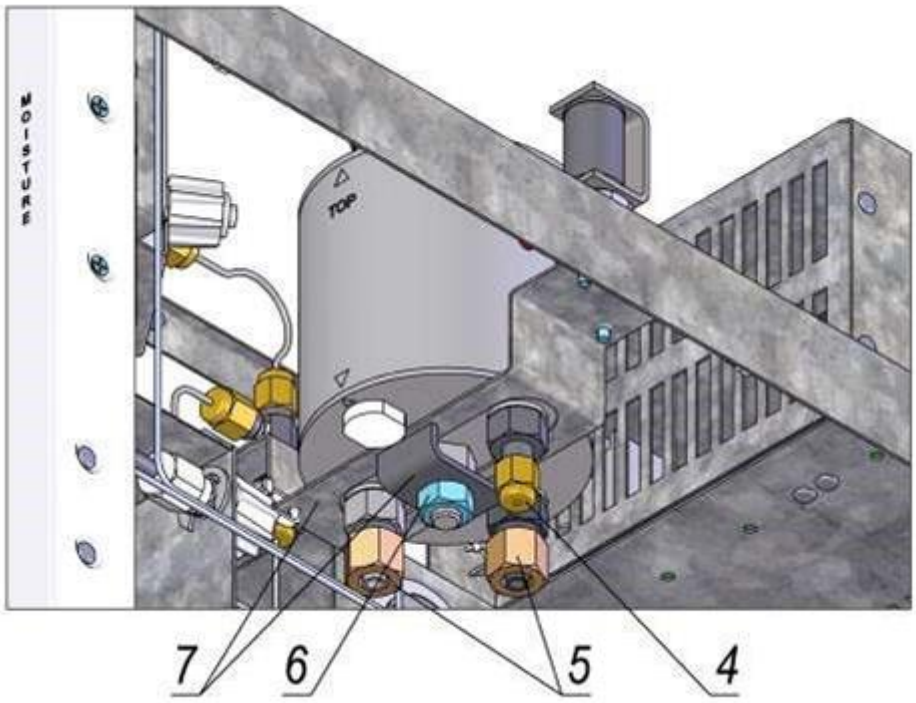


1 – separator body; 2 – stud; 3 – water level sensors in the separator ("short" sensor is from the left, "long" sensor is from the right); 4 – hydrogen input fitting; 5, 9 – nuts; 6 – hydrogen output fitting; 7, 8 – flanges; 10 – water draining fitting.

Figure A2 – Separator (for mod. 10.600; 10.600HPM)



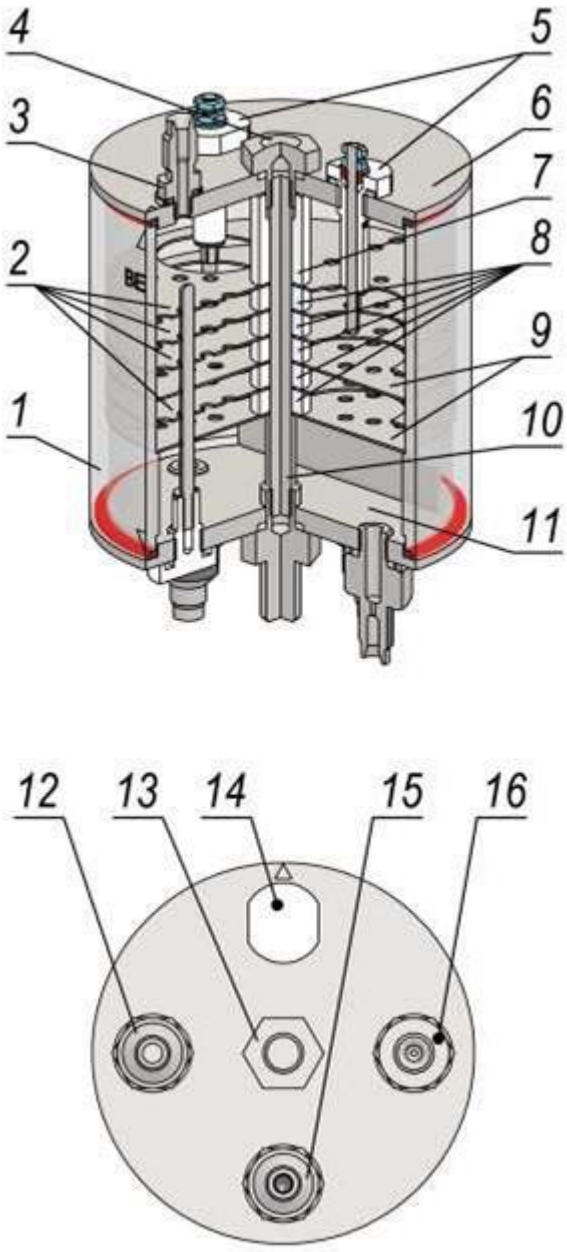
Top view



Bottom view

1 – separator; 2 – nuts fixing wires to water level sensors; 3 – button for forced draining water from separator; 4, 5 – tubing connection nuts; 6 – nut fixing separator; 6 – brackets; 7 – holders.

Figure A3 – Separator (for mod. 16.600; 25.600; 16.600HPM; 25.600HPM). Top and bottom views



1 – separator body; 2, 9 – splitters; 3 – hydrogen output fitting; 4, 5 – nuts; 5 – water level sensors in the separator ("long" sensor is from the left, "short" sensor is from the right); 6, 11 – flanges; 7, 8 – inserts; 10 – stud; 12 – fitting for draining water into electrolysis module; 14 – lock; 15 – hydrogen input fitting; 16 – fitting for draining water into reservoir.

Figure A4 – Separator (for mod. 16.600; 25.600; 16.600HPM; 25.600HPM)