ISO 9001:2008 certified company

Electrical Breakdown Voltage Express Tester

Model

TOR-80

Application.

The unit is designed to determine the electrical breakdown voltage of transformer oil and other liquid dielectrics in accordance with IEC 60156, ASTM D877, GOST 6581.

It is a fully automatic device that provides testing according to the procedures defined by these standards, as well as according to the user procedures specified in the corresponding section of the installation menu.

Description and working principle.

1.1. Technical characteristics.

1.1.1. The main technical characteristics of the device are shown in the Table 1.

Table 1 – Technical specification.

№	Parameter	Value	Notes
1	Operating voltage AC, V.	85 - 264	
2	Supply frequency, Hz.	48 – 63	
3	Power consumption, VA.	max 250	
3	Maximum output voltage, kV.	Sinusoidal, up to 80 kV	
4	Output voltage measurement precision	±2 %	
5	Voltage rate of rise, kV / s	from 0,1 to 5	variable
6	Resolution when displaying the output voltage, V.	100	
7	High voltage shutdown time after breakdown, µs	10 max, 4 typical.	
8	Volume of a measuring cell, cm^3	500	
9	Range of measurement of ambient temperature, C	0 - 100	
10	Resolution when measuring temperature, C	1	
11	Integrated printer	yes	
12	Working temperature, C	0 - 50	
13	Storage temperature, C	from – 20 to + 60	
14	Relative humidity, %	Up to 90 without condensation	
15	Overall dimensions, mm LxWxH	490X320X300	
16	Weight, max	25	

Comparison of the main characteristics of TOR with the corresponding characteristics of the best world samples.

Parameter	TOR-80	(other manufacturers)
Maximum output voltage U out.	80 kV.	80 kV.
Error U out.	± 1%	± 1%
Slew rate U out.	0,1 – 5 kV/s	0,1 – 5 ; 0,5 – 10 kV/s
Display Resolution U out.	0,1 kV	0,1 kV
Disconnection time U out. After breakdown	4 µs	5 µs
Temperature measuring range	0 – 100 ^{o}C	0 – 100 ^{o}C
Temperature resolution	1 ^{o}C	1 ^{o}C

Set of supply.

Set of supply is shown in the table 2.

Table 2 – Set of supply.

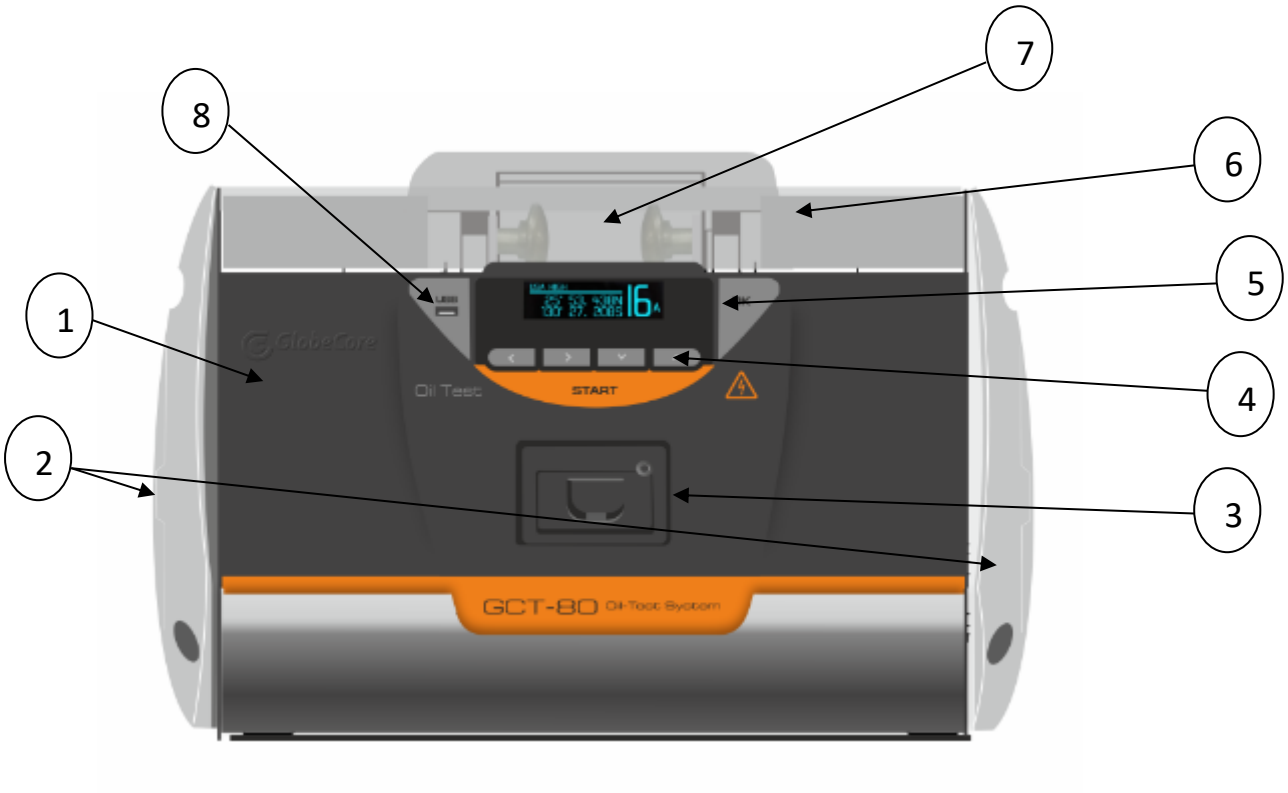
item	Name	quantity	notes
	Device TOR-80	1	
	measure cell	1	
	gap clearance setting device 2,5 mm	1	In the set with measure cell
	Magnetic Oil Stirrer	1	In the set with measure cell
	Magnetic stick to remove the stirrer	1	In the set with measure cell
	Electrode polishing cloth.	1	In the set with measure cell
	Mushroom chaped electrodes	2	In the set with measure cell
	Flat electrodes	2	As per special order
	Spherical electrodes	2	As per special order
	gap clearance setting device 2,0 mm	1	As per special order
	USB Flash drive	1	
	Power cable	1	
	I/F cable RS-485	1	
	Interface converter RS-485 – USB	1	

	Protective ground wire.	1	
	paper roll	1	
	Operation manual	1	
	Fuses	2	
	stowage box	1	

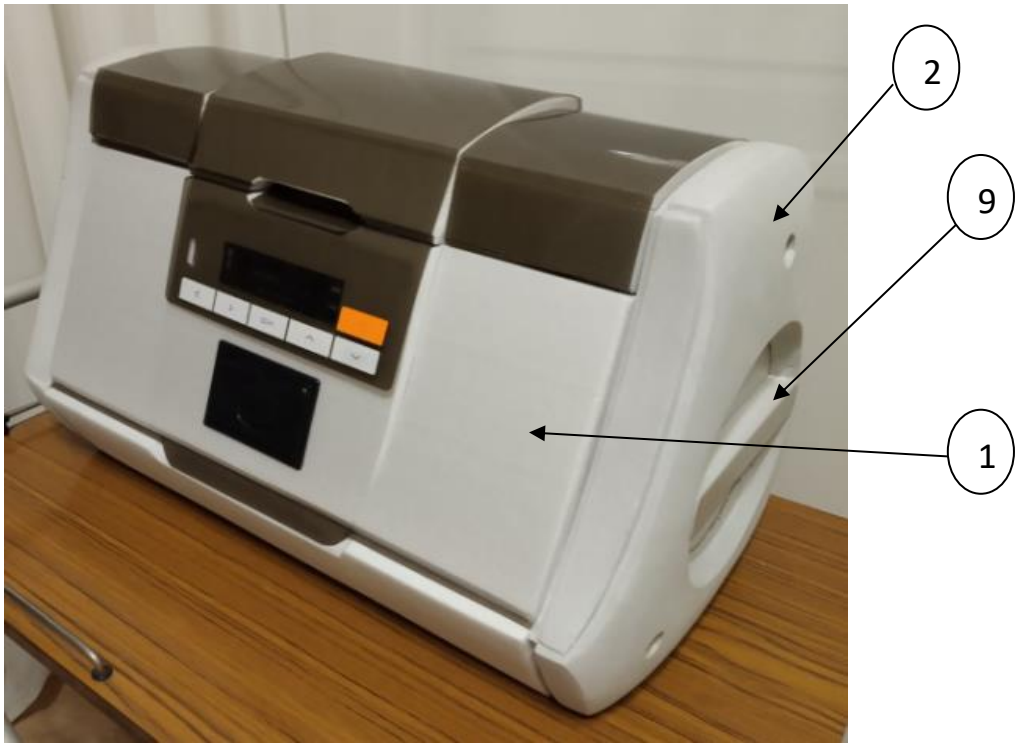
Main components description.

The general view of the device is shown on the figures 1 and 2.

Figure 1. Front view.



Figuure 2. General view.



Components:

1. Front panel,
2. Side panels,
3. Printer,
4. keyboard,
5. Display,
6. Top cover,
7. Measure cell, installed under top cover,
8. USB port,
9. Handles for carrying the installation.

The following controls and devices are located on the front panel (1) of the installation:

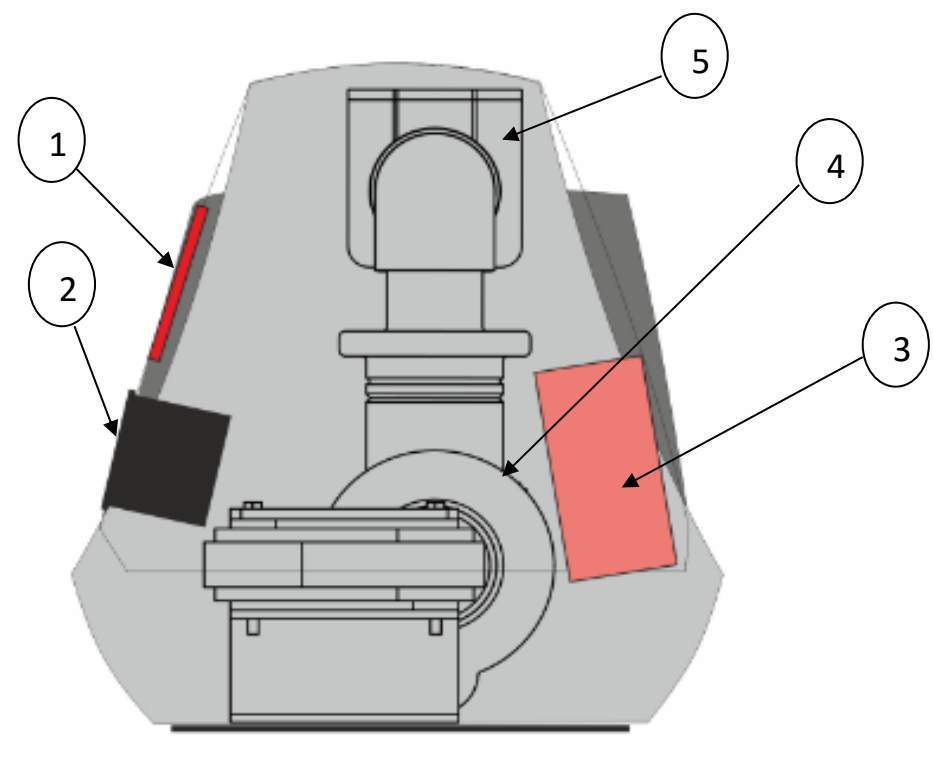
Thermal printer (3) for printing reports on oil test results. Keyboard (4) for controlling the operation of the device, input of initial data on tests and service information. Display (5) for indicating operating modes, test progress, test results, operating and service information entered from the keyboard, designed to control the device when used as intended, set operating modes and other necessary parameters.

The top cover of the unit (6) is designed to protect the samples and the working area of the device from pollution, to shield the environment from electromagnetic interference arising from the operation of the high-voltage transformer and breakdowns, as well as to prevent the possibility of danger to personnel when working with high-voltage equipment. For this, the lid is equipped with a position control device (open / closed), which provides blocking of the voltage rise when the lid is open.

The measuring cell (7) is mounted on the high voltage contacts of the step-up transformer. It is described in more detail below.
The USB Flash drive port (8) is used to connect a flash drive to record information from the test data archive for further downloading to a computer.
Handles for carrying the unit (9) are integrated in the side panels (2) of the unit.

The internal structure of the installation is shown in Figure 3.

Figure 3. The internal structure of the installation.



1. Display and keyboard module,

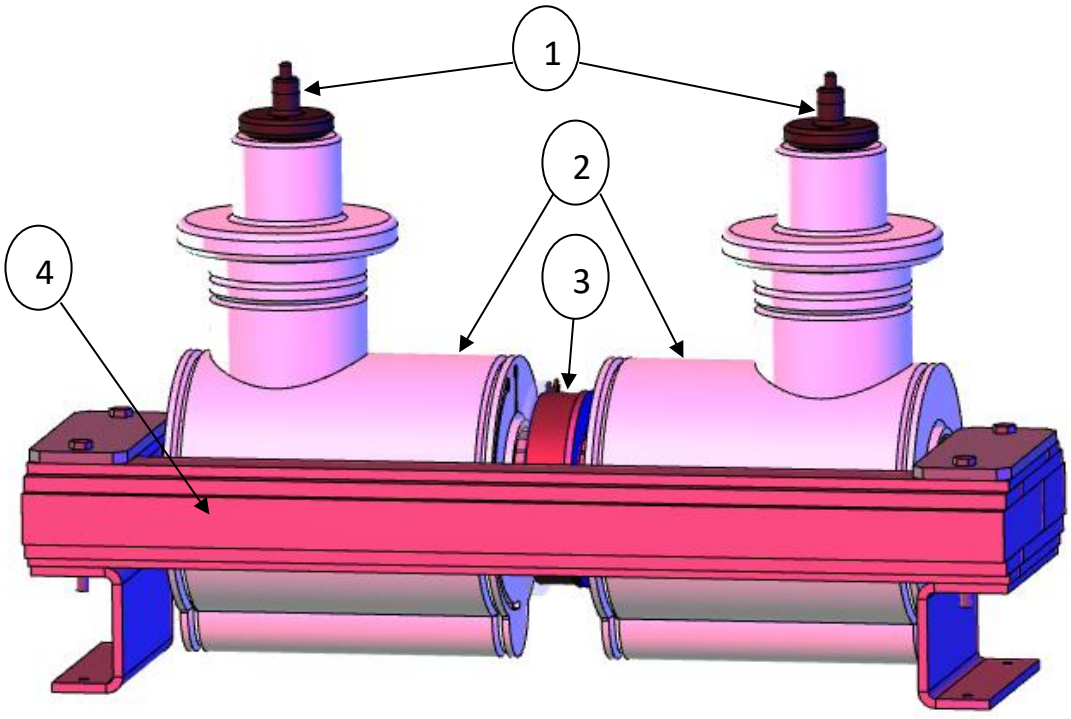
2. Printer,
3. Electronics Modules,
4. High voltage transformer,
5. Measuring cell.

The working core of the device is a high-voltage transformer (4) and electronics modules (3). The principle of operation of the device is to gradually increase the voltage on the secondary winding of the high voltage transformer from zero to maximum, or to a value at which occurs the breakdown of the liquid dielectric filled into the measuring cell (5) installed on the high voltage contacts of the transformer.

The voltage rise on the secondary winding of the transformer occurs due to a gradual increase in voltage on the primary winding when a sinusoidal voltage is supplied to it from a controlled master inverter, which is an integral part of the electronics modules.

General view of the high voltage transformer is shown in Figure 4.

Figure 4. General view of the high voltage transformer

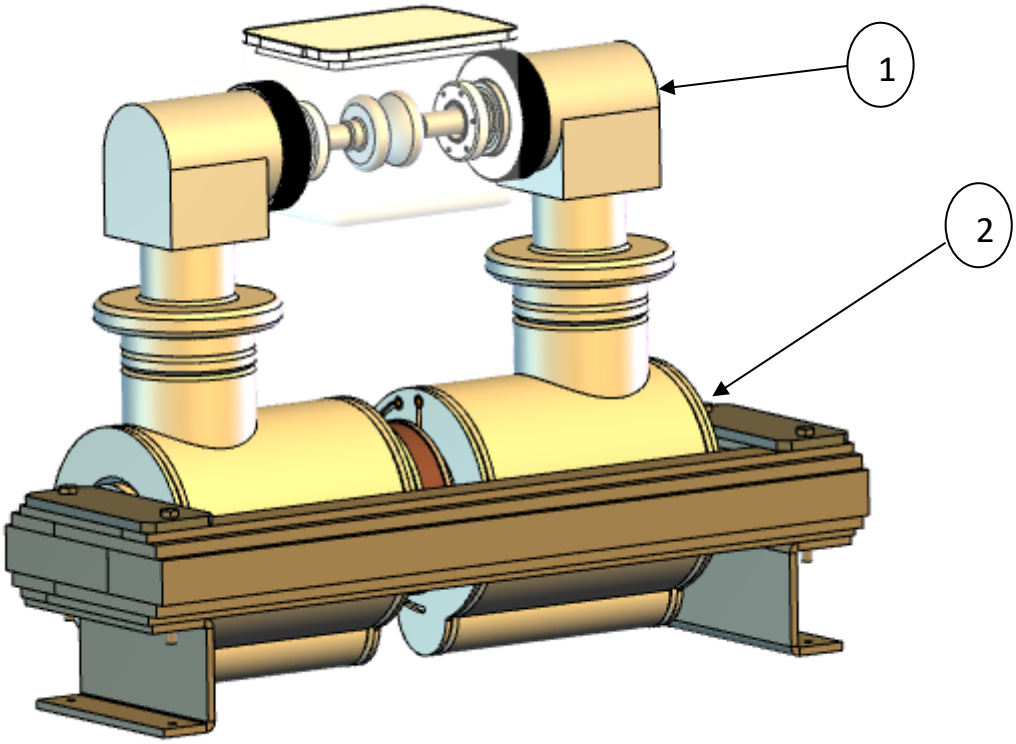


1. Contacts of high voltage electrodes,
2. Coils of the secondary windings,
3. Primary winding,
4. Magnetic circuit.

The rise in voltage is controlled by a microcontroller that controls the operation of the master inverter. The microcontroller is also an integral part of electronic modules.

During operation, a measuring cell is installed on the high-voltage contacts of the transformer, as shown in Figure 5.

Figure 5. Location of the measuring cell on the high voltage transformer.



1. Measuring cell,
2. High voltage transformer.

During the operation of the device, an alternating (50-60 Hz) high voltage from the contacts of the secondary winding through the electrodes of the cell enters the liquid dielectric filled into the cell cup. Breakdown occurs between the electrodes of the cell through a space filled with a liquid dielectric.

The general view and internal structure of the measuring cell are shown in figures 6 and 7.

Figure 6. General view of the measuring cell (with cover removed).

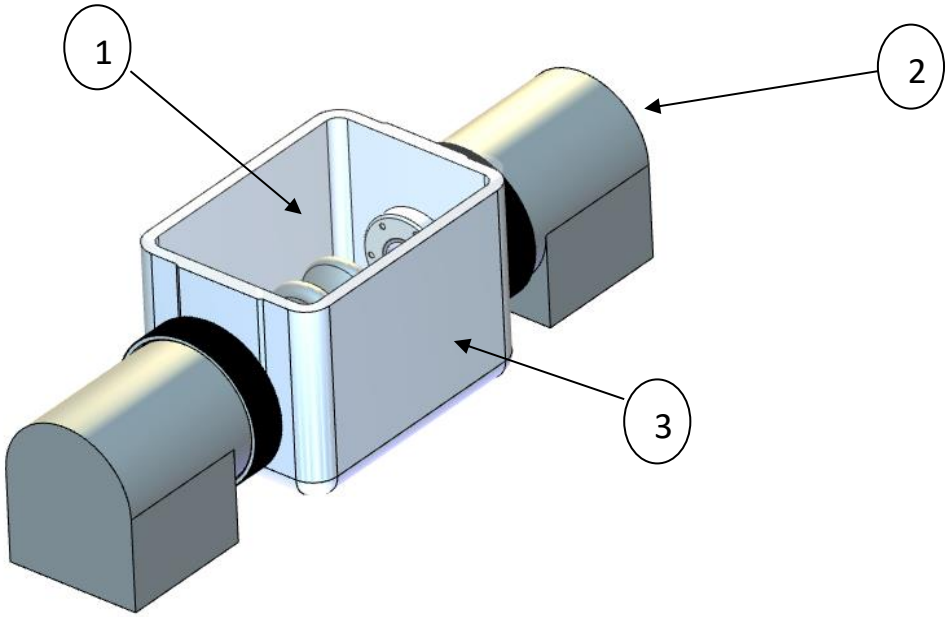
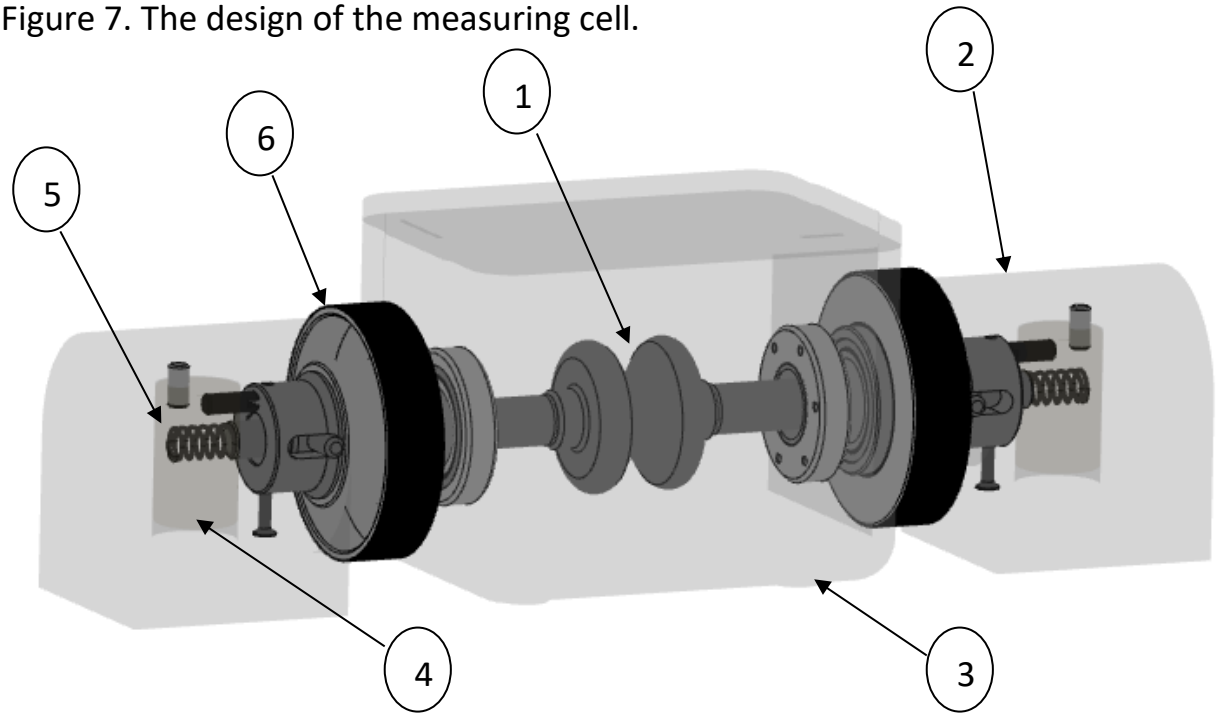


Figure 7. The design of the measuring cell.



1. High voltage cell electrodes,

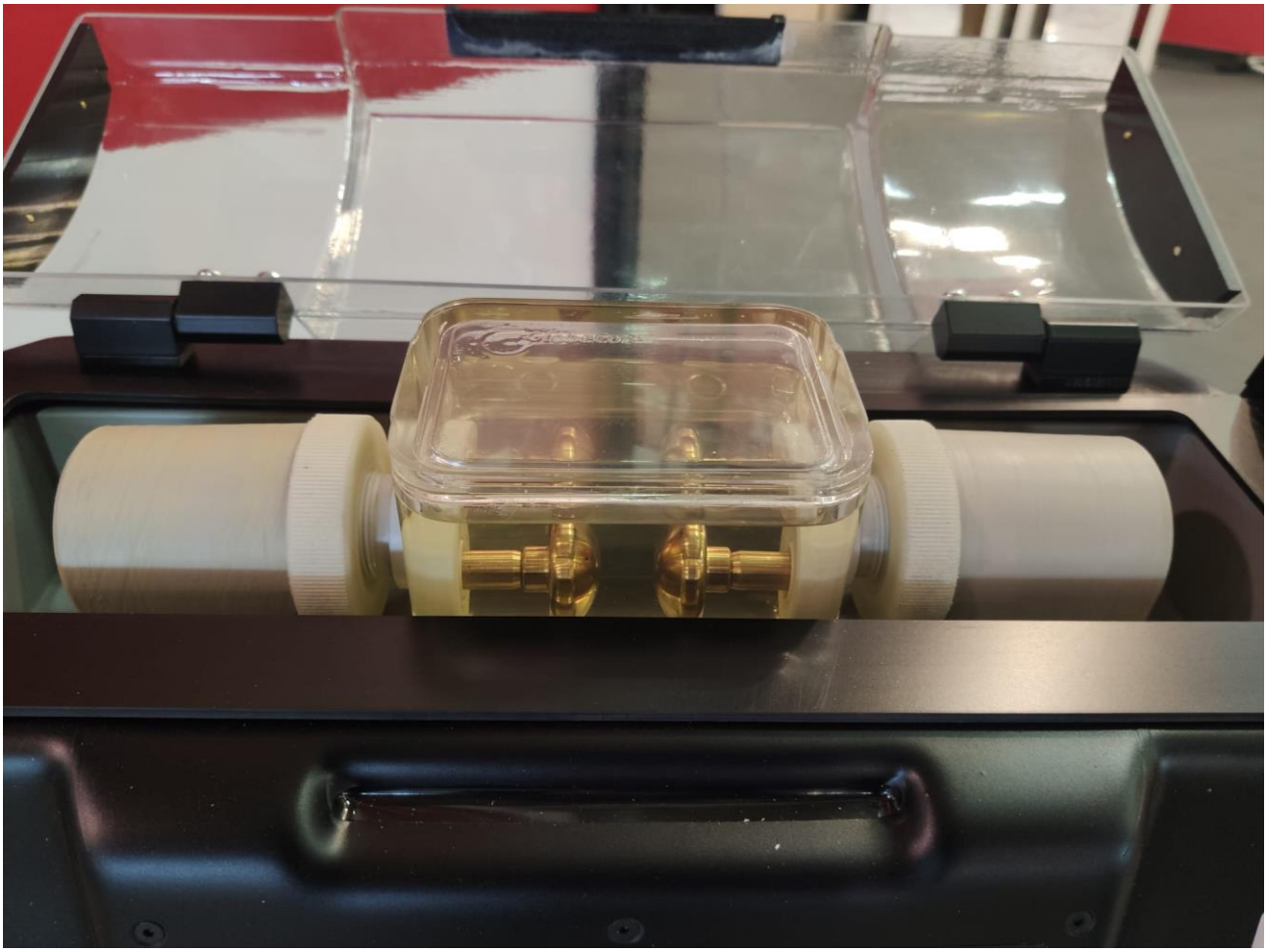
2. The body of the electrode with current-carrying parts,

3. The cup of the cell,

4. High voltage supply contacts,

5. Conductive parts of supports,

6. Adjusting nuts.




TOR-80
Oil Test System