OVEN COOLING SYSTEM

USER MANUAL

214.2.964.010UM

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1 Important notes

Before using the equipment accurately read the present User Manual.

Instructions marked by this box are necessary for carrying out in order to avoid injuries sustaining at working with IUTD and to avoid IUTD damage.



This symbol makes warning about danger of burn.

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.

This User Manual (UM) is intended to get familiar with the Oven Cooling System (hereinafter – the OCS) when working with gas chromatographs "Chromatec-Crystal 5000" model 1, " Chromatec-Crystal 5000" model 2, and " Chromatec-Crystal 9000", to provide its proper operation.

At running the OCS, accurately read this User Manual and User manual for accompanied chromatograph.

2 Description and operation

2.1 Purpose

The Oven Cooling System (the OCS) ensures the operation of the oven of the chromatograph columns within the temperature range below ambient temperature.

For cooling, the OCS uses the closed refrigeration circuit with the circulating non-consumable refrigerant.

Cooling of the column oven is performed during its purging with cooled air.

Products of SDO “Chromatec” may contain non-essentially upgraded parts in accordance with the new developments or may be subject to irrelevant non-essential improvements that do not affect the technical specifications and safety requirements not included in this document.

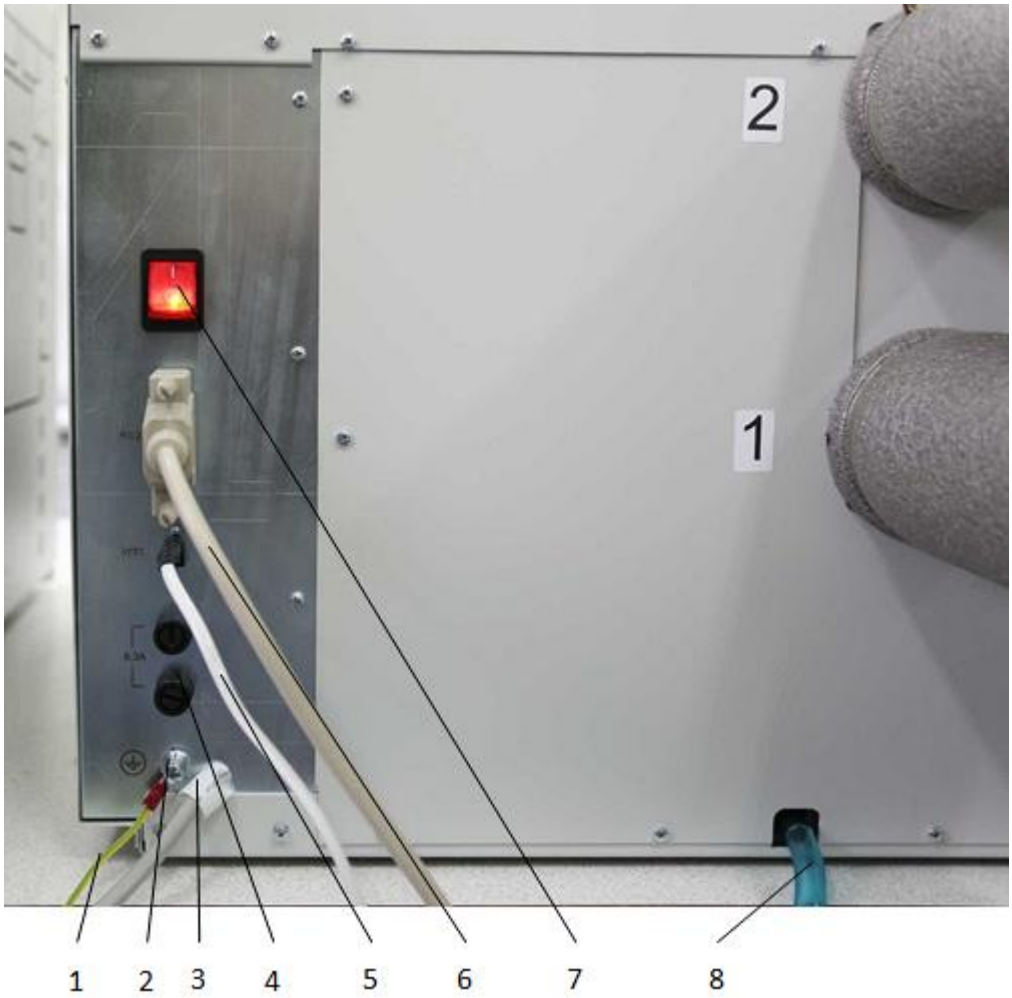
2.2 Arrangement and operation

The front view of the OCS connected to the chromatograph is shown in Figure 1. The back views of the cooling device and system are shown in Figures 2 and 3 respectively.



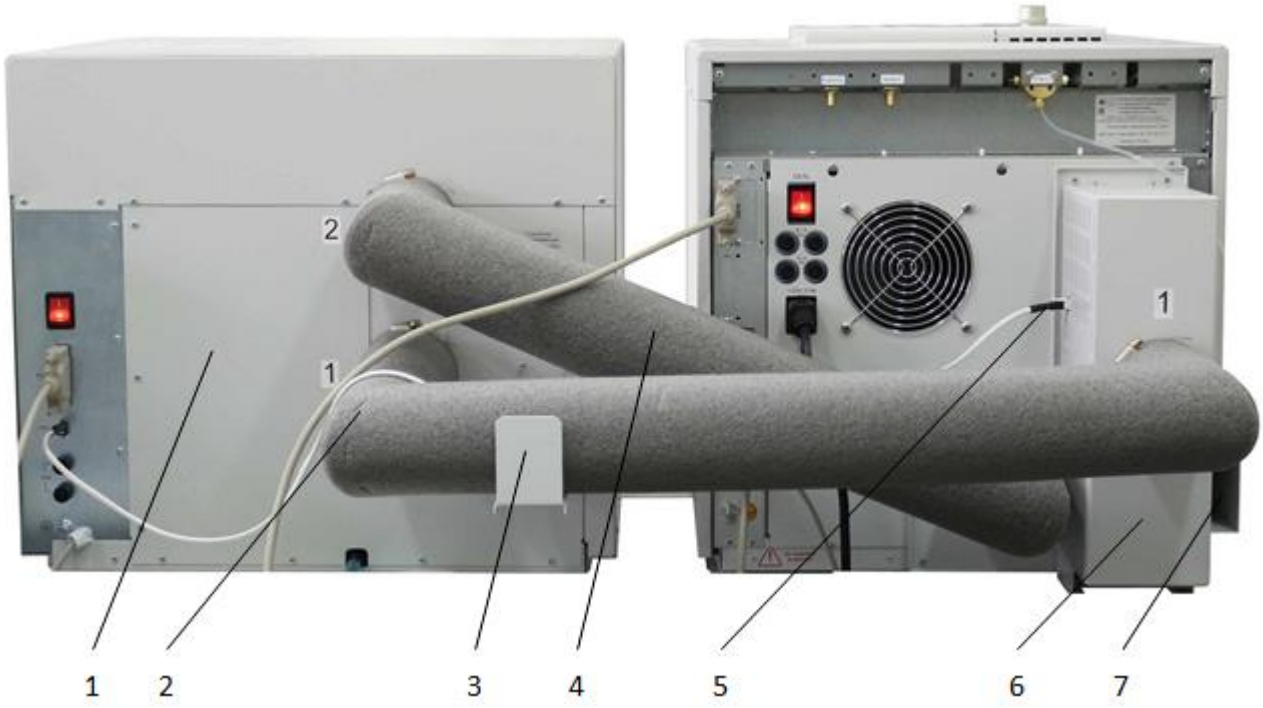
1 – chromatograph; 2 – retaining mechanism 214.6.275.025; 3 – cooling unit 214.5.883.089.

Figure 1 – Over cooling system. Front view



1 – grounding cable 214.6.644. 056 (see shipping kit); 2 – earth connector; 3 – network cable; 4 – protection devices; 5 – cable 214.6.644.115; 6 – interface cable RS232; 7 – mains switch; 8 – PVC pipe (condensate drain).

Figure 2 – Cooling unit. Back view



1 – cooling unit 214.5.883.089; 2 – pipeline 214.6.457.172-01 (disposal); 3 – holder 214.8.091.292; 4 – pipeline 214.6.457.172 (supply); 5 – cable 214.6.644.115 (flow switch input); 6 – Air flow switcher assy 214.5.874.007 (flow switch); 7 – hot air output.

Figure 3 – Oven cooling system. Back view

The chromatograph column oven is purged with cooled air (through thermally insulated pipelines and an air flow switcher assy, see Figure 3) by the cooling unit. The air conditioner "GENERAL CLIMATE" of model GCW-05CM or similar is used as the air cooler.

1.4.2 The operating modes of the OCS are shown in Figure 4. The OCS is operated in two modes – "Ventilation" and "Cooling".

"Ventilation" mode

In the "Ventilation" mode, the air from the chromatograph column oven is discharged into the environment through the air flow switcher.

The compressor of the cooling device is switched off.

The environmental air is pumped into the chromatograph column oven by the fan of the cooling device through the air flow switcher and the radiator.

In the "Ventilation" mode, when the compressor is switched off, the external air passes through the radiator of the cooling – it is thawed. Then this air cools the chromatograph column oven.

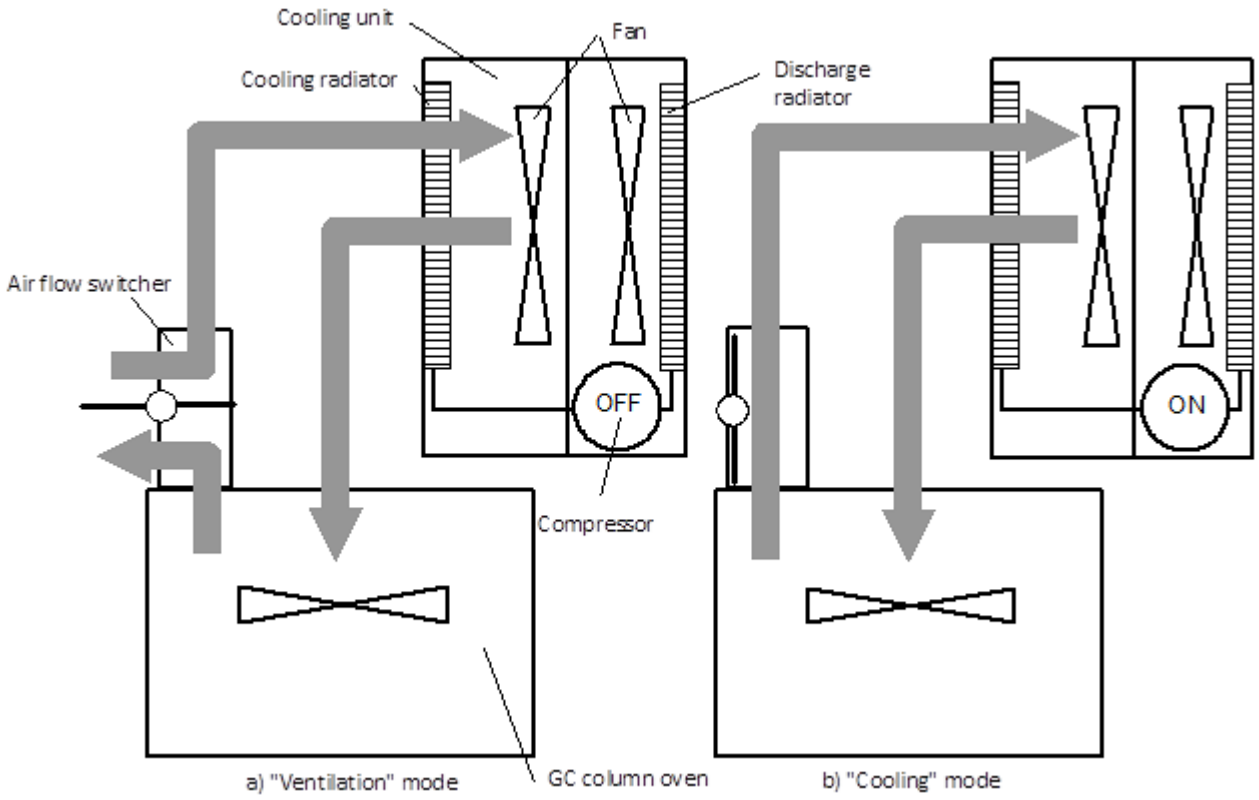


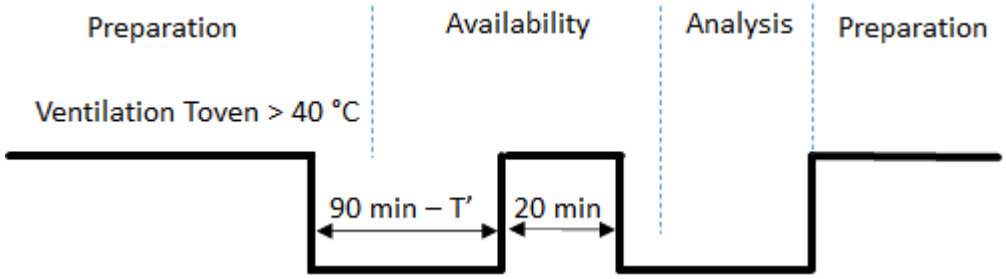
Figure 4 – Operating modes of the cooling oven system

"Cooling" mode

In the "Cooling" mode, when the compressor is switched on, air is circulating inside the cooling system and the chromatograph column oven and is cooled while passing through the radiator of the cooling device.

Cooling is performed up to the set temperature in the chromatograph column oven.

The operation stages of the chromatograph and the cooling system are shown in Figure 5.



T_{oven} – temperature of the column oven. T' – period of time, when temperature **during the analysis** does not exceed 40°C

Figure 5 – Operation stages of the cooling system

When operating with the cooling system, the chromatograph shall be in the "operating" mode.

The cooling system starts operation when it is switched on and the chromatogram analysis mode is set. When the cooling system is turned on for the first time (power supply), the "Cooling" mode is possible not earlier than 5 minutes after it has been switched on.

When setting the column oven temperature of above 40°C, the OCS does not participate in the thermal regulation process (standby mode); the thermal regulation is carried out by means of chromatograph.

When the column oven temperature is set to 40°C or lower (or when the temperature is programmed with the transition through this temperature point), the OCS starts operation according to a certain algorithm in the "Ventilation", "Cooling" modes, or can be switched off. If during the OCS operation in the "Cooling" mode the column oven temperature rises to 40°C, then the OCS is switched to the "Ventilation" mode.

The operating time of the OCS in the "Cooling" mode is limited – it is 90 minutes and includes the set analysis time (in the case of operation in the temperature programming mode, the analysis time during which the temperature in the column oven shall be below 40°C is considered) and the current cooling time. At the same time, the time required for the "Analysis" stage is reserved, that is, 90 minutes are available for other operation stages (if the "Analysis" stage does not occur) less the analysis time (estimated time).

When the operating time in the "Cooling" mode exceeds the estimated time, the OCS is switched to the "Ventilation" mode for 20 minutes, then the "Cooling" mode with the time counting follows. This can occur at any stage of the chromatograph operation (except for the "Analysis" stage).

Operating procedure of the OCS (in accordance with the chromatograph operation stages) is as follows.

Preparation stage

The cooling system is operated at first in the "Ventilation" mode that continues until the column oven is cooled to below 40°C, after which it is switched to the "Cooling" mode. From this moment, the estimated cooling time shall begin. If this time is more than 90 minutes, then the "Ventilation" mode is switched on for 20 minutes.

Availability stage

The cooling system is in the "Cooling" mode. The estimated time countdown is continued. If it is more than 90 minutes, the "Ventilation" mode is switched on for 20 minutes (see Figure 5).

Analysis stage

When the START key is pressed, the chromatograph is switched to the "Analysis" stage. The cooling system is in the "Cooling" mode. When the chromatograph column oven temperature exceeds 40°C (when the column oven temperature is programmed), the "Ventilation" mode is activated. After 20 minutes, the "Ventilation" mode is automatically turned off.

The maximum possible time for keeping the cooling system at 0°C is at least 1 hour at an ambient temperature of 35°C and a relative humidity of 80%.

Upon completion of the "Analysis" stage, the chromatograph is switched to the "Preparation" stage, the "Ventilation" mode is activated.

Notices on the chromatograph's display.

When the ACCESS key of the chromatogram control panel is pressed, the information on the completion time of the OCS operation mode is printed on the display (in accordance with Figure 5).

```
      Out of range
Time of cooling T 20:00←
Тк 0/40.0
```

Time prior to the completion of the OCS operation mode

Information relating to other parameters being out of the chromatograph's range is also displayed.

3 Intended use

3.1 Safety precautions



Hot air discharged from the cooling system in the "ventilation" mode is the hazard and can lead to burns.

There shall be the warning sign in the place of hot air blowout.

3.1.1 The cooling unit shall be grounded. Grounding is carried out using the mains plug and auxiliary grounding. The "⊥" terminal of the mains socket and the auxiliary ground terminal must be connected to the external ground loop using the copper wires with a section of at least 1.5 mm^2. For additional grounding, it is recommended to use the cable 214.6.644.056 and fasteners from the set of spare parts.

3.1.2 It is **PROHIBITED** to the consumer to perform any readjustment works independently.

3.1.3. In order to switch the cooling unit on and off, use only the "Mains" switch located on the back wall of the cooling unit. In the case of shutdown period, switch the “Mains" key into the "O" position (OFF).

3.1.4 Do not cover the upper and side ventilation openings of the cooling unit.

3.1.5 Safety precautions during the chromatograph operation are given in the operation manual for the chromatograph .

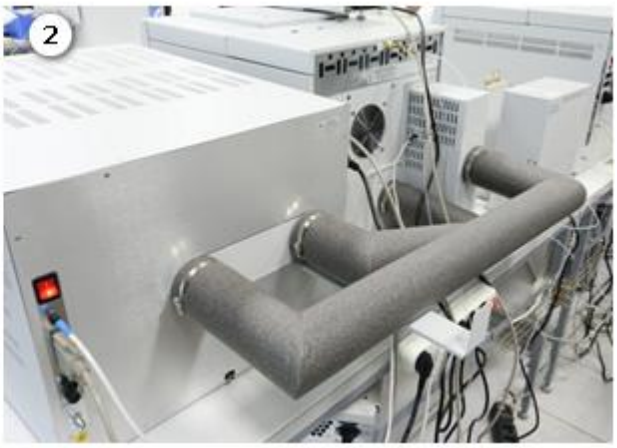
3.2 Setting-up procedures and operation procedure

The compulsory condition for connecting the OCS is the modification of the chromatograph.

3.2.1 Modification of the chromatograph for the operation of the oven cooling system is carried out only by the representative of the supplier (manufacturer).

3.2.2 The horizontal surface with an area of 1.0 m^2 (0.8 x 1.3 m) is required to arrange the OCS and the chromatograph.





1. The Oven Cooling system is mounted right to the GC and occupies 600mm more width space of working benchtop.
2. The Air flow switcher and tube channels for air circulation will occupy 400 mm rear space of the GC and the OCS.

If other devices should be mounted on the left side of the GC (e.g. AS-2M(3D), MSD detector), additional space is needed to the left of the GC.

3.2.3. During installation, it is necessary to provide a free space of at least 0.3 meters in front of the hot air discharge nozzle of the air flow switcher and discharge radiator of the cooling unit (Figure 3).

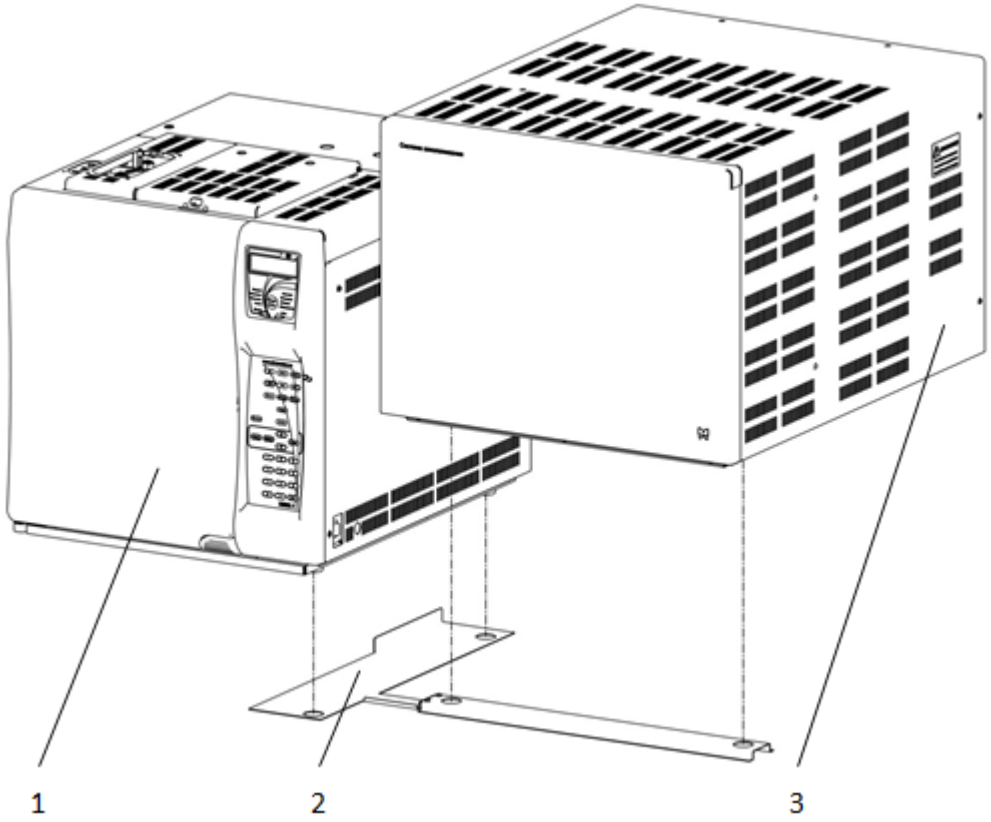
3.2.4. The OCS requires a power supply that is a single-phase alternating current network with a voltage of 220 V, a frequency of 50 Hz, and a power of at least 1.5 kW.

3.2.5 Preparation of the OCS for operation is usually performed by the representative of the supplier (manufacturer) or the dealer (regional representative), and also can be performed by a specialist of the consumer who has passed special training at SDO “Chromatec”.

Preparation is carried out using the products from the delivery set (see Appendix A).

The main stages of preparation of the OCS for operation are as follows:

- To install the air flow switcher on the chromatograph using 6 M3x16 screws;
- To prepare the chromatograph for operation in accordance with the instructions of the operational documentation;



1 – Chromatograph; 2 – Retainer 214.6.275.025; 3 – Cooling unit 214.5.883.089.

Figure 6 – Disposition of the GC and the OCS on the benchtop

- To install the chromatograph and the cooling unit on the retaining device (Figure 1), to install and secure the pipelines with the clamps. The PVC pipe for the condensate drain (Figure 2) shall be installed on the pan tube of the cooling unit; the other end of the PVC tube is connected to the drain tank;
- To connect the cable 214.6.644.115 to the air flow switcher, to connect the other end of the cable to the FSD terminal of the cooling unit;
- To connect the RS232 interface cable to the "AP" terminal of the chromatograph, to connect the other end of the cable to the "RS232" terminal of the cooling unit;
- To connect ground and power cables.

3.2.6 If other periphery devices are connected to the “AP” terminal (gas or liquid metering devices, etc.), the chromatograph cable with the RS232 output shall be replaced with the cable 214.6.644.204-01 from the additional delivery set. In this case, the interface cable is connected to the terminal RS232 of the chromatograph (cable output 214.6.644.204-01).

3.2.7 Switch on the cooling unit; for some time (from 1 to 10 s) the sound of the drive in the air flow switcher shall be heard. Proceeding to further actions is possible only if this condition is met.

3.2.8 Switch on the chromatograph. The temperature of the chromatograph column oven is set in the range from 0 to 450°C following the procedure specified in the operation manual for chromatograph.

Further actions are performed in accordance with the instructions for chromatographic analysis.

4 Maintenance

4.1 Types of maintenance

Two types of maintenance are provided for the OCS:

- Routine maintenance;
- Preventive maintenance.

4.1.1 Routine maintenance

Parameters of the routine maintenance are given in table 1.

Table 1 – Routine maintenance parameters

Operations	**Frequency**
Overall assessment: reliability testing of the pipeline fittings	Every week

Activities:

Check the condition of the pipeline mounting clamps and, if necessary, tighten them.

4.1.2 Preventive maintenance

Parameters of the preventive maintenance are given in 3.

Table 3 – Preventive maintenance parameters

Procedures	**Frequency**
Cleaning of the cooling unit	Annually
Condition inspection of the cooling unit	Annually

All preventive maintenance operations shall be carried out with the cables disconnected from the mains power supply.

4.1.3 Cleaning of the cooling unit

Procedures:

- Remove the cover of the cooling unit;
- Rinse the cooling unit and pan with a sponge soaked in warm soapy water. Wipe and dry thoroughly;
- Clean the discharge radiator of the cooling unit with a soft brush.

Do not use the abrasive cleaners.

4.1.4 Condition inspection of the cooling units.

Procedures:

- Remove the cover of the cooling unit;
- Check the mounting screws between the parts of the cooling unit and, if necessary, tighten them.

4.2 Troubleshooting guide

Possible faults and troubleshooting methods are given in table 4.

Table 4 – Possible faults and troubleshooting methods

Fault	**Possible reason**	**Troubleshooting method**
The cooling unit cannot be switched on	Main voltage is not applied	To replace the fuses of the cooling unit
Increase of the acoustic noise level of the cooling unit	The fasteners of the unit are loosened	To tighten the loose fasteners

5 Transportation and storage

4.1 The OCS in manufacturers package can be shipped over any distance by any transport except for non-pressurized aircraft compartments and open decks of sea transport. Ensure adequate protection of shipping container from atmospheric precipitations.

4.2 The way of boxes stacking in transporting means should exclude their moving. During loading and offloading operations boxes should not be exposed to hits and atmospheric precipitations impact. Impact loads at violation of rail transportation, are unallowable.

4.3 Transportation conditions:

- ambient temperature from minus 50 to plus 50 °C;
- relative air humidity up to 98 % at 35°C;
- Presence in air of dust and aggressive admixtures vapors is not allowed.

4.4 The UCS should be stored in the packed state indoors under following conditions:

- ambient temperature from minus 50 to plus 40 °C;
- relative air humidity up to 98 % at 25°C;
- Presence in air of dust and aggressive admixtures vapors is not allowed.

4.5 The OCS in package must be kept at least 4 hours at operational conditions, if it had been exposed to negative temperatures at transportation or storage.

6 Claims

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

- draw up a technically reasoned act of defects concerning its incompliance with technical requirements, specified in Passport;
- make abstracts from section "Acceptance certificate";
- specify the organization that carried out commissioning;
- 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.

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