

Explanatory note

Initial data for design

Initial data for design of supply-exhaust ventilation and air conditioning system of the Reference-laboratory located at the address: Turkmenistan, Dashoguz, Niyazov's District, TB Hospital, include:

- technical documentation on electrotechnical section of the design;
- task for development of automation systems in HV part.

System of automation and control of supply-exhaust plant is a complex device. Prior to its operation it is necessary to get acquainted with the technical documentation. Inappropriate operation of the system may result in emergency situation and breakdown of the elements of the system.

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1. General part

Design solutions accepted in the project are subject to technology requirements (control, adjustment, operation, alarms, etc.) and should comply with labor safety requirements.

In order to implement design solutions there have been chosen commercially available pieces of equipment and automation aids pursuant to acting stock-lists and subject to environmental conditions of the rooms. For installation of automation aids commercial or customized cabinets can be used, automation aids are installed on-site.

Three-phase alternating current $U \sim 380V$, 50Hz and single-phase alternating current $U \sim 220V$, 50Hz are used for power supply of the equipment, devices and automation aids. Selection and protection of power cables is pursuant to Electrical Installation Code (EIC). Operation and protection of control cables and installation wires are pursuant to Construction Rules and Regulations (SNIIP) 3.05.07-85.

2. Main design solutions, accepted in the project

Based on the accepted technological solutions the following elements are subject to automation in AHV part:

- supply equipment of general dilution ventilation S1-S4;
- exhaust equipment of the general dilution ventilation E1-E7;
- air conditioners C1, C2, C3.

During operation of the ventilation the following systems: S1, E1 and E4 should work simultaneously, as they serve the high risk zone of the Reference – laboratory (BSL 3).

The following Normative Documents were used for the project development:

- State Standard 1.101-97 “System of design documentation for construction. Main requirements to design and working documentation”;
- State Standard 21.408-93 “System of design documentation for construction. Rules of industrial processes automation working documentation execution”;

- State Standard 21.404-85 “System of design documentation for construction. Automation of technological processes. Conventional symbols for devices and automation aids on schemes”;
- EIC “Rules for the design and operation of electrical installation”.

The project provides for:

1. S1, S2, S3 and S4.

There will be one-piece control box ACSC #1, Systemair company devices and automation aids for controlling operation of supply equipment. As per the design this is a customized box, but it can be a commercial one as well.

This box and frequency transducers are located in switchboard room #25. All the elements of the power and control parts consist of module devices and are installed on DIN-rail. All external connections are done through screw couplings.

Systems S1 and S2 include the following equipment: filters, electric air heaters, channel air conditioners and fans.

For heating of supplied air during cold period (systems S1 and S2) there are two steps:

- 1st step: electric heaters for heating the air from -17°C to -5°C with total heat power of 21.3 kW;
- 2nd step: electric heaters of channel air conditioners for heating the air from -5°C to +20°C with total heat power of 42.0 kW.

For remote start/stopping of supplied systems S1 and S2 there is a button-control station with respective switches and standard wire controls, located in rooms #3 and #24.

Electric air heaters of systems S1 and S2 have speed controls so fans speed control is highly restricted in order to avoid overheating of the electric heating elements. When using the electric heaters as 1st step heaters, the automatics operates on the basis of duct temperature sensors, which are installed in supplied and exhaust air ducts.

Systems S3 and S4 include only channel air conditioners which operate in straight flow mode. They are operated with complete wire controls (rooms #12 and #14) without any additional equipment.

Main control and operation functions are implemented in box:

- maintaining supplied air temperature downstream the plant within the range set by the controller program (in winter time: +20°C, in summer time: +16°C);
- indoor temperature control from standard wire controls (rooms #3, #12, #14 and #24);
- fan testing (for the systems S1 and S2);
- supply fan speed control (for the systems S1 and S2);
- air filters loading control (for the systems S1 and S2);
- electric air heater control (for the systems S1 and S2);
- emergency supply system shutdown (power interruptions, fires).

2. E1, E2, E3, E4 и E5

For the ease of operation control of these systems is separate for every electric motor. Power section elements are located in ACSC #2, which is located in switchboard room #25. The latter presents a metal box with arranged there inside module power devices on the assembly panel and alarm fittings on the front panel. As per the design this is a customized box, but it can be a commercial one as well.

All systems are equipped with speed controls, also located on the assembly panel of ACSC #2 or close to it.

Main control and operation functions implemented in the box:

- exhaust fans speed control;
- switch on/off of UV lams in the section of bactericidal air treatment jointly with fans of the systems (E1 and E4);
- emergency system shutdown (power interruptions, fire).

Start/stopping control of electric motors E1, E2, E3, E4 and E5 is conducted from button control stations located in rooms #3, #12, #14 and #24.

3. E6 и E7

Voltage supply for systems E6 and E7 is conducted by means of lighting of rooms #6 and #11 through timer Б3Т-300СУ.

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4. C1, C2 и C3.

ACSC #3 is a plastic box with module power and signaling fittings on the front panel, which is located in switchboard room #25. As per the project this cabinet is a customized one. Air conditioners (split-systems) wire controls are located in attended rooms under the internal units, as they have built-in temperature sensors.

5. Cables, stipulated by the project, secure connection of primary automation aids located on pieces of equipment to switch boards. Metal trays are secured to walls and ceiling by means of arm supports and are taken to the plants. From the trays cables are laid to the consumers in corrugated PVC pipes immediately by plants.

3. Preparation of ACS to operation

1. Check accuracy of connection in accordance with the basic circuit diagram.
2. Check accuracy of connection of external circuits of system control and command and ground circuits.
3. Check parameters on automatic switches in order to ensure power supply of electric motors of the fans.

4. Labor safety and protective safety measures

To ensure labor safety for the staff and protect them from electrocution all metal parts should be connected to the protective ground common bus.

Parameters of devices and automation aids are pursuant to the classification of premises.