Technical assignment

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| 1 | The name of the object | “Iaghluja” |
| 2 | Brief description of the object | P/S “Iaghluja” is located in Rustavi City (02.04.05.108). The pumping station pumps water to “Mtisdziri” reservoir.  Currently, the pumps are managed (turning on and off) mechanically, from the place, through the machine operator. |
| 3 | System name | Arrangement remote control and monitoring SCADA system for P/S “Iaghluja” |
| 4 | Main functions of the system | Management of pump units:   1. Manually from the place (preferred pump start/stop and speed adjustment if “VFD” is installed, emergency stop). 2. Automatically from the place (all devices participating in the management process, the valve, the pump, etc. are managed automatically, taking into account the signals coming from various sensors or control devices). 3. Manually by remote (preferred pump start/stop and speed adjustment if “VFD” is installed, emergency stop). 4. Automaticly by remote (all devices participating in the management process, the valve, the pump, etc. are managed automatically, taking into account the signals coming from various sensors or control devices). 5. Remotely-the possibility of changing the pressure task (when adjusting the pressure of the pressure network). 6. Remotely, the possibility of changing the water level range in the reservoir (when adjusting the reservoir level). 7. Remotely, the possibility of changing the speed of the motor (if there is a "VFD"). 8. Open/Close of the electrically controlled walve both from the place and remotely. 9. Remotely, reset the control system.   Monitoring:   1. Motor winding temperature for each device. 2. Pump bearing temperature for each device. 3. Vibration for each pump-unit. 4. Suction and discharge network pressure. 5. Water flow. 6. Information about the task "Setpoint" (in the case of pressure regulation in the network, the given pressure task. When controlling the reservoir level, the adjustment range). 7. Information obtained from the pump-unit control process (mains voltage, frequancy, motor condition, number of motors, current, consumed power, information about the faults). 8. Condition of electrically controlled valves (on/off). 9. Indoor and outdoor temperature of the building, noise.   Note: The information listed above should be visualized both on the on-site control panel and in the company's central SCADA station. |
| 5 | Facilities and equipment in the station | **Two pump units are installed in P/S with the power:**   1. 160 KW 2. 160 KW   Motors are started by the direct starting method "DOL".  Note: "Soft Starter" installation is planned, therefore, this fact should be taken into account when arranging the control system. |
| 6 | Control devices (control signals) | 1. PLC/RTU. 2. Analog/Digital IO. |
| 7 | List of works to be performed | **Direction from P/S "Iaghluja" to “Mtisdziri" reservoir:**   1. Install a control shield for remote control and monitoring, with integrated "PLC"/"RTU" and HMI device. 2. Install the device for measuring electrical parameters of the motor. 3. Set up a motor thermal protection system with PT100/1000 sensor input (for all motors). 4. Set up a pump thermal protection system with a PT100/1000 sensor input (for all pumps). 5. Install an electrically controlled valve on the inlet and outlet pipe. 6. Install a vibration sensor on all devices individually.   **„Mtisdziri“’s reservoir:**   1. Setting up a analog water level meter (if there is a level meter, its integration with the new management system). 2. Integration of the existing water flowmeter with the new management system.[[1]](#footnote-1)   **General works to be carried out in the station:**   1. Arrangement of temperature and noise monitoring inside and outside the building. 2. Arrangement of fire protection system. 3. Arrangement of anti-flooding system. 4. Arrangement of building security system.   Note: The information listed above should be visualized both on the on-site control panel and in the company's central SCADA station. |
| 8 | Special requirements | 1. It is preferable to transfer information through a network cable connection, instead of cellular connection. 2. The management system should be equipped with devices manufactured by the following companies:      * **SOFREL**      * **MICROCOM** |

## Introduction

Considering the specifics of work, pumping stations are divided into two types:

**1) Supplies the network ("booster station"\_B.P.S).**

**2) Supplies the reservoir ("pumping station"\_P.S).**

The specifics of operation of network-operated devices are different from reservoir-operated devices. In the case of operation in the water network, the pressure of the pressure network is controlled, and for the reservoir, the water level range is controlled.

**Maintaining the desired pressure ("booster station"\_B.P.S).**

In the pressure network, the desired pressure is maintained by one or several interconnected pump units. The control scheme is cascaded and the pressure is regulated through one or more frequency converters. The frequency converter(s) may be controlled either independently with an integrated PID controller or through an additional control panel consisting of a PLC and HMI.

**Filling the storage tank ("pumping station"\_P.S).**

Reservoir filling is carried out by one or several pump units. The number of working pumps depends on both the day and night period and the time of the year. In many cases, the water level is controlled between the minimum and maximum limits. If the level in the reservoir falls below the predetermined level mark, the pump unit should be turned on, and if it exceeds the limit, then it should be turned off.

**Description of the management principle**

## Direction from P/S "Mtisdziri" to reservoir of "Mtisdziri”

Through the first switch on the control shield, we choose whether the control is carried out from the local or remotely. If the management is local, then by pressing the second switch, we select the mode:

• Automatic.

• Manual.

If management is remote, then the decision on the type of management is made remotely.

• Automatic.

• Manual.

In both cases of automatic control, be it remote automatic control or local, the pump station control system must maintain the level of the reservoir according to predetermined level marks.In the management process, the condition of the existing pump units and the number of working hours should be taken into account. The control system must determine both the selection of the appropriate pump for the operation, as well as count the operating hours of each pump and keep the current setting equal for both pumps.

**Automatic Control**

After we give the command of the automatic control from the place or remotely, the control system must determine: the voltage, the number and sequence of phases, the working condition of the engine, as well as the pressure in the intake network and the state of the orders. If the pressure on the suction network is normal (within the range defined by us), while the pump units are ready to work, the control system should check the water level in the reservoir of " Mtisdziri ". If the actual level is less than the lower level mark, then the pump-set should be turned on, and if it exceeds both the upper level mark and the tank level, then wait until it falls below the lower level mark. Increasing the number of working pump units should be done by us by selecting the number of working and reserve pumps.

**Mechanical Control**

In the case of manual control, the control of the control process is the responsibility of the service personnel or the SCADA operator. In this case, the staff takes responsibility to turn on or off the desired pump unit regardless of the emergency signal from the control process.

**Conditions for turning off the station:**

1) Manual emergency shutdown.

2) During mechanical control (from the place or remotely).

3) During automatic management (in case of water shortage at the suction, in case of phase loss or phase shift in the supply network).

4) Alarm signal received from the fire safety system.

5) Alarm signal received from anti-flooding system.

## The station must be managed both on-site and remotely through the company's SCADA system. As for control devices (motor and frequency converter), information about the control process should be displayed on the local control panel, as well as remotely on the SCADA system monitor. The change in water level range should be possible both, from the site and remotely.

1. For more information, see the paragraph 1.2. [↑](#footnote-ref-1)