***Annex 1 Terms of reference***

***Generator Brake System Rehabilitation***

***Terms of Reference***

Zhinvali hydro generator, type СВ 425/135-14 is manufactured by Kharkov factory “ELECTROTIAJMASH” in 1983-84. Vertical shaft generator is powered by type РО 170-В-180 hydro-turbine. Number of rotations is 428.6 rounds per minute.

Power of the generator is 32.5 megawatt; Quantity of units- 4.

Braker system for two units was rehabilitated in 2023.

The rehabilitation of the rest two units needs to be conducted in accordance with the requirements presented in this TOR.

**Works to be conducted for brake system rehabilitation purposes:**

1. Modernization of existing mechanical brake jacks and replacement with modern system, without rotor removal, replacement of brake pads and brake cuffs; (For two pcs Unit) Installation must be finished in 2024 year.
2. Number of brake jacks- 12 units; (6 for each unit)
3. Structure of the brakes shall be prepared in a manner, which ensures safe landing of the brake cylinders after the pressure is released;
4. Brake system cabinet shall be replaced. Current of the cabinet is DC 220; brake system and rotor elevation system shall be placed in one cabinet;
5. Brake jacks shall be equipped with remote switch in order to examine condition of the braking pads;
6. Brake pad wearing out control system is required;
7. Brake pad surface shall be covered with synthetic materials, which does not create asbestos and coal dust conducting electricity. Brake pads shall be heat resistant and sustainable in usage;
8. Braking of the hydro generator shall allow automatic, normal, and emergency braking when speed of rotation ins 25-30% of the normal rotation. Discharge air- 8 bar- shall be taken from the plant braking piping;
9. As solenoid valve is controlled by direct current, any signs of direct current on the solenoid valve shall be excluded before relay starts operating. Brake cabinet shall include electric contact manometers;
10. Mechanical braking cabinet shall be equipped with an electromagnetic valve before and after discrete pressure transmitter in order to regulate operating limits;
11. Brake system shall be equipped with manual braking capacities;
12. Equipment for lifting rotor shall be portable, with high pressure lubricant pump, control system and lubricant collector. Brake structure and piping system shall include means to remove the lubricants once the rotor is lifted. Device shall be able to automatically control the levels of height. It is desirable for two devices to be capable of lifting one rotor. Rotor lifting pressure is 200 bars. Height of rotor lifting is 15-20 mm. Rotor lifting device have manual lifting capacity;
13. Brake system shall be linked to device hydro-automated relay scheme and installed in the existing computerized control system in order to ensure full automated launch of the device;
14. High pressure piping with 0,5-inch diameter, (the length of pressure pipes needs to be calculated), operating pressure 200 bars.
15. **Delivery and installation new SCADA COMPUTER for all units, as per requirements set below:**

# **SCADA system**

Will be possible control and signalling all technological parts, will be able automatic start and automatic shutdown of units, all failure of technology will be monitors, all signals commands and trends will be archive. SCADA system will be consisting from 1 PC with backup function. SCADA computer must be control all 4 units. Computer will be fitted by 2 monitors, keyboard and mouse.

Parameter of this computer will be minimal following:

Case for rack mounting

Processor Core i7 or higher.

Memory: 16GB (2 x 8GB Kingston DDR4)

HDD: 1000 GB

Graphic card 2 HDMI

ODD: DVD-RW

Connectivity 2xPS/2 for mouse and keyboard, USB from front site, RJ-45

Net card 1000Mbit Ethernet

Keyboard PS/2 English

Mouse Optical oil resistant

Cooling Ventilators with ball-bearing or passive

Monitors 24” LCD resolution 1280x1024, HDMI or DVI - 2 pcs or higher

### **Daily log**

SCADA system (PC) will be archived all this signals, commands and trends in folder by month (for example 07\_02). Each day will be archive in independent file. This file will be naming by year, month, day and meaning. For example 23\_12\_24\_LOG will be daily log of commands and signals from 24. December 2023. There will be used colours – warning will be yellow, failure red and switch to normally state green, other will be black. In daily log will be following columns: Date and time (for example 09.01.01\_00:00:01), KKS marking , text signification, Logical meaning (for example YES), name of log in user (only for commands).

### **Trends**

SCADA system (PC) will be archived choice measuring value in folder by month (for example 09\_01). Each day will be archive in independent file. This file will be naming by year, month, day and meaning. For example 23\_08\_01\_BEARINGS will be daily trends of bearings measuring from 1. August 2023. In this file will be columns for date, time (for example 09.01.01\_00:00) and measuring values.

### **Access**

PC shall be with automatic start to first level of visualisation software. Shall be impossible switch of this software – it will be able in third level of control. Shall be impossible switch to other application – shall be prohibited special keyboard clicks as Ctrl+Alt+Del, Alt+Tab etc. Shall be prohibited automatic start or reading of external devices connect by USB (flash disk, USB external disk, etc.)

There will be a user access system available to protect running application against unauthorized person intervention. This access system will be in 3 levels. First level for view (unauthorized), second for operator - control parameter for start and shutdown units, changing basic parameter of system and third for full control include changing and debugging all parameter of system (e.g. temperature limit, parameter of static for speed regulator or used current mode in excitation set, etc.).

* +

# **Screen of SCADA**

### **Main menu bar**

On upper of screen will be common bar with this buttons: Unit1; Unit2; Unit3; Unit4, switch for change of language, acknowledge of signalization (siren), acknowledge of failure, alarms list, switch of application, log on/out button, printer, keyboard, displayed of log user, time and date, GWP logo. This menu will be always visible.

### **Alarm list**

On this screen will be full failure of control system. This will be colours by three levels: information (black), warning (yellow) and failure (red). This will be sort be time of event.

### **Common screens**

##### Overview

On this screen will be main devices with control and monitoring. There will be possible start and shutdown unit and setting power and reactive power mode and value.

##### Common failure

On this screen will be monitoring of common failure.

##### Industry Ethernet nets

On this screen will be full structure and monitoring of network with signalling of failure each component.

##### Trends and graph

On this screen will be trends and graph of energy, water level, temperature.

### **Control levels of HPP**

The control of a HPP will be in these hierarchical levels:

* Equipment control – hardware control each equipment
* Local control – software control each equipment
* Unit control – software control of Unit in automatic mode

##### Equipment control (Service)

Switch Remote - Service on switchboard on control system will be to in position service. Control all equipment will be possible only from local box exception local (hardware) automatic independent on the control system. In this position will be all controls from DCS hardware blocked with using packet on this switch.

##### Local control

Switch Remote - Service on switchboard on control system will be to in position remote. Start or stop components will not be possible from local box. Equipments in local mode will be control from screen of HMI or SCADA. In this mode will be working all automatic function and blockade of unit (refilling of oil, etc.). Local control will be able from HMI or SCADA (switch-over this mode on the screen).

##### Unit control

Unit will be control from screen of HMI or SCADA. Unit will be working full automatically. Unit will be possible control in all modes (according to level access