

MIDDLE VOLTAGE SWITCHGEAR SPECIFICATION

1. INTRODUCTION

This specification is related to the 1500 TPD concentrator for a polymetallic ore located in Bolnisi Georgia. The present technical sheet covers the specifications for Middle voltage switchgear

2. PROJECT GENERAL DATA

- Mining method: Underground.
- Process type: Flotation.
- Ore type: Polymetallic ore.
- Location: Bolnisi - Georgia (Eastern Europe).

3. SCOPE OF SUPPLY

The present document describes the minimum specifications required for the design, Installation and tests for middle voltage switchgear. The supplier will remain responsible on the technical quality of its supply.

The quantities of equipment to be provided are listed in the table below:

ITEM	TAG	SERVICE VOLTAGE	TYPE	Frequency
1	MV-SWG-001	10kV	Vacuum	50Hz

4. REFERENCE DOCUMENTS

- Applicable Standards.
- The present document.
- The Single Line Diagram
- Technical data sheet

5.0 STANDARDS, CODES AND REGULATIONS

The equipment shall comply with the latest editions of appropriate UL, CSA or IEC standards, codes and regulations.

In general, MV swg will be designed, manufactured, tested and installed in accordance with the relevant European.

6.0 TECHNICAL SPECIFICATIONS

- Service Voltage: 10,000V.
- Frequency: 50Hz.
- Type: Metal-Clad.
- Insulation: Air
- Busbars: insulated
- Circuit Breakers Type: Withdrawable type.

- Circuit Breakers Insulation: vacuum
- Construction: Self-supporting.
- Material: galvanized or electro-galvanized steel sheets.
- Protection: IP42.
- Installation: Indoor.
- Incoming Cables: top side
- Outgoing Cables: top side

7.0 SWITCHGEAR DESIGN

The Switchgear will contain Circuit Breakers protecting the primary side of the MV/LV main transformers and also to feed MV loads (SAG MILL & BALL MILL).

It will be constructed with the following minimum features:

- Fully compliant with Standards.
- Metal-Clad Type.
- Operation service 10kV.
- Frequency 50Hz.
- Manually operated Vacuum Circuit Breakers with visible Non-Load Disconnects.
- Protection relays (ref/rem620(615)).
- Lights for power presence indication
- Temperature-Rises: At rated current under steady-state conditions the maximum temperature-rises related to the average temperature of the air outside the external enclosure are those permitted by sub clause 4.4.2 of IEC Standard 60298.
- All control equipment and bus bars of MV switchgears shall withstand fault currents that may occur in the Unit distribution system. Bus bars shall be insulated
- The withdrawal or engagement of a circuit-breaker shall not be possible unless this device is in the open position.
- It shall be possible to close the earthing switch only when the circuit breaker is drawn-out; the engagement of the circuit-breaker shall not be possible unless the earthing switch is in the open position.
- It shall be possible to prevent the earthing switch from closing if the incoming lines are not surely de-energized.
- In order to avoid a false handling of 10 KV switches and earthing blades, necessary mechanical and electromagnetic interlocks shall be implemented excluding the possibility of any voltage applied to engaged earthing blades.

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- Low Voltage Circuits: The rated voltages of the auxiliary circuits are specified in data sheet and it shall be manufacturer's care to check the correct operation of the equipment manufactured or chosen by the manufacturer.
- Cabinet-to-cabinet interconnection wiring shall be laid in ducts made of self-extinguishing material, properly arranged and easily accessible, while wiring passing through the "MV equipment" or "external connections" compartments or entering said compartments for connecting the auxiliary or measuring circuits of the equipment, shall be protected by means of metal tubes or cases.
- The L.V. interconnections of devices placed in different sections shall not be made directly but by means of terminal blocks placed in the relevant sections. Identification marks shall be put on conductor ends and on terminals and other devices to permit the easy identification of the various circuits. Labels shall also be provided for each apparatus, marked with the relevant item indicated on the elementary diagram.
- The following equipment shall usually be of the "draw-out" type: Circuit-breakers, VT's and relevant fuses.
- Overvoltage limiters shall be installed in the cubicles with vacuum circuit breaker.
- The current transformers shall be capable of withstanding the heating due to short-time currents and the dynamic stresses due to short-time current initial peak values. The instrument transformers shall ensure the correct operating of the protection and measuring equipment they supply. The instrument transformers shall always be insulated. The CT's on the incoming and outgoing lines shall not be installed in the housing of the bus-bars nor shall be electrically connected on the bus-bars side of the isolating means of said lines. Whatever may be the function of the CT's installed in stationary position, with the enclosure door open, CT terminals shall be easily accessible to carry out tightening operations, changes of ratio (where possible), etc. without removing the CT or any other device or connection.
- Each enclosure of the switchgear shall be fitted with a voltage indicator on the incoming or outgoing line. Each enclosure of the switchgear shall be fitted with a

voltage indicator on the incoming or outgoing line. The voltage presence indication shall be operating even with a line voltage drop of 30 %.

- Relay protection functions should be performed by “intellectual” microprocessor devices, using IEC 61850 communication protocol, oriented on automatic dispatcher electric power control system. The secondary circuit protection circuit breakers shall be capable of breaking the maximum expected short circuit currents
- For 10/0.4 kV transformers, the following protection types shall be provided:
Overcurrent protection without time delay; Overcurrent protection with current independent time delay; Overload alarm operating protection; Ground fault alarm operating protection; Overheating two-step tripping and alarm operating protection of transformer windings.
- Motor feeder protection: Tripping protection (current cutoff) against multiphase faults in stator winding (for motors of ≤ 2 MW); Overload tripping protection with current-independent time delay; Ground fault tripping protection; Under voltage protection; Tripping and alarm operating protection against overheating of stator winding and bearings (according to special requirements of Motor feeder protection: Tripping protection (current cutoff) against multiphase faults in stator winding (for motors of ≤ 2 MW); Overload tripping protection with current-independent time delay; Ground fault tripping protection; Under voltage protection; Tripping and alarm operating protection against overheating of stator winding and bearings
- 10kV switchgear cubicles for the motors shall be fitted with the following: two relays to provide external emergency disconnection of a 10kV switch from PLC system; two relays of motor closing-tripping commands; alarm operating ground fault protection in 10kV mains.
- For 10kV switchgear bus protection, the following shall be provided:
 - partial differential current protection with two-step time delay;
 - arc protection with starting by voltage or by current (including arc flash)
 - logic bus protection
- Optical fast arc detector sensors should be installed in:
 - bus bar compartment;
 - vacuum circuit breaker compartment;
 - cable connections compartment
- For switchgear, as a rule, two-step group undervoltage protection and power-loss protection shall be provided. For the first - motors without self-starting, for the second-motors with self-start.
- All switchgear cubicles shall be fitted with protection operation indicators.

- Control of main switches, switches of outgoing lines to transformer is local and performed from switchgear cubicles.
- Control of cubicles of motors is performed as follows:
 - start/stop from a pushbutton console nearby the motor;
 - emergency stop from the device control panel;
 - start/stop by PLC, from the rack the rack room or control room
- All switchgear cubicles shall be fitted with light indication as follows:
 - lamps of switch on- and off- positions;
 - lamps of switch emergency turn-off
 - all analog measuring parameters shall be displayed on the switchgear using microprocessor based metering and protection unit.
- Circuit labels: each assemble shall be provided with the following circuit identification label - circuit label on the front of the fixed and removable part of withdrawable units; identification number of the connected equipment or circuit destination; circuit labels should be installed on the front and on the rear side of the switchgear cell; warning plates - in locations where dangerous situations may be created.
Cabinet and panel board front door shall bear tag number and operational description of equipment connected to or controlled from the respective cabinet.
- Documentation: the supplier shall provide a factory certificate for the switchgear and two copies of the operating manual in English, assembly drawing, general arrangement, single line diagrams, control schematics, internal wiring diagrams, technical passport, interlock/intertrip diagram with downstream/upstream of the the MV switchgear .
- Voltage transformers must be in the windrawable version. Rack out position must be achieved by the same mechanism as that of the vacuum circuit breakers (by means of trolley and handle).
- During switchgear construction, the manufacturer shall allow the purchaser's inspector to access his factory in order to check that the work progress is technically correct and in in accordance with the scheduled time. The costs of the routine tests are charged to manufacturer, excepting the expenses of the purchaser's inspector.

8.0 LOCAL CONDITIONS

- Seismic activity: Yes, zone 1.
- Climat: Continental.
- Plant elevation: 750 m above mean sea level.
- Outside temperature: -24 to 39 °C minimum and maximum (annual average).

- Relative humidity: 76% (average).
- Rainfall: 512 mm (monthly average).
- Snow accumulation: 10 cm (max, during January).

9.0 SHIPPING

The equipment must be packed in suitable packaging for transportation to Poti port, Georgia (for foreign suppliers) and then by train or trucks to project site.

10.0 APPENDIX - MV SLD

