DISTRIBUTION TRANSFORMERS 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 Electrical Distribution Transformers.

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, construction and tests of hermetically sealed with integral filling transformers. The supplier will remain responsible on the technical quality of its supply.

The transformers will be installed in outside.

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

ITEM	TAG	RATING	TYPE	TYPE OF COOLING	
1	T-001	1600 kVA	DRY TYPE	AIR COOLED	

4. REFERENCE DOCUMENTS

- Applicable Standards.
- The present document.
- The Single Line Diagram.

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, the transformers will be designed, manufactured, tested and installed in accordance with the relevant European or North American standards.

6. TECHNICAL SPECIFICATIONS

- Primary Voltage: 10,000V.
- Secondary Voltage: 400V.
- Frequency: 50Hz.
- Z%: 6%
- Coupling: D/Y with accessible Neutral.
- Insulation: Dry type transformer.
- Winding Material: Copper.
- No-Load Taps: +/- 2.5% & +/-5%.
- Installation: Indoor
- Cooling: AN
- Incoming Power Source: MV Switchgears.
- Neutral System: Solid Grounding

7. TRANSFORMER DESIGN

7.1 General Information

- All the transformers will be installed inside.
- Overall dimensions shall be as small as possible.
- The project site is located in a seismic region (zone 1)
- Transformers must be designed in accordance with IEC 60076-1
- The transformer shall be able to withstand short circuit having duration of two seconds and magnitude specified by IEC 60076-5 standard
- Outside temperature: -24 to 55 °C minimum and maximum (annual average)

- Relative humidity: 76% (average)
- The system impedance shall be neglected in the calculation of short circuit current, if the short circuit apparent power of the system at the transformer location is not specified in data sheet.
- Windings shall be made of high grade electrolytic copper and cores shall be made of high grade, low loss, grainoriented, cold rolled steel sheet.
- The Transformer shall be tested at Manufacturer's works using the method to ensure its integrity during all service life.
- Insulation, impregnation and encapsulation materials shall be nonhygroscopic, flame retardant and selfextinguishing. Exposure to an electric arc or direct flame shall not cause emission of toxic fumes.
- Jacking facilities shall be located near the base of the transformer, and designed so that lifting members of the jack can be inserted. The dimensions, locations and clearances for jacking provisions shall be clearly shown on the Manufacturer's drawings.
- Sound levels shall not exceed 65 decibels any deviations must be cleared with the Purchaser
- Insulation: Epoxy resin cast windings with class F insulation may be used, depending on environmental and operating conditions. Or class H, if it is proved from manufacturer
- Core/coil assembly shall be the 3-limb core type except where specified otherwise. Coils shall be wound with copper conductors. Magnetic flux shall be kept well below the saturation point
- The transformer shall normally be equipped with an off-circuit tap-changer. Four taps adjustable to 2.5 % of the nominal voltage shall be provided on the HV windings. Two taps above nominal voltage and two taps below. The tap-changer shall be arranged at HV terminals side, on the transformer front or in other easy accessible location. Voltage tap change shall be achieved by connecting off-circuit suitable links to the selected tap. A well visible engraved tag shall indicate the tap changer position, expressed as a percentage of voltage ratio. Tap changer shall be provided in the form of bolted links on coil surface
- The transformer shall have natural air cooling (AN) with capability for forced air fans. Vibration isolation frame shall be installed on the transformer. Transformer rating and over temperatures shall take into account the air circulation restriction, if any, due to the enclosure. On LV side, the enclosure shall be provided with suitable cable glands for cable entry, with flange for connection to busway or direct connection to the switchgear. A removable side plate on the transformer housing for HV cable connection with sufficient space for installation and maintenance shall be considered. Unless otherwise indicated, the transformer base shall be

equipped with wheels for possible sliding in the two main directions. Two stainless steel rating-plates shall be placed on the long sides, indelibly engraved with data prescribed by IEC 60726 std. The Buyer's name and purchase order number shall be included on the rating plate or alternatively a separate plate with this information shall be added. There shall be the following sign fixed to the transformer case, “CAUTION ELECTRIC TENSION”

- Earthing: Two earth connectors shall be provided at the frame bottom on opposite sides. Each terminal shall comprise a M10 stud, nut and washers. A separate earth terminal shall be furnished near the neutral terminal to include an earth strap for earthing the neutral.
- All auxiliary equipment necessary for safe operation of the transformer, as per IEC 60076 shall be included in the supply.
- Auxiliary cooling equipment shall be provided to supply as a minimum 140 % of AN rating of the transformer if it is specified in the data sheet. A separate terminal box shall be provided for the wiring of the fans. Auxiliary cooling equipment control shall be automatic with provisions for manual override. Automatic control shall be by the winding temperature method
- Winding temperature actuated device that shall include an indicator readable from base level and shall have electrical contacts for control of the auxiliary cooling equipment, and 1 additional contact which opens to alarm on high temperature. This device may be incorporated in the dial type thermometer. Manually operated switch for choosing automatic or manual control. All motors, motor controllers, relays, terminal blocks, fans, fuses, circuit breakers or disconnect switches necessary for the operation of the auxiliary cooling system. All cable laying and wiring accessories necessary to connect the control equipment into a complete, functional system. All wires shall be connected to terminal blocks
- LV terminals shall be arranged at top, on the side opposite to HV terminals. When connection is by means of busway, the Manufacturer shall provide a coupling flange around the bushings for bus-way connection. If the transformer is provided with enclosure, the coupling flange shall be on the enclosure, and supports, bar conductors and bushings, for connection of the bus ends to transformer terminals, shall be included in the supply. The degree of protection of terminal housing shall be ≥ IP55. It shall have two earthing connectors (one inside and another outside)

7.2 Routine Tests: The tests shall be at manufacturer's charge and performed at Manufacturer's workshop and witnessed by Purchaser's inspectors. The following tests shall be performed:

- Wiring diagram check.
- Ratio tests (on all taps); (IEC 60076-1 or CLC/HD 398 part I, clause 8.3).

- Winding resistances measurement; (IEC 60076-1 or CLC/HD 398 part I, clause 8.2).

- Insulation-resistance measurements, by means of a megger with minimum voltage 2.5 kV, between windings and between each winding and earth.

- Dielectric tests (applied voltage tests); (IEC 60076-3 or CLC/HD 398 part III, par. 10).

- Induced voltage test, (IEC 60076-3 or CLC/HD 398 part III, par. 11).

- No-load losses and current measurement; (IEC 60076-1 or CLC/HD 398 part I, clause 8.5).

- Load losses and impedance voltage measurement; (IEC 60076-1 or CLC/HD 398 part I, clause 8.4)

- The Purchaser reserves the right to require the short circuit test (IEC 60076-5 or CLC/HD 398 part V). A type-test report, if any, can be accepted by Purchaser

Structural drawings, completely dimensioned, showing:

- Arrangement.

- Equipment general view

- Required clearances.

- Entrance locations for both top and bottom entrance.

- Bus bar locations and configurations.

- Incoming and outgoing cable terminator positions.

- Purchaser's wiring terminal block locations, and all other terminal block locations.

- Anchor bolt locations.

- Grounding connections.

- Weight of equipment.

- Heat dissipation values.

Schematic Diagrams: schematic wiring diagrams shall be furnished; each diagram shall show all control devices and device contact; each diagram shall show device, terminal block and terminal numbers.

Vendor shall furnish the complete sets of installation, operating, and maintenance instructions in English language.

All transformers and associated equipment will be accompanied by technical passport documentation in English.