

**= Belt Conveyor System =**

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## **8.0 ELECTRICAL DESIGN REQUIREMENTS**

### **8.1 General**

In the existing configuration of stockyard equipment, each machine is presently operating on its individual rail track. However, with the new scheme proposed for the Modernization of the MOHP, two machines will be operating on a common rail track. Such an arrangement will provide additional stockyard capacity which will be possible only after removing the Shipping (Reclaimer) tracks and installing the new Reclaimers on Stacker tracks. In effect, what this means is that, a Reclaimer conveyor and a Stacker conveyor will lie within one rail track. This necessitates the realignment and replacement of existing conveyors R5, R6 & R7, which are presently located in the centre of the Stacker rail track, and the shortening of Conveyors R1, R2 & R3 feeding these conveyors. The existing stacking conveyors R5, R6 & R7 will be shifted from the centre line of the track to accommodate the yard conveyor for reclaiming operation. The existing drives of conveyors R1, R2 & R3 will have to be relocated after modification. The capacity of only R5, R6 & R7, whose present belt width is 1200 mm, will be augmented to 1400 mm and renamed R5A, R6A & R7A.

The entire work will be carried out in two stages and only Stage-1 is included in the scope of this tender. The scope of Stage-1 includes utilizing the existing 3.3 KV motors (Primary motor: 500 HP Secondary motor: 200 HP) and Motor HT & LT control panels by shifting these to the new locations. The motors, electrical panels & other switch gear shall be reconnected with appropriate sizes & lengths of new cables on new cable trays as required and termination shall be carried out with lugs and glands. The gear boxes, pulleys and fluid couplings along with its actuators and control panels used will all be brand new.

Interfacing of the operations of the conveyors with the existing Control System and commissioning to ensure satisfactory performance of the system.

The existing power and control cable for Stacker laid along side the conveyor shall be dismantled and the same shall be relaid with new cable tray alongside the new conveyor upto the payout and terminated as required.

In Stage-2, which is not part of this tender, the existing 3.3 KV motors will be replaced by brand new 6.6 KV motors (Primary motor: 375KV Secondary motor: 225 KW) on commissioning of the 6.6 KV Substation along with all its control gear.

Further, MPT proposes to modernize the electrical control system at Stage-2 to enhance operational efficiency, reduce the downtime of the equipments and introduce Management Information System (MIS) in respect of operation and maintenance of the conveyors of the Mechanical Ore Handling Plant.

The PLC system that will be installed in Stage -2 would;

- a) Diagnose/troubleshoot the faulty component of the conveyor system and provide MIS.
- b) Display the various performance parameters and efficiency parameters of the conveyor system while running and provide MIS.
- c) Perform Condition Based Monitoring (CBM) of the various components of the conveyor system and provide MIS.

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In view of the works that are proposed to be carried out at Stage-2, the bidder shall ensure that the design and selection of electrical equipment he proposes to use in Stage-1 will enable seamless Integration when Stage-2 is implemented, Towards meeting this requirement, the bidder shall design the motor foundation for subsequent installation of 6.6 KV motor. Further, he shall also ensure that the location where he Intends to install the existing 3.3 KV panel will be such that it can be easily supplanted by the 6.6 KV panel. Besides this, the new field cables to be installed must support the PLC and MIS proposed for Stage-2.

- a) All cables shall be designed and manufactured such that no damage occurs during transportation, installation and operation of the cables under stipulated conditions.
- b) The cables shall be suitable for laying in trays, pipes, ducts, dosed trenches and directly buried underground.
- c) The cables shall be designed so that the conductor temperature does not exceed 90 deg. C while carrying steady state rated current
- d) The maximum short circuit conductor temperature shall not exceed 250° C.
- e) All cables shall be armoured type.

## **8.2 Manufacturer's Identification**

The cables shall be identified throughout the length of cable by manufacturer's name' or trade-mark and the voltage grade, type FRLS and year of manufacture indented, printed or embossed. The indentation, printing or embossing shall be done only on the outer sheath.

## **8.3 Packing and Marking**

8.3.1 The cable shall be wound on a wooden drum and packed as per the requirement of IS: 10418-1982. The ends of the cable shall be sealed by means of non-hygroscopic sealing material.

8.3.2 The cable shall carry the following information either stenciled on the drum or contained in a label attached to it:

- a) Reference to Indian Standard
- b) Manufacturer's name' or trade-mark
- c) Type of cable and voltage grade
- d) Number of cores
- e) Nominal cross-sectional area of conductor
- f) Cable code
- g) Length of cable on the drum
- h) Number of lengths on the drum (if more than one)
- i) Direction of rotation of drum (by means of an arrow)
- j) Gross mass
- k) Year of manufacture.

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**8.4 Despatch**

The cables shall be in despatchable drums with weatherproof packing.

**8.5 H.T. Cables**

**8.5.1 System Particulars**

- i) Voltage Grade : 3.3 KV
- ii) Normal system voltage : + 10%
- iii) Highest system voltage : 3.6 KV
- iv) Frequency : 50 Hz  $\pm$  3%

**8.5.2 Construction and Composition**

- i) Aluminium conductor material : Stranded aluminium conductor/ Aluminium wires as per IS 8130
- ii) Conductor screening : Extruded semi-conducting compound
- iii) Conductor insulation : Cross linked polyethylene (XLPE) insulated.
- iv) Core screening : Extruded semi-conducting compound followed by copper tape screening
- v) Inner Sheath : Common Covering of plastic tape wrapping/wrapped extruded inner sheathed.
- vi) Armouring : Galvanized Steel flat strip
- vii) Outer sheath : PVC compound conforming to the requirement of type-ST2 of IS 5831, suitable compounded for FRLS properties of heavy duty cables, with anti-termite and anti-rodent properties.
- viii) Core identification : Red, Yellow and Blue.

**8.5.3 Cable Code**

The following code shall be used for designating the cable:

Sl.No.	Constituent	Code Letter
1.	Aluminium conductor	A
2.	XLPE insulation	2X
3.	Steel round wire armour	W
4.	Non-magnetic round wire armour	Wa
5.	Steel strip armour	F
6.	Non-magnetic strip armour	Fa
7.	Double steel round wire armour	WW
8.	Double steel strip armour	FF
9.	PVC insulation/outer sheath	Y

**8.6 LV Cables (Power and Control)**

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**8.6.1 System Particulars**

- i) Voltage Grade : 1100 V
- ii) Normal system voltage : 415V + 10%
- iii) Frequency : 50 Hz  $\pm$  3%

**8.6.2 Construction and Composition**

- i) Aluminium conductor material : Stranded aluminium conductor/ Aluminium wires as per IS 8130
- ii) Conductor insulation : XLPE insulated
- iii) Inner Sheath : Common covering of plastic tape wrapping/wrapped extruded inner sheathed.
- iv) Armouring : Galvanized Steel flat strip/round wires
- v) Outer sheath : PVC compound conforming to the requirement of type-6 of IS 5831, suitable compounded for FRLS properties of heavy duty cables, with anti-termite and anti-rodent properties.
- viii) Core identification : Red, Yellow and Blue & Grey (Control Cables)

**8.7 Control Cables**

This specification covers the requirements for Voltage Grade 1100 V armoured, copper conductors, multi core XLPE (cross linked polyethylene) insulated and PVC sheathed, FRLS cables for control purposes.

All cables shall be designed and manufactured such that no damage occurs during transportation, installation and operation of the cables under stipulated conditions.

The cables shall be suitable for laying in trays, pipes, ducts, closed trenches and directly buried underground. All cables shall be armoured type.

Cables shall be provided with additional overall Shielding with Aluminum mylar tape with 100% coverage and 25% overlap on laid up cores for shielding against static/electromagnetic interference.

**System Particulars**

- Voltage : 1100 V grade
- Ambient Temperature : 45 deg.C.

**Colour Scheme for Identification of Cores**

Cores shall be identified by colour scheme of PVC/ XLPE insulation. The following colour scheme shall be adopted:

upto five cores- Red, Yellow, Blue, Black and Grey.

For cables having more than five (5) cores and having black colour, the core insulation shall be numbered all along the length.

**8.8 Field Safety Devices**

**8.8.1 Pull Cord Emergency Switches**

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Heavy duty enclosed epoxy painted dust and vermin proof Pull Cord Switches with IP-65 degree of protection shall be provided on both sides of conveyor at intervals of about 50 metres.

Pull Cord Switches shall be microprocessor based system for higher degree of reliability and stable operation in noisy/dusty/humid/hot environment. It shall have intelligent Digital or Analog communication between the electronic sensors mounted inside the switches and Master units placed at Head End of each conveyor(s). The baud rate and response time shall be less than millisecond and uniform for all sensors.

Master unit shall have four potential free changes over relay output contacts (2 N.O/2 N.C) suitable for 10 A 110V DC / 10 A 220 V AC. It shall have built-in switch mode power supply.

Master units shall have RS-485 communication port and Ethernet (10 MBPS) TCP/IP. It shall be communicated with Remote I/O or PLC systems.

The switches shall have a vertical lever with a suitable rope clamping device. It shall be feasible to actuate the switch in a maintained mode by pulling on the rope from either side of its normal vertical axis. A manual resetting lever shall be provided to reset the switch to its normal position. All internal connections shall be wired up and terminated in a terminal block inside the terminal box. Three numbers of cable glands suitable for 7 core 2.5 sq.mm, copper conductor, PVCA shall be provided. Two numbers of earthing terminals suitable for 8 SWG GI wire shall be provided on the body of the switch. The actuation of these switches shall stop the motor in either the Local or Auto modes. The sensors shall have 2 N.C potential free contacts suitable for 10 Amp at 110V DC/220V AC.

Any open link (cable/contact) in the serial pull cord switches, shall be annunciated both at Master Control Unit and Central Control Room.

The Contractor shall ensure that the voltage drop at the receiving end of the control cable connections is within acceptable limits to ensure reliable operation and that delay in delivery of a stop signal to the drives is the minimum.

The cables to PLC shall be isolated from the power, cables by atleast 300mm spacing, while laying.

- a) Master unit shall be installed at head end of each conveyor 5A, 6 A and 7A. Pull chord switches (Slave) shall be mounted at every 30 m of conveyor length and on either side of conveyor. These switches shall be wired by 5 core 2.5 mm<sup>2</sup> copper control cable upto the master unit at head end.
- b) A 7 core 2.5 mm<sup>2</sup> copper control cable shall be laid between pull chord master unit at each head end of conveyor 5A, 5B & 5C to the respective control panel located at electrical room (ER) near House H-11A. A power supply of 230 V single phase shall also be provided from electrical room to these master units through the same cable.
- c) In master unit, a provision is kept for future use to communicate through RS-485.

### **8.8.2 Belt Side Travel Switches (BSTS)**

Heavy duty long vertical roller lever type belt side travel switches in epoxy painted IP 65 protected enclosure, shall be provided on both sides of Belt Conveyors at transition point near head end and tail end respectively. Sufficient over travel shall be provided to avoid damage during impact of the belt. This switch shall be a momentary contact/self reset type. Each switch shall have 2 NO + 2 NC potential free contacts suitable for 10 Amp at 110V DC/220V AC and shall be wired to an internal terminal block. Two numbers cable entries suitable for double compression cable glands for 5 x 2.5 sq. mm. copper conductor armoured cable. Two numbers of earthing terminals suitable for 8 SWG GI wire shall be provided on the body of the switch.

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These switches shall operate only in the Auto mode/Manual and shall stop the drive only after an adjustable time delay.

These switches shall be mounted on either side of the conveyor and at 50 M distance in the entire length of the conveyor and shall be wired by 5 core 2.5 mm<sup>2</sup> copper control cable and shall be connected upto control panel of each conveyor located at ER near house H-11A.

**8.8.3 Zero Speed Switches**

A non-contact electronic type Zero Speed Switch shall be provided on a tail end pulley of each Belt Conveyor. The switch shall have a sensing device. The switch shall serve to interlock the feeding conveyor and stop it or prevent it from starting if the pulley is not rotating at a preset speed (security for speed setting shall be provided). Suitable control cable shall be provided for connection between the sensors. 240 Volt AC power supply cable shall be provided for the monitoring unit. Contractor shall draw the power from nearest Control D.B. The actuator shall also be in the scope of supply and shall be mounted on the tail pulley. Each switch shall have 2 NO + 2 NC potential free contacts suitable for 10 Amp at 110V DC/220 V AC and shall be wired to internal terminal blocks. Two numbers earthing terminals suitable for 8SWG GI wire shall be provided on the enclosure of monitoring unit. The component enclosures shall meet IP:65 protection standards.

These switches shall be mounted at the tail end of the conveyor and wired by 7 core 2.5 mm<sup>2</sup> copper control cable upto the conveyor control panel located at ER near house H-11A.

**8.8.4 Belt Take Up Switches**

These switches shall be provided and installed so as to be actuated by an extreme movement of the conveyor belt take ups should the belt tension not be adequate for any reason. Each switch shall be dust and vermin proof and shall have a degree of protection IP65. Each switch shall have 2 NO + 2 NC potential free contacts suitable for 10 Amp at 110V DC/220v AC and shall be wired to an internal terminal block.

These switches shall be mounted take-up pulley frame and shall be wired by 5 core mm<sup>2</sup> copper control cable upto the conveyor control panel of respective conveyor at ER near House H-11A.

**8.8.5 LOCAL HAND-OFF AUTO Push Button Station**

Local-Off-Remote selector lockable in off position and push -button start/stop selector switch required as per plant requirement. The push button shall be of spring return heavy duty shrouded type. The contact rating shall be adequate for the duty to be performed. Push button shall be of illuminated type. Wiring shall be by 7 x 2.5 mm<sup>2</sup> copper control cable. The HOA switch shall be connected to control panel of each conveyor located at ER near House H-11A.

**Field Safety Devices BOQ:-**

Sl. No.	Conveyor Designation	PCS (Pull Cord Switch @50M (Qty)	BSTS (Belt Side Travel Switch) Qty.	Zero Speed Switch Qty.	Belt Take-up Switch Qty.	Local Hand-off Auto Push Button Station
1.	R-5A	Master Unit – 1 No. PCS – 30 Nos.	4	1 Each	1 Each	1 Each
2.	R-6A	Master Unit – 1 No. PCS – 30 Nos.	4	1 Each	1 Each	1 Each
3.	R-7A	Master Unit – 1 No. PCS – 30 Nos.	4	1 Each	1 Each	1 Each

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**Scope of Supply**

S. No.	Description	Quantity (in metres)
1.	7 core 2.5 sq.mm Control Cable	2800
2.	5 core 2.5 sq.mm Control Cable	2500
3.	Required accessories and steel wire (3.15 diameter) PVC coated Rope for Pull Cord Switches	2500