ROURKELA STEEL PLANTROURKELA

BF1, RSP

TENDER SPECIFICATION

FOR

INSTALLATI

ON OF

1 NO. SLAG DISPOSAL CONVEYOR SLC#3

STEEL AUTHORITY OF INDIA LIMITED

CENTRE FOR ENGINEERING &

TECHNOLOGYRANCHI - 834002

JUNE 2022 **CET/05/RN/3170/TS/ME/02/R=2**

CONTENTS - CHAPTERS

PACKAGE LEADER(PL)	TASK FORCE LEADER(TFL)	HOD (PL)
SHRAWAN PRADHAN GM, Mechanical	MANOJ KUMAR LAL GM, Iron & Sinter	SK DAS GM I/c, Mechanical

CONTENTS - ANNEXURES

CONTENTS - SCHEDULES

CONTENTS – DRAWINGS

1. INTRODUCTION

1.1. GENERAL:

1.1.1. Blast Furnace no. 1 (BF#1) has been upgraded having useful volume of 1710 m^3 for a hot metal production of 2900 tpd (average). Approximately 1000 tpd of slag shall be generated from the Blast Furnace which shall be disposed near pulverized coal yard of BF4 through a series of new extended conveyors (SLC#1, SLC#2 & SLC#3) covering a distance of 240m approximately after existing slag disposal conveyors.

1.1.2. INBA Disposal Conveyor

1.1.3. The extended slag disposal conveying systems starting after existing junction house JH#2, shall consist of 3 conveyors SLC#1, SLC#2 and SLC#3 with respective junction houses JH#3, JH#4 and JH#5 having total length of 240m (indicative). The belt conveying system for the 1st part (SLC#1), (approximately 60m) and slag conveyor SLC#2 along with junction houses JH#3 and JH#4 have already been installed at site. The remaining 1 conveyor, slag conveyor SLC#3 with tripper facility along with end junction house JH#5 shall be installed as per the scope of work of this tender specification. These conveyors are a part of the INBA slag disposal system.

1.1.4. Slag Conveyor No.- SLC#3

1.1.4.1. This belt conveyor shall receive the material from SLC#2 at the junction house JH#4. SLC#3 shall be laid parallel to the scrap highlinetrack and shall have sufficient clearance from the track. SLC#3 shall have a tripper facility for a minimum tripper travel length of 70m withchute for slag disposal at both side of the conveyor.

1.1.4.2. SLC#3 shall have tripper facility with chute for disposal at both sides and having

isolation mechanism. The tripper shall have movement

1.1.4.3. **F**or 70m minimum. The angle of inclination of the chute shall be such that flow of slag is ensured without jamming. On one side, thedisposal of slag shall be at the centre line of the track for loading intothe flat rail wagons while on the other side, it will be disposed at ground and transported through road.

1.2. EXISTING FACILITIES

1.2.1. The complete slag discharged from the INBA system shall be carried through a series of belt conveyors up to Junction House No.5 (JH#5)as shown in the attached layout drawing.

1.2.2. Existing Junction house JH#2 has been provided with by-pass chute arrangement for dumping of granulated slag in case of any breakdown/ emergency in the slag disposal yard.

1.2.3. Slag conveyor SLC#1, junction house JH#3, conveyor SLC#2 and junction house JH#4 have already been installed.

1.2.4. Battery limit for this project starts from receiving of slag from conveyor SLC#2 in JH#4 inclusive of discharge chute from SLC#2 and its liners.

1.3. OVERVIEW OF THE PROJECT

1.3.1. 1 no. conveyor (SLC#3) with tripper facility shall be installed for disposing the slag generated from the Blast Furnace No.1 near pulverized coal yard of BF4 covering a distance of 120m approximately. Battery limit for this project shall start at JH#4 where slag dispatched by SLC#2 at JH#4 shall be received at tail end of SLC#3. Discharge chute from SLC#2 along with liners shall also be in the scope of the work. The layout has been shown in the attached drawing No. CET RN 3170 ME1 00 002, R=1. The conveyors shall be installed as per the attached drawing no. CET RN 3170 ME1 00 004, R=1 (SLC#3).

1.4. IMPLEMENTATION STRATEGY

1.4.1. This tender specification pertains to “Installation of 1 no. Slag Disposal Conveyors SLC#3 along with Junction House no. 5 (JH#5)”, to beexecuted on turnkey basis which includes installation of conveyors SLC#3 with tripper facility for discharging slag on both sides and with1 no. Junction House (JH#5).

1.4.2. Other Site Related Details:

1.4.2.1. Details of over ground facilities at erection site which may need diversion and special handling equipment to be deployed at site, if any, are to be clearly brought out by the bidder in their offer.

1.4.3. INTENT OF SPECIFICATION

1.4.4. The intent of this tender specification is to furnish required details for enabling the bidder to submit their best offers (technical & commercial) as per the scope of work mentioned at chapter 2.0, technical specifications at chapter 3.0, and commissioning & performance guarantee at chapter 4.0.

1.4.5. This tender specification shall be read in conjunction with other documents enclosed with the NIT.

1.4.6. SITE VISIT AND OTHER REQUIREMENTS

1.4.7. The bidder shall visit the site, study drawings/ documents and discuss with the employer/ consultant, if required, regarding any technical clarification and get satisfied with respect to the nature and extent of work involved. The bidder shall also obtain first-hand information regarding location, work terrain, climate condition, railways, roads, airports and communication etc. before offering the bid for the job.

1.4.8. All materials/ equipment/ machinery/ fabricated items used shall be according to the specification given herein and any deviation should be clearly brought-out in schedules of exclusions and deviations attached with this TS. No mention of exclusions and deviations will mean that the bidder has accepted the scope and specification given herein.

1.4.9. DRAWINGS AND TECHNICAL DOCUMENTS TO BE SUBMITTED WITH THE OFFER

1.4.10. The bidder shall submit along with the bid, drawings / documents / data as per the following details:

1.4.10.1. Electrical single line diagram.

1.4.10.2. Schedule of quantity of equipment, equipment list and document list.

1.4.10.3. Delivery/ commissioning schedule (Bar chart/PERT Network).

1.4.10.4. Weight and mounting arrangement of equipment.

1.4.10.5. Details of major construction equipment required for carrying out the job within the stipulated time which they possess, with location and details of construction equipment, which they would hire to facilitate the dismantling, and construction activities.

1.4.10.6. Drawings & documents listed are minimum requirement only. The bidder shall ensure that all other necessary write-ups, curves and information, required to fully describe the equipment and system offered, are submitted with this offer.

2. SCOPE OF WORK

2.1. GENERAL

2.1.1. The bidder shall be responsible for execution of the various jobs related to mechanical, civil, structural & electrical envisaged for complete erection, testing and commissioning of slag conveyor system which consists of 1 no. belt conveyor SLC#3 with tripper facility along with 1 no. Junction House, electric hoists with monorails for maintenance purpose and other accessories mentioned in the respective clauses of the TS on turnkey basis to the satisfaction of the employer. The conveyors are a part of the INBA Slag Disposal System.

2.1.2. The scope of work shall cover design, engineering, procurement, manufacture, fabrication, supply, transportation, insurance, storage, handling, storing, stacking of all materials including paint materials, dismantling & removal of debris if any, construction, erection, testing, commissioning, stabilisation and demonstration of

performance guarantee of the conveyor which are part of the INBA Slag Disposal **System**. The jobs shall be carried out along with the associated electrical, PC&A, structural, civil and utility jobs mentioned in respective clause no. 2.3, 2.4, 2.5, 2.6 and 2.7 of TS.

2.1.3. All indigenous items shall be as per the "List of Acceptable Makes of equipment and supplies" furnished at Annexure-2.1.3-1.

2.1.4. Also please note that:

2.1.4.1. Where more than one Vendor is listed, the Contractor is free to choose any of them, but it must notify the Employer of its choice well in advance prior to appointing any selected Vendor.

2.1.4.2. The contractor shall not be permitted to propose a new vendor for items where at least three approved vendors are available for providing supplies. However, where at least three vendors are not available to provide supplies, the contractor may propose additional vendors for approval of the employer.

2.1.4.3. No approval of the Employer is required to be obtained by the contractor for procurement of items that are not listed Annexure 2.1.3-1

2.1.5. The equipment and facilities envisaged in this TS shall be located as per general layout drawing nos. CET RN 3170 ME1 00 002, R=1, CET RN 3170 ME1 00 004, R=1 enclosed with the TS. Layout of plant and equipment shall have provision for easy and safe movement of operation/ maintenance personnel for operation/ inspection of the running plant. Adequate space for dismantling/ removal of equipment/ parts for repair shall also be built in the layout.

2.1.6. All the manufacturing/ fabrication works shall be carried out only on the basis of approved drawings and schemes or as directed by the employer. Approval given by the employer shall not relieve the bidder of any obligations under the contract.

2.1.7. Wide Parallel Flange Beam (WPB) and Narrow Parallel Flange Beam (NPB) sections, being produced by SAIL, shall be used. In case of non-availability/non- suitability of WPB or NPB sections, tapered rolled SAIL sections or built-up sections using SAIL steel shall be used. This is in addition to the relevant clauses of SBD with regards to usage of

SAIL steel

2.1.8. Any equipment/ work/ service, which may not have been specifically mentioned in this document but is necessary for completeness of the work, shall be clearly brought out in the bid and included in their scope of work.

2.1.9. Scope of Services:

2.1.10. Receiving of equipment from bidder's stores/ employer's stores and transportation to site.

2.1.11. Unloading of equipment at site, unpacking, cleaning up, and checking for completeness and transportation to site for erection.

2.1.12. Site cleaning, preparation, transferring of centre lines and levels from standard benchmark(s), including geodetic survey, checking & fixing, aligning of structures, final cleaning of site after completion of work.

2.1.13. Filling of lubricants/ grease as per manufacturer's instructions.

2.1.14. Supply of all erection consumables like oil, kerosene, cotton waste, oxygen and acetylene gas cylinders, electrodes, asbestos sheets, asbestos ropes, sealing compounds etc.

2.1.15. Arranging tools, tackles, cranes and other handling equipment, scaffolding, temporary platforms, erection fixtures etc.

2.1.16. Required loading/ unloading / transportation of the equipment part, which may require repairs at employer's repair shop(s).

2.1.17. Arranging inspection of equipment at manufacturer's/ sub- supplier's works wherever required as per approved QAP.

2.1.18. Arranging and rendering equipment and personnel to employer for checking the correctness of the work in progress.

2.1.19. Submission of test certificates and data sheet from approved third part testing

laboratory or manufacturer respectively

2.1.20. All equipment shall conform to the relevant provisions of Statutory and other Regulations in force such as Indian explosives Act, Indian Factories Act, Indian Boiler Regulation, State Factories Act, Indian Electricity Rules, Central Pollution Control Board and Indian Weights & Measures Act as applicable. The bidder shall provide all necessary assistance to the employer to get all the installations within the scope of supply approved by the concerned legal authorities.

2.1.21. Any rectification/ modification of existing facilities required during erection of equipment.

2.1.22. The bidder shall be responsible for protection and/ or diversion of underground and all existing over-ground services, wherever required and/ or diversion of the underground services which are indicated in the drawing made available to the bidder. In case there are under-ground services which need to be protected and/ or diverted but are not shown in the drawing, the bidder shall be responsible to execute the same at extra price, if any, to be mutually agreed between bidder & employer.

2.1.23. Sundry works such as making of holes, grouting, chiseling of holes/ opening through walls, ceiling, floors, steel structures, etc. including providing inserts as per requirement, cleaning of site periodically and at the time of final handing over.

2.1.24. Periodic transportation including Loading, unloading and spreading the unserviceable material, debris & surplus excavated earth with all lift and lead within plant premises unless otherwise specified.

2.1.25. All instructions in the manuals for assembly, erection, testing and commissioning of the equipment shall be in English.

2.1.26. Clearance of installations from the statutory and other concerned authorities on behalf of Employer. The successful bidder shall also assist in preparing application forms, providing necessary drawings, documents, test certificates etc., including necessary co-ordination with statutory and other concerned authorities

2.1.27. Implementation Schedule

2.1.28. The project shall be implemented within a period of 10 months from the effective date of contract up to commissioning.

2.1.29. An indicative implementation schedule is shown at Annexure 2.1.9.2-1. However, the bidder may improve upon the same and submit a schedule with their offer, showing all major activities, with respective duration proposed.

2.1.30. Discipline wise scope of work has been elaborated in the subsequent clauses of this chapter.

2.1.31. MECHANICAL

2.1.32. The following technical details of belt conveyor system in addition to the job mentioned

under Clause no. 2.1 and its sub clauses of the TS shall be considered under the scope of work:

2.1.33. Bidder shall follow the General Layout (GL) of the conveyors (SLC#1, SLC#2 & SLC#3) and General Arrangement (GA) drawing of the conveyors attached with the TS vide drawing nos. CET RN 3170 ME1 00 002, 004, R=1 respectively as a basis of design for the proposed conveyors. Length (centre to centre) of SLC#3 shall be 120m (approx.) with a tripper travel length of 70m (approx.) SLC#3 shall be laid parallel to the scrap highline track and shall have sufficient clearance from the track.

2.1.34. The conveying lengths mentioned above are indicative and the exact length shall be finalised during detail engineering.

2.1.35. The conveyor shall have dual drive facility (one working and one standby).

2.1.36. SLC#3 shall have junction house (JH#5) at its head end respectively. JH#5 shall be equipped with 1 electric hoist of 3t capacity at head end of conveyor SLC#3 and 1 electric hoist of 5t capacity for maintenance of mobile tripper.

2.1.37. Belt changing facility shall be provided with the conveyor.

2.1.38. SLC#3 shall have tripper facility with bifurcated chute for disposal at both sides and having motorized flap gates isolation mechanism. The tripper shall have movement for

70m minimum. On one side, the disposal of slag shall be at the centre line of the track forloading into the flat rail wagons while on the other side, it will be disposed at ground and transported through road. The chute shall be designed for disposal at the center line of the track. The tripper chute shall be lined with suitable lining material to ensure smooth slag flow and long life.

2.1.39. Discharge chute with manganese liners shall be considered for discharge of material from SLC#2 to SLC#3 at Junction House No.4.

2.1.40. The conveyor system shall have the following minimum items:

2.1.41. Conveyor belting

2.1.42. Electric motors

2.1.43. Gearbox

2.1.44. Fluid coupling (input)

2.1.45. Pin-bush coupling (output)

2.1.46. Pulleys

2.1.47. Idlers & idler brackets

2.1.48. Bearings and Plummer blocks

2.1.49. External & Internal belt scrapers

2.1.50. Safety switches

2.1.51. Take-ups and transfer towers.

2.1.52. Suitable maintenance & handling facilities for drive and non- drive ends

2.1.53. Motorised mobile tripper with travel of 70m minimum having both side discharge with electromechanical flap gate.

2.1.54. The belt width shall be 1200mm. The conveyor gallery shall be covered having clear walkways of width 1000mm on both sides. The conveyor shall have a maintenance walkway (750mm approx.) in between the tripper discharge chute and the belt.

2.1.55. The belt conveyor shall be provided with suitable belt guard along with the cleaning provision.

2.1.56. The general technical specification of the conveyor, SLC#3 are given in the TS clause no. 3.2.

2.1.57. Distance between the finished floor level of the drive pulley and bottom level of monorail beam at junction houses shall be minimum 5m.

3. TECHNICAL SPECIFICATION:

3.1. ELECTRICAL

3.1.1. The broad scope of electrical system shall include design, engineering, supply, erection, testing & commissioning of complete electrics as given below:

3.1.1.1. One no. Motor Control centre (MCC) including auxiliary relay panel. This MCC shall feed all the loads for the electrical equipment under the scope of this TS including belt conveyor, motor of existing SLC#1 and SLC#2 conveyor, PDB and any other load under the scope of this TS.

3.1.1.2. Power for the new MCC (Incomer-1 and 2) shall be taken from existing LCSS -1 Substation with necessary ACB feeder extension at both sections (total 2 nos. 800A ACB extension).

3.1.1.3. One no. new PDB having two incomers and bus coupler shall be provided. This PDB shall be feed ventilation system and auxiliary PDB (for loads like hoist, welding etc.) any other auxiliary loads.

3.1.1.4. Complete electrics related to tripper conveyor shall be under the scope including cables and cabling arrangement, Trailing cable arrangement, panels, field equipment, brake panel and all accessories related to tripper conveyor.

3.1.1.5. Hooking up of the conveying system under this TS and existing SLC#1 and SLC#2 conveyor with the existing automation system (Rockwell PLC system) shall be under the scope of the bidder, which shall include necessary modification& addition in the existing PLC Hardware's(like IOs, racks if required, other items) and Software. It should

be in line with the present system configuration. All the Input and out puts of the SLC#1,2 &3 are to be integrated with existing Rockwell PLC of BF#1 INBA. Integration of software and hardwares are to be supplied and commissioned by the bidder with assistance from RSP.

3.1.1.6. Local control stations (LCS) shall be provided for all the motorized equipment. LCS shall be of Poly carbonate material.

3.1.1.7. One no. Auxiliary PDB shall be provided by the bidder at SLC#3 Junction house for welding machine, Electric Hoist and other auxiliary power requirements.

3.1.1.8. Complete illumination for the proposed conveyor system along with junction house under this TS shall be under the scope. 20A, 230 Volt AC switch sockets shall be provided at 25-meter intervals for the conveyor under this TS. Source for the illumination shall be taken from existing MLDB at BF#1substation by suitable extension. For yard lighting on both side of conveyor SLC#3, 20 nos. 400W LED flood lights (10 nos. at each side of conveyor) shall be provided. SLDBs with timer circuit are to be given for individual conveyors and yard lighting.

3.1.1.9. Complete earthing & lightning protection system associated with the proposed system under this TS.

3.1.1.10. One no. 63A welding Socket with ELCB shall be provided at the junction house. This welding socket shall be fed from the PDB.

3.1.1.11. Pull cord switches (PSS), belt sway switches (BSS) and zero speed switches (ZSS) shall be provided for the conveyor under this TS. PCS and BSS shall be addressable type with indicating lamp for easy identification of the switch and shall communicate with the existing PLC. Additionally a common hardwired interlocking shall be provided with the MCC control circuit.

3.1.2. Complete power & control cables, cabling arrangement including cable trays, GI conduits, supports, termination, glands, junction boxes and all cabling accessories as required for the proposed system under this TS and interfacing with existing system shall be under the scope. Power cables of existing SLC#1 & SLC#2 conveyors will be diverted from existing MCC to new MCC. For diverting the cables, if additional length of power cables are required, same shall be provided by the bidder with cable jointing.

New Junction box will be provided at the existing MCC room for all the control cables of existing SLC#1 & SLC#2 conveyors. New control cables will be provided from the junction box up to the proposed new MCC panel. Control cables along with cabling arrangement as required for interfacing of new SLC#3 conveyor and existing SLC#1 and SLC#2 conveyor with existing Rockwell PLC shall be under the scope.

3.1.3. Brake panel for the conveyor shall be under the scope. Brake supply shall be 220V DC. All brake units shall have standby rectifier unit. DCEM brake circuit shall have economy resistance.

3.1.4. Complete electrics for hoists shall be under the scope. Power feeder for the electric hoists shall be taken from new PDB with required cables. Electrical hoist panels are to be fixed at the floor and control supply should be 240-volt AC. DC Electromagnetic brakes of 220-volt DC to be provided for all hoists.

3.1.5. Bidder's scope shall include all the LT motors as required for the proposed system.

3.1.6. The conveyor belt motor shall have power junction boxes near the motor. Connections of

the motor from the power junction boxes shall be done with copper flexible cables. Power and control junction boxes shall be of poly carbonate enclosure and shall have double door. For all the redundant/ dual drive system, a junction box shall be provided with link arrangement for connection with both motors. Link panel shall have cables up to the local junction box. From local J/B to motor, flexible copper cable shall be provided. . Power JBs shall be provided with Bus Bar arrangement inside the JB.

3.1.7. 240 Volt Distribution boards are to be given at each junction house. Power to be taken from the SLDB of each junction house.

3.1.8. Bidder's scope shall include submission of drawings and documents for approval/reference.

3.2. PROCESS CONTROL & AUTOMATION

3.2.1. Electrical room and cable cellar shall be covered under the scope of FDA (Fire Detection

and Alarm) System. Requisite FDA equipment (multi-criteria detectors etc.) shall be provided for the electrical room and cable cellar and the same shall be suitably integrated with the existent FDA System. All cables, cabling accessories, hardware and works needed to achieve the above-mentioned integration shall be in bidder's scope.

3.2.2. One (01) set of belt-scale (belt weighing) system shall be provided for the new disposal conveyor. Continuous, analogue signal from the same shall be hooked-up with the existing ROCKWELL make INBA PLC located in INBA – 1 control room through paired signal cable. Spare Analogue Input (AI) for such hooking-up is already available in the INBA PLC and necessary PLC & HMI software modifications shall be carried out by the bidder with RSP‟s assistance in the existent ROCKWELL makes INBA PLC for incorporation of the new belt-scale signal (AI).

3.2.3. 02 nos. of IP based, fixed-type CCTV cameras for slag loading/ unloading yard along with 02 nos. of 32-inch monitors shall be provided. One monitor shall be installed in the BF – 1 Main Control room and the other monitor shall be installed in the Blast Furnace Shipping Office.

3.2.4. UPS power supply and distribution equipment for new CCTV system, new belt-scale system etc. shall be provided. The UPS power shall be fed from existing UPS systems. Tapping, rectification, and conversion of required power shall be suitably done. All cables, cabling accessories and hardware needed for the same shall be suitably provided

3.3. STRUCTURAL WORKS

3.3.1. The scope of structural steelwork and cladding work covers design, engineering, preparation of drawings, supply of all materials including paint materials, fabrication, erection, loading, unloading, transportation, inspection, painting, dismantling of existing structures including disposal (if any), testing and commissioning involved for the Installation of slag conveyor SLC#3 of RSP.

3.3.2. The following gives only general description of structural steel works under the Bidder's scope of work. The structural steelwork shall not be limited to these but shall be guided by mechanical/technological scope of work and specification covered in chapter 3.

3.3.2.1. Structural covered shed with both side walkways for tripper conveyor from JH#4 to JH#5.

3.3.2.2. Covered Junction house (JH#5) including different level platforms, stairs and handling facilities. Flooring shall be of RCC slab over steel beams.

3.3.2.3. All the conveyor galleries and junction houses shall be covered with galvanized color coated sheets.

3.3.2.4. Painting of new structures as per specification

3.3.3. Scope of Services:

3.3.3.1. The bidder shall submit all GA/ Design drawings along with supporting design calculations to the employer and shall obtain employer's approval (after incorporating employer's comments/ observations if any) on them prior to preparing fabrication drawings. The Employer reserves the right of offering, at his discretion, his comments/ observations on them which the Bidder shall incorporate in his drawings to the satisfaction of the Employer and submit the revised drawings. Design drawings shall be submitted for approval while design calculation shall be under reference category

3.3.3.2. The bidder shall remain fully responsible for the completeness, adequacy, correctness of his design and successful implementation and satisfactory performance of the equipment/ structures.

3.3.3.3. Bidder shall prepare fabrication drawings based on approved GA/ design drawings prior to start of actual fabrication. Fabrication drawings along with BOQ shall be prepared in strict adherence to the approved design drawings. Bidder shall submit fabrication drawings (based on approved GA/ design drawing) along with BOQ to the Employer for record purposes. Soft copies of "As-Built" drawings shall be submitted to the employer after the completion of erection for records.

3.3.3.4. Structural analysis shall be carried out using STAADPRO software. However, major load carrying members shall be designed in manually/excel format. Input load data shall be calculated manually and clearly shown with the help of diagrams and submitted along

with design calculations.

3.3.3.5. Bidder shall procure all raw structural steel from SAIL Stockyard on chargeable basis. Please refer to the commercial terms and conditions for issue of steel. Transportation from store/ stockyard & handling of raw and fabricated steel shall be in the scope of the Bidder

3.3.3.6. Bidder, prior to submission of his offer, visit the site and make himself acquainted with the site condition.

3.3.3.7. Supply of materials for fabrication, transportation, delivery and storage of the equipment, including erection bolts, fixtures, all consumables, handling equipment, labour etc. complete in all respects shall be in the scope of the bidder.

3.3.3.8. Erection of equipment as well as fabricated structures (including tools, tackles, labour, cranes, handling equipment and any staging or false work required for erection), alignment, leveling, fixing, bolting/ welding, inspection and testing of weld shall also be considered in the scope.

3.3.3.9. All necessary site measurement and study of available existing drawings as may be required for developing the aforesaid design and drawings shall also be deemed to be under the scope of the bidder.

3.3.3.10. Mobile equipment and cranes including Tower crane as may be required to facilitate dismantling, handling and erection and shall be supplied by the bidder along with all construction and erection materials, equipment and consumable including, but not limited to, gauges, welding, brazing, gases and rods, electrodes and wires, oxygen, acetylene, fuel, bolts, nuts, washers, shims and temporary support etc. as required for incidental work and for the completion of erection work.

3.3.3.11. Inspection, testing and commissioning of all steel structures shall be in scope of work of the bidder.

3.3.3.12. CIVIL WORKS

3.3.3.13. Civil works for INBA Slag Disposal System, in addition to clause 2.1 is elaborated as under.

3.3.3.14. RCC foundations for 2 legged & 4-legged structural steel trestles for conveyors. The walkways in conveyor galleries shall be provided over the structural steel frame works in pre-cast RCC construction with required floor finish.

3.3.3.15. RCC foundations for junction house. The working floors of junction shall be provided over the structural steel frame works in RCC construction with required floor finish.

3.3.3.16. RCC framework for tripper conveyor with provision of supporting structural steel shed conveyors & equipment over it including RCC walkways, all inserts, embedment, bolts etc.

3.3.3.17. The RCC framework shall be provided at least up to the height where the slag will come in contact with frame elements. Moreover, end frames shall be provided with RCC walls to prevent spillage of slag in outside areas.

3.3.3.18. Area development between the railway tracks by bush/shrub cutting, area gradation, RCC floor over stone pitching on the slope of highline track and compacted boulder soling in slag storage area, RCC retaining wall for protection of railway track at lower elevation, drainage network (covered) in RCC construction & its interconnection with existing drain, approach road & its interconnection with nearest existing plant road shall also be under the scope of work.

3.3.3.19. Construction of MCC room with cable cellar in main ECR building, in RCC framed construction with brick cladding walls with all finishes, RCC floor, exterior emulsion paint, internal acrylic emulsion paint, roof treatment with 4mm thick APP membrane as per manufacturer's specifications and screed concrete of grade M-20 in proper slope (minimum thickness 25mm) over APP, doors, windows, rolling shutter etc. complete.

3.3.3.20. This room shall be located at the free space on the roof of main ECR building between axis 5 & 6 and row A‟ to B. The disposition & levels of column, beam & slab and floor finish of the new room, shall match with interconnected existing panel room.

3.3.3.21. Other works for integration of proposed MCC room with main ECR building such as drilling hole and fixing stub bars by means of chemical/ epoxy grout for columns, beams & slab and/or dismantling of RCC element and integrating the reinforcement by means of double pin joint (as per SP:34), epoxy based bonding agent, interconnecting door

between new room & existing building, fire escape door towards roof, structural steel staircase for fire exit, dismantling of RCC, PCC & brick work, inserts etc. shall be under the scope of bidder. The floor finish in the new room shall be same as interconnected existing panel room.

3.3.3.22. The work shall be carried out in such a way to cause minimal or no disturbance to the operation of existing MCC room. Any existing facility, which got disturbed during the execution, shall be brought to its original form by the bidder at his own cost up to the satisfaction of executing authority.

3.3.3.23. The scope of civil works also covers all associated works such as excavation, PCC, grouting, shuttering & centering, scaffolding, inserts, bolts and other embedment etc. as per the technological requirements.

3.3.3.24. Dismantling of RCC, PCC & Brickwork as required or encountered during execution of civil works shall be under the scope of civil works. This also includes loading, transportation, unloading and dumping within plant boundary as per instructions of Engineer-In- Charge. Miscellaneous works such as dismantling & reconstruction of surface drain, cleaning of site etc., if any, shall be under the scope of work.

3.3.3.25. The scope of works for the bidder shall also include procuring, hiring of equipment, machines, materials & labour for the execution of the jobs. No separate payment shall be made towards this.

3.3.3.26. The bidder shall render all labour, tools and appliances to the employer for day-to-day supervision of the work & checking of the accuracy of works. The bidder shall also be responsible for co-ordination with other agencies working for the successful and timely implementation of the work. The bidder shall abide by the safety rules of the RSP and all rules imposed by State Government & Central Government as in force.

3.4. UTILITY:

3.4.1. VENTILATION SYSTEM:

3.4.1.1. For smooth and trouble free operation of electrical and electronic equipment inside the following premises mentioned below shall be provided with Dry Pressurized

Ventilation System.

3.4.1.2. TABLE

Sl. No.	Premises	System description
1	New Electrical room	Dry Pressurized Ventilation System
2	Cable cellar below new Electrical room	Dry Pressurized Ventilation System

3.4.1.3. The Ventilation system as listed above shall be complete along with all required Electrics and cables.

3.4.1.4. All civil, structural work required for the installation of the ventilation system. Necessary wall/ floor openings for pipes, ducts & cables and making them good to the original finish of the building

3.4.1.5. Fire Fighting System

3.4.1.6. The conveyor gallery shall be equipped with water based firefighting system. For this, firefighting water header of DN 100 along the gallery of proposed conveyor for firefighting purpose shall be provided. New line shall be tapped from nearest existing fire water header. Isolation valve shall be provided at the tapping point.

3.4.1.7. Pipelines along with isolation valves and landing valves, hoses, including quick coupling and nozzle shall be provided as per requirement inside the gallery and junction house.

3.5. DRAWINGS AND TECHNICAL DOCUMENTS:

3.5.1. Following drawings and documents are to be submitted by the bidder within 30 days of effective date of contract.

3.5.2. A drawing including plan, elevation and section of conveyor showing slag receiving

arrangement from SLC#2.

3.5.3. GA drawing of conveyor drive arrangement.

3.5.4. Drawing and document list.

3.5.5. The following drawings/ documents shall be submitted by the bidder after placement of order:-

3.5.6. TABLE

Discipline	Description
Mechanical	1) GA drawing inclusive of slag receiving arrangement from SLC#2 conveyor. The drawing shall be complete with all major components with relevant views, technical details, dimensions, B.O.M., weight andmounting arrangement of equipment etc. 2) GA drawing of mobile tripper, Chutes withgate arrangement etc. 3) L-2 network (To be submitted within 3 weeks of placement of order)
	4) GA of conveyor drive arrangement and itscomponents 5) Reference Sizing for complete drive system. 6) Technical specification/ data sheet of allequipment 7) Bill of material 8) Quality Assurance Plan for all areas
Electrical	1. Single line diagram 2. Electrical equipment layout drawing 3. GA, BOM, schematic diagram of all electricalpanels 4. Technical datasheet of all equipment 5. Cable schedule 6. Drawing for Interfacing with existing PLC 7. Illumination drawings 8. Earthing and lightning protection drawings

Discipline	Description
Structural	1. Design criteria 2. G.A & design drawings along with supportingdesign calculation.
Civil	1. All civil drawings including shuttering details ,reinforcements details, bar-bending schedules along with supporting design calculations
Utility	1. GA and detail drawings of firefighting system. 2. GA and detail drawings of dry pressurizedventilation system
Manuals	1. Operation Manual 2. Maintenance Manual 3. Erection Manual

3.5.6.1. The drawings/ documents submitted after placement of order shall be submitted for approval as per SBD Cl. No. 20.3. The drawings of sub-suppliers shall be duly vetted and stamped by the principal bidder before submission to employer.

3.5.6.2. Drawings shall be submitted in pre-decided and agreed sequence. In order to expedite the approval of drawings, engineering meeting shall be routinely held with the bidder at plant/ consultant's location every 2 to 4 weeks for clearing of drawings across the table and sorting out issues, if any. These meetings are to be held during the entire engineering phase of a project.

3.6. Drawing/ Document Submission Methodology:

3.6.1. The bidder shall submit 2 hard copies of the drawing to the consultant and 3 hard copies to the employer for approval in accordance with SBD sub-clause 20.3.1 to 20.3.3. Within fourteen (14) days after receipt by the Project Manager/Consultant of any drawing/ document, the comment of consultant along with the comments from the employer shall be incorporated in the hard copy and necessary stamping shall be done by the consultant. Scanned copy of the stamped drawing shall then be mailed to the bidder by the consultant. Within seven (7) days after receipt of the scanned copy of the drawing from consultant through e-mail, the bidder shall take out 5 prints of the same

and out of these, 4 hard copies shall be sent to the employer and one hard copy shall be sent to the consultant.

3.6.2. In case, the drawing is not approved, the bidder shall prepare the revised drawing, after suitably incorporating the comments given by employer/ consultant, and submit the same for approval, in 2 hard copies of the drawing to the consultant and 3 hard copies to the employer for scrutiny within 10 days from the receipt of scanned copies from the consultant. The above process shall be continued till the drawing is approved.

3.6.3. After approval and stamping, the consultant shall send the scanned copy of the approved drawing to the bidder by e-mail. Within seven

3.6.4. (7) days after receipt of the scanned copy of the drawing from consultant through e-mail, the bidder shall take out 5 prints of the same and out of these, 4 hard copies shall be sent to the employer and 1 hard copy shall be sent to the consultant. In addition to the above, bidder shall also submit all the drawings in soft format in suitable media for approval/ reference etc.

3.6.5. Format of bidder drawing list shall have minimum following fields:-

3.6.5.1. Sl. No.

3.6.5.2. Employer drawing No

3.6.5.3. Bidder drawing No

3.6.5.4. Name of consortium member

3.6.5.5. Area

3.6.5.6. Drawing/Document Name

3.6.5.7. Category (Approval/Reference)

3.6.5.8. Discipline

3.6.5.9. Stage (BE/DE)

3.6.5.10. Schedule date of submission

3.6.5.11. Remarks

3.6.6. Drawing list shall be in MS-excel format. Any additional field, if required, shall be added after Column 11. In case the drawing has more than one sheet, employer drawing shall include the sheet number as part of drawing number.

3.6.7. Editable format soft copies (3 sets) on CD/DVD of all "As-Built" drawings (full set of drawings as per the approved drawing list) and manufacturing drawings of critical parts, spares and fast wearing parts shall be supplied by the bidder.

3.6.8. In case the proposed plant uses any process, equipment or software which is covered under any patent and SAIL/RSP is required to have the relevant user's license for the same, the scope of work of this tender shall include transferring such licenses to SAIL and indemnifying SAIL against infringement of any intellectual property rights.

3.7. BATTERY LIMIT:

3.7.1. Battery limit for each area shall be as specified as below:-(TABLE)

Incoming	ABC
Mechanical, Civil & Structural	The battery limit of the scope of work under this TS shall start after Junction House No.4 (JH#4) where slag dispatched by Slag Disposal Conveyor SLC#2 at JH#4 shall be received at tail end of Slag Conveyor No. SLC#3. The layout has been shown in the attached drawing No**. CET RN 3170 ME1 00 002, R=1**. The conveyors shall be installed as per the attached layout drawing no. **CET RN 3170 ME1 00 004, R=1 (SLC#3).**

Incoming	ABC
Electrical	415V Power Source Tapping Incoming power for the new MCC shall be taken by breaker extension at both sections of PCC located in BF#1 substation. Incoming power for lighting shall be taken by extension ofexisting MLDB at BF#1 substation.

3.8. EMPLOYER'S OBLIGATION:

3.8.1. Construction water and power shall be provided to the bidder as per SBD Cl. No. 20.4.2 and 20.4.3.

3.8.2. The bidder will identify any hazard / risks which may result in fatal accidents / severe damage to human health and safety, damage to equipment and material resulting in loss of time and having cost implication. The bidder will carry out the above assessment and formulate appropriate action plan to prevent such incidents. This action plan shall be submitted to the Employer before start of the work.

4. TECHNICAL SPECIFICATION:

4.1. GENERAL:

4.1.1. Location-Rourkela Steel Plant is located in the north-western tip of Odisha and at the heart of a rich mineral belt. It is well connected by both railways and road transport. The nearest railway station is Rourkela on the Howrah- Mumbai rail mainline. Rourkela is very well connected with most of the important cities of India.

4.1.2. Site Location-The plant site is about 2 km(s) from Rourkela Railway Station. BF#1 is the end furnace of BF shop. Bidder shall plan all the work under his scope without affecting the existing set up of the plant.

4.1.3. Climatic Conditions-Climatic data in the vicinity of the Plant is as follows:

4.1.3.1. TABLE

A	B	C
1.	Barometric Pressure	760 mm of Hg
2.	Ambient Temperature	55°C(Max.) and 8°C (min.)
3.	Relative Humidity	100% (max.)
4.	Wind Load	As per IS 875:1987(Part-3)
5.	Earthquake Load	As per IS 1893:2002(Part-1)
6.	Atmospheric Condition	Dust Laden

4.1.3.2. However, maximum temperature and maximum relative humidity shallnot occur at the same time

4.1.3.3. Atmospheric Condition Dust Laden

4.1.4. Nearest Airport-The nearby airports are Ranchi (173 km), Bhubaneswar (378 km) and Kolkata (413 km).

4.1.5. Sea Port-The site can be served by both Kolkata and Haldia ports which are approximately 413 km away from the site by rail.

4.1.6. Communication Facilities-Postal, Telegraph, Telephone, Internet and Fax facilities are available at Rourkela.

4.2. MECHANICAL

4.2.1. This specification covering broad technical parameters and requirements shall be applicable for design, manufacture, supply, erection, painting, testing and commissioning of equipment complete with standard accessories:

5. Design criteria for belt conveyor system and accessories:

5.1. Application

5.1.1. This covers general requirements for belt conveyor for handling of proposed material. Specific requirement and layout shall be as per Technical Specification and drawings mentioned in this document.

5.1.2. The belt conveyors shall include all types of pulleys, idlers, belting, drive unit, drive frame, head frame, tail frame, take-up unit, short post, stringer channel, deck plate, seal plate, discharge chute, skirt board, external scraper, internal scraper, protection switches, protection cage, fastener between equipment and its support.

5.1.3. Design of Belt Conveyors

5.1.3.1. Belt Conveyors shall be designed as given below:-(TABLE)

S.N.	**Item**	**Description**
i.	Belt Conveyors	IS 11592:2000 However, the design capacity of the conveyor belts shall be 1.2 times of the rated capacity and the design factor for kW calculation of the motor shall also be 1.2
ii.	Maximum percentage loading	70% of rated capacity
iii.	Gearbox	kW ratings of gearbox=1.8 x Selected Motor

S.N.	Item	Description
		kW
iv.	High Speed Fluid Coupling	Rating of High- S p e e d Coupling =SelectedMotor kW
v.	Low Speed Coupling (Kw/ rpm)	=(Selectedmotor kW*1.5) / (Motor rpm/reduction ratio)
vi.	Braking Torque (DCEM) (Nm)	=(Selected motor kW*1.36*1.5*4500*10) /(2*3.14*Motor rpm)
vii.	Pulleys	IPSS: 2-03-007-88 / Equivalent internationalstandard
viii.	Idlers	IS 8598:1987
ix.	Plummer Blocks	Plummer blocks for pulleys shall be with 4 bolts (both mounting and cap) andhorizontally split type construction made of cast iron.
x.	Take-up Arrangements	Vertical gravity takes up as per IS 11592:2000
xi.	Take up travel	2.5% * Belt C/C distance(mm) + 600 mm

5.1.3.2. Broad technical parameter of the new belt conveyors shall be as below:(TABLE)

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
	Rated Capacity (tph)	900
	Designed capacity (tph)	1080
	Material to be handled	Granulated slag

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
	Bulk density (t/m^3)	1
	Lump size (mm)	0-6
	Moisture (%)	15
	Ambient temp (°C)	50^0C
	Belt Width (mm)	1200
	C/C Length (m)	120 (indicative)
	Lift (m)	6 (approx.)
	Belt Speed (m/s)	2.5
	Length of skirt (m)	6
	Deck plate thickness (mm)	3.15
	Take Up	VGTU
i.	Belting	
	Type	Nylon/ Nylon
	Rating	800/4 HD
	Cover grade	HR T1
	Top cover	5mm
	Bottom cover	2mm
ii.	**Drive System**	
	Electric Motors	
	Type	TEFC Sq. Cage Induction

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
		Motor
	Quantity (No.)	2 (One working one standby installed on other side of the drive pulley for quick changeover)
	Rating(kW)	As per design calculation (75kW minimum)
	Starting	DOL
	Speed (rpm)	1500
iii.	Gear Boxes	
	Type	Triple Stage Helical withHold back
	Quantity(No.)	2
	Reduction ratio	As per requirement
	Nominal rating (kW)	1.8 times selected motorkW
iv.	High Speed Coupling	
	Type	Fluid Coupling
	Quantity(No.)	2
	Rating (kW)	Selected motor kW
v.	Low Speed Coupling	

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
	Type	Pin Bush
	Quantity(No.)	2
	Rating (kW/ rpm)	=(Selected motor kW*1.5) / (Motor rpm/reductionratio)
vi.	Brakes	
	Type	DCEM. Braking torqueshall be as per requirement.
	Brake Drum (dia.) mm	As per requirement
	Quantity	2
vii.	**Pulleys**	
	Drive Pulley	
	Quantity (No.)	1
	Pulley diameter (unlagged) (mm) (minimum)	800
	Pulley face width (mm)	1400
	Bearing C/C (mm)	1850
	Shell thickness(mm)	16
	Shaft Dia. at bearing (mm)-both sides extended	160 (minimum)
	Tail, Take up, Bend and tripper Pulley	
	Quantity (No.)	As per requirement
	Pulley diameter (unlagged) (mm)	630

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
	Pulley face width (mm)	1400
	Bearing c/c (mm)	1850
	Shell thickness(mm)	16
	Shaft Dia. at bearing (mm)	140
	Snub Pulley	
	Quantity (No.)	2 (one at drive pulley and one at tail pulley end)
	Pulley diameter (unlagged) (mm)	500
	Pulley face width (mm)	1400
	Bearing c/c (mm)	1850
	Shell thickness(mm)	12
	Shaft Dia. (mm)	80
viii.	**Idlers**	
	Carrying idler	3 equal rolls
	Quantity (sets)	As per requirement
	Troughing angle	35^0
	Belt width (mm)	1200
	Idler diameter (mm)	152.4
	Length per roll (mm)	465
	Type	Inline (1490-hole CRS)
	Impact idler	3 equal rolls
	Quantity (sets)	As per requirement
	Troughing angle	35^0

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
	Belt width (mm)	1200
	Idler diameter (mm)	152.4
	Length per roll (mm)	465
	Type	Inline (1490-hole CRS)
	Return idler	Return @ 3000mm, singleroll
	Quantity (sets)	As per requirement
	Belt width (mm)	1200
	Idler diameter (mm)	152.4
	Length of roll (mm)	1400
	Type	Inline (1490-hole CRS)
	Self-aligning carrying idler	@ 15000mm in between and 4000mm from headpulley, 3 equal rolls
	Troughing angle	350
	Belt width (mm)	1200
	Idler diameter (mm)	152.4
	Length per roll (mm)	465
	Type	Inline (1490-hole CRS)
	Self-aligning return idler	Return @ 30000 mm and4000 mm from head pulley, single roll
	Belt width (mm)	1200
	Idler diameter (mm)	152.4
	Length per roll (mm)	1400
	Type	Inline (1490-hole CRS)
	Transition idler	3 equal rolls

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
	Troughing angle	20^0 (2 sets) and 10^0 (2sets)
	Belt width (mm)	1200
	Idler diameter (mm)	152.4
	Length per roll (mm)	465
	Type	Inline (1490-hole CRS)
ix.	**External scrapper**	
	Type	Primary scrapper: Sprung bladed with modular segment and PUtip. Spring shall be provided at both sides ofthe scrapper. Secondary scrapper:Spring bladed with modular segment, tungsten tip. Spring shall be provided at both sides of the scrapper
	Location	Discharge pulley ofconveyor.
	Internal scrapper	
	Type	V-plough
	Location	Upper side of the returnbelt near tail end. Scrapper shall be mounted on SS plate along with SS fastener.

S.N.	Item	Description
	Belt Conveyor Detail	**Belt Conveyor SLC#3**
x.	**Self-driven Mobile Tripper**	Yes
	Drive for mobile tripper	2 nos.
	Scrapper	Primary and secondary scrapper at discharge pulley of the tripper
	Gate changing device	Motorised flap gate to beprovided
	Discharge	Discharge at both ends through bifurcated chutehaving motorised flap gate.

5.1.3.3. Minimum shell thickness of idler shall be 5.4mm. Shaft diameter at bearing shall be 30mm for all carrying & return idlers. For impact idlers, the shaft dia. shall be 35mm.

5.2. STEEL STRUCTURE:

5.2.1.1. Steel structure specified herein shall be applied to steel structures such as conveyor stringers, short posts, head frame, drive frame, take up structure, tail frame etc. The spacing of short posts of conveyors shall not exceed 3000 mm. The construction of stringer and short post shall be of ISMC 125 (minimum section).

5.2.1.2. Construction of steel structures shall be rigid being made by shaped steel and steel plate.

5.2.1.3. Conveyors shall be provided with continuous steel deck sheet of

5.2.1.4. 3.15 mm thickness.

5.2.1.5. Conveyors shall be provided with skirt plate of 6m length at every discharge point.

5.2.1.6. Couplings shall be covered with protection covers made of 3.15 mm thick sheet.

5.2.1.7. Tail pulleys shall be covered with protection cages.

5.2.1.8. Belt changing arrangement/provision shall be provided. 2 nos. pulley of 400mm dia. having shaft dia. 100mm shall be provided in the return belt.

5.2.1.9. Conveyor frames shall be made of joists and/ or channels suitably stiffened and braced. The spacing of supports shall not exceed 3000 mm. Frames shall be connected to floor beams/ civil foundation of junction house by bolting

5.2.1.10. Drive Base Frame- The drive unit consisting of motor, gear-box, coupling and brakes along with protective guards shall have a common base frame and shall be fabricated form heavy structural sections and plates. Suitable bracings should be provided wherever necessary on the drive unit base frame and structure to make it rigid. Proper arrangements shall be provided with gear- boxes and motors to maintain correct alignment with finish pads for mounting. The drive base frames shall be bolted to the structural floor beams/civil foundation of junction houses.

5.3. HEAD PULLEY FRAME, TAIL PULLEY FRAME, & BEND PULLEY FRAME:

5.3.1. The head pulley frame shall be fabricated from steel sections of (minimum) ISMC250 back-to-back with a stiffener plate of 10mm in between them. Suitable bracings should be provided wherever necessary on the base frame and structure to make it rigid. The drive base frames shall be bolted to the structural floor beams/ civil foundation of junction houses.

5.3.2. The tail pulley frame & Bend pulley frame shall be fabricated from steel sections of (minimum) ISMC200 back-to-back with a stiffener plate of 10mm in between them.

5.3.3. Guards on the conveyor shall comply with the relevant IS/IPSS Standard. Safety guards shall be provided for all couplings, brakes etc. of the conveyor drive and screwed on the above base frame

5.4. CHUTES AND LINERS, SKIRT BOARDS AND HOODS:

5.4.1. All transfer points shall be provided with non-choking chutes and shall be designed such that impact of the material on the conveyor is minimum. It shall be designed to ensure continuous flow of material to the centre of the belt. Minimum angle of slope of chute

plate shall be 60 deg. The slope angle shall be suitably increased for handling wet or sticky material.

5.4.2. Chutes shall be made of 12 mm thick MS plates with angle stiffeners and shall be rectangular cross-section with welded connection. Chutes shall be constructed in pieces of suitable size and length so as to facilitate their maintenance. Chute pieces shall be joined together by bolted flange connection with rubber sealing in between two flanges. Inclination angle of chutes shall be sufficient to facilitate easy flow of materials.

5.4.3. All surfaces of chutes shall be provided with 30 mm thick wear resistant manganese steel liners (11-14% manganese steel conforming to IS 276: 2000 (Grade I) fitted with countersunk bolts. Snub pulley and belt cleaner for head pulley shall be provided inside the chute to prevent raw materials from spilling from the conveyors. Each chute shall be provided with inspection hole with hinged cover at suitable height and location. Adequate sized flanged openings with inspection doors are to be provided near bends etc. where there is chance of clogging for inspection and poking to clear the accumulation. Chute construction below gate shall be such that there shall not be any clogging of materials between chute and gate in that zone.

5.4.4. Skirt boards of minimum 6000mm length shall be provided at each feeding point of conveyors and shall terminate above the idler. The width of skirt shall be two third of conveyor width. The thickness of the skirt plate shall be 10 mm with 12 mm thick wear resistant manganese steel liners (11-14% conforming to IS 276: 2000 Grade I) fitted with countersunk bolts. Skirt shall flare slightly outwards in the direction of belt travel to prevent material from wedging. The height of the skirt boards shall be 450 mm and shall be sufficient to contain the material volume as it is loaded on the belt. The skirt plates shall be fitted with rubber strips (100 mm wide x 12mm thick) of hardness 65-700 Shore A by means of vertically slotted holes to permit adjustment. Cut pieces of conveyor belting shall not be used. Rubber strips shall be so fixed as to facilitate easy replacement. Edges of rubber strips shall have an angle for providing better seal. All care shall be taken while designing to combine sealing with minimum belt wear. Rubber curtains shall be provided at the exit of skirt to enclose the chute outlet. The thickness of top cover plate shall be 3.15 mm.

5.4.5. Discharge hood over the head pulley of the conveyors shall be made of 6 mm thick MS plate with stiffeners and shall be provided with hinged and gasket inspection doors with a suitable access to them. The serrated rubber seals shall also be provided at the very inlet of head chute to minimise dust nuisance. Discharge hood shall be detachable type.

6. BELT CLEANERS:

6.1. INTERNAL SCRAPER:

6.1.1. Each belt conveyor shall be provided with 1 No. V-type internal scrapper on the upper side of the return belt near the tail end fitted with wear resistant non-metallic scraper blade to remove spilled materials on the belt. The blade shall be adjustable after the wear. Scrapper shall be mounted on SS plate along with SS fastener

6.2. EXTERNAL BELT CONVEYOR:

6.2.1. Belt conveyor shall be provided with 1 No. sprung bladed tungsten tip type primary belt cleaner and 1 no. polyurethane type secondary belt cleaner with modular segments complete with all accessories at the discharge pulley of the conveyors as well as trippers.

6.2.2. The cleaners shall be mounted on an elastomount system to facilitate automatic blade adjustment on wear. The inclination of the blades should be such as to effect efficient scrapping of the belt. The spring action of the individual metallic blades should ensure constant contact with belt during operation and suitable sprung deflection of contact with uneven surface of the belt. The blades shall be in segments for ease of replacement and mounting on the head pulley frame. The material scrapped should fall inside the discharge chute directly.

6.3. BELT TAKE-UP ARRANGEMENT:

6.3.1. Vertical gravity take-up shall be provided for all the conveyors. Vertical take up shall be complete with pulleys, counter weights & all other accessories. The counter weight shall be of cast iron and each block shall weigh 20 kg approx.. Suitable stair case, handrails etc. shall be provided for maintenance of the vertical gravity take- up system. A protection cage of suitable size and expanded metal construction shall be provided. Necessary safety

arrangement with sand bed shall be provided for the vertical take up system.

6.3.2. 350mm ISMB Monorail beam shall be provided for lifting counterweight in the take-up arrangement.

7. SAFETY SWITCHES:

7.1. PULL CORD SWITCHES:

7.1.1. Pull cord switches shall be provided for emergency stoppage of conveyor. Pull cord switches shall be placed on both sides of the belt conveyor with a spacing of 20 mm in-between them, along the profile of the belt conveyor. Minimum 2 pairs of switches shall be provided if the centre-to-centre distance is less than 20 m. All pull cord switches shall have individual local indication lamps to indicate when operated.

7.2. BELT SWAY SWITCHES:

7.2.1. Belt sway switches shall be provided on each conveyor for protection against excessive sway of the belt. Belt Sway switches shall be placed on both sides of the belt conveyor with a spacing of 20 m in-between them, along the profile of the belt conveyor. Minimum 1 pair of switch shall be provided if the centre-to-centre distance is less than 20 m. A pair of these switches shall also be provided before the belt weighing scale.

7.3. ZERO SPEED SWITCH:

7.3.1. 1 no. zero speed switch shall be provided at tail pulley of all the conveyors.

7.4. BELT SLIP SWITCH:

7.4.1. Belt slip switches shall be provided for each conveyor to stop the drive in case of excessive slippage of belt or over speeding. Provision shall be made such that preceding conveyor does not start unless the running conveyor picks up 80% of the rated speed

7.5. BELT RUPTURE SWITCH:

7.5.1. Belt slip switches shall be provided for each conveyor to stop the drive in case a belt tearing is sensed. The switch shall have IP-65 grade of protection.

7.6. DRIVE SYSTEM:

7.6.1. Drive systems consisting of motors, gearboxes, couplings, brakes etc. as per the system requirement. The design capacity of the conveyor belts shall be 1.2 times of the rated capacity. The details are furnished below:

7.7. GEAR BOXES:

7.7.1. The gearbox casing shall be of fabricated construction and free from harmful defects.

7.7.2. The gearbox shall be selected with a service rating of minimum 1.8 times of motor kW.

7.7.3. Breathers, inspection covers, drain out plugs and dowel holes shall be provided at conveniently accessible location. There shall be a provision for indicating the level of oil. Dowel pins shall be supplied along with the gearbox.

7.7.4. The bearings shall be of antifriction type. The offered bearing life shall be minimum 60000 working hours.

7.7.5. Oil splash lubrication shall be provided.

7.7.6. Every gear box shall have a name plate bearing the following particulars:

7.7.6.1. Manufacturer‟s name, trade-mark and year of manufacture

7.7.6.2. Designation of gear box indicating its size, reduction ratio, input power, input speed and output torque

7.7.6.3. Manufacturer‟s serial number

7.7.7. Every gear box shall be accompanied with the following information

7.7.7.1. Specification and quantity of lubricant

7.7.7.2. Bearings and oil seals used

7.7.7.3. List and specification of wearing parts

7.7.8. The Gearbox input couplings, output couplings and drive pulleys shall be assembled at supplier‟s works by the bidder and shall be dispatched after dismantling the coupling bolts only with half coupling fitted on the respective shafts. Care must be taken while dispatching to avoid any damage to the mounted coupling or shaft. Proper markings are to be given for easy assembling at site

7.8. BRAKES WITH BACK PANEL:

7.8.1. D.C. Electro-magnetic brake shall be provided on all conveyors after calculating the coasting time. Brake shall have min 1.5 times the maximum calculated torque rating.

7.8.2. Brakes shall be mounted on brake drum coupling at input shaft end of gear box. Rectifier panel complete with contactors, timer, fuses, rectifier, resistors etc. shall be provided with each brake

7.9. FLUID COUPLING:

7.9.1. Fluid coupling shall be manufactured conforming to following specification:

7.9.1.1. Impeller, casing and runner shall be made of high tensile aluminium alloy castings conforming to IS 617:1994

7.9.1.2. Shaft shall be made of steel conforming to class IV of IS 1875:1992 or C40 of IS 7283:1992.

7.9.1.3. The material of coupling shall conform to Grade 20-40 of IS 1030:1998

7.9.1.4. Brake drum along with coupling

7.9.1.5. The fluid coupling shall be traction type.

7.10. PULLEYS:

7.10.1. Pulleys shall be of welded construction as per IPSS: 2-03-007-88. All drive pulley surfaces shall be hot lagged with vulcanised natural rubber lagging of hardness 65 shore A, grooved in diamond pattern. The lagging thickness shall be 20 mm (minimum). The depth and width of the grooves in the lagging shall be 6 mm spaced at 30mm interval. The eccentricity of pulley shell shall not be more then + 0.5% of the diameter prior to lagging.

7.10.2. All pulleys shall be statically balanced to minimize the vibration during running.

7.10.3. All non-drive pulley (tail/take-up/bend and snub) surfaces shall be hot lagged with vulcanised natural rubber of hardness 65 shore-A, with plain lagging. The lagging thickness shall be 12 mm (minimum).

7.10.4. Pulley shafts shall be provided with double row spherical roller bearings with proper greasing arrangement. The Plummer blocks for pulleys shall be horizontally split type construction made of cast iron. The Plummer blocks shall be dust tight with double labyrinth

seals. Conical head shape nipples conforming to IS 4009 (Part II):1981 shall be provided for greasing. Side covers of Plummer blocks shall be heavy-duty metallic sheets. No plastic components shall be used. Minimum shaft dia. shall be 100 mm. Plummer blocks shall have 4 holes covers & 4 holes mountings.

7.10.5. The thickness of the drive, tail, take-up, bend and tripper pulley shell shall be 16 mm and snub pulley shell shall be 12 mm.

7.10.6. Welding on the pulley shell shall be tested radio graphically or by ultrasonic method. Pulley shafts shall be ultrasonically tested.

7.11. IDLERS:

7.11.1. The idlers shall conform to IS 8598:1987.

7.11.2. Roller used in idlers shall be made from Carbon steel ERW steel tube. Wall thickness shall be 5.4 mm. The roller spindles shall be provided with seize resistant type ball bearings of 30 mm size for carrying and return idlers. The bearings shall be adequately sealed and lubricated for life. All bearings shall be rated for minimum 40,000 working hours. The rolls shall be supported from fabricated steel brackets. Fixing arrangement of rollers with brackets shall be drop-in type. For adjusting the alignment of the idlers, slotted holes shall be provided in idler supporting base plates. Direction of belt travel shall be clearly marked on the brackets of carrying idlers.

7.11.3. Idler rollers shall be waterproof, dust proof and weather proof against a high velocity water jet. All idlers shall be provided with minimum double labyrinth dust seal.

7.11.4. Impact idlers used at the loading and transfer point shall be so designed as to avoid direct impact, belt damage and excessive punishment to the carrier. The material used in construction of this type of idlers shall be of resilient type.

7.11.5. The self-aligning idlers shall be direct acting type, complete with actuating rollers fitted with the grease lubricated anti-friction bearings at pivot points and mounted inclined towards the belt. The idler frame shall be suitably cradled about a vertical pivot, supported in bearing over a fixed plate. Adequate sealing arrangement shall be provided to prevent contamination of the lubricant by dirt and moisture.

7.11.6. Proper arrangement shall be provided in the brackets of all types of idlers for presenting the rollers from coming out of the brackets during normal / abnormal conditions.

7.11.7. The idler sets shall consist of idlers along with mounting brackets.

7.11.8. The spacing for idlers shall be as follows:

7.11.8.1. The carrying idlers shall be placed 1000 mm apart along the profile of the belt conveyor.

7.11.8.2. 2 nos. 100 and 2 no.200 transition idler shall be located at the head as well as tail end of all the belt conveyors. The transition distance shall be approximately equal to the belt width.

7.11.9. Impact idlers shall have a spacing of 400 mm shall be located at each feed point of material of the belt conveyor, along the profile of the belt conveyor.

7.11.10. Self-aligning carrying idlers shall be provided for all the conveyors as per requirement.

7.11.11. Self-aligning return idlers shall be provided for all the conveyors at a suitable distance

7.11.12. The return idlers shall be placed 3000 mm apart along the profile of the belt conveyor.

7.12. BELTING:

7.12.1. Conveyor belts shall be provided as per IS 1891:1994

7.12.2. In general belts shall be heavy duty N/N cover grade HR T1 with no longitudinal cut / joint for any applications.

7.13. MOBILE TRIPPER:

7.13.1. The mobile tripper car shall be motor driven with both side discharge through flap gate arrangement and having a travel speed of 0.2 m/s (approx.). The tripper car shall be provided with 2 nos. drive system with 1 no. at each of two diagonally opposite wheels. The drive system shall be connected to the wheels by couplings. It shall consist of structures, supports, necessary length of rails to cover the runway length, supporting structure for the rails with necessary end stops, belt scraper with adjustable rubber strip, rubber lagged discharge and bend pulleys complete with shaft and bearing, idlers, chutes, limit switches, brakes etc. Design basis shall be IS 14386:1996.

7.14. BEARINGS:

7.14.1. All bearings shall be of antifriction type and shall be located in dust tight enclosures. Adequate provision for their lubrication shall be made.

7.15. LUBRICATION:

7.15.1. Provision shall be made for lubrication of all moving parts & bearings of the equipment. Lubricating nipples and adapters shall be easily accessible and shall generally comply with the relevant Indian standards. All exposed bearings shall be suitably sealed. First fill of the lubricating oil/grease shall be supplied along with the equipment. One centralized grease lubrication system with hand pump (metallic body) shall be provided.

7.16. ELECTRIC HOIST:

7.16.1. Broad details of electric hoist with monorails are as follows:(TABLE)

Sl. No.	**Nomenclature**	**Description**	
1	Location	Junction House 5 & conveyor gallery (SLC#3)	
2	Purpose	For maintenance and handling of head pulleys at the junction house and take up counter weights.	
3	Type	Electrically operated	
4	Capacity (t)	3t	5t
5	Quantity	1 in JH#5 with monorails Suitable capacity Monorails to be provided for take-ups and head pulleys of SLC#3.	1 (For handling of mobile trolley along the travel length for maintenance of mobile tripper, Monorail size beam shall be minimum)
6	Length of Travel (approx. In m)	To be decided by the bidder	Shall cover the whole length of travel of mobile tripper.
7	Lift (approx. In m)	Minimum 5 m	As per the conveyor gallery height.
8	Hoisting speed (m/min)	3.0	3.0
9	Travel speed	10.0	10.0

Sl. No.	Nomenclature	Description	
	(m/min)		
10	Monorail	Suitable for selected electric hoist	Suitable for selected electric hoist
11	Standard to be followed	Duty class II as per IS 3938:1983	Duty class II as per IS 3938:1983
12	Gearbox rating	1.25 (min.) times selected motor kW	1.25 (min.) times selected motor kW

8. ELECTRICAL:

8.1. BASIC DESIGN & SITE CONDITIONS:

8.1.1. Power Supply System Voltages

8.1.1.1. LT Power: 415 V + 10%, AC 3-phase, 4-wire, 50 Hz + /-5%, solidly earthed system with 50kA (r.m.s) for 1 s.

8.1.1.2. Control Voltage for LT Board and MCC: 240 V AC

8.1.1.3. The Bidder shall develop all other voltages (AC, DC) as required for his system from the above power supply. DC brake supply shall be 220V DC.

8.1.2. For the purpose of equipment design, the ambient conditions are to be considered as 500C for indoor & 550C for outdoor equipment and 100% maximum relative humidity

8.1.3. All equipment and accessories shall conform to the latest revision of the Indian Electricity Rules, as regards safety, earthing and essential provisions specified therein, for installation and operation of electrical plants.

8.2. STANDARDS:

8.2.1. The electrical equipment/ items shall be designed, manufactured, installed and tested in accordance with latest IS/ IPSS/ IEC, as applicable to respective equipment.

8.2.2. All equipment/ items shall generally comply with the latest revision of the following:

8.2.2.1. Indian Electricity Rules, 1956 (latest revision)

8.2.2.2. Indian Electricity Act, 1910 (latest revision)

8.2.3. All equipment/ items shall also comply with the statutory requirements of the Government of India and the Government of Odisha.

8.2.4. Design and selection of equipment/ items shall be done taking into consideration of easy inspection, testing, maintenance, cleaning etc. to be carried out at site without disrupting process or taking prolonged shutdowns.

8.3. BRIEF DESCRIPTION OF ELECTRICAL SYSTEM:

8.3.1. Proposed LT Power Distribution

8.3.1.1. Incoming power for the MCC shall be taken by new air circuit breaker extension at existing PCC (installed under pkg. - TK- 01) at both sections. MCC shall feed all the loads related to process.

8.3.1.2. 2 nos. Incoming power for PDB shall be taken from MCC. PDB shall feed loads like hoist, welding and any other auxiliary load.

8.3.1.3. Source for illumination of the concerned areas shall be taken from nearest MLDB (under pkg-TK-01) by suitable extension

8.4. CONTROL/ OPERATION:

8.4.1. All equipment is considered to be operated generally in following modes:-

8.4.1.1. Automatic operation through PLC

8.4.1.2. Remote manual operation from HMI monitor

8.4.1.3. Local operation from LCS

8.5. New Electrical Room:

8.5.1. One no. new electrical room alongwith cable cellar to be constructed at the space available on the roof above LT transformer rooms in the 33/6.6kV substation building of BF#1. Dry pressurized ventilation system shall be provided for the cellar and MCC room.

8.6. AIR CIRCUIT BREAKER EXTENSION PANEL:

8.6.1. The air circuit breakers shall be electrically operated drawout type 800A, 50kA for 1 sec and shall have microprocessor based overload, short circuit and earth fault protection feature. Required CT, ammeter, indication lamp shall be provided. Panel shall have IP-54 protection.

8.7. MCC:

8.7.1. MCC shall be conventional draw out type having two incomers, bus- coupler, required outgoing feeders for the conveying system including belt conveyor, tripper conveyor, two motor feeder for existing slag disposal conveyor SLC#1 and SLC-2 (tentative 55kW or one size higher), PDBand any other load under this TS. The MCC shall have spare modules of each type to handle the criticality at the time of breakdown. The draw out type shall not have any non-metallic type components for rack-out and rack-in of the module. Control transformer shall have redundancy with an auto-manual changeover switch. One relay logic panel shall be provided in the MCC for necessary interlock and operating philosophy.

8.7.2. All the incomers , bus coupler and outgoing feeders shall have MCCBs. . All the Conveyor(SLC#1, SLC#2 ,SLC#3 and Tripper Car) feeder modules shall be of Drawout type with minimun one spare of each type. All other power feeders shall be fixed type.

8.7.3. The MCCs shall be modular, sheet steel enclosed, operable from front, floor mounted type. Heavy duty and reliable type of isolating contacts (both power & control) shall be provided

for draw out MCCs modules.

8.7.4. The power bus bars shall be 415 V, 3-phase, 50 Hz with grounded neutral, and short circuit level is 50 kA for 1 sec.

8.7.5. Control circuits of MCCs shall be 240 V, 1-phase, 50 Hz. Provisions shall be made for two power supply sources (two transformers of 415/ 240 V each at full power rating) for the MCCs.

8.7.6. Technical Particulars(TABLE)

A	B	C
1.	Reference Standards	IS 60947 : 2004- Low Voltage Switchgear and Control gear IS 8623 (Part 1-3): 1993- Low voltage switchgear and control gear assemblies
2.	Supply system & variation	
	Voltage	415 V$\pm$10%, 3 ϕ& Neutral
	Frequency	50 Hz $\pm$ 5%
3.	Neutral system	Solidly grounded
4.	System Fault level	50 kA (RMS) for 1 second
5.	Rated Insulation Voltage	2.5 kV for 1 min
6.	Construction	
	a) Type of board	Single front compartmentalised &draw out type

8.7.7. **Power Distribution Board (PDB)**

8.7.8. Power distribution board (PDB) shall be complete with MCCBs,Aluminium bus bar, ammeters & voltmeters, power & control terminal boards, clustered LED lamps for indications, necessary protections including power & control cables.

8.7.9. The PDBs shall meet the specifications given below:(TABLE)

A	B
Type	Sheet steel clad, fully compartmentalized, non-draw out, indoor type, floor mounted, free standing conforming to IS 8623 (Part 1-3): 1993- Low voltage switchgear and control gear assemblies
Enclosure	IP54
Incomer	2 nos. incomers and buscoupler of suitable rating MCCBs
Outgoing feeders	MCCBs (no. & rating as required), 20% spare feeders shall be provided.
Busbars	3 phase, 4 wire, electrolytic grade Aluminium
MCCBs	All MCCBs shall be of 50kA breaking capacity with short circuit, overload and earth fault protection.

8.7.10. LT Induction Motors

8.7.11. Technical particulars:(TABLE)

A	B	C
1.	Type of motor	Squirrel cage induction motor
2.	Energy efficient motors	All LT Motors shall be energy efficient IE3 as per IS 12615:2011

A	B	C
3.	Variation in Rated voltage (%)	+ 10%
4.	Rated frequency	50 Hz
5.	Variation in rated frequency (%)	+ 5%
6.	Duty	As per requirement
7.	Speed (RPM)	To be matched with the driven equipment
8.	Time to withstand 120% of rated speed	2 minutes
9.	Mounting	Horizontal/ Vertical mounting as per application
10.	Type of enclosure	TEFC: for 415 V motors
11.	Degree of protection	IP 55
12.	Class of insulation	F
13.	Temperature rise (over ambient temp. of 50oC).	70oC
14.	Starting current in percentage of rated current (Ist / Ir)	600 % maximum
15.	Power factor at rated voltage and load	tentatively 0.9 or better
16.	Starting time at 100% and 85% rated voltage with load	Not more than 10/ 15 sec for 100% voltage.
17.	Safe stall time at 110% rated voltage at Hot condition	5 –10 Sec more than locked Rotor withstand time
18.	Thermal time constant, in min.	45 min.

A	B	C
19.	Margin on Hot thermal withstand curve	Minimum 10% over full load current to facilitate relay setting using motor‟s rated capacity
20.	Minimum permissible voltage at terminal for starting (with full load)	80% of rated voltage
21.	Permissible running time with full load at minimum (75%) allowable voltage.	5 min
22.	Whether suitable for 150% of rated voltage during Bus transfer.	Yes
23.	Transient recovery after temporary system disturbance for 0.2 Sec and sudden restoration to 70% of rated Voltage	The motor shall be capable to accelerate with load to rated operating point from such condition.
26.	Direction of rotation	Bi-direction
27.	Winding Material	Copper
29	Winding connection	Delta
30.	Whether windings have adequate tropical protection against fungus, corrosion etc. provided.	Yes
32.	Motor terminal box type (for 415 V motors)	It shall be suitable for termination of actual no. and size of cables as per kW rating of the motor considering derating due to site ambient temp. as well as method of installation.
33.	Degree of protection for terminal boxes	IP - 55

A	B	C
38.	Bearing	For LT motor NDE shall be provided with ball bearing. Upto 15kW or as per manufacturer‟s recommendation, DE shall have ball bearing & above that DE shall have roller bearing.
39.	Earthing of motor body	Each motor frame shall have two distinct grounding pads, one on each side, complete with tapped hole and bolt
40	The motor shall be provided lifting devices and with the foundation bolts.	Yes
41.	Noise level	The noise level shall be as per IS 12065:1987 and shall not exceed 85 dBA at 1 m. from motor

8.7.12. Local Control Station (LCS)

8.7.13. Technical details of local control station shall be as follows:

8.7.14. All Local Control stations shall be made of poly carbonate type enclosure and shall be provided with double door, canopy and Degree of protection shall be IP-55.

8.7.15. The Local Control Station shall be provided with "DRIVE ON, OFF &TRIP" indicating lamps. LED cluster type Indicating lamps suitable for panel mounting shall be provided.

8.7.16. Local control stations shall have required push buttons like start –stop. The stop push-button shall be of red colour, mushroom headed with „press to lock" and Lockable type feature. The start push-button shall beof green colour and shrouded spring return type. Selector switch, if any, based on control philosophy shall also be provided.

8.7.17. The LCS shall have industrial type heavy-duty terminal block and the terminals shall be suitable for termination of 2.5 mm2 copperconductors. Each terminal-block shall have 20%. terminal as spare terminals.

8.7.18. For motors rated 110kW and above ammeter shall also be provided at LCS.

8.7.19. Illumination System

8.7.20. Complete Illumination of all the areas under the scope of this TS shall be provided. Illumination system shall include Lightning distributionboard (LDB), Sub Lighting Distribution Boards (SLDBs), timers, lighting fixtures, GI conduits, cables, complete wiring with accessories,

8.7.21. TABLE

Sl. No.	**Room/ Area**	**Average IlluminationLevel (Lux)**	**MaintenanceFactor**	**Type of Fittings**
1.	MCC room	200	0.7	LED fixtures
2.	Staircases, cable basement	70	0.7	LED fixtures
3.	Conveyor Houses / conveyor gantries / junction houses	70	0.7	Industrial well-glass LED fixtures

8.7.22. For yard lighting on both side of the conveyor gallery and around new junction house, total 20 nos. 400W LED flood lighting fittings (10 nos.at each side) shall be provided.

8.7.23. The distribution of lighting power supply for the individual areas shallbe done at

415V, 3 phase, 4 wire bus system through Lighting Distribution Board (LDB). The outgoing feeders of the LDB shall feed the required numbers of Sub Lighting Distribution Boards (SLDB) for lighting. Each SLDB shall receive power at 415V AC, 3 phase, 4 wire and distribute it into 240V, 1 phase circuits for connection to the lighting fixtures and 240V receptacles. The SLDB shall be located in the rooms, junction houses etc. covering the respective zone. Automatic switching ON/OFF of these circuits shall be done through timers.

8.7.24. There shall be three types of LDB/SLDBs for three different purposes as indicated below:-

8.7.25. Type-1: All lights that required to glow for 24 hours.

8.7.26. Type-2 : All lights that required to glow from dusk to dawn

8.7.27. The selection and operation switching shall be carried out with Timer and Contactors and at either LDB or SLDB level considering thereliability of desired operation.

8.7.28. Illumination wiring from SLDBs upto the light fittings of conveyor gallery shall be through 1.1kV PVC insulated, PVC sheathed, 2.5 sq.mm copper unarmoured cables in GI conduit/through 1.1kV PVC insulated, PVC sheathed armoured cables in trays and 2.5sq.mm copper wires in GIconduits at rooms.

8.7.29. The switches shall be provided for controlling lighting circuits. The rotary or toggle switches provided will be of sturdy design. The unit will be housed in cast iron or cast aluminium box having gasketted, screwedfront cover plate, fixing lugs and suitable provision for terminatingconduit/cable at the top, bottom or sides as specified.

8.7.30. <u>Lighting Distribution Board (LDB)</u>

8.7.31. The LDB shall be metal enclosed, single front, fixed type fabricated from CRCA sheet steel of minimum 2 mm thick, wall mounting factory assembled. The LDB shall be

indoor type, dust and vermin proof with neoprene rubber gaskets having degree of protection of IP-54.

8.7.32. The LDB shall have enclosed busbar chamber at the top,vertical busbars for outgoing feeders. Maintenance accessshall be provided from front only after opening the front covers/doors.

8.7.33. LDB shall have two nos. TPN MCCB incomers and TPN MCBs as outgoing feeders. The MCCBs shall have Short circuit, overload and earth fault protection features. MCCB shall be have 50 kA breaking capacity.

8.7.34. Each outgoing feeder will feed lighting power to the respective Sub Distribution Board (SDB) for lighting. 30% spare outgoing feeders shall be provided with minimum of 2 nos.

8.7.35. Cable entries shall be made from the bottom. Detachable cable gland plates of minimum 3 mm thick sheet steel with knock-out type cable entry holes shall be provided.

8.7.36. LDB shall have one no 0-500V voltmeter (size:72mmx72mm) with selector switch and 3 nos. indication lamps for R-Y-B indication in each incoming cubicle. LDB shall have Ammeter at the incomers.

8.7.37. <u>Sub Lighting Distribution Boards (SLDBs)</u>

8.7.38. SLDBs shall be metal-enclosed, cabinet type, fabricated from CRCA sheet steel minimum 2 mm thick, suitable for wall/column mounting on brackets.

8.7.39. SLDBs shall be indoor and outdoor type as required. Indoor panels shall be dust and vermin proof, IP-54 or better. Outdoor panels shall be weather-proof, double door withcanopy, IP-55.

8.7.40. Each SLDB shall have an incoming triple pole MCB and a number of 20A, 240V,

double-pole MCBs as outgoing feeders. The quantity of MCBs shall correspond to the requirement with at least 30% spare quantity of actual use. The total outgoing feeders shall preferably be minimum six (6) nos. up to maximum twenty four (24) nos. and with a multiple of six (6) in between.

8.7.41. Each 20A MCB of a SLDB shall feed a group of lighting fixtures and a group of maximum 2 nos. receptacles.

8.7.42. The incoming TPN MCBs shall be of 63A/32A rating withsuitable nos. of outgoing feeders of 20MCB with 30% spare MCBs.

8.7.43. Receptacles with Socket, Plug & Switch

8.7.44. The receptacles to be installed shall be of the following types:

8.7.45. 5/15A, 240V AC, 2 pole, 3 pin with third pin earthed, decorative type suitable for flush mounting in MCC room. The switch shall also be flush mounted piano type.

8.7.46. 20A, 240 V AC, 2 pole, 3 pin with third pin earthed, industrial type wall/column mounted metal clad gasketted construction, 20 mm conduit entry, screwed metal cover tied to it by metallic chain, weather-proof, suitable for indoor & outdoor installation.

8.7.47. Receptacles shall be fed from the nearest SLDB.

8.7.48. The conduit box of the receptacle shall be provided withearthing screws with washer and nuts, welded on the surface for grounding with 16 SWG G.I wires. Arrangement shall be provided inside the conduit box for grounding of third pin.

8.7.49. 20A Receptacles shall be of cast steel/ aluminium heavy duty type.

8.7.50. Shrouded type plug shall be provided with corresponding matching arrangement at sockets to prevent accidental contact with finger during plug insertion.

8.7.51. Welding Receptacle

8.7.52. Welding receptacles shall be 63A, 415V, AC, 3phase, 50Hz with socket outlet, interlocked 63A TPN switch fuse/ELCB & plug made of poly carbonate type enclosure shall be considered. The receptacle shall be dust & vermin proof, gasketted industrial type with degree of protection IP-55 and interlocked type.

8.7.53. Electrics for handling facilities

8.7.54. Electrical Hoists

8.7.55. Motors: The motors shall be generally as per AC motor specification given above. The motor shall be suitable forHoist & Crane duty i.e. for plugging / reversible type of operation and suitable duty class (S4) with 150 starts per hourand Cyclic Duration factor (CDF) not less than 40%.

8.7.56. Electrical Starter Panel: The panel shall be made of 2 mmthick sheet steel and shall be of box type construction. The panel shall be wall/floor mounted.The incoming and outgoing cables from the panel shall be terminated at the lower part of the Panel on the terminals consisting of cadmium coated bolts mounted on at least 15 mm thick fiber insulating sheets. All the control cables shall be terminated in one clip-on type terminal block and both end of cables shall be properly ferruled and identified.

8.7.57. The control voltage shall be 230V AC where operation is fromcontrol panel directly. Following indication lamps shall be provided at the paneldoor:

8.7.58. Power Supply On

8.7.59. Drive On

8.7.60. Drive trip

8.7.61. Limit switches: Limit Switches shall be provided at both ends of the monorail to stop the Hoist before hitting the mechanical buffer. Hoist motion shall be provided with rotary-geared type Limit Switches to prevent over Hoisting and over lowering. These offered Limit Switches shall be as per relevant clause of IS 3938:1983. These limit switches shall automatically reset, when the hook is returned to normal operating zone. Gravity type limit switch shall also be provided for back-up protection against over Hoisting.

8.7.62. Emergency Stop Push Button: Lockable mushroom head off push-button shall be provided to cut off / trip main power in case of any fault or emergency. It shall be provided on the Pendant Push Button Station. The colour of the Push Button shall be red.

8.7.63. Cabling: 3.5 cores, 1.1 kV grade PVC armoured, aluminium conductor cable from the outgoing terminals of starter panel up to the Junction Box at one end of the monorail shall be provided. From junction box to hoist, 1.1 kV, flexible trailing, Copper conductor cable shall be supplied and laid with festoon arrangement.

8.7.64. The number of jockeys shall be selected based on the span ofthe Hoist, cable size and minimum clearance as required for smooth travel. All the jockeys shall be connected with link chain smaller than the cable length so that load is not transferred on the cable during pulling of the jockeys. The cable shall have ample length and shall be supported bymeans of properly designed movable clamps.

8.7.65. Earthing: The Hoist structure, motor frames and metal cases of all electrical equipment, including metal conduit or cable guards shall effectively be connected to earth.

8.7.66. Cables & Cabling Accessories

8.7.67. <u>LT Power Cables</u>

8.7.68. LT power cables shall be 1.1 kV grade multicore heavy duty PVC/XLPE insulated, PVC inner sheathed and FRLS PVC outer sheathed, steel round/flat armoured with stranded aluminium conductor as per IS: 1554(Part-1) -1988/7098 (Part-1)-1988. The insulation of inner and outer sheath shall be of extruded PVC (ST2) as per IS: 5831-1984. Minimum size of multicore stranded aluminium LT power cables shall be 6 sq.mm. For motor rated 2.2kW and below2.5mm^2 copper cables shall be considered.

8.7.69. Control Cables

8.7.70. LT control cables shall be 1.1 kV grade multicore heavy duty PVC/XLPE insulated, PVC inner sheathed & FRLS PVC outer sheathed, steelround/flat armoured with 2.5 sq. mm stranded copper conductor as per IS: 1554 (Part-1) -1988/ 7098 (Part-1)-1988 . The inner & outer sheaths shall be of extruded PVC (ST2) as per IS: 5831-1984.

8.7.71. Cable Laying & Installation

8.7.72. Cables shall be taken in Structure/ galleries (overhead cable routes), underground cable trenches (concrete or buried) and along Wall, etc. on MS fabricated cable trays depending on necessity of Cabling. The mode of Cable laying to be followedshall comply with site condition, required precautions etc. Fireretardant paint shall be applied at required interval for all cables.

8.7.73. Power and control cables installed along buildings and technological structures, ceiling, walls etc. which are required to be protected against mechanical damage and/or radiation of heat shall be taken in GI conduits. GI conduits shall also be used for flame-proof installation, where required. In corrosive atmosphere where 1,100 V grade cables are required to be taken in pipes, rigid heavy duty PVC pipes shall be adopted. Where direct heat radiation exists, heat isolating barrier shall be provided.

8.7.74. Cables to individual drives, control devices etc. shall be taken in embedded/ exposed rigid GI pipes/ flexible conduits. Extra length of cables shall be provided suitably

where possible for any future contingency.

8.7.75. All cables irrespective of type of installation shall beprotected by means of GI pipes or sheet metal protective cover up to a height of 1500 mm from the working floor leveland platforms for protection against mechanical damage.

8.7.76. For higher size cables a loop of about 4/ 5m is to be kept in the cables for meeting future contingency of jointing/termination length.

8.7.77. The installation work shall be carried out in neat workmen likemanner by skilled, experienced and competent workmen, with experience in jointing and termination of aluminium conductor cables. Cable runs shall be uniformly spaced, properly supported and protected in an approved manner.

8.7.78. All bends in runs shall be well defined and made with due consideration to avoid sharp bending and kinking of the cable.

8.7.79. The bending radius of various types of cables as per IS: 1255- 1983.

8.7.80. Cable installation shall be properly co-ordinated at site with the routing of other services/utilities. Where necessary, suitable adjustment shall be made in the cable routings witha view to avoid interference with any part of the building, structures, equipment, utilities and services. Exit of cablesfrom underground trenches or tunnels shall be through pipe sleeves. Pipe sleeves shall be properly sealed.

8.7.81. All cables shall be provided with identification tags indicating cable numbers in accordance with the cable/circuit schedule. Tags shall be fixed at both ends of cable, at joints and at 20 mspacing for straight runs. When a cable passes through a wall, tags shall be fixed at both sides of the wall. The tags shall be of aluminium sheet with the numbers punched on them and securely attached to the cables with non-corrosive wire. For single core cables wire shall be non-ferrous materials. Individual cores of control cables shall have for identification, plastic ferrules with engraved

numbers at both ends of the circuit.

8.7.82. All cables shall be tested for proper insulation prior to laying. The cable drums shall be transported on wheels to the place of work. The cable shall be laid out in proper direction as indicated on the drum using cable drum stands. In case of higher size cables, the laid out finally transferred carefully on to the trenches and racks. Care shall be taken so that kinks and twists or any mechanical damage does not occur in cables. only approved cable pulling grip or other devices shallbe used.

8.7.83. Adequate length cables shall be pulled inside the switchboards, control panels, terminal boxes etc. so as topermit neat termination of each core/ conductor. Control cables entering switchboard or control panels shall be neatly bunched/ strapped with PVC perforated tapes and suitably supported to keep it in position at the terminal block. All spare cores shall be neatly dressed and suitably tapped at both ends.

8.7.84. Power cable terminations shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamps near the terminals. All power cable terminations shall be by means of crimping type cable lugs. Control cables shall be terminated directly at the terminal blocks by screws.

8.7.85. No joint shall normally be made at any intermediate point in through runs of cables unless the length of the run is more than the length of standard cable drum. In cases where jointing is unavoidable, the same shall be made by means of standard cable jointing kits.

8.7.86. All opening for cable entry in the equipment shall be sealed and made proof against entry of creeping reptiles.

8.7.87. Ladder type cable racks shall be selected from three sizes viz.,300, 450 and 600 mm and shall be fabricated from 50 x 50 x 6mm MS angles for longitudinal members and 30 x 6 mm MS flats for cross members placed at an interval of 300 mm alongthe

length of the rack with a provision of double cross members at locations, where cables are to be clamped. Supporting brackets for ladder type racks shall be provided atan interval not exceeding 1500 mm. Both horizontal and vertical members shall be of 50 x 50 x 6 mm MS angle and the bracket shall be welded to the embedded inserts. Alternatively prefabricated sheet steel/ aluminium racks and supporting brackets of bolted construction may be used for power and control cables.

8.7.88. Cable racks shall be mounted vertically to the extent possible.

8.7.89. Vertical spacing between cable racks shall be between 300 mm to 250m depending upon size and number of cables.

8.7.90. Power cables of different voltage grades shall be laid in separate racks/ hooks. Control cables as well as signal and communication cables shall be laid in separate racks. Thecables in racks/hooks shall be laid in the order of their voltage grades such that the cables of lowest voltage grade are on the topmost tier and highest voltage grade on the bottom-most tier.

8.7.91. Where there is possibility of mechanical damage cable rack shall be adequately protected by sheet steel covers.

8.7.92. For future installation of cables, provision shall be made to keep 20 percent space as spare on each rack. Alternatively, one spare rack can be provided all along the route.

8.7.93. Cable racks shall be so arranged that they do not obstruct or impair movement in passage way. Particular attention shall begiven to this aspect at rack crossing in cable tunnels and cable cellars where a minimum clearance of around 1800 mm shall be kept for free movement. For dusty area cable racks shall be vertical type(for horizontal run).

8.7.94. For laying cables along steel/technological structures on concrete walls/ceiling etc. the cable shall be taken by clamping with MS saddles screwed on to MS flats

welded to the structure or to embedded inserts provided in walls. Where inserts are not available the saddles may be directly fixed to the walls using rawl plugs and MS flat spacers of minimum 6 mm thick.

8.7.95. The MS saddles shall be placed at an interval of not less than 500 mm both for horizontal and vertical runs. However, at bends, it shall be placed within 300 mm and when terminatedto equipment/junction box the cable shall be clamped immediately before such termination. In areas prevailing with corrosive atmosphere, PVC saddles instead of MS saddlesshall be provided.

8.7.96. GI Pipes

8.7.97. GI pipes shall generally be adopted for routing cables embedded through concrete foundations/ floors/walls (including the portion above floor level to be laid in continuation for protection against mechanical damage) generally in plant buildings. These shall be medium gauge, hot dip galvanised, electric resistance welded (ERW) screwed type conforming to IS: 1239-1990 (Part-I). All pipe fittingsshall conform to IS: 1239 -1992 (Part-II).

8.7.98. Not more than 40% of GI pipe cross sectional area shall be used (Blocked).

8.7.99. G.I conduits shall generally be used for exposed cabling along building walls/structures etc. in both plant and non-plant buildings as well as concealed cabling in offices, canteens and other non-plant buildings. These shall be of galvanised steel, screwed type conforming to IS: 9537-1981 (part-II). Conduit accessories and fittings shall be of standard types conformingto IS: 3837-1976 and IS: 2667-1988.

8.7.100. All GI pipes/conduits shall be provided with pull wires tofacilitate cable pulling.

8.7.101. GI pipe/conduit runs shall not have more than three 900bends (2700 total) including bends immediately at the outlet or fitting. Straight runs shall be limited to 30 m by

providing approved type pull/junction boxes as required.

8.7.102. Normally, no joints shall be made in through runs unlesssame is more than standard cable lengths. In cases where a jointing is to be done, the same shall be made with proper jointing material and kits.

8.7.103. G.I conduit/PVC pipe systems shall be firmly supported in position by means of heavy gauge saddles screwed to concrete/brick walls using suitable plugs or screwed to MS brackets/cleats welded on to building structures. The spacing between support for both horizontal and vertical runs shall not be more than 1000 mm for straight runs. At or termination to junction/pull boxes, the nearest support shall be 300 mm from such fittings. Exposed GI conduits shall run parallel or perpendicular to column/building lines to match the existing architectural arrangement. Embedded GI pipes shall however, run in direct lines with minimum bends.

8.7.104. Bends for GI pipes/conduit where required shall be made such that the diameter of the pipe is not deformed. Theradius of inner edge of field bend shall not be less than 8 times diameter for GI pipes and 6 times for conduits.

8.7.105. In damp locations exposed GI conduit and fittings shall be made water tight. Also, the conduit shall be mounted on steelspacers having a minimum thickness of 6 mm. Stub ups of embedded GI pipes shall be fitted with coupling pluggedsuitably to avoid damage to threads or entry of foreign matters during construction.

8.7.106. GI pipes/conduits shall be selected on the basis of percent fill in area as given in IS:1239-1990 (Part-I) for medium gauge GI pipe as per IS 9537-1981 (Part-II).

8.7.107. The termination of GI pipes/conduits to rotating or otherequipment subject to vibration or connection/disconnection at intervals shall be made by means of flexible metallic conduits. The use of flexible metallic conduits in outdoorlocations shall be avoided as far as practicable.

8.7.108. Flexible pipes shall be liquid tight, galvanised heavy duty interlocked type with extruded PVC jacket on top generally conforming to IS:3480-1966. The adapter for coupling flexible conduit to rigid pipes/equipment shall be of cast aluminium, screw/gland type. Alternatively, steel wire reinforced PVC hose may be used with matched adapters.

8.7.109. All fabricated pull/junction boxes shall be made of 3 mm thick sheet steel, painted as specified. The pull boxes shall be sized to suit the largest recommended bending radius of the cables to be accommodated. Larger boxes (generally exceeding 600 mm in length) shall be fabricated with standard steel sections.

8.7.110. Termination and Jointing

8.7.111. Termination and jointing of aluminium conductor power cables shall be by means of compression type aluminium lugs. Alternatively, tinned copper compression type lugs may also be used with application of corrosion inhibiting compound. Copper conductor control cables shall be terminated directly into screwed type terminals provided in the equipment.

8.7.112. Straight-through joints and end sealing of cross linked polyethylene cables shall be of any of the following types:

8.7.113. Heat shrinkable type

8.7.114. Self-amalgamating tape type

8.7.115. The jointing and end sealing kits shall be complete with stress relief system and all accessories, straight through joint for direct burial installations shall be provided with cast resin enclosure for protectionagainst water and corrosion.

8.7.116. Straight-through joints for 1100 V grade PVC insulated cables shallbe with epoxy resin compound for direct burial cables. Cable glands for terminating PVC insulated,

armoured/ unarmoured cables shallbe made of brass or aluminium alloy.

8.7.117. Earthing System

8.7.118. Earthing network with new earth pits and underground earthing ring shall be provided for the complete system under the scope. Earthing network shall be separate from lightning arrestor circuit. Earthing network shall include equipment level earthing ring. All new electrical equipment shall be connected to respective earthing network. Earthing shall conform to IS 3043 -1987. GI pipes and galvanised MS flats shallbe used for earthing& earth grids. All joints shall be made with pressure type fitting or welded. New earthing system shall be connected with existing earthing system. Earthing network shall have earthing resistance below 1 Ohm.

8.7.119. Earth electrodes shall have facilities for measurement of resistance and watering during dry season.

8.7.120. Earthing conductors of following minimum sizes & materials shall be used in the power earthing system as listed below:(TABLE)

Sl. No.	**Description**	**Size**	**Material**
1.	Main Earthing ring/ grid below ground	75x10 mm Flat	Galvanised Steel conductors
2.	Sub grid above ground	50x6 mm Flat	-do-
3.	Riser/ Pigtail from earthing grid/ Mat	50x6 mm Flat	-do-
4.	Earth Electrodes	50 mm dia, 3metres long pipe.	-do-

Sl. No.	Description	Size	Material
5.	Conductors to be used for ground connection of various equipment/ structures as listed below:-		
a)	415V Motor Control Centre/ Power Distribution Boards etc.	50x6 mm flat	-do-
c)	Local Panels	25x6 mm flat	-do-
Sl. No.	Description	Size	Material
d)	Motors:		
e)	Above 90 kW	50x6 mm flat	-do-
f)	Above 30 kW upto 90 kW	25x6 mm flat	-do-
g)	Above 5 kW upto 30 kW	25x3 mm flat	-do-
h)	Upto 5 kW	8 SWG Wire	-do-
i)	Miscellaneous items, viz. Push Button Station, Junction Boxes etc.	8 SWG Wire	-do-

8.7.121. Lightning Protection

8.7.122. Lightning protection system shall be designed as per IS/IEC: 62305.

8.7.123. Lightning mast shall be provided on structures to protect all the equipment / structure. The vertical Air termination rods shall be of25mm dia. galvanized steel rods. Whereas the horizontal air terminationconductor and down conductor from air

terminals (mast) to earth electrode shall be of 50x6mm^2 size galvanised steel strip..

8.7.124. PROCESS CONTROL & AUTOMATION

8.7.125. **IP based CCTV system(TABLE)**

A	B
Item	CCTV camera
Type	Fixed
Night vision	yes
Resolution	6 megapixels
IR range	8 m minimum
Digital noise reduction	3D
Motion detection	Required
Network	RJ-45
Power input	DC 12 V/ POE
Protection index	IP-67
Safety standards	"EU: EN60950-1 North America UL listed to UL/CSA 60950-1"
Operating Humidity	Less than 95% RH
Operating temperature	-30°C~+60°C
Local storage	Micro SDHC up to 128GB
Quantity	02 Nos.
Notes: - The CCTV system shall have built-in memory to store data for at least a week. Concerned cameras (02 nos.) shall be hooked up with 02 nos. of 32 inch monitors (one in BF – 1 Main Control Room and the other one in Blast Furnace Shipping Office). The CCTV system shall include suitable network video recorders (NVRs), cables including necessary Fiber Optic (FO) cables, cabling accessories, hardware, network switches, keyboards, mouse(s) etc. (**as required**).	

8.7.126. Belt Weighing System

8.7.127. Belt weighing system shall be complete with load cells, weighing controller panel, requisite cables, all required hardware and software. Weighing controller panel shall be installed within a separate FRP cabinet having an enclosure protection class of IP-65 (**at a minimum**) and shatterproof viewing glass in the front.

8.7.128. STRUCTURAL WORKS

8.7.129. **Codes and Standards**

8.7.130. The Bidder shall carry out the complete design and engineering of the structural steelwork as per provisions of Indian codes and standards. In all cases, the latest revision with amendments, if any, shall be followed. All steel structures shall be designed to meet the technological & service requirements with due consideration to the existing plant & facilities.

8.7.131. Design parameters

8.7.132. The steel structures envisaged here shall be designed as per IS: 800- 2007. Conveyor gallery shall be designed as per IS: 11592-2000. Dead load shall be considered as per IS: 875 (Part-I)-1987. Superimposedloads shall be considered in accordance with IS: 875(Part-II)-1987 in addition to technological loads from equipment as supplied by equipment manufacturer. Structures shall be designed either for wind or seismic loads whichever produces worse effect. Wind load on structures shall be considered as per IS: 875(Part-III) - 2015 whereas seismic loads shall be taken as per IS: 1893(all parts). Load combinations shall be considered as per IS: 875(Part-V)-1987. Structural steel work shall be of welded construction as far as possible. Necessary provision in the design shall be kept for temporary loads, which are expected during erection and maintenance of equipment.

8.7.133. Structural analysis/ design shall be carried out using STAADPRO software/ Excel spread sheet/ manual calculation etc. Softcopy of analysis of structures/ design of structures is to be submitted along with load calculation. All loads applied on structural frame work inSTAADPRO input shall be clearly shown in load calculation

8.7.134. The structures shall be designed to resist full dead load, live load,superimposed load, technological load, equipment load, construction load with appropriate combination of wind or seismic load and due allowances for impact, vibration, temperature and other secondary effects. Structures shall be designed either for wind or seismic loads whichever produces worse effect.

8.7.135. Dust load on roofs shall be taken as 50 kg/m2 over and above the specified live load

8.7.136. Permissible vertical and horizontal deflection shall generally be as per IS800:2007 unless otherwise specified.

8.7.137. For all major structural columns, base shear shall be transferred to the foundation by shear keys only and not through foundation bolts. Tension in column member shall be transferred to foundation by foundation bolts.

8.7.138. General Specification for conveyor gallery and Junction house

8.7.139. For single belt conveyor galleries, walkways on either side of belt shallbe minimum 1000 mm wide. 1000 mm high handrails shall be provided. Clear height from floor level to the underside of the projecting roof supporting structures shall not be less than 2400 mm. Pre cast RCC slab shall be provided for all walkways along conveyor galleries. Conveyor gallery shall, generally, be structurally free from junction houses. Space for accommodating utility and power lines shall be considered. Galvanized color coated sheeting shall be provided for roof and wall respectively. For conveyor gallery slope between 6^0 to12^0, anti-skid angle shall be provided along walkways at a spacing not more than 500 mm. For slope more than 12^0, steps shall be considered

on walkways.

8.7.140. Junction houses shall be braced on all four sides for structural stability and to control deflection. Flooring shall be of RCC slab over steel beams. Horizontal bracing shall be provided to take care of laterally applied load on floors. Handling facility shall be provided from under side of roof/ floor for maintenance of head/ tail ends of conveyors. Access and platform shall be provided for maintenance of hoists. Openable doors shall be provided on walls for monorails for maintenance hoists to be projected outside building. Inclination of main stair with horizontal shall preferably be maintained in the range of $38^0$to 40^0. Galvanized color coated sheeting shall be provided for roof and wall respectively. There shall be provision for natural ventilation and in the form of louvers etc.

8.7.141. Type of Structures

8.7.142. Generally steel structures shall be of welded beam column type construction. Steel structures shall generally be fabricated at shop according to the assembly requirements.

8.7.143. Splices in structures required for transportation, assembly and erection facilities should be developed by cover plates/angles, bolts and forplates by butt-welding.

8.7.144. Stability and rigidity

8.7.145. The support structures shall be designed for adequate rigidity and stability in both the directions. Normally rigidity shall be provided by fixing the column base into the concrete foundation by means of foundation bolts. Suitable column bracings shall also be provided to maintain the rigidity of the frames.

8.7.146. General Provision

8.7.147. Staircase shall generally be provided instead of vertical ladders, except where ladders

are absolutely necessary. Minimum width of flight shallbe 800 mm.

8.7.148. When ladders are used, its minimum width shall be 500 mm. Maximum spacing of rungs shall be 300 mm. Safety cage shall be provided where ladder height is more than 2200 mm from floor/GL.

8.7.149. Width of walkway shall generally be 800 mm and in exceptional case shall never be less than 600 mm.

8.7.150. All openings on platforms shall be either covered with steel removable covers or handrail all around shall be provided.

8.7.151. Height of handrail shall be 1000mm.

8.7.152. Connection System of Structural Steel Members Minimum weld size is 6mm. All erection bolts shall be 16mm diameter (min.). Minimum size of permanent bolt shall be 20mm dia.

8.7.153. Type of Construction

8.7.154. The steel structures shall generally be of shop-welded construction. Siteconnections shall generally be provided by

8.7.155. Welding with erection bolts.

8.7.156. Bolting with turned and fitted or high strength friction grip (HSFG)bolts.

8.7.157. Bolting with black bolts.

8.7.158. Elements shall be fabricated in largest possible sizes optimal with transport requirements to minimize site work.

8.7.159. Important members shall be assembled under control assembly inmanufacturing shop to prevent mismatch at site.

8.7.160. Minimum Thickness of Metal & Member size

8.7.161. Minimum member size

8.7.162. Sizes of ISA, ISMC and ISMB shall not be less than the following:-ISA 65x65x6

8.7.163. ISMC 125

8.7.164. ISMB 150

8.7.165. Gusset plate shall not be less than 8 mm.

8.7.166. Minimum Thickness of Metal

8.7.167. Steel used for construction exposed to weather or other corrosive influences shall not be less than 8 mm in thickness and in construction not exposed to weather, thickness shall not be less than 6 mm. The controlling thickness as specified above, for rolled beams and channels shall be taken as the mean thickness of flange, regardless of web thickness.

8.7.168. Sealed tubes and sealed hollow box sections if used for external construction exposed to weather shall not be thinner than 4 mm and forconstruction not exposed to weather shall not be thinner than 3 mm.

8.7.169. Splices in structures

8.7.170. Shop splice: Where shop splices in plates are necessary due to non- availability of plates in required lengths, full penetration defect free sound butt welds shall be made. Shop splice in rolled steel angle, joists and channels shall be developed by fillet welding and cover plates/angles etc.

8.7.171. Site splice: Site splice for members required due to transportation, assembly and erection facilities shall be developed by fillet welds and cover plates and angles or high strength friction grip bolts. In case, butt welding in plates is employed for site

splice, the same shall be sound, defect free and of full penetration.

8.7.172. Material Specification

8.7.173. Structural steel

8.7.174. All structural steel shall be of tested quality. Structural steel conforming to IS 2062: 2011(grade as applicable). Steel grating and stair treads shallbe galvanized as per IS: 4759-1996.Steel tubes wherever used shall beas per IS 1161: 2014, yield strength 240 MPa and grade medium.

8.7.175. Chequered plates wherever used shall be as per IS 3502: 2009.Skelp plates shall conform to IS 10748: 2004.

8.7.176. The bidder shall submit the test certificates conforming to appropriate standards of all steel materials used for fabrication. All structural steel shall be free from rust, scales, lamination, cracks, fissures and other surface defects.

8.7.177. Bolts and Nuts

8.7.178. All bolts and nuts shall conform to IS 1363 (Part1): 2019, IS 1363 (Part2): 2018, IS 1363 (Part3): 2018 or IS 1364 (Part 1): 2018, IS 1364 (Part 2): 2018, IS 1364 (Part 3): 2018, IS 1364 (Part 4): 2003, IS 1364 (Part 5): 2002,IS 1364 (Part 6): 2018 as applicable and unless specified otherwise shall be hexagonal. All nuts shall conform to property class compatible to theproperty class of the bolt used. High strength friction grip bolts (HSFG bolts) shall conform to IS: 3757-1985. The nuts for the same shall conform to IS: 6623-2004. Hexagonal fit bolts shall conform to IS: 3640- 1982 with matching nuts and washers. The Bidder shall submit test certificates when called for.

8.7.179. Washers

8.7.180. Plain washers shall be made of mild steel conforming to IS 5369: 1975 unless otherwise specified. One washer shall be supplied with each boltand in case of

special types of bolts more than one washer as neededfor the purpose shall be supplied. An additional double coil helical spring washer conforming to IS 6755: 1980 shall be provided for bolts carrying dynamic or fluctuating loads and those in direct tension.

8.7.181. Tapered washers conforming to IS 5372: 1975 and IS 5374: 1975 shall beused for channels and beams respectively. Heavy washers shall conform to IS 6610:1972. Spring washers shall conform to type B of IS 3063:1994.Washers for high strength friction grip bolts shall conform to IS: 6649-1985.

8.7.182. Electrodes

8.7.183. Mild steel electrodes shall conform to IS 814:2004.

8.7.184. Fabrication

8.7.185. Standard

8.7.186. All fabrication of structural steel works shall be in accordance with IS 800:2007 and tolerances of fabrication of structures shall be as per IS 7215:1974 unless otherwise specified.

8.7.187. Welding

8.7.188. The welding and the welded work shall generally conform to IS 816:1969 and IS 9595:1996 unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence ofoperations shall be so arranged as to eliminate distortion and shrinkage stresses.

8.7.189. Machining of Butts, Caps and Bases

8.7.190. Butt joints of struts and compression members depending on contactfor stress transmission shall be accurately machined and close butt over the whole section.

Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by more than 0.8mm.

8.7.191. Welded joints should satisfy the following requirements

8.7.192. Strength quality with parent metal.

8.7.193. Absence of defects.

8.7.194. Corrosion resistance of the weld shall not be less than that of parentmaterial in aggressive environment.

8.7.195. Criteria for test of weld

8.7.196. Visual Examination: 100% of the welded joints for fillet welds and butt welds.

8.7.197. Ultrasonic Test: 100% for all butt-welded joints.

8.7.198. The bidder shall engage a reputed or any Government test agencyhaving Level II Ultrasonic examination certificate holder inspector to carry out the Ultrasonic or X-ray examination tests. The third party shallcarry out tests, interpret test results and recommend necessary rectification measures. Bidder shall carry out the rectification work as recommended by the test agency to ensure defect free welding. Bidder shall obtain certificates from the testing agency certifying defect free welds and submit to the employer.

8.7.199. Erection

8.7.200. For erection of steel structures, IS 800:2007 shall be followed and erection shall be carried out ensuring best workmanship, with specified standard limits and tolerances. The tolerances in erection of steel structures shall conform to IS 12843:1989.

8.7.201. Roof and side Covering

8.7.202. General

8.7.203. This specification covers the detailing, supply and erection colour coated sheets with all necessary laying, fixing etc.

8.7.204. Pre-painted Al-Zn coated profiled sheeting: Roof and Wall panels shall be of skin passed pre-painted Al-Zn coated trapezoidal profile. The base metal shall have minimum 550 MPa yield strength with hot dip metallic coating composed of 55% Al and balance Zn with minor addition of control elements. Thickness of base metal shall be minimum 0.45 mm and total coated thickness shall not be less than 0.5 mm. Coating mass shall be minimum 150 gm/sq.m. inclusive of both sides. Coating mass shall be minimum 60 gm/sq.m. on one surface for single spot test.

8.7.205. Pre-painted Al-Zn coated sheet shall conform to IS 15965: 2012.

8.7.206. Sectional properties, i.e. depth and pitch of trapezoidal profile shall depend on the structural arrangement of purlins and side runners and the adequacy of sheeting work in terms of strength and suitability of application shall be substantiated by submitting necessary data and calculation.

8.7.207. The paint system shall be factory pre-painted on a continuous line. The paint system shall comprise of conversion coating, corrosion inhibitive polyester / super durable polyester primer (both faces), final coat (on external surface) and wash coat on the bottom side of metallic coat. Paint system shall comprise of 15 microns (minimum) final coat on exposed surface and 4 micron (minimum) wash coat on bottom surface over 4 micron (minimum) primer coat on both surfaces. Conversion coating should be applied to both the surfaces of the metallic coated steel before application of the primer paint. Flashings etc. shall be madeof same material and specification as that of Roof and Walls.

8.7.208. The fastener shall be fixed on crest of roof sheets for connecting with purlin. The wall cladding could be crest fixed or valley fixed as recommended by the manufacturer.

All fasteners shall be strictly as per profiled sheet manufacturer‟s specification and recommendations. Manufacturer's recommended installation methodology shall strictly be adopted for installation of all pre-painted Al-Zn coated profiled sheets for roof and wall cladding. Colour scheme of sheet shall be as approved by the employer.

8.7.209. The bidder shall submit manufacturer‟s test certificates of all materials supplied by him and used for fabrication and erection.

8.7.210. Painting

8.7.211. All structures shall be given two coats of single pack air drying phenolic modified alkyd composition with zinc phosphate as a primer having minimum dry film thickness of 80 microns (40 microns/ coat). One coat of primer shall be applied before erection and one coat after erection.

8.7.212. Final paint shall be two coats of single pack air drying high glossphenolic alkyd modified synthetic enamel paint as finishing coat having minimum dry film thickness of 50 microns (25 microns/ coat).

8.7.213. For outdoor structures, an intermediate coat shall be applied over primer coats. Intermediate paint shall be one coat of single pack high build phenolic based paint with micaceous iron oxide (MIO) having minimum dry film thickness of 75 micron.

8.7.214. <u>Surface preparation:</u>

8.7.215. All surfaces shall be cleaned of loose substance and foreign materials

8.7.216. e.g. dirt, rust, scale, oil, and grease, welding flux etc. so that the prime coat adheres to the original metal surface. Any oil, grease, dust or foreign matter deposited on the surface after preparation shall be removed and care shall be taken so that the surface is not contaminatedwith acids, alkalis or other corrosive chemicals. The primer coat shall be applied immediately after the surface preparation is completed. Surface

preparation shall be either by hand tool cleaning or by power tool cleaning or by solvent cleaning. The grade of surface preparation shall be strictly in accordance with manufacturer's recommendations.

8.7.217. Paint application

8.7.218. Paint shall be applied strictly in accordance with manufacturer's recommendations. The work shall generally follow IS: 1477-1971 (Part- II). Prior approval of the employer shall be taken in respect of all primersand/or paints before their use in the works.

8.7.219. Testing Erection & Commissioning

8.7.220. Fabrication, erection, testing and commissioning of steel structures shall be in accordance with IS: 800-2007, IS: 7215-1974. Erection tolerances shall be in accordance IS: 12843-1989

8.7.221. CIVIL WORKS

8.7.222. **Design Specifications**

8.7.223. This specification covers the design criteria for Civil Engineering work for the Rourkela Steel plant (RSP). The term „Design Criteria" includes loading standards, permissible stresses, functional requirements andquality standards to be adopted as a basis for preparation of designs and drawings by the bidder. These designs and drawings will cover buildings for production and non-production facilities, auxiliary facilities,ancillary buildings and structures, foundations for buildings andequipment, roads, drains, sewers and other miscellaneous civil engineering items of work to be provided and/or to be modified/ rectified by the bidder.

8.7.224. The designs prepared by the bidder shall not only provide for therequirements indicated in this specification but also consider the overall process requirements, service conditions and provisions to be made for future expansion. The designs shall

be compatible with the operating conditions in the Plant and the atmospheric conditions prevalent at Rourkela.

8.7.225. Standards and unification shall be carried out to the maximum extent possible and in the interest of standardisation. RSP reserves the right of selecting a particular make of materials and components. The bidder shall supply materials/components of the particular make, if so required.

8.7.226. Standards

8.7.227. The design criteria for civil engineering work shall be in accordance with this specification. Detailed instructions on such aspects as are not indicated herein shall be as per the latest standards, codes. In theabsence of suitable IS specification and codes of practices other recognised international standards and codes may be followed with the prior approval from employer.

8.7.228. In respect of pollution control, safety, sanitary and hygienic requirements the stipulations of the Department of Environment of the Government of India, stipulations of the Indian Factories Act, Odisha Government Factories Rules, RSP‟s Safety Rules, notification of Odisha Government Department of Science, Technology and Environment on Water and Air Pollution and other statutory authorities shall be satisfied.

8.7.229. This specification covers design of major Civil Engineering items ofwork. Other items of work shall be designed according to the relevant standards, recommendations and stipulations referred above. This design specification shall also be read in conjunction with the General specifications for Civil Engineering Work.

8.7.230. In case anything mentioned in this specification is at variance with IS or other codes of specification mentioned herein, the provisions of this specification shall prevail.

8.7.231. Concrete And Reinforced Concrete For Structures And Foundations

8.7.232. Design of all reinforced concrete structures shall be as per the latest IS: 456 – 2000. For equipment/ trestles/ other structural supports theallowable settlement shall not exceed 25mm.

8.7.233. For calculation purpose „Limit State Design" methods shall be adopted.

8.7.234. The minimum grade of RCC shall be M25 and PCC shall be M10.However, PCC of grade M5 shall be used for mass filling.

8.7.235. Grouting

8.7.236. Grouting under the base plate shall be done with readymix, non-shrink, free-flow cementatious grout of approved make as per manufacturer"s specifications.

8.7.237. Load Condition

8.7.238. All foundations and concrete structures shall be designed to resist full operating dead and live loads, with appropriate combination of wind and seismic forces and with due allowance for impact, inertia loading, vibration etc. Requirement of seismic load analysis shall be based on type & importance of structure, mass concentration etc. and shall be decided at the time of detail engineering.

8.7.239. Concentrated and uniformly distributed live load on floors and platforms shall be considered depending upon the usage and in accordance with a maximum expected process requirements, to be indicated by the equipment manufacturers.

8.7.240. The design & construction of machine foundation shall strictly in accordance with latest IS:2974 (relevant part).

8.7.241. Design of structures shall also account for temporary maintenance of plant and equipment.

8.7.242. In case of moving loads, full load under worst operating condition together with

minimum 25 percent vertical impact factor shall be considered for vehicles and machinery travelling / mounted on tracks (rails).

8.7.243. Permissible Stresses

8.7.244. Allowable stresses for all reinforced concrete structures shall be as perIS: 456 – 2000.

8.7.245. Soil Conditions

8.7.246. Soil investigation & survey report is available with the employer and shall be referred on request. For designing of foundation for facilities in the proposed area, the allowable bearing capacity shall be taken as 20t/Sq.m. at 2.5m depth from natural ground level in the virgin strata.

8.7.247. However, In case of encountering the loose soil strata at 2.5m depth, the excavation shall be taken down upto the depth where virgin strata ismet and the extra excavation shall be filled up with PCC of grade M-5.

8.7.248. Foundations

8.7.249. The foundations for structures and equipment shall be proportioned to resist the worst conditions of loadings and shall be generally designed as per the provisions of IS: 1904 – 1986.

8.7.250. Equipment requiring special foundations as a result of dynamic, unbalanced forces, shall be designed as per IS: 2974 (Part-1) – 1982, (Part-3) – 1992 & (Part-4) – 1979. The foundation shall be investigated for natural frequency and designed properly to avoid resonance and the amplitude shall be kept within allowablelimits.

8.7.251. The depth of foundation shall be as per soil investigation report. However, in no case shall be the foundation is taken down to lessthan 600 mm below natural ground level in case of soil and 200 mm in case of rocky strata.

8.7.252. In no case foundation shall be rested on the filled up soil and the depth of the foundation shall be taken upto the depths wherethe virgin soil strata is found.

8.7.253. Requirements of Durability

8.7.254. This shall be as per the provisions of IS: 456-2000 for moderate or severe exposure conditions.

8.7.255. Floors

8.7.256. Floors on the sub-grade shall of minimum 150 thick RCC with top & bottom both-ways reinforcements over 250mm thick compacted boulder soling with moorum blinding (on horizontal surface) and 225mm thick stone pitching (on sloping surface). Building paper shall be provided on top of sub-grade (boulder soling & stone pitching) before casting the concrete slab.

8.7.257. Floor Finishes

8.7.258. Floor finishes shall be provided according to functional, service and duty requirements, wherever applicable.

8.7.259. In new MCC room, the floor finish shall be same as the existing floor finish of panel room.

8.7.260. In slag storage area, over the sloping & horizontal RCC slab, 40mm thick screed concrete of grade M30 with 10mm & down size coarse aggregate shall be provided. Pre-mix ready to use floor hardener, Sika Chapdur of Sika or equivalent shall be used as per the manufacturer‟s specifications. The minimum consumption of dry shake surface hardener shall be 6 Kg/Sqm.

8.7.261. External Cladding, Internal Partitions & Finishes

8.7.262. This section deals with cladding, internal partitions and finishes for production

buildings and associated ancillary and auxiliary buildings.

8.7.263. External cladding shall be constructed of brick masonry. The thicknessof brick masonry walls shall be minimum 230mm. However, for transformer & other hazardous rooms, the minimum thickness of walls shall be as per safety guidelines of BIS / standard practices. The Design of masonry walls shall conform to IS: 1905 – 1987.

8.7.264. Cement sand mortar shall be 1:6 for external walls having minimum thickness of 230mm and also for brick work in protection walls towaterproofing membrane in tunnels, basements etc.; for walls of thickness 110mm mix shall be 1:4 with HB wire netting reinforcement at every third layer.

8.7.265. All brick and rubble masonry walls shall be plastered on both sides. Thickness of plaster shall be minimum 20mm for external surfaces and 15mm for internal surfaces of walls. Thickness of plaster for ceiling shall be upto 10 mm.

8.7.266. Cement sand mortar mix for all plasters, shall be 1:4.

8.7.267. All outside plastered surfaces of masonry walls shall be applied with weather-proof paint of approved make and quality and to be applied as per manufacture‟s specification.

8.7.268. Inside surfaces of masonry walls shall be treated with acrylic emulsion paints of approved quality, make and colour, or to be tiled as the case may be, on the basis of technological and/or aesthetic requirements. Necessary surface preparation shall be done prior to application ofpaints.

8.7.269. Depending on technological considerations, walls of some premisesmay be made of reinforced concrete and finished appropriately.

8.7.270. Design Calculations, Drawings And Documents

8.7.271. The design calculations shall be submitted by the bidder for approval, prior to submission of construction drawings shall include but not be limited to, the following.

8.7.272. Foundation Design

8.7.273. The design calculations shall include static design calculations for allstructures and foundations, dynamic analysis for all important structures and foundation subjected to impact, vibrations etc. induced by equipment and other external forces shall be done in accordance with latest relevant IS codes.

8.7.274. Measures required for the safety of foundations & facilities shall also be given.

8.7.275. Drawings

8.7.276. The bidder shall prepare general layout drawings giving salient levels and dimensions of the whole area showing all over ground and underground services and facilities, buildings, roadways, railways etc. provided for co-ordination with the other areas of the plant. Detailed working drawings shall be prepared on the basis of the general layout drawings considering overall foundation layout for all the required facilities. The bidder shall submit a comprehensive and complete unit wise classified list of drawings in reproducible form/softcopy.

8.7.277. The bidder shall submit for approval / reference of the employer general arrangement and detailed working drawings for all concrete, reinforced concrete and other civil work, as follows:

8.7.278. Foundation plans and sections.

8.7.279. Loading drawings indicating superstructure loading, equipment loading, floor loadings, etc.

8.7.280. Comprehensive anchor hole plan along with complete detailsof anchor bolts and

anchor pockets for foundation for steel columns and equipment etc. including schedule for bolts andanchor plates. Design of anchor bolts should be such that it should be possible for any replacement of the same in future,if required.

8.7.281. Reinforcement details with bar bending schedules for all reinforced concrete works.

8.7.282. Drawings for all types of bolts, inserts, embedments, covers, miscellaneous steel works etc.

8.7.283. Underground storm water drainage drawings for areas and buildings within the battery limit.

8.7.284. Workmanship & Material Specification

8.7.285. General

8.7.286. Local conditions

8.7.287. The bidder, before submitting his tender, shall visit the site and ascertain the local conditions, labour rules, availability of construction materials, traffic restrictions, all obstructions in the area and also ascertain all site conditions including the sub-soil conditions and shall allow for any extras likely to be incurreddue to all such conditions in his quoted prices. After the award of work no additional claims will be entertained on these accounts under any circumstances, whatsoever, from the bidder.

8.7.288. Setting out and levelling

8.7.289. The bidder shall set out and level the work and will be responsible for the accuracy of the same. He is to provide all instruments and proper qualified staff with labour for getting his work checked by Engineer, if so desired by the Engineer. Such checking, if any, shall not, however, relieve the bidder in any way, of his responsibility for correct setting out.

8.7.290. Safety

8.7.291. The bidder shall take adequate precautions to ensure complete safety and preventions of accidents at site and shall be responsible for the same. The safety precautions shall conform to the safety regulations prescribed by the Safety Code forconstructions and relevant Indian Standard Codes, some of which are stated below:

8.7.292. Keeping work free from water

8.7.293. The bidder shall provide and maintained at his own cost, pumps and other equipments to keep the works free from water and continued to do so until the handing over of the works

8.7.294. Rubbish

8.7.295. The bidder shall keep the site clear on a continuous basis of all rubbish etc. which may arise out of the work executed by him and dispose them suitably in allotted areas.

8.7.296. Bench Marks, Reference Pillars etc.

8.7.297. The bidder shall protect all bench mark, and reference pillars/lines including ground water gauges from damage or movement during working. In case of any damage the bidder shall have to restore the same to its original condition at his own cost.

8.7.298. Standards

8.7.299. Unless otherwise mentioned in the specifications, all applicable codes /standards as published by the Bureau of IndianStandards on the date of award of contract shall governed the work in respect of design, workmanship, quality and properties of materials, method of testing and other pertinent features. In case of variance

between this specifications and IS Codes/Standards, the provisions of this specification shall prevail uptothe extent of such variance.

8.7.300. Excavation and Back Filling

8.7.301. Stripping

8.7.302. The bidder shall strip the surface of the site prior to the commencement of excavation to remove vegetable soil andcarry such soil to separate spoil dumps in the allotted site/areas.The bidder shall not remove any tree without permission of the Engineer.

8.7.303. Excavation for foundations and Trenches

8.7.304. The bidder shall excavate at various levels including hard rock to remove materials of any nature or description, which may be encountered. Side slopes, benching and/or shoring/strutting for excavation work shall be soleresponsibility of the bidder. The bed of the excavation shall be properly dressed and made level. All mud and slush shall be removed before taking up concreting work. The last 150 mm of excavation shall be done just prior to laying of concrete. The excavated materials shall not be placed within

8.7.305. 1.5 m from the edge of any excavation. The bidder shall take suitable precautions to prevent ingress of water into the excavated areas during construction.

8.7.306. The bidder shall account for all excavated rock, if any. Heshall stack excavated rock and if the bidder for his works requires serviceable boulders, it may be issued based onstack measurement less 40% for voids at the rate to be decided by the employer.

8.7.307. The surplus excavated materials and excavated unserviceable materials from rock excavation shall be transported and disposed off by the bidder in spoil dumps or fill

areas as directed by the employer.

8.7.308. If the bidder excavates to levels lower than those shown on the drawings, he shall fill up such extra depth at his own cost to the proper level with lean concrete of grade M-10B.

8.7.309. Should the bottom of any excavation appear to be soft, unsound or unstable, the bidder shall excavate the same to required depths and the extra depth shall be filled up by the bidder with lean concrete of grade M-5B.

8.7.310. The bidder shall take all precautions against slips and falls in the excavation. No extra payment will be made for removalof slips and for back filling the space with materials as directed by the employer.

8.7.311. The excavation shall be kept free from water by pumping. In small pits water may be bailed out with buckets. Pumping of water shall be carried out either directly from the excavation or from sumps made outside the excavation as directed.Adequate care shall be taken to prevent movement of water through freshly laid concrete or masonry work.

8.7.312. If any excavation for foundation gets filled up with water due to rain, seepage or for any reason, the water shall be removed and bottom of the excavation shall be completely cleared of all silt/slush by the bidder at his own expense.

8.7.313. All water pumped or bailed out during de-watering of pits and trenches shall be disposed off suitably through properly laid channels or pipes. Disposal of water shall be carried out in such a way that no inconvenience or nuisance is caused to the work in progress in the area or to other agencies workingin the area or cause damage to property and structures nearby.

8.7.314. Back Filling

8.7.315. Materials

8.7.316. Suitable materials obtained from excavation of foundations shall be used as far as possible for back filling. Earth used for filling shall be free from organic and other objectionable matter. All clods of earth shall be broken or removed. If sufficient amount of suitable materials are not available atsite to complete filling work, then earth shall be brought to site from outside by the bidder as directed by the employerat his own cost.

8.7.317. Filling around foundations with earth

8.7.318. Before commencement of back filling, the bidder shall remove from the space around foundations all accumulated water and slush, shoring and formwork, all debris, brickbats, bits of timber, cement bags and all other foreign materials. Filling shall be carried out in uniform horizontal layers, each layer not exceeding 200 mm in thickness. Each layer shall be watered, rammed, and thoroughly compacted before the next layer is deposited.

8.7.319. Plinth filling and special compaction with earth

8.7.320. Plinth filling or filling where special compaction is required shall be carried out in uniform horizontal layers, each layer not exceeding 150 mm in thickness. Each layer shall be well watered and compacted by mechanical means. The bidder shall take core samples for each layer, determine the dry density and maintain logs. The minimum dry density to be achieved shall be 95% of maximum dry density as obtainedby Standard Proctor Test. Tests shall be conducted by the bidder as directed by the Employer at his own cost.

8.7.321. Removal of heaps & Mounds

8.7.322. Immediately upon completion of each phase of work, the bidder shall at his own cost clear the mounds or heaps of earth which may have been raised or made and remove

all earth and rubbish which may have become surplus in the execution of works, as directed.

8.7.323. Filling with sand

8.7.324. Filling with sand shall be carried out in uniform horizontal layers, each layer not exceeding 200 mm in thickness with approved river sand and each layer to be watered and compacted mechanically to a well compacted mass.

8.7.325. Plain And Reinforced Concrete Work

8.7.326. Materials

8.7.327. Cement

8.7.328. Ordinary Portland cement shall conform to IS: 269-1989/ IS: 8112-1989 and Portland blast furnace slag cement shall conform to IS: 455-1989. Soundness test is to be carried out on cement samples from time to time. Frequency of these tests shall be increased during monsoon period.

8.7.329. Aggregates

8.7.330. All aggregates shall conform to IS: 383-1970.

8.7.331. Reinforcement

8.7.332. Reinforcement in general shall be of tested quality. TMT bars conforming to IS: 1786-2008 as shown in drawings shall be free from oil paint and rust coatings. However, MS round bars conforming to IS: 432-1982 or IRC mesh fabric reinforcement conforming to IS: 1566-1982 can also be used if specifically required. The binding wire shall be 20 SWG approved annealed iron wire.

8.7.333. Shuttering

8.7.334. The material for shuttering shall be steel plates as per IS: 2062-1999 or wooden

planks as per the requirement.

8.7.335. Water

8.7.336. Water shall be clean and of potable quality as per clause 5.4 of IS: 456-2000.

8.7.337. Workmanship

8.7.338. Concrete

8.7.339. Production and control of concrete shall be as per IS 456-2000. The grades of concrete shall be as indicatedin the drawing. The bidder shall at his own cost, grade the aggregates and control the water cement ratio, design the different mixes to required strength and workability. The designed mix shall conform to the requirement of IS 456-2000 and recommended guidelines in SP: 23-1982. All concrete shall be machine mixed, and no hand mixing shall be permitted.

8.7.340. The maximum size of aggregates used shall be as indicated in the drawings and IS: 456-2000.

8.7.341. Where nominal mixed concrete is permitted by the employer for any specific reason, the same shall bedone in accordance with the provisions of IS: 456-2000.

8.7.342. Mixing

8.7.343. Mixing shall be carried out in mechanical mixers and preferably a batch mixing plant shall be used. Mixing of concrete shall confirm to provision of Latest BIS codes.

8.7.344. Consistency

8.7.345. Consistency of concrete shall be controlled as per IS: 456- 2000 and the bidder shall carry out slump tests in accordancewith IS: 1199-1959.

8.7.346. Work tests

8.7.347. Over the full period of construction, the bidder shall carry outworks tests of concrete cubes at his own cost. Sampling, making up, curing and testing of specimen shall conform to IS: 456-2000, IS: 516-1959 and IS: 1199 -1959. The number of specimen to be tested, frequently and their criteria for acceptance shall be according to IS: 456-2000.

8.7.348. Reinforcement

8.7.349. Workmanship shall conform to IS 2502-1963. All reinforcement shall be free from loose mill scale, rust, oil, grease and paint, etc. Reinforcement shall not be bent or straightened in a manner that will injure the material, and all bars shall be bent cold.

8.7.350. Reinforcement bars shall be placed and maintained accurately in the position as shown in the drawings. Thecorrect cover to the reinforcement shall be maintained by useof pre-cast concrete blocks.

8.7.351. All intersections of longitudinal and transverse bars of stirrups and all laps shall be securely tied together with approved binding wire. The binding wire shall be so placed that it touches all the four corners of the intersection and the two ends shall be looped with pliers and the end should be turned into the body of the concrete.

8.7.352. Welded joints may be used in cases of important connectionstests shall be made at the cost of the bidder to prove that thejoints have reached the strength of the bars connected.

8.7.353. Welding shall be done in accordance with IS:2751-1979 and special precautions shall be adopted for cold worked bars. Butt-welding between the ends of a rod in line, whereby stress is transferred across the section may be adopted only for mild steel bars. In case of tack welding for fixing reinforcements in their position, no special precautions need to be taken.

8.7.354. Embedment

8.7.355. All embedment shall be accurately set and rigidly fastened. Anchor bolts shall be set to template and firmly secured in vertical and horizontal line at required positions.

8.7.356. Anchor holes and anchor bolts shall be protected suitably after thorough cleaning.

8.7.357. Placing of concrete

8.7.358. Transporting concrete

8.7.359. Transportation of concrete shall be as per IS: 456-2000.

8.7.360. Placing

8.7.361. Placing of concrete shall be in strict accordance with IS: 456- 2000 and standard practices followed at RSP.

8.7.362. Construction joints

8.7.363. Construction joints shall be located such that they do not impair the strength of the structure. In walls and columns, height of each lift shall not generally exceed 1.5 m unless otherwise specified in the drawings. Method of forming all construction joints shall conform to the provision of IS: 456- 2000.

8.7.364. Expansion joints

8.7.365. Expansion joints, if required, shall be provided as per latest relevant IS code.

8.7.366. Compaction

8.7.367. Concrete in general shall be consolidated by vibration using high frequency mechanically driven vibrators. Concrete shall be placed in layers at least 300 mm deep in walls and approximately 450 mm in mass pours. Vibrators shall not penetrate more than 50 mm into the surface of previously placed layer but shall completely vibrate the working layer. Care shall be taken not to over vibrate any concrete and especially those with higher slumps. Under no circumstances vibrator shall be

attached to or allowed to touch reinforcement. Spare vibrators in good operating condition shall be in hand during placing operations.

8.7.368. Curing and protecting

8.7.369. Curing of concrete with water shall be as per IS: 456-2000.

8.7.370. Repairing and patching

8.7.371. Pockets honey combing and other defects, which may be formed due to segregation, improper vibration and any otherreason whatsoever shall be completely repaired to the satisfaction of the Engineer. The voids, if any, shall be properly keyed and reinforced, if necessary. The face shall be tightly formed and arranged for providing a head in theconcrete. The cavities shall be filled with the same concrete as used for the structure and thoroughly rodded or vibrated where possible. The filled hopper shall be left in place until shrinkage has taken place and the concrete sets sufficientlyto stay in place. While still `alive', the upper part of form hopper shall be removed and excess concrete struck off and finished with wooden flat or trowel to match existing concrete. Any fins or unsightly grout runs or bulges shall be removed from the surfaces exposed to view. The rod holes shall be finished with cement or grouted to match the existing surface as closely as possible. No cement wash shall be used unless particularly called for in the drawings.

8.7.372. Tolerances

8.7.373. Tolerances shall confirm to IS: 456-2000 and equipment manufacturer, whichever is stringent.

8.7.374. <u>Form Work</u>

8.7.375. All form work, shuttering, supports, ties and its tolerance, setting & striking shall confirm to the provision of IS:456-2000 and standard practice of RSP. Suitable

provision of inserts, embedment & bolts shall be made in the form work.

8.7.376. The material & workmanship specification of items, not covered above, shall be as per provisions of latest relevant IS codes and manufacturer‟s specifications, if any.

8.7.377. UTILITY

8.7.378. **Ventilation System**

8.7.379. The following premises mentioned below shall be provided with Dry Pressurized Ventilation System:-(TABLE)

Sl. No.	**Premises**	**Internal Temperature (ºC)**	**System details**
1	New Electrical room	Ambient temp. + 3ºC permissible rise.	Dry Pressurized Ventilation System consisting of Tube Axial Fan with drive and accessories with 50% standby.
2	Cable cellar below new Electrical room	Ambient temp. + 3ºC permissible rise.	- do -

8.7.380. The bidder shall size ventilation systems based on actual solar & internal heat load of different rooms, or at least 25 air changes per hour, whichever is higher. The heat load and calculations and system design should be submitted for employer‟s approval.

8.7.381. reinforced- dry panel type- washable type air filter complete with mounting structure, outlet grill, gravity louvers, DOL starters, and all necessary accessories.

8.7.382. The bidder shall size ventilation equipment based on actual solar& internal heat

load of different rooms, or at least 25 air changes per hour, whichever is higher. Extra 10% margin shall be considered for all ventilation system. The bidder shall submit heat load calculations and equipment sizing calculations for all ventilated premises during detail engineering for approval andselection of the system.

8.7.383. Technical Specification of Ventilation System

8.7.384. Heavy Duty Tube Axial Fan

8.7.385. The tube axial fan shall be industrial, heavy duty type, suitable for continuous operation, statically and dynamically balanced, single stage, directly coupled with drive motor and shall be manufactured, tested according to IS:3588-1986.

8.7.386. Gravity Type Louvers

8.7.387. The gravity type louvers shall be fabricated from 2.0mm thick M.S. sheet finished with two coats of red oxide painting and two coats of finished paints matching to the interior decor. The number and location of exhaust air grills shall be carefully decided considering room size, 15 air changes per hour, air velocity and 2mm WG positive inside pressure, etc.

8.7.388. Grills and Diffusers

8.7.389. The grills and diffusers shall be fabricated from M.S. sheet ofthickness not less than 2.0 mm. All supply air grills shall be rectangular/circular type with adjustable louvers, whereas return airgrill shall be fixed type, fresh grills shall be adjustable type with wire mesh filter.

8.7.390. Filter

8.7.391. Air filter shall be HDPE- Steel wire reinforced- dry panel type. It should be easily removable and washable type. This filter should be complete with bolted construction facilities easy to handle and transportation.

8.7.392. Electrics for ACVS System

8.7.393. Electrical items shall be as per specification stipulated under electricalchapter.

8.7.394. Civil and Structural Work

8.7.395. Civil & structural works shall be as per specification stipulated under respective chapters.

8.7.396. Painting

8.7.397. All mild steel equipments, structures grills, pipes, etc. pertaining to ACVS shall be suitably painted with 2 coats of red-oxide primer and finished with two coats of finished paint. The bidder should strictly follow standard colour codes for suction and discharge refrigerant pipes etc. for quick and easy identification. Colors of the grills shall match with the interior decor of control room/ painting of walls.

8.7.398. The inside conditions in the ventilated rooms shall be maintained throughout the year.

8.7.399. The bidder shall furnish the following for approval / reference.

8.7.400. Heat load calculation and design criteria including duct-sizing calculation of for approval.

8.7.401. Technical specification for reference.

8.7.402. Literatures /catalogues for record of all the equipment covered under Ventilation system

8.7.403. Fire Fighting system

8.7.404. For new electrical room and Cable cellar below new Electrical room, suitable number of Portable Fire extinguishers shall be considered as per norms.

8.7.405. Fire fighting water header of DN 100 along the gallery of proposed conveyor for fire fighting purpose shall be provided. New line shall be tapped from nearest existing fire water header. Isolation valve shall be provided at the tapping point.

8.7.406. Fire fighting system for the gallery and junction house shall be complete with headers, pipelines, isolation valves, landing valves, hoses, quick coupling and nozzles etc. Nearby water source shall be utilised as watersource for the system.

8.7.407. GA drawing of the fire fighting system and its lay out along with BOM shall be submitted for approval.

8.7.408. INSPECTION AND TESTING

8.7.409. **Test at Site**

8.7.410. IS 11592 shall be followed during inspection of the conveyor. In general following test shall be carried out at site to the satisfaction ofthe employer:

8.7.411. Insulation resistance and earth test for all electrical apparatus.

8.7.412. Continuous operation of the conveyor and simulated starts andstops as per applicable standards.

8.7.413. No load current and voltage readings.

8.7.414. Stalling current and voltage and time taken to operate overload.

8.7.415. Overload protection. (Electrical).

8.7.416. Speeds of the conveyor. Speed shall be maintained as given in technical specification.

8.7.417. Smooth operation of the take up.

8.7.418. Smooth operation of the mobile tripper.

8.7.419. Smooth discharge of material from the chutes of the mobiletripper.

8.7.420. Smooth operation of the gates in the mobile tripper.

8.7.421. Operation of controllers.

8.7.422. Demonstration of the device to the satisfaction of theemployer

8.7.423. Demonstration of operation to the satisfaction of theemployer

8.7.424. Demonstration of the safety devices and interlocks thereof.

8.7.425. Other test as required by employer as per the IS.

8.7.426. COMMISSIONING AND PERFORMANCE GUARANTEE

8.7.427. PRELIMINARY ACCEPTANCE

8.7.428. On completion of erection of the facilities by the bidder, trial runs for individual equipment / units shall be conducted by the bidder to prove that the facilities have been supplied and erected as per contract and after erection, facilities are fit for start-up and commissioning. After liquidation of all the defects and after fulfilling all the provision **of clause 24 of GCC of Standard Bidding Document (SBD)** employer shall issue Preliminary Acceptance Certificate (PAC) for the subsequent commissioning of facilities.

8.7.429. COMMISSIONING

8.7.430. Commissioning test shall be undertaken by the bidder as per the provisions of **Clause 25 of GCC of SBD**. On successful completion of commissioning test employer shall issue commissioning certificate.

8.7.431. The commissioning test shall be conducted as per mutually agreedschedule.

8.7.432. The facilities shall be deemed to be commissioned on fulfilment of following:

8.7.433. Operation of Conveyor with 2.5 meter/sec belt speed.

8.7.434. Trouble-free operation with material loading for not less than 168 hours

8.7.435. In case of any interruption during the specified period/ duration of commissioning on account of reasons attributable to the Employer, the acceptance of commissioning with regards to duration of commissioning tests shall be as per the mutually agreed terms between the Employer and the bidder.

8.7.436. PERFORMANCE GUARANTEE

8.7.437. **General**

8.7.438. The bidder shall guarantee the equipment for its workmanship, materials, design and satisfactory operation in accordance with relevant specifications and provisions of the contract. The guarantee for performance shall include individual items and systems for various ratings / out puts as well as for the integrated operation of the plant.

8.7.439. The details of the performance guarantee tests, test procedures, test schedules for the demonstration of performance guarantee parameters shall be submitted to the employer which shall be mutually agreedupon.

8.7.440. The bidder shall conduct the performance guarantee tests to demonstrate PG parameters as defined hereunder in subsequent para and as per provisions of **Clause 27 of GCC and Appendix-V of SBD.**

8.7.441. PG Test shall be conducted within a period of six months after the date of commissioning once facilities achieve stable operation as well as production level.

8.7.442. Period of PG Test shall be for 3 days during which the bidder shall demonstrate the PG parameters.

8.7.443. Preconditions for Performance Guarantee Tests

8.7.444. Preconditions for the employer

8.7.445. Availability of power

8.7.446. Availability of operating and maintenance personnel during PG Test.

8.7.447. Preconditions for the bidder:

8.7.448. All new installations as per scope covered in these specifications are successfully completed.

8.7.449. After minimum one-month of regular operation from the date of commissioning of each system, bidder shall offer the equipment for carrying out Performance Guarantee Test. Starting time of Performance Guarantee Test shall be mutually agreed uponbetween employer and bidder

8.7.450. Bidder shall carry out regulation of newly erected equipment and shall take full responsibility of operation of equipment and carrying out PG test using their experts.

8.7.451. Performance Guarantee Parameters

8.7.452. Bidder shall have to demonstrate following parameters as listed hereunder:(TABLE)

Sl. No.	PG Parameter	Guaranteed Value
1	Belt Speed (under loaded condition)	2.5m/s (minimum)

8.7.453. Variance of input conditions for PG parameters

8.7.454. In the event of any variance in the input conditions w.r.t quality, quantity, or any other parameter as defined in cl. 4.3.2 and 4.3.3, which has a bearing on the PG

parameter, the output PG parameter shall be mutually discussed and revised as per the agreement between the employer and bidder, before the start of PG tests.

8.7.455. Non fulfillment of Performance Guarantee Parameters

8.7.456. In case the bidder is unable to attain the guaranteed value of performance guarantee parameters then bidder shall rectify the system in order to achieve the performance parameters.

8.7.457. FINAL ACCEPTANCE

8.7.458. Final acceptance shall be as per **clause no. 28 of GCC of SBD**.

End of Clauses

SCHEDULE NO. 1.8-1

DECLARATION OF SITE VISIT

(To be filled up by the bidder)

I, hereby, declare that I have visited the site to understand the site conditions, and acquainted myself with atmosphere prevalent therein. I have also understood the extent of total works involved for this TS.

Signature of the bidder:

Seal of company

Name:

Designation:

SCHEDULE NO. 1.8-2

LIST OF EXCLUSIONS

Sl. No.	Reference clause of TS	Details of Exclusions	Reasons

Signature of the bidder

Seal of company

Name

Designation

SCHEDULE NO. 1.8-3

LIST OF DEVIATIONS

Sl. No.	Reference clause of TS	Details of Deviations	Reasons

Signature of the bidder

Seal of company

Name

Designation

SCHEDULE NO. 1.8-4

LIST OF RECOMMENDED SPARES FOR

TWO YEARS NORMAL OPERATION

(To be filled by the bidder)

Bidder shall recommend and tabulate below the list of additional spare partsfor two years trouble free operation. Additional sheet of like format may be used if necessary.

Sl. No.	Name of Sub Assembly	Description of Items	Quantity recommended

Seal of Company

Signature of the bidder

Name:

Designation:

SCHEDULE NO. 1.8-5

LIST OF COMMISSIONING SPARES

(To be filled by the bidder)

Bidder shall tabulate below item wise the list of commissioning spares necessary for the equipment offered. Additional sheet of like format may be used if necessary.

Sl.No.	Name of Sub Assembly	Description of items	Quantity recommended

Seal of Company

Signature of the bidder

Name:

Designation

SCHEDULE NO. 1.8-6

LIST OF FIRST FILL OF OILS AND LUBRICANTS

Sl. No.	Description	Quantity

Signature of the bidder

Seal of company

Name

Designation

SCHEDULE NO. 1.8-7

DETAILS OF AUTHORISED PERSON OF BIDDER DURING TENDER EVALUATION

1. Name of Project :
2. Tender No. :
3. Name & Address of bidder :

4. Name of authorized person (TECHNICAL) :
5. Email address :
6. Mobile No. :
7. Name of alternate authorised person (TECH) :
8. Email address :
9. Mobile No. :
10. Name of authorized person (COMMERCIAL) :
11. Email address :
12. Mobile No. :
13. Name of alternate authorised person (COMM) :
14. Email address :
15. Mobile No. :

Authorised Signatory

SCHEDULE NO. 1.8-8

REQUIREMENT OF CONSTRUCTION WATER & POWER

Sl. No.	Description	Quantity

Signature of the bidder

Seal of company

Name

Designation

SCHEDULE NO. 1.8-9

IMPLEMENTATION SCHEDULE

(To be filled by the bidder)

Sl. No.	Description	Months									
		1	2	3	4	5	6	7	8	9	10
1	Placement of order										
2	Design & Engineering										
3	Manufacture of equipment										
4	Supply of equipment										
5	Area Development										
6	Civil/ Structural works for Conveyor installation										
7	Erection of conveyor										
8	Testing & Commissioning										

ANNEXURE. 2.1.9.2-1

IMPLEMENTATION SCHEDULE

(Proposed Tentative Schedule)

Sl. No.	Description	Months									
		1	2	3	4	5	6	7	8	9	10
1	Placement of order										
2	Design & Engineering										
3	Manufacture of equipment										
4	Supply of equipment										
5	Area Development										
6	Civil/ Structural works for Conveyor installation										
7	Erection of conveyor										
8	Testing & Commissioning										

X+120.000
PACKAGE-TK06

X+61.300

RAIL LINE

LEVEL 222.150

LEVEL 220.553

X+70.000

EXISTING
JH-03

LEVEL 218.267

EXISTING
JH-04

NEW JH-05
(PACKAGE-TK06)

ENTRY

PROPOSED GRAN. SLAG DUMP YARD

LEVEL 217.125

LEVEL 216.801

LEVEL 216.942

LEVEL 216.500

LEVEL 216.323

PN

RAIL LINE

LINE MAY VARY SLIGHTLY

TOP OF BUILDING LEVEL 220.900

TOP OF PIPE 227.023

Transformer
Rooms

CENTRAL HYDRAULIC WORK SHOP

PIPE RACK

PIPE NETWORK ZONE

TOP OF PIPE 223.894

UNDERGROUND C B E TUNNEL

LP

LP

LP

LP

ROAD

X+58.700
EXISTING PACKAGE

ROAD

+216.713

ROAD

X 3249. 20
X 3250.880

WATER LINE 1100 DIA
PIPE TOP RL 214.500
WATER LINE 700 DIA

PIPE RACK
BOTTOM OF PIPE 221.821

EXISTING
JH-02

X+1.850

SLAG CONVEYOR FROM INBA

CENTRE FOR ENGINEERING & TECHNOLOGY, RANCHI

CET RN 3170 ME1 00 002 R=1

NO.	DATE	REMARKS	BY	APPD.	DRG. NO.	DETAILS
01	23-05-2022	FACILITIES ALREADY CONSTRUCTED BY DC UPDATED IN DRAWING	VB	SP		

REVISIONS

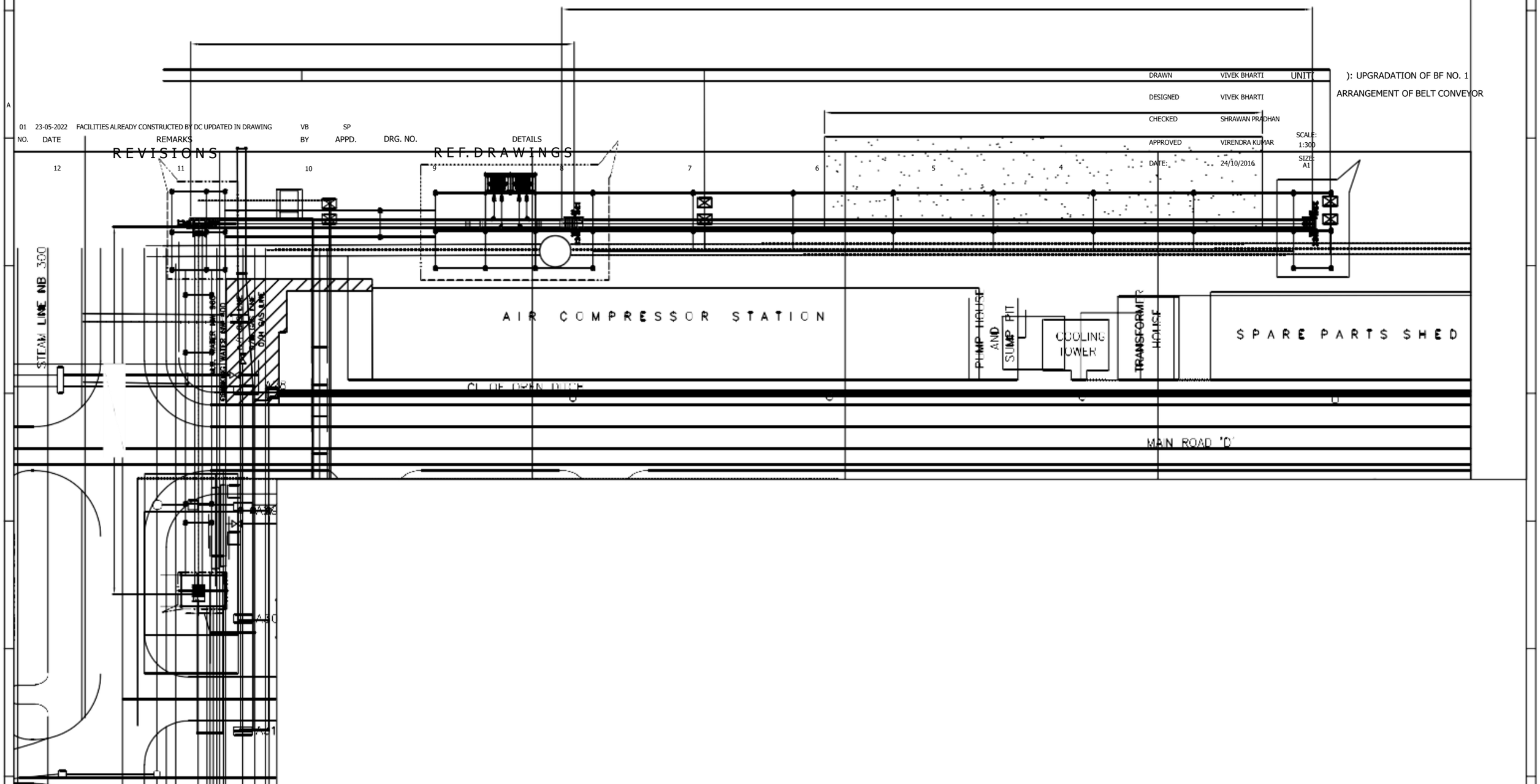
REF.DRAWINGS

DRAWN	VIVEK BHARTI	UNIT
DESIGNED	VIVEK BHARTI	
CHECKED	SHRAWAN PRADHAN	
APPROVED	VIRENDRA KUMAR	
DATE:	24/10/2016	

SCALE: 1:300
SIZE: A1

): UPGRADATION OF BF NO. 1

ARRANGEMENT OF BELT CONVEYOR



FOR T.S. PURPOSE ONLY

NOTES:

1. ALL DIMENSIONS IN MM & LEVELS & CO-ORDINATES ARE IN MTR
2. ±0.00 CORRESPONDS TO 216.713 M RL TOP OF HM TRACK IN BF#1 AREA.
3. FOR COLUMN & BEAM SIZES ARE TENTATIVE AND SHALL BE AS PER ACTUAL DETAIL DESIGN.

NOTES

CLEARANCE		
SECTION	BY	DATE

स्टील अथॉरिटी ऑफ इण्डिया लिमिटेड
STEEL AUTHORITY OF INDIA LTD.
सेन्टर फॉर इंजीनियरिंग एण्ड टैक्नोलॉजी रांची

PLANT (संयंत्र) : ROURKELA STEEL PLANT

एकाई

PLAN OF INBA SLAG DISPOSAL SYSTEM

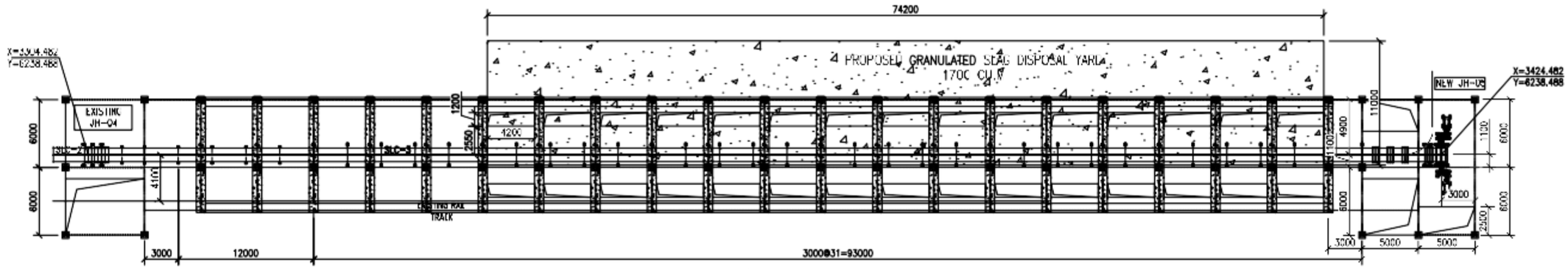
DRG.NO. CET RN 3170 ME1 00 002 REV R= 01

SHEET 01 OF 01

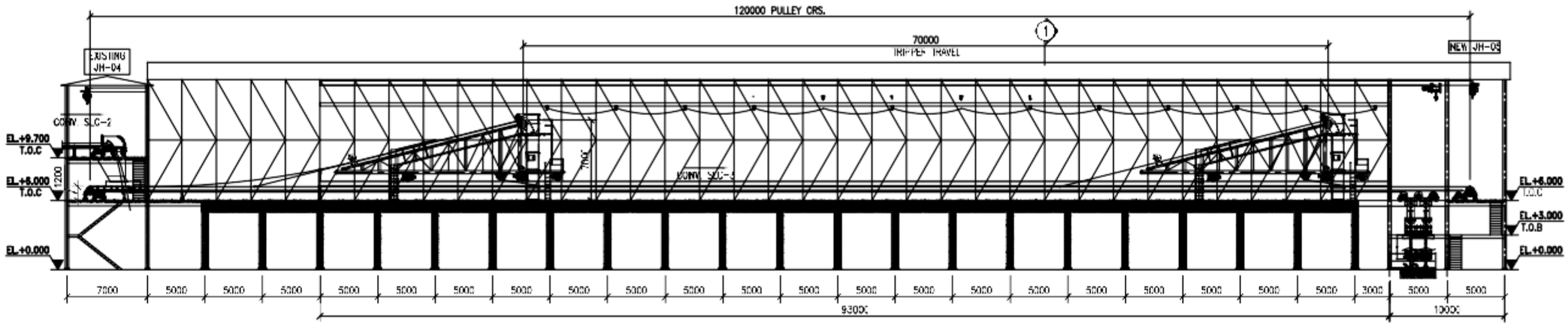
Plot Date: 23/05/2022

D:\CET-Working\05-DE-3170-RSP-BF1\03_Engineering\03_Mechanical\05_Slag Granulation Plant\Package TK-6_T8\CET RN 3170 ME1 00 002_R01_Plan of INBA Slag Disposal System.dwg

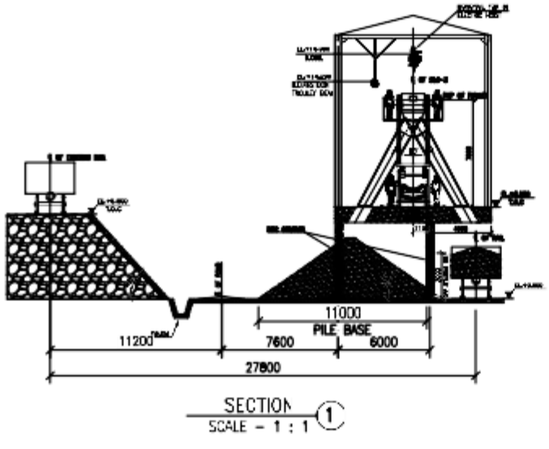
DRG.NO. CET RN 3170 ME1 00 004 R=1



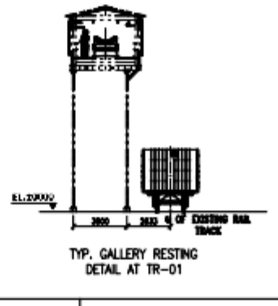
PLAN



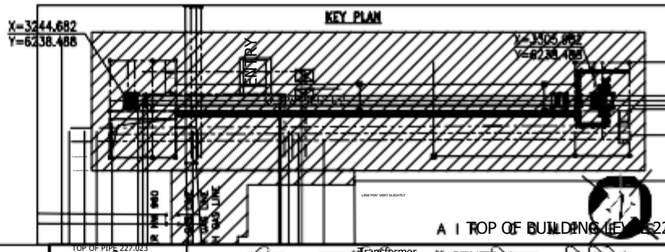
ELEVATION



SECTION ①
SCALE – 1 : 1



TYP. GALLERY RESTING DETAIL AT TR-01



NOTE:
1. ALL DIMENSIONS IN MM & LEVELS & CO-ORDINATES ARE IN MTR
2. ±0.00 CORRESPONDS TO 218.713 M RL TOP OF RM TRACK IN BF#1 AREA.
3. FOR COLUMN & BEAM SIZES ARE TENTATIVE AND SHALL BE AS PER ACTUAL DETAIL DESIGN.

NOTES

CLEARANCE		
SECTION	BY	DATE
	10	

NO.	DATE	REMARKS	BY
01	23-05-2022	FACILITIES ALREADY CONSTRUCTED BY DC UPDATED IN DRAWING	VB SP

EVISIONS

12 11

R

सेल अथॉरिटी ऑफ इंडिया लिमिटेड
STEEL AUTHORITY OF INDIA LTD.
सेन्ट्रल इंस्टीट्यूट फॉर इंजीनियरिंग एण्ड टेक्नोलॉजी रांची
CENTRE FOR ENGINEERING & TECHNOLOGY, RANCHI
WORK ZONE

PLANT (संयंत्र) : ROURKELA STEEL PLANT

SLC-3

DRG.NO. CET RN 3170 ME1 00 004 | REV R=01

SHEET01 OF 01

DETAILS

Plot Date: 23/05/2022

D:\CET-Working\05-DEA-3170-RSP-BF1\03_Engineering\03_Mechanical\05_Slag Granulation Plant\Package TK-6_TS\CET RN 3170 ME1 00 003&004_R01_GA Belt Conveyor SLC-2&SLC-3.dwg

REF. DRAWINGS

4

5 6 7

8 9

DRAWN DESIGNED CHECKED

APPROVED

DATE:

VIVEK BHARTI

VIVEK BHARTI

SHRAWAN PRADHAN

VIRENDRA KUMAR

21/10/2016

UNIT(

):

UPGRADATION OF BF NO. 1

ARRANGEMENT OF BELL CONVEYOR

SCALE: 1:200

SIZE: A1

ANNEXURE 2.1.3-1

CET

सेल SAIL

Experience that delivers

LIST OF ACCEPTABLE MAKES OF EQUIPMENT & SUPPLIES

(Indigenous Supplies Only)

MARCH 2022

PREAMBLE

This document "ACCEPTABLE MAKES OF EQUIPMENT AND SUPPLIES" is for indigenous supplies/ bought out items only and is a part of the tender specification for variouspackages.

The "makes" of variousequipment and supplies are listedout in this document. It is essential that the equipment/ component/ materials to be supplied indigenously by the bidder will be of any one of the makes listed against thatparticular equipment/ component/ material in this document as further detailed subsequently.

CATEGORY 'A' ITEMS

These are critical equipment and items. Contractor/ bidder to ensure that items listed under this category shall be supplied only from the makes listed.

In exceptional cases, if less than three makes out of the listed makes for a particular equipment/ item are available to the bidder/ contractor for supply then additional makes can be proposed. However, bidder/ contractor shall establish the non-availability of the listed makes. Additional makes proposed by bidder/ contractor shall be approved subject to fulfilling the acceptance criteria stipulated alongside.

ACCEPTANCE CRITERIA

- Vendor shall have established Quality Management System certified as per ISO-9001 or equivalent
- Vendor should have installed/ supplied at least any of the following within last 7 years for the item(s):

  Either at least 2 reference in any of the SAIL plants/ RINL

  Or at least 3 references in any of the private Integrated Steel Plants

  Or at least 3 references in Maharatna Public Sector Undertakings/ Navratna Public Sector Undertakings/ Listed Indian companies (excluding financial institutions) having turnover in excess of ₹5000 crores in last financial year.

  Copy of purchase orders along with satisfactory performance certificate/ inspection certificates for the above references shall be provided from theclients
- Self-declaration from vendor that the company is not blacklisted in any SAIL Plants or PSUs.

CATEGORY 'B' ITEMS

These equipment/ items are for general purpose. Bidder may suggest additional makes, if any, during tendering stage with credentials to fulfil the acceptance criteria stipulated alongside.

In case of non-availability of listed makes during implementation, procedure listed under category A will apply.

ACCEPTANCE CRITERIA

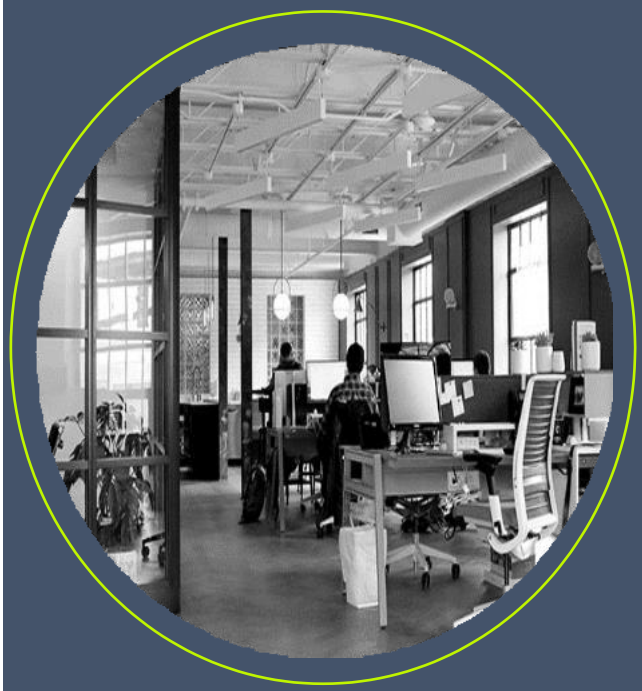
- Vendor shall have established Quality Management System certified as per ISO-9001 or equivalent
- Vendor should have installed/ supplied at least any of the following within last 7 years for the item(s):

  Either at least 2 references in any of the SAIL plants /RINL

  Or at least 3 references in any of the private Integrated Steel Plants

  Or at least 3 references in Maharatna Public Sector Undertakings/ Navratna Public Sector Undertakings/ Listed Indian companies (excluding financial institutions) having turnover in excess of ₹5000 crores in last financial year.

  Copy of purchase orders along with satisfactory performance certificate/ inspection certificates for the above references shall be provided from theclients
- Self-declaration from vendor that the company is not blacklisted in any SAIL Plants or PSUs.



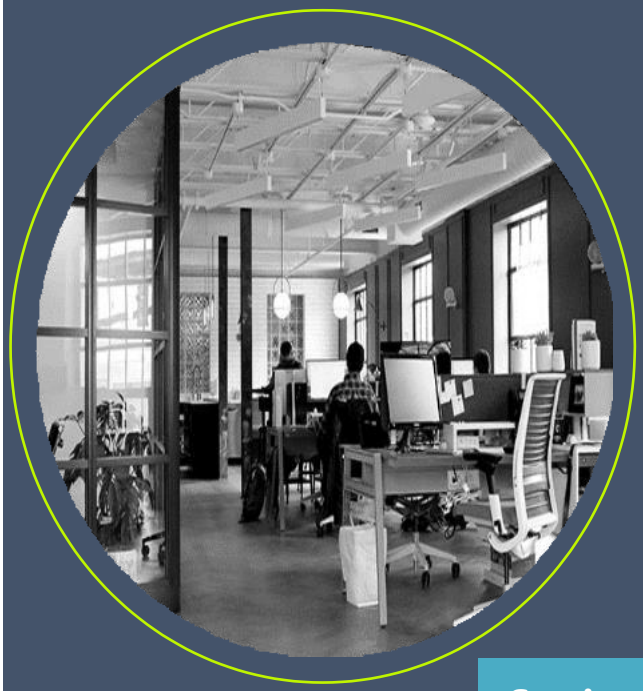
Note:

- *The above categorization has been given for ease of project management. However, in exceptional cases, empowered committee of the Plant may approve additional makes.*
- *If any of the "makes" included in this list is banned as per the "Banning of Business Dealings" with SAIL, it would be applicable as per the banning order.*

Other Items not listed

Contractor may supply any other item not mentioned in this list from any make.

- Self-declaration from vendor is required that the company is not blacklisted in any SAIL Plants or PSUs.



CONTENTS

SECTION-A

ELECTRICAL

S No.	ITEMS	CATEGORY	MAKE
1.	**132 kV & ABOVE EQUIPMENT**		
1.1.	132 kV/ 220 kV Gas Insulated Switchgear	A	**ABB POWER PRODUCTS & SYSTEMS INDIA LIMITED, CG POWER & INDUSTRIAL SOLUTIONS LTD, GE T&D, SIEMENS**
1.2.	132kV/ 220 kV outdoor Isolator/ Disconnecting Switch	A	**ABB POWER PRODUCTS & SYSTEMS INDIA LIMITED, CG POWER & INDUSTRIAL SOLUTIONS LTD, GR POWER, RAYCHEM, SIEMENS, SWITCHGEAR & STRUCTURALS, ELPRO**
1.3.	132kV/ 220 kV outdoor Circuit Breaker	A	**ABB POWER PRODUCTS & SYSTEMS INDIA LIMITED, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, GE T&D, SIEMENS**
1.4.	132kV/ 220 kV outdoor CT/ PT/CVT	A	**ABB POWER PRODUCTS & SYSTEMS INDIA LIMITED, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, GE T&D, MEHRU, SIEMENS, TELK**
1.5.	132kV/ 220 kV outdoor Lightning Arrestor	A	**BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, ELPRO, OBLUM, RAYCHEM, SIEMENS**
1.6.	132kV/ 220 kV cable XLPE	A	**CCI (Cable Corporation of India), KEC, KEI, UNIVERSAL**
1.7.	132kV/ 220 kV outdoor Insulator & Bushing	B	**ADITYA BIRLA INSULATORS, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, CJI, JAYSHREE INSULATORS, MODERN, OBLUM, WSI**
1.8.	ACSR Conductor for 132kV/ 220 kV Transmission Line	B	**APAR, CABCON, STERLITE**
2.	**33kV EQUIPMENT**		
2.1.	33 kV Indoor Switchgear	A	**ABB, SCHNEIDER, SIEMENS**

S No.	ITEMS	CATEGORY	MAKE
2.2.	33 kV Gas Insulated Switchgear	A	**ABB, SCHNEIDER, SIEMENS,**
2.3.	33kV outdoor Isolator/ Disconnecting Switch	A	**ABB POWER PRODUCTS & SYSTEMS INDIA LIMITED, CG POWER & INDUSTRIAL SOLUTIONS LTD, GR POWER, RAYCHEM, SCHNEIDER, SIEMENS, SWITCHGEAR & STRUCTURALS, ELPRO**
2.4.	33kV outdoor Circuit Breaker	A	**ABB, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, SCHNEIDER, SIEMENS**
2.5.	33kV outdoor CT/ PT	A	**BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, ECS, MEHRU, TELK**
2.6.	33kV outdoor Lightning Arrestor	A	**BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, ELPRO, OBLUM, RAYCHEM**
2.7.	33kV outdoor Insulator & Bushing	B	**ADITYA BIRLA INSULATORS, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, CJI, JAYSHREE INSULATORS, MODERN, OBLUM, WSI**
2.8.	ACSR Conductor for 33kV transmission line	B	**APAR, CABCON, STERLITE, GUPTA POWER**
3.	**MEDIUM VOLTAGE – INDOOR (3.3 kV to 11kV)**		
3.1.	Switchgear (Circuit Breaker with panels)	A	**ABB, BHEL, L&T, SCHNEIDER, SIEMENS**
3.2.	Vacuum Contactor	A	**ABB, ANDREW YULE, BHEL, JYOTI, SCHNEIDER, SIEMENS, L&T**
3.3.	CT & PT	B	**AEL, JYOTI, KALPA, KAPPA, PRAGATI, PRAYOG, ECS, SCHNEIDER**
3.4.	Isolator	B	**ABB, A BONDSTRAND, MEGAWIN, PANICKKERSWITCHGEAR PVT. LTD,**

S No.	ITEMS	CATEGORY	MAKE
3.5.	HT Bus duct	B	**BHEL, C&S, ECC, STARDRIVE BUSDUCTS LTD.**
4.	**PROTECTION & METERING**		
4.1.	Protective Relays	A	**ABB, GE T&D, SIEMENS, SCHNEIDER**
4.2.	SCADA/ SAS System	A	**ABB, ECIL, ETAP, GE T&D, HONEYWELL, SIEMENS**
5.	**LT SWITCHGEAR**		
5.1.	Intelligent motor controller for IMCC	A	**ABB, L&T, ROCKWELL AUTOMATION, SCHNEIDER, SIEMENS**
5.2.	Power Control Centre (PCC)	B	**ABB, BCH, IEE PROJECTS, L&T, PCE PROJECTS PVT. LTD., SCHNEIDER, SIEMENS**
5.3.	Motor Control Centre (MCC) up to 1000 Amps and PDB	B	**ABB, BCH, C&S, HAVELLS, IEE PROJECTS, L&T, MARINE ELECTRICAL, MEDITRON, PCE PROJECTS PVT. LTD, SCHNEIDER, SEN & SINGH, SIEMENS, SWITCHING CIRCUITS**
5.4.	Motor Control Centre (MCC) above 1000 Amps	B	**ABB, BCH, C&S, L&T, SCHNEIDER, SIEMENS**
5.5.	Air circuit breaker (ACB)	B	**ABB, L&T, SCHNEIDER, SIEMENS**
5.6.	Moulded case circuit breaker (MCCB) (with positive isolation)	B	**ABB, BCH, C&S, HAVELLS, L&T, SCHNEIDER, SIEMENS, EATON, ANDREW YULE**
5.7.	Motor Protection Circuit Breaker (MPCB)	B	**ABB, BCH, C&S, L&T, SCHNEIDER, SIEMENS, SPRECHER & SCHUH, HAVELLS, EATON, ROCKWELL AUTOMATION**

S No.	ITEMS	CATEGORY	MAKE
5.8.	Power Contactors, Auxiliary contactors/ Auxiliary relays	B	**ABB, BCH, C&S, L&T, SCHNEIDER, SIEMENS, ANDREW YULE, SPRECHER & SCHUH, EATON, ROCKWELL AUTOMATION-ALLEN BRADLEY, OEN (AUXILIARY/CONTROL RELAY ONLY)**
5.9.	Control switches	B	**ABB, BCH, EPCC, GE POWER CONVERSION, KAYCEE, L&T, SCHNEIDER, SIEMENS, SALZER**
5.10.	Thermal bimetallic Overload relays	B	**ABB, ANDREW YULE, BCH, C&S, L&T, ROCKWELL AUTOMATION, SCHNEIDER, SIEMENS**
5.11.	Electronic over current relay/ Electronic motor protection relay (EOCR/ EMPR)	B	**ABB, BCH, C&S, L&T, SCHNEIDER, SIEMENS, SPRECHER & SCHUH, ROCKWELL, EATON**
5.12.	LT bus duct	B	**ECC, LOTUS POWER, L&T, SPEARHEAD, STARDRIVE BUSDUCTS LTD.**
6.	**ILLUMINATION**		
6.1.	Lighting fixtures	B	**BAJAJ, Crompton Greaves, GE LIGHTING, HAVELLS, PHILIPS, SURYA, SYSKA, WIPRO**
6.2.	High Mast Tower	B	**BAJAJ, Crompton Greaves Consumer Electricals Limited, PHILIPS, TRANSRAIL, VALMONT, CONSOUL, BP PROJECTS, VENTURA**
7.	**TRANSFORMER**		

S No.	ITEMS	CATEGORY	MAKE
7.1.	Up to 33 kV	A	**ABB, BHARAT BIJLEE, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, ESENNAR TRANSFORMER, KIRLOSKAR ELECTRIC COMPANY, PROLEC GE, RAYCHEM-RPG, SCHNEIDER, SIEMENS, VOLTAMP TRANSFORMERS LTD, ANDREW YULE, TRANSFORMER & RECTIFIER, KOTSONS (UPTO 630kVA only)**
7.2.	Above 33 kV	A	**ABB POWER PRODUCTS & SYSTEMS INDIA LIMITED, BHARAT BIJLEE, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, GE T&D, TELK, SCHNEIDER, SIEMENS, TRANSFORMER & RECTIFIER, KIRLOSKAR ELECTRIC COMPANY**
7.3.	Dry type	A	**ABB POWER PRODUCTS & SYSTEMS INDIA LIMITED, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD, ESENNAR TRANSFORMER, KIRLOSKAR ELECTRIC COMPANY, RPG-RAYCHEM, VOLTAMP TRANSFORMERS LTD, SUDHIR**
8.	MV REACTOR	A	**CG POWER & INDUSTRIAL SOLUTIONS LTD, GE T&D, PS ELECTRICALS, QUALITY POWER, TRANSFORMER & RECTIFIER, SCHNEIDER**
9.	**DRIVES**		
9.1.	Variable frequency drive (VFD)<1.1kV	B	**ABB, CG POWER & INDUSTRIAL SOLUTIONS LTD. (for motor upto 30 kW), DANFOSS, GE POWER CONVERSION, HITACHI-HIREL, ROCKWELL AUTOMATION, SCHNEIDER, SIEMENS, TMEIC, YASKAWA, FUJI, DELTA ELECTRONICS INDIA PVT LTD (upto 90kW only)**

S No.	ITEMS	CATEGORY	MAKE
9.2.	Thyristor Converter/ DC DRIVE	B	**ABB, GE Power Conversion, ROCKWELL AUTOMATION, SIEMENS, FUJI**
9.3.	Soft starter	B	**ABB, L&T, PARKER, ROCKWELL AUTOMATION, SIEMENS, SCHNEIDER, DANFOSS**
9.4.	FCMA /series reactor type soft starter	B	**ABB, INNOVATIVE TECHNOMICS, ROCKWELL AUTOMATION, SCHNEIDER, SIEMENS, LECON ENERGETICS PVT LTD**
10.	**MOTORS**		
10.1.	Synchronous Motor	A	**ABB, BHEL, SIEMENS, GE**
10.2.	HT – AC	A	**ABB, BHEL, CG POWER & INDUSTRIAL SOLUTIONS LTD., KIRLOSKAR ELECTRIC COMPANY, SIEMENS, WEG, TMEIC, JEUMONT ELECTRIC INDIA PVT LTD**
10.3.	LT – AC	B	**ABB, BHARAT BIJLEE, CG POWER & INDUSTRIAL SOLUTIONS LTD., KIRLOSKAR ELECTRIC COMPANY, LHP, SIEMENS, WEG, NGEF, BHEL, NORD**
10.4.	DC	B	**BHEL, IEC, KIRLOSKAR ELECTRIC COMPANY, CG POWER & INDUSTRIAL SOLUTION**
11.	**CABLES**		
11.1.	33kV cable XLPE	A	**CCI (Cable Corporation of India), CRYSTAL, GLOSTER, KEC, KEI, POLYCAB, UNIVERSAL**
11.2.	HT (up to 11kV) cable XLPE	A	**CCI, GEMSCAB INDUSTRIES LTD., GLOSTER, HAVELLS, KEC, KEI, POLYCAB, STERLITE POWER, UNIVERSAL**

S No.	ITEMS	CATEGORY	MAKE
11.3.	LT power & control cable	B	**CCI, FINOLEX CABLES, GEMSCAB INDUSTRIES LTD., GLOSTER, HAVELLS, INSUCON, KEC, KEI, POLYCAB, RAVIN, THERMO CABLES, UNIVERSAL, LAPP, NANGALWALA INDUSTRIES (P) LTD**
12.	**MISCELLANEOUS**		
12.1.	Battery charger	B	**AMARA RAJA POWER SYSTEMS LTD, APLAB, CHLORIDE (EXIDE), CHABI ELECTRICALS, LIVELINE ELECTRONICS, NELCO, SABNIFE (HBLNIFE POWER SYSTEMS), STANDARD**
12.2.	Battery Bank	B	**AMARA RAJA, AMCO, EXIDE, FURUKAWA, PANASONIC, SABNIFE (HBLNIFE POWER SYSTEMS), STANDARD**
12.3.	Master controller	B	**EATON, ELECTROMAG, EPCC, KAYCEE, L&T, SIEMENS, KAKKU, SPHONBUCKART, GESMANN, SCHNEIDER**
12.4.	Un-interruptible power supply (UPS):	B	**FUJI ELECTRIC CONSUL NEOWATT P LTD, HITACHI-HIREL, LIVE LINE ELECTRONICS, NUMERIC, SCHNEIDER (APC), VERTIV ENERGY PRIVATE LIMITED**
12.5.	Nitrogen injection fire protection system	B	**CTR, EASUN-MR TAP CHANGERS(P) LTD., TECTONICUS, VENDERE**
13.	**GENERATOR**	B	**ABB, BHEL, SIEMENS, TOYO DENKI**
14.	**AVR**	B	**ABB, BHEL, SIEMENS, TOYO DENKI**

SECTION-B

MECHANICAL

S No.	ITEMS	CATEGORY	MAKE
1.	**GENERAL**		
1.1.	Gearbox (50 kW and above)	A	**BONFIGLIOLI, ELECON, SIEMENS-FLENDER, ROSSI, SUMITOMO, HEC, KIRLOSKAR, SHANTHI**
	Gearbox (below 50 kW)	B	**BONFIGLIOLI, ELECON, SIEMENS-FLENDER, ROSSI, SUMITOMO, ESSENTIAL POWER TRANSMISSION, HEC, KIRLOSKAR, NAW, SHANTHI, PREMIUM TRANSMISSION, SAN ENGG. LOCOMOTIVE COMPANY LTD., SUMI- CYCLO DRIVE INDIA PVT. LTD., TRIVENI, SCHMIEDE AND MASCHINEN**
1.2.	Geared Motor (5 kW and above)	A	**BONFIGLIOLI, CYCLO TRANSMISSION, ROSSI, SIEMENS, NORD, SEW-EURO DRIVE**
	Geared Motor (below 5 kW)	B	**BONFIGLIOLI, CYCLO TRANSMISSION, ROSSI, SIEMENS, NORD, SEW-EURO DRIVE, ESSENTIAL POWER TRANSMISSION, IC INDIA LTD., POWER BUILD, SHANTHI, SUMI-CYCLO DRIVE INDIA PVT.LTD.**
1.3.	Geared Coupling (50 kW and above)	A	**ELECON, FLEX-TRAN INDUSTRIES, RATHI (LOVEJOY), SIEMENS-FLENDER, TIMKEN, FENNER**
	Geared Coupling (below 50 kW)	B	**ELECON, FLEX-TRAN INDUSTRIES, RATHI (LOVEJOY), SIEMENS-FLENDER, TIMKEN, ALLIANCE ENGG. CO., CONCORD STEEL WORKS PVT. LTD., ESCO, GBM, NAW, ROMA MECHANICAL ENGINEERING CO, WELLMAN WACOMA, FENNER, SCHMIEDE AND MASCHINEN**
1.4.	Pin Bush/ Bibby Coupling (10kW and above)	A	**ELECON, GBM, RATHI (LOVEJOY)**
	Pin Bush/ Bibby Coupling (below 10kW)	B	**ELECON, GBM, RATHI (LOVEJOY), NAW, ROMA MECHANICAL ENGINEERING CO, FENNER**

S No.	ITEMS	CATEGORY	MAKE
1.5.	Barrel Coupling	A	**JAURE, MALMEDIE, RINGFEDER POWER TRANSMISSION**
1.6.	Fluid Coupling	A	**ELECON, FLUIDOMAT, GHATGE-PATIL INDUSTRIES, PREMIUM TRANSMISSION, VOITH**
1.7.	Resilient Coupling	A	**ELECON, FENNER, RATHI (LOVEJOY), NAW, TIMKEN, WELLMAN WACOMA**
1.8.	Transmission Chain & Sprocket	B	**DIAMOND, REYNOLD, ROLKOBO, ROLCON, ROLON, GOLDEN ENGG & ENTERPRISE**
1.9.	DCEM Shoe Brake	A	**BCH ELECTRIC LTD, ELEKTROMAG, KAKKU, KATEEL, SIBRE, SPEED-O-CONTROL, EMCO PRECIMA ENGINEERING PVT LTD.(BUBENZER BREMSEN)**
1.10.	DCEM Disc Brake	A	**BCH ELECTRIC LTD, ELEKTROMAG, KAKKU, KATEEL, PETHE, SIBRE, SPEED-O-CONTROL, EMCO PRECIMA ENGINEERING PVT LTD.(BUBENZER BREMSEN)**
1.11.	Hydraulic thruster brake	A	**EMCO PRECIMA ENGINEERING PVT LTD.(BUBENZER BREMSEN), KATEEL, SIBRE**
1.12.	Non-metallic Liner	B	**KAVERI, TEGA, THEJO**
1.13.	Wearing Plates (Metallic)	B	**NLMK INDIA, QUARD, HARDOX**
1.14.	Lathe & Shaper	B	**BATLIBOI, GUJARAT LATHE MANUFACTURING COMPANY PVT. LTD., HEC, HMT**
1.15.	Welding Rectifier/ transformer	B	**ADVANI, ADOR, ESAB, MOGORA COSMIC, MEMCO**
1.16.	Bearing	A	**FAG, NTN, SKF, TIMKEN, KOYO, SCHAEFFLER**
1.17.	Slew Bearing	A	**ROTHE ERDE, SKF, LIEBHERR**
1.18.	Split Bearing	A	**COOPER, TIMKEN, SKF**

S No.	ITEMS	CATEGORY	MAKE
1.19.	Passenger cum Goods Elevator (544 kg and above)	A	**MITSUBISHI, OTIS, SCHNEIDER, THYSSENKRUPP, SCHINDLER**
	Passenger cum Goods Elevator (below 544 kg)	B	**MITSUBISHI, OTIS, SCHNEIDER, THYSSENKRUPP, SCHINDLER, ECE, KONE ELEVATOR, OMEGA**
1.20.	Hook (up to 10 t)	B	**FREE TRADING CORPORATION, HERMAN MOHTA, SMRITI FORGING & ENGG, MACHINE TOOLS, ESKAY MACHINERY, STEEL FORGINGS & ENGINEERING**
1.21.	Hook (above 10t)	A	**FREE TRADING CORPORATION, HERMAN MOHTA, SMRITI FORGING & ENGG, STEEL FORGINGS & ENGINEERING**
1.22.	Wire Rope	B	**BHARAT WIRE ROPES, FORT WILLIAM, BOMBAY WIRE ROPE, ORION ROPES, USHA MARTIN**
1.23.	Expansion Joint for Hot Blast system (metallic)	A	**FLEXATHERM, FLEXICAN, LONE STAR, MB METALLIC BELLOWS**
1.24.	Stove Valves (two lever/ three lever/ double eccentric butterfly valve)	A	**FOURESS, JOSHI & JAMPALA, INTERVALVE, DELVAL FLOW CONTROL, TYCO, L&T**
1.25.	Coil Strapping M/c	B	**KOHAN KOGYO CO., SIGNODE, SUND BRISTA, TITAN**
2.	**MATERIAL HANDLING EQUIPMENT**		
2.1.	Conveyor Belt	B	**FORECH INDIA LTD, FENNER-DUNLOP, HINDUSTAN RUBBER, JONSON RUBBER INDUSTRIES LTD., NORTH LAND RUBBER, ORIENTAL RUBBER, PHOENIX CONVEYOR BELT (INDIA) PVT. LTD, SEMPERTRANS NIRLON**

S No.	ITEMS	CATEGORY	MAKE
2.2.	Idler	B	**AMPS ENGG. & EQUIPT. PVT. LTD., BENGAL TOOLS, BEVCON, ELECON, GOLDEN ENGG & ENTREPRISE, GOLDEN ENGINEERING INDUSTRIES, HITECH EQUIPMENTS PVT. LTD., INDIANA CONVEYORS, L & T, MACMET, MCNALLY SAYAJI ENGINEERING LIMITED, NEWALL INDUSTRIES, SANRAJ PROJECTS PVT. LTD., SANDVIK ASIA, SOLCON, TECHNO IMPEX, VINAR SYSTEMS, VN INDUSTRIES**
2.3.	Pulley	B	**AMPS ENGG. & EQUIPT. PVT. LTD., BENGAL TOOLS, BEVCON, ELECON, GOLDEN ENGG & ENTREPRISE, GOLDEN ENGINEERING INDUSTRIES, HITECH EQUIPMENTS PVT. LTD., INDIANA CONVEYORS, L & T, MACMET, MCNALLY SAYAJI ENGINEERING LIMITED, NEWALL INDUSTRIES, SANRAJ PROJECTS PVT. LTD., SANDVIK ASIA, SOLCON, TECHNO IMPEX, VINAR SYSTEMS, VN INDUSTRIES**
2.4.	Belt Weigher / Weigh feeder System	A	**ACME, FLSMIDH, PFISTER, PRECIA MOLEN, SCHENCK, SIEMENS (MILTRONICS)**
2.5.	Plummer Block (100mm shaft dia at bearing and above)	A	**FAG, MASTA, SKF, TIMKEN**
	Plummer Block (below 100mm shaft dia at bearing)	B	**FAG, MASTA, NANDY ENGINEERING CONCERN, SKF, TIMKEN**
2.6.	Belt Scraper (belt width 1000mm and above)	B	**HOSCH, KAVERI, THEJO**

S No.	ITEMS	CATEGORY	MAKE
	Belt Scraper (belt width below 1000mm)	B	**HOSCH, KAVERI, INDIANA CONVEYORS, THEJO**
2.7.	Vibrating Screen (100tph and above)	A	**METSO, SCHENK PROCESS, SANDVIK, FLSMIDTH**
	Vibrating Screen (below 100tph)	B	**ELECTRO ZAVOD, ELEKTROMAG-JOEST VIBRATION PVT. LTD., IC INDIA LTD., McNALLY SAYAJI ENGINEERING LIMITED, METSO, SCHENK PROCESS, SANDVIK, FLSMIDTH,**
2.8.	Vibrating Feeder	A	**ELECTRO ZAVOD, ELEKTROMAG-JOEST VIBRATION PVT. LTD, IC INDIA LTD., McNALLY SAYAJI ENGINEERING LIMITED, METSO, SCHENK PROCESS, SANDVIK, FLSMIDTH,**
2.9.	Apron Feeder (500tph and above)	A	**L & T, THYSSEN KRUPP, SANDVIK, METSO**
	Apron Feeder (below 500tph)	B	**ELECON, HAZEMAG, L & T, McNALLY SAYAJI ENGINEERING LIMITED, TENGL, THYSSEN KRUPP, SANDVIK, METSO**
2.10.	Screw Conveyor	B	**GMV ENGG, MASYC, VINAR SYSTEMS**
2.11.	Electro mechanical Actuator	B	**AUMA, LIMITORQUE, PREPEC, ROTORK**
2.12.	EOT Crane (all capacities)	A	**ANUPAM INDUSTRIES, HEC, JINDAL STEEL & POWER, MUKAND, TATA GROWTH SHOP, UNIQUE INDUSTRIAL HANDLERS**
	EOT Crane (maximum 50 t)	A	**CENTURY CRANE, ELECTROMECH, MELTECH CRANES PVT. LTD., FAFECO, SMACO, ALPHA**

S No.	ITEMS	CATEGORY	MAKE
	EOT Crane (maximum 10 t)	B	**EDDY CRANE, SHIVPRA, TUOBRO FURGUSON, ELECTRO THERAPY**
2.13.	Electric Hoist	B	**BRADY & MORRIS, CENTURY CRANE, EDDY CRANE, ELECTROTHERAPY, GRIP ENGRS., HERCULES HOIST LTD. (INDEF) , HI-TECH INDUSTRIES, MELTEC, REVA ENGG, SHIVPRA**
2.14.	Electric Winch	B	**EDDY CRANE, ELECTROMECH MHS PVT. LTD. ENGG, ELECTROTHERAPY, HMTC ENGG. CO., PULLMAN**
2.15.	Jib Crane	A	**BRADY & MORRIS, CENTURY CRANES, GRIP ENGG, MELTEC, EDDY CRANE**
2.16.	Chain Pulley Block & Hand Operated Travelling Crane	B	**BRADY& MORRIS, CENTURY CRANES, HERCULES HOIST LTD. (INDEF), HI-TECH., LIGHT LIFT IND., REVA ENGG,TRACTEL TRIFOR**
2.17.	Underslung Cranes	B	**EDDY CRANE , CENTURY CRANES, FAFECO, MUKAND, KONE CRANES & DEMAG, REVA ENGG, ALPHA, BRADY & MORRIS, SHIVPRA, TUOBRO FURGUSON**
2.18.	Shock Absorbers /Hydraulic Buffer	A	**ENIDINE, OLEO, ACE CONTROLS**
2.19.	Electro Magnet	A	**ELEKTROMAG, SGM, SUPERLIFT**
2.20.	Tongs	B	**BUCK, HEPPENSTALL, SOMERS, YELLOW STONE INDIA**
2.21.	Stacker or Reclaimer	A	**ELECON, FLSMIDTH, HEC, L & T, McNALLY SAYAJI ENGINEERING LIMITED, METSO, SANDVIK ASIA, THYSSENKRUPP**
2.22.	Stacker-cum-Reclaimer	A	**FLSMIDTH, HEC, L & T, McNALLY SAYAJI ENGINEERING LIMITED, METSO, SANDVIK ASIA, THYSSENKRUPP**

S No.	ITEMS	CATEGORY	MAKE
2.23.	Bucket-Wheel Reclaimer	A	**FLSMIDTH, HEC, L & T, McNALLY SAYAJI ENGINEERING LIMITED, METSO, THYSSENKRUPP, SANDVIK ASIA**
2.24.	Wagon Tippler	A	**ELECON, FLSMIDTH, HEC, L & T, McNALLY SAYAJI ENGINEERING LIMITED, METSO, THYSSENKRUPP**
2.25.	Hanging Magnet/ Cross belt/ Inline Magnetic Separator	A	**ELECTRO ZAVOD, ELEKTROMAG, HUMBOLDT WEDAG, MAGNET INDUSTRIES (CAL) PVT. LTD., McNALLY SAYAJI ENGINEERING LIMITED, METSO**
2.26.	Fork Lift	B	**GODREJ, TIL, VOLTAS**
2.27.	Crusher (Cone / Gyratory / Jaw)	A	**FLSMIDTH, HEC, L&T, McNALLY SAYAJI ENGINEERING LIMITED, METSO, SANDVIK, THYSSENKRUPP, URALMASH**
2.28.	Impact / Hammer Crusher	A	**HEC, L&T, McNALLY SAYAJI ENGINEERING LIMITED, METSO, SANDVIK, TERRASOURCE, THYSSENKRUPP**
2.29.	Roll Crusher	A	**ELECON, FLSMIDTH, HEC, L&T, McNALLY SAYAJI ENGINEERING LIMITED, SANDVIK, THYSSENKRUPP, URALMASH**
2.30.	Rotary Breaker	A	**L&T, McNALLY SAYAJI ENGINEERING LIMITED, TERRASOURCE, THYSSENKRUPP**
3.	**HYDRAULICS SYSTEM**		
3.1.	Hydraulic Cylinder	A	**CANARA HYDRAULICS, DANVER, EATON, HYDRO PNEUMATIC CONTROLS, OSCAR, PARKER, REXROTH, VEKTRA ENGG., VELJAN, WIPRO, YUKEN**
3.2.	Hydraulic System with Accessories	A	**EATON, HYDAC, PARKER, REXROTH, YUKEN**
3.3.	Hydraulic Valves	A	**CANARA HYDRAULICS, EATON, HYDAC, MOOG, PARKER, REXROTH, YUKEN**

S No.	ITEMS	CATEGORY	MAKE
3.4.	Accumulator	A	**BOSCH, EATON, EPE, HYDAC, PARKER, REXROTH, YUKEN**
3.5.	Hydraulic Fitting & Clamp	B	**EPE, FLUID CONTROL HYDROCRIMP, HYDAC, HYDAIR, HYDROMATIK, HYTECH, PTS, STAUFF**
3.6.	Hydraulic Filter	B	**HYDAC, INTERNORMEN, PARKER**
3.7.	Hydraulic Motor	A	**EATON, MAHA HYDRAULICS, PARKER, REXROTH, SAUER DANFOSS, YUKEN**
3.8.	Hydraulic Pump	A	**SAUER DANFOSS, EATON, MAHA HYDRAULICS, PARKER, REXROTH, YUKEN**
3.9.	Hose	B	**AEROFLEX, EATON, HYDROKRIMP, HYDROLINE, INDIA FLEX INDUSTRIES, INDO INDUSTRIAL SERVICES, PARKER, PSI HYDRAULICS, SONI RUBBER PRODUCTS LTD., SUPERSEAL**
4.	**PNEUMATIC SYSTEM**		
4.1.	Pneumatic Cylinder	B	**CANARA HYDRAULICS, EL-O-MATIC (INDIA) PVT. LTD., GABRIEL PNEUMATICS, HYDAIR, HYDRO PNEUMATIC CONTROLS, I.L. PALAKKAD, NUCON, ROTEX, SHRADER, SMC, VELJAN, WIPRO**
5.	**LUBRICATION SYSTEM**		
5.1.	Oil Lubrication System for Rolling Mills, Sinter Plant, Blast Furnace, Bulk material equip	A	**HYDAC, SKF LINCOLN, LUBRICATION SYSTEM LTD., BIJUR DELIMON, REBS LUBRICATION**
5.2.	Oil Lubrication System other than above (Cl. 5.1)	B	**HYDAC, SKF LINCOLN, LUBRICATION SYSTEM LTD., PRAKASH LUBRIQUIPMENT, SHAAN LUBE, BIJUR DELIMON, REBS LUBRICATION**

S No.	ITEMS	CATEGORY	MAKE
5.3.	Screw Pump	B	**ROTO, TUSHACO, UT PUMPS & SYSTEM**
5.4.	Gear Pump	B	**ALFA, PARKER, REXROTH, ROTO, ROTODEL, TUSHACO**
5.5.	Filter Strainer	B	**MULTITEX FILTRATION, OTOKLIN, SPAN ASSOCIATES PUNE, SUPERFLOW FILTERS**
5.6.	Oil Mist / Oil-Air Lubrication System	A	**BIJUR DELIMON, SKF LINCOLN, REBS LUBRICATION**
5.7.	Grease Lubrication System for Rolling Mills, Sinter Plant, Blast Furnace, Bulk material Handling Euip	A	**BIJUR DELIMON, SKF LINCOLN, REBS LUBRICATION**
5.8.	Grease Lubrication System other than above (Cl 5.7)	B	**AFMC, BIJUR DELIMON, CENLUB SYSTEMS, SKF LINCOLN, PRAKASH LUBRIQUIPMENT, REBS LUBRICATION**
5.9.	Hose	B	**AEROFLEX, HYDROKRIMP, HYDROLINE, INDO INDUSTRIAL SERVICES, PSI HYDRAULICS, SONI RUBBER PRODUCTS LTD., SUPERSEAL**

SECTION-C

MINING & MINERAL PROCESSING AREA

S No.	ITEMS	CATEGORY	MAKE
1.	Sizer	A	**FLSMIDTH, MMD, SANDVIK, THYSSENKRUPP**
2.	Ball / Rod / Ag Mill	A	**CEMTEC, CHANDERPUR WORKS PVT. LTD., FLSMIDTH, HEC, L&T, McNALLY SAYAJI ENGINEERING LIMITED, METSO, OUTOTEC, SANDVIK , THYSSENKRUPP, URALMASH**
3.	Classifier	A	**DORR OLIVER, DURGA METALS, EIMCO-KCP, FLSMIDTH,METSO, MBE-CMT**
4.	Thickener	A	**EIMCO-KCP, FLSMIDTH, McNALLY SAYAJI ENGINEERING LIMITED, METSO, OUTOTEC, TENOVA-DELKOR, WESTECH**
5.	Jig	A	**ALLMINERAL, MBE-CMT, TENOVA-DELKOR**
6.	Filter(Vacuum /Pressure)	A	**ANDRITZ, EIMCO-KCP, FLSMIDTH, METSO, OUTOTEC, TENOVA-DELKOR, TH COMPANY, WESTECH**
7.	Wet High Intensity Magnetic Separator / High Gradient Magnetic Separator	A	**ALLMINERAL, ERIEZ, MBE-CMT, METSO, LONGI MAGNET, MINERAL TECHNOLOGIES, OUTOTEC**
8.	Low Intensity Magnetic Separator	A	**ERIEZ, LONGI MAGNET, MBE-CMT, METSO, MINERAL TECHNOLOGIES, MULTOTEC**
9.	Dewatering Screen	A	**DERRICK, FLSMIDTH –LUDOWICI, IC , METSO, McNALLY SAYAJI ENGINEERING LIMITED, SCHENCK PROCESS, WEIR MINERALS**
10.	Spiral – Gravity Concentrator	A	**AKW A+V GMBH, FLSMIDTH, MINERAL TECHNOLOGIES, MULTOTEC, OUTOTEC**
11.	Hydrocyclones	A	**CDE, FLSMIDTH KERBS, McNALLY SAYAJI ENGINEERING LIMITED, METSO, MOZLEY, MULTOTEC, WEIR MINERALS**
12.	Metal Detector	A	**ELECTRO ZAVOD,ELEKTROMAG, ERIEZ, MBE-CMT, METSO**

SECTION-D

PROCESS CONTROL & AUTOMATION

S No.	ITEMS	CATEGORY	MAKE
1.	**FIELD INSTRUMENTATION**		
1.1.	Pressure/differential pressure/Level/Flow Transmitter	A	**ABB, EMERSON, E&H, FUJI, HONEYWELL, YOKOGAWA, SIEMENS**
1.2.	Temperature Transmitter	A	**ABB, E&H, EMERSON, HONEYWELL, SIEMENS, YOKOGAWA**
1.3.	Pressure / DP switch	A	**ASHCROFT, BAUMER, DANFOSS, INDFOS, WIKA, SWITZER,**
1.4.	Tuning Fork/ Rod type Level Switch	A	**ABB, E&H, EMERSON, NIVO CONTROL, SAPCON, SIEMENS, VEGA**
1.5.	Conductivity/RF/Capacitance type Level Switch	A	**E&H, NIVO CONTROL, P&F, SAPCON, VEGA,**
1.6.	Float type Level Switch	A	**BAUMER, EMERSON, ENDRESS & HOUSER, KROHNE MARSHALL, LEVCON, NIVO CONTROL, SAPCON, TRAC**
1.7.	Ultrasonic Level Sensor	A	**E&H, EMERSON, KROHNE MARSHALL, P&F, SIEMENS, SICK, VEGA**
1.8.	Radar Type Level Sensor	A	**E&H, EMERSON, KROHNE, MARSHALL, SIEMENS, VEGA**
1.9.	Electro Magnetic Flow Meter	A	**E&H, EMERSON, KROHNE MARSHALL, YOKOGAWA, SIEMENS**
1.10.	Flow Elements (Orifice / Venturi / Flow nozzle / Pitot tube / Annubar)	A	**ENGG SPECIALTIES, EMERSON, UNI CONTROL, WIKA**
1.11.	Radiation Pyrometer (online/portable)	A	**CHINO, EUROTHERM, LAND, WILLIAMSON CORPORATION, FLUKE**

S No.	ITEMS	CATEGORY	MAKE
1.12.	Level SW/ Transmitter (Nucleonic type)	B	**BERTHOLD, E&H, THERMOFISHER**
1.13.	Temperature Switch	B	**E&H, IFM, HYDAC, WIKA**
1.14.	Flow Switch	B	**EMERSON, IFM, KROHNE MARSHAL, KOBOLD**
1.15.	Vortex Flow Meter	A	**E&H, EMERSON, KROHNE MARSHAL, SIEMENS, YOKOGAWA**
1.16.	Mass (Coriolis) Flow	A	**ABB, E&H, EMERSON, KROHNE MARSHAL, SIEMENS, YOKOGAWA,**
1.17.	Level Switch/Transmitter (Displacer Type)	B	**CHEMTROL, DK INSTRUMENTS, EMERSON, LEVCON**
2.	**CONTROL VALVES**		
2.1.	Globe Valve	A	**FISHER, FORBES MARSHALL, IL PALAKKAD, KOSO, SAMSON, SEVERN, UNIFLOW CONTROLS**
2.2.	Butterfly Valve	A	**AIRA, DEL VAL, FISHER, FOURESS, IL PALAKKAD, KOSO, SEVERN**
2.3.	Pneumatic Actuator	A	**DEL VAL, FORBES MARSHALL, IL PALAKKAD, KOSO, OM CONTROL, ROTEX, SAMSON, UNIFLOW CONTROLS**
2.4.	Electrical Motor Actuator	A	**AUMA, BERNARD, LIMITORQUE, ROTORK,**
2.5.	Electro Pneumatic Positioner	A	**ABB, EMERSON, FORBES MARSHALL, SIEMENS**
3.	**CONTROL SYSTEM EQUIPMENT**		

S No.	ITEMS	CATEGORY	MAKE
3.1.	Signal Isolator	A	**MASIBUS, MICROSYSTEMS & CONTROLS, MTL, P&F, PHOENIX, STAHL, YOKOGAWA**
3.2.	Distributed Control System	A	**ABB, EMERSON, HONEYWELL, TOSHIBA, YOKOGAWA,**
3.3.	PLC System	A	**ABB, HITACHI, HONEYWELL, EMERSON AUTOMATION (FORMERLY "GE INTELLIGENT"), ROCKWELL, SCHNEIDER, SIEMENS**
3.4.	Technological Control System/ Multi Tasking Control System/ Embedded Control System	A	**ABB, DANIELI, EMERSON AUTOMATION (FORMERLY "GE INTELLIGENT"), SIEMENS, SMS, TMEIC**
3.5.	PDA	A	**DANIELI, IBA, LMS, MICA, SOMAT**
3.6.	Panel / Enclosure / Rack	B	**APW PRESIDENT, HOFFMANN, PYROTECH, RITTAL, VALRACK**
3.7.	Surge Protection	A	**DEHN, MTL, P&F, PHOENIX CONTACT, OBO BETTERMANN**
4.	**PANEL BASED INSTRUMENTATION**		
4.1.	Single Loop Stand Alone Controller	A	**ABB, FUJI, HONEYWELL, SIEMENS, TOSHIBA, YOKOGAWA**
4.2.	Paperless Recorder	A	**CHINO, EUROTHERM, FUJI, HONEYWELL, LAXONS, YOKOGAWA,**
4.3.	Alarm Annunciator	B	**IIC, IL, MINILEC, PROCON, SEMUDA**
4.4.	Regulated DC Power Supply Unit / SMPS	A	**APLAB, COSSEL, PHOENIX CONTACT, SIEMENS, WAGO**
5.	**ANALYSERS**		

S No.	ITEMS	CATEGORY	MAKE
5.1.	Gas Analyser	A	**ABB CHEMTROL (AMETEK), EMERSON, FUJI, FORBES MARSHALL, HONEYWELL, PANAMETRICS, SICK, SIEMENS, YOKOGAWA**
5.2.	Gas Detector	A	**BEILER & LANG, DETRONICS, DRAGGER, INDUSTRIAL SC. CORPN MSA, TELEDYNE**
5.3.	Flame Detector	A	**DURAG, ENDEE, HONEYWELL, SICK, YAMATAKE**
5.4.	Moisture Analyzer (Nucleonic)	A	**CHINO, BERTHOLD, EMERSON, THERMO FISHER**
5.5.	Moisture Analyzer (Microwave/ Capacitance Type)	A	**ABB, CHEMTROL, MOISTECH, NDC, SIEMENS**
5.6.	Opacity Analyser	A	**DURAG, FORBES MARSHALL, MAIHEK, SICK,**
5.7.	Calorific Value Analyser	A	**CHEMTROL(AMS), REINEKE, UNION CALORIMETER, YOKOGAWA, IGCA**
5.8.	pH / Conductivity / ORP Analyser	A	**ABB, E&H, EMERSON, FORBES MARSHAL, HONEYWELL, YOKOGAWA,**
5.9.	SO_X / NO_X/ CO Analyser	A	**ABB, AIC (FUJI), EMERSON, FUJI, FORBES MARSHAL, HONEYWELL, SICK, SIEMENS, YOKOGAWA**
5.10.	Elemental Analyser	A	**JICO, MAYA, PANALYTICAL, REAL TIME, SCANTECH, THERMO SCIENTIFIC**
6.	**WEIGHING**		

S No.	ITEMS	CATEGORY	MAKE
6.1.	Electronic Weighing System (Hopper Weighing / Platform / Scales / In-motion W.B.)	A	**ABB, ACME, AVERY KELK, BEST, MINEBEA INTEC (FORMERLY SARTORIOUS), PRECIA MOLEN, RICE LAKE, SCHENK, TRANSWEIGH**
6.2.	Load Cells & Accessories	A	**ABB, FLINTEK, HBM, MINEBEA INTEC (FORMERLY SARTORIOUS), PRECIA MOLEN, PRECISION, RICELAKE, SCHENCK, SIEMENS, KELK**
7.	**SPECIAL INSTRUMENTS**		
7.1.	Thickness Gauge	A	**IMS, IRM, MESACON, TOSHIBA, THERMO SCIENTIFIC,**
7.2.	Hot Metal Detector	A	**AMERICAN SENSORS, DANIELI, DELTA, SICK,TOSHIBA, HOKUYO AUTOMATIC CO. LTD.**
7.3.	Width Gauge	A	**ABB, DELTA, DANIELI, IMS, PSYSTEME, THERMO SCIENTIFIC, TOSHIBA**
7.4.	Vibration Monitoring System	B	**GE OIL & GAS, IRD MECHANALYSIS, SHINKAWA**
7.5.	Portable Vibration Monitor with analysis software	B	**BENTLEY NEVADA, FORBES MARSHAL, IRO**
7.6.	Test & Measuring Equipment	B	**APLAB, FLUKE, KANE, SCIENTIFIC, TECHNOFIX,**
7.7.	Laboratory Equipment	B	**BEAMEX, FLUKE, SCANDURA,WIKA**
7.8.	Digital Multi-Function Meter	B	**ACORD, CONSERVE, L&T, RISHAV, SECURE**
7.9.	Strip Profile Gauge	A	**IMS, MESACON, NDC (IRM), THERMO SCIENTIFIC, TOSHIBA,**

S No.	ITEMS	CATEGORY	MAKE
7.10.	Flatness/ Shape Gauge	A	**ABB, DELTA, IMS, P-SYSTEME, SIEMENS, THERMO SCIENTIFIC,**
7.11.	Laser Doppler Velocity Meter	A	**ACCUSPEED, AMERICAN SENSORS, DELTA, KELK, LASER SPEED,**
7.12.	Optical Barrier	A	**ABB, AMERICAN SENSORS, DELTA, PAULI, SICK,**
7.13.	Position Transducer	A	**LEONARD BAUR, NSD, SONY MAGNESCALE, TEMPOSONIC, DELTA**
7.14.	Optical Encoder	A	**HUBNER, LINE & LINDEY, STEGMANN**
7.15.	Surface Inspection System	A	**ABB,COGNEX, PARSYTEC, SIEMENS, SURCON**
8.	**COMMUNICATION EQUIPMENT**		
8.1.	Wireless Communication Equipment	A	**CISCO, EXTREME, GE, JUNIPER, LOTUS WIRELESS, MOTOROLA, MOXA, RADIUS, SATELLINE, SHEETAL WIRELESS, STAHL, PHOENIX CONTACT**
8.2.	EPABX	A	**ALCATEL, AVAYA, ERICSON, ITI, SIEMENS**
8.3.	PA System/ Conferencing system	B	**AHUJA, BOSCH, HONEYWELL, PHI AUDIO COM**
9.	**DISPLAY & FDA SYSTEM**		
9.1.	Alpha Numeric Display/ Jumbo Display	B	**AGLA, BCH, BEMCO, BLE BELL, EPCC, ESSEN, GE, KHERAJ, LECTROTEK, MICROTECH, VINAY**
9.2.	Large Screen Display	B	**HITACHI, LG, PANASONIC, SAMSUNG, SONY**

S No.	ITEMS	CATEGORY	MAKE
9.3.	Video Walls (LED)	B	**DELTA, HITACHI, LG, PANASONIC, SAMSUNG, SONY**
9.4.	Fire Detection and Alarm (FDA) System	A	**BOSCH, HONEYWELL (ESSER), HONEYWELL (NOTIFIER), SECURITON, SIEMENS, TYCO**
10.	**INSTRUMENTATION CABLES**		
10.1.	Instrumentation/ Screened/ Co-axial/ Special Cables	A	**CCI, CORDS, DELTRON, FINOLEX, LAPP, MEM, NICCO, THERMOCABLES, TOSHNIWAL, UNIVERSAL, SUN**
10.2.	Telephone Cable	B	**BELDON, DELTON, FINOLEX, NICCO, TELE LINK, UNIVERSAL,**
10.3.	Load Cell Cable	A	**FLINTEC, HBM, PRECIA MOLEN, RICELAKE, SARTORIOUS, SCHENK, SIEMENS**
10.4.	T/C Extension cable, Compensating cable, PTFE cable	A	**BELDEN, LAPP, MEM, TEMCON, TEMPSENS, THERMOCABLE, TOSHNIWAL CABLES**

SECTION-E

REFRACTORY

S No.	ITEMS	CATEGORY	MAKE
1.	Fireclay Refractories (Alumina Up to 44 %)	B	**ARUN REFRACTORIES, ARVIND INDUSTRIES, ASSOCIATED CERAMICS LTD., BRAHMA REFRACTORIES PVT. LTD., BURNPUR CERAMICS, BURNPUR INDUSTRIES, CHAMPION CERAMICS PVT. LTD., DALMIA CEMENT (BHARAT) LTD., INDUSTRIAL ASSOCIATES, MAHAKOSHAL REFRACTORIES PVT. LTD., MAITHAN CERAMIC LTD., MANISHRI REFRACTORIES & CERAMICS PVT. LTD., PREMIER REFRACTORIES PVT. LTD., RAJHANS REFRACTORIES PVT. LTD., SAIL REFRACTORY UNIT, SHREEKANT INDUSTRIES, TRL KROSAKI REFRACTORIES LTD., VALLEY REFRACTORIES PVT. LTD.**
2.	High Alumina Refractories (Alumina Above 44 %)	B	**ASSOCIATED CERAMICS LTD., BRAHMA REFRACTORIES PVT. LTD., CHAMPION CERAMICS PVT. LTD., DALMIA CEMENT (BHARAT) LTD., INDUSTRIAL ASSOCIATES, MAHAKOSHAL REFRACTORIES PVT. LTD., MAITHAN CERAMIC LTD., MANISHRI REFRACTORIES & CERAMICS PVT. LTD., PREMIER REFRACTORIES PVT. LTD., RAJHANS REFRACTORIES PVT. LTD., RANCHI REFRACTORIES (INDIA) PVT. LTD., SAIL REFRACTORY UNIT, SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES, TRL KROSAKI REFRACTORIES LTD.**
3.	Silica Refractories	B	**DALMIA CEMENT (BHARAT) LTD., TRL KROSAKI REFRACTORIES LTD., SAIL REFRACTORY UNIT**

S No.	ITEMS	CATEGORY	MAKE
4.	Insulation Refractories	B	**ACHINT CHEMICALS, ASSOCIATED CERAMICS LTD., CALDERYS INDIA REFRACTORIES LTD., CARBORUNDUM UNIVERSAL LTD., MAITHAN CERAMICS LTD., MURUGAPPA MORGAN THERMAL CERAMICS LTD., NAVRANG REFRACTORIES PVT. LTD., NEWKEM PRODUCTS CORPOPRATION, NUTECH REFRACTORIES PVT. LTD., PREMIER REFRACTORIES PVT. LTD., RAJASTHAN CERAMICS INDUSTRIES, RELIABLE REFRACTORIES PVT. LTD., VALLEY REFRACTORIES PVT. LTD., SHREE CERAMICS FIBERS PVT. LTD.**
5.	Basic Refractories (Magnesite/ Mag Chrome/ Chrome Mag/ Magnesia-Carbon/ Alumina Magnesia Carbon)	B	**CHAMPION CERAMICS PVT. LTD., DALMIA CEMENT (BHARAT) LTD., MAITHAN CERAMIC LTD., MANISHRI REFRACTORIES & CERAMICS PVT. LTD., RANCHI REFRACTORIES (INDIA) PVT. LTD., RHI MAGNESITA INDIA LTD., SAIL REFRACTORY COMPANY LTD., SAIL REFRACTORY UNIT, SARVESH REFRACTORIES PVT. LTD., TRL KROSAKI REFRACTORIES LTD., VESUVIUS INDIA LTD.**
6.	Purging Refractories (Porous Plug/ Purging Plug)	B	**DALMIA CEMENT (BHARAT) LTD., HI-TECH CHEMICALS (P) LTD, IFGL REFRACTORIES LTD., MANISHRI REFRACTORIES & CERAMICS PVT. LTD., RHI MAGNESITA INDIA LTD., SARVESH REFRACTORIES PVT. LTD., TRL KROSAKI REFRACTORIES LTD., VESUVIUS INDIA LTD.**

S No.	ITEMS	CATEGORY	MAKE
7.	Pouring Refractories (Well block/ Inner Nozzle/ Outer Nozzle/ Slide gate)	B	**DALMIA CEMENT (BHARAT) LTD., HI-TECH CHEMICALS (P) LTD, IFGL REFRACTORIES LTD., MANISHRI REFRACTORIES & CERAMICS PVT. LTD., RANCHI REFRACTORIES (INDIA) PVT. LTD., RHI MAGNESITA INDIA LTD., SARVESH REFRACTORIES PVT. LTD., TRL KROSAKI REFRACTORIES LTD., VESUVIUS INDIA LTD.**
8.	Black Refractories (Shroud/ Mono block Stopper/ Tundish Nozzle/ SEN/ Single Taphole Sleeve)	B	**DALMIA CEMENT (BHARAT) LTD., HI-TECH CHEMICALS (P) LTD, IFGL REFRACTORIES LTD., RHI MAGNESITA INDIA LTD., SARVESH REFRACTORIES PVT. LTD., TRL KROSAKI REFRACTORIES LTD., VESUVIUS INDIA LTD.**
9.	Silicon Carbide Refractories	B	**CARBORUNDUM UNIVERSAL LTD., SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES**
10.	Alumina-Silicon Carbide-Carbon (ASC) Refractories	B	**CHAMPION CERAMICS PVT. LTD., DALMIA CEMENT (BHARAT) LTD., MANISHRI REFRACTORIES & CERAMICS PVT. LTD., RAASI REFRACTORIES LTD., RHI MAGNESITA INDIA LTD., TRL KROSAKI REFRACTORIES LTD.**
11.	Acid Resistant Refractories	B	**CHAMPION CERAMICS PVT. LTD., MAHAKOSHAL REFRACTORIES PVT. LTD., MANISHRI REFRACTORIES & CERAMICS PVT. LTD., RAJHANS REFRACTORIES PVT. LTD., BURNPUR CERAMICS, SB STEEL, ORIENT REFRACTORIES, JARIDIH CHEMICALS & INDUSTRIES**

SECTION-F

UTILITIES & SERVICES

S No.	ITEMS	CATEGORY	MAKE
1.	**PUMPS**		
1.1.	Centrifugal Pumps (Horizontal Split Casing / Horizontal Back Pullout / Vertical axial, Volute & Mixed flow Types – All ranges)	A	**BHEL, FLOWMORE, FLOW SERVE, KIRLOSKAR (KBL), KSB, SAM, SULZER, WILO-MATHER & PLATT, WPIL, JYOTI PUMPS**
1.2.	Centrifugal Pumps (Horizontal Split Casing / Horizontal Back Pullout / Vertical axial, Volute & Mixed flow Types – Less than 100 m3/h)	A	**BEST & CROMPTON, CALAMA, CHEMFLO, CRI, SAM, SJ INDUSTRIES, SPX FLOW (JOHNSON)**
1.3.	Boiler Feed Pumps / Condensate Extraction Pump	A	**BHEL, KIRLOSKAR EBARA PUMPS LIMITED (For boiler capacity upto 50 tph), KSB, SULZER**
1.4.	Submersible pump	B	**CALAMA, CRI, DARLING, FLOWMORE, KISHOR PUMPS, KSB, LUBI, SAM, SU MOTORS, SULZER, VARAT, WPIL, XYLEM, KBL, WILO-MATHER & PLATT**
1.5.	Horizontal Centrifugal Pumps For Slurry Handling	A	**BEST & CROMPTON, CRI, FL SMIDTH (DORR OLIVER), FLOWMORE, FLOW SERVE, METSO, SAM, WEIR MINERALS**
1.6.	Reciprocating Slurry Pump	A	**FL SMIDTH (DORR OLIVER), ROTO, WEIR MINERALS**
1.7.	Vertical Centrifugal Pumps for Slurry Handling	A	**METSO, SAM, WEIR MINERALS**
1.8.	Reciprocating Pumps	A	**ACME, AIRAUTO, CHEMTROL ENGG., FLOW SERVE, SWELORE**
2.	**VALVES & GATES**		

S No.	ITEMS	CATEGORY	MAKE
2.1. **FLUIDS (EXCEPT STEAM & OXYGEN) SERVICE** **General Services-Make-up water system, Cleaning & Washing, Service air system, Purging system**			
2.1.1.	Gate and Globe (Cast Steel) **General Services**	B	**BHEL, FLUIDTECH EQUPT., FOURESS, GM ENGG., INTERVALVE, IVC, JOSHI JAMPALA, KIRLOSKAR, KSB, L&T, MASCOT, OSWAL INDUSTRIES, STEELSTRONG, TYCO VALVES, UNIVERSAL ENGG. CONCERN, VALVE TECH IND., LEADER, SWIMS TECHNOLOGIES**
2.1.2.	Gate and Globe (Cast Steel) **All Process**	A	**BHEL, FLUIDTECH EQUPT., FOURESS, KSB, L&T, TYCO VALVES, SWIMS TECHNOLOGIES**
2.1.3.	Non-return Valves (Cast Steel) **General Services**	B	**ADVANCE, BHEL, DEZURIK, FLUIDTECH EQUPT., FOURESS, GM ENGG., INTERVALVE, KIRLOSKAR, KSB, L&T, OSWAL INDUSTRIES, STEELSTRONG, UNIVERSAL ENGG. CONCERN, UNIVERSAL ENGG., VALVE TECH IND, LEADER SWIMS TECHNOLOGIES**
2.1.4.	Non-return Valves (Cast Steel) **All Process**	A	**BHEL, FLUIDTECH EQUPT., FOURESS, KSB, L&T, SWIMS TECHNOLOGIES**
2.1.5.	Gate, Globe and Non-return Valves (Forged Steel) **General Services**	B	**BHEL, FOURESS, HYDRO TECH ENGG., INTERVALVE, JOSHI JAMPALA, KIRLOSKAR (KBL), KSB, L&T, OSWAL INDUSTRIES, VALVE TECH IND.,SWIMS TECHNOLOGIES**
2.1.6.	Gate, Globe and Non-return Valves (Forged Steel) **All Process**	A	**BHEL, FOURESS, KSB, L&T, SWIMS TECHNOLOGIES**

S No.	ITEMS	CATEGORY	MAKE
2.1.7.	Gate and Globe Valves (SS & Alloy Steel)	A	**BHEL, FOURESS, INTERVALVE, KSB, L&T, OSWAL INDUSTRIES, SWIMS TECHNOLOGIES**
2.1.8.	Gate, Globe, Non-Return Valves (Cast Iron, & SG Iron) **General Services**	B	**BANKIM, CALSEN, CHEMTECH, DURGA VALVES, FLUIDTECH EQUPT., GM DALUI, IVC, JOSHI JAMPALA, KIRLOSKAR, LEADER, SHIVA DURGA, SIGMA FLOW, UNIVERSAL ENGG. CONCERN, UNIVERSAL ENGG., UPADHYAY, VALVE TECH IND**
2.1.9.	Gate, Globe, Non-Return Valves (Cast Iron, & SG Iron) **All Process**	A	**FLUIDTECH EQUPT., IVC, JOSHI JAMPALA, KIRLOSKAR, SHIVA DURGA, UPADHYAY**
2.1.10.	Double Eccentric Butterfly Valves	A	**DELVAL FLOW CONTROLS, FOURESS, INTERVALVE, JOSHI JAMPALA, L&T, STAFFORD (VIRGO), VALVE TECH IND., SWIMS TECHNOLOGIES, KSB, KIRLOSKAR, IL**
2.1.11.	Triple Eccentric Butterfly Valves	A	**DELVAL FLOW CONTROLS, EMERSON (VIRGO), FOURESS, INTERVALVE, JOSHI JAMPALA, L&T, PENTAIR (TYCO), SWIMS TECHNOLOGIES**
2.1.12.	Butterfly Valve **General Services**	B	**BRAY CONTROLS, DELVAL FLOW CONTROLS, DEMBLA, DEZURIK, DURGA VALVES, CHEMTECH, FLOW SERVE, FOURESS, INTERVALVE, JOSHI JAMPALA., KIRLOSKAR, KSB, L&T, MASCOT, METSO, ROTEX, SIGMA FLOW, STAFFORD CONTROLS, TYCO VALVES, UNIVERSAL ENGG. CONCERN, UNIVERSAL ENGG., VALVE TECH IND.,AVCON, SWIMS TECHNOLOGIES , LEADER**

S No.	ITEMS	CATEGORY	MAKE
2.1.13.	Butterfly Valve **All Process**	A	**BRAY CONTROLS, DELVAL FLOW CONTROLS, FLOW SERVE , FOURESS, INTERVALVE, KSB, L&T, METSO, TYCO VALVES, SWIMS TECHNOLOGIES**
2.1.14.	Fabricated Valves (Gate Valves)	A	**FLUIDTECH EQUPT., FOURESS, JOSHI JAMPALA, L&T, CHEMTECH**
2.1.15.	Fabricated Valves (Butterfly Valves)	A	**FLUIDTECH EQUPT., FOURESS, IL, INTERVALVE, JOSHI JAMPALA, L&T**
2.1.16.	Goggle Valves	A	**FOURESS, JOSHI JAMPALA, Zimmerman & Jhonson-India, CHEMTECH**
2.1.17.	3 or 4 Way Cock/Plug valve (CI / CS/ FS)	B	**FLOWSERVE, UNIVERSAL ENGG. CONCERN, L&T**
2.1.18.	Ball Valve (SS/CS / FS / CI) **General Services**	B	**AQUA VALVES, DELVAL FLOW CONTROLS, EMERSON (VIRGO), INTERVALVE, KSB, L&T, MASCOT, OSWAL INDUSTRIES, MICROFINISH, NSSL, PENTAIR (TYCO), ROTEX, VALVE TECH IND., SWIMS TECHNOLOGIES**
2.1.19.	Ball Valve (SS/CS / FS / CI) **All Process**	A	**DELVAL FLOW CONTROLS, EMERSON (VIRGO), INTERVALVE, KSB, L&T,MICROFINISH, , PENTAIR (TYCO), ROTEX, SWIMS TECHNOLOGIES**
2.1.20.	Float Valve	B	**CALSEN, IVC, LEADER, LEVCON, SHIVA DURGA, UPADHAYA,**
2.1.21.	Foot Valve	B	**CALSEN, DEZURIK, IVC, KIRLOSKAR (KBL), LEADER, LEVCON, SHIVA DURGA, UPADHAYA, SWIMS TECHNOLOGIES**
2.1.22.	Diaphragm Valve	A	**CRANE PROCESS, FLUID SYSTEM, MASCOT, SWIMS TECHNOLOGIES**

S No.	ITEMS	CATEGORY	MAKE
2.1.23.	Air Release Valve	B	**BANKIM, CALSEN, IVC, LEADER, LEVCON, SHIVA DURGA, SIGMA FLOW, UPADHYAY**
2.1.24.	Safety Valve	A	**BHEL, IL, FORBES MARSHALL, MEKASTAR, PENTAIR (TYCO), SWIMS TECHNOLOGIES**
2.1.25.	Needle Valve	A	**AIR CHEM, DUNCUN, SCHRODER, SEIMAG, VALVE TECH IND**
2.1.26.	Knife-edge Gate Valve	A	**DEZURIK, FLOWLINK SYSTEMS, HABONIM VASS, JASH, JOSHI JAMPALA, METSO, ORBINOX, PENTAIR (TYCO), VALVE TECH IND, WEIR-MINERALS, BRAY CONTROLS**
2.1.27.	Pressure Reducing Valve	A	**CRESCENT, FLOWTEK, FORBES MARSHALL, IL, MEKASTER**
2.1.28.	Sluice Gate	B	**IM ENGG, INTERVALVE, JASH, LEVCON**
2.1.29.	Non-Ferrous Valves (General Purpose)	B	**AKSONS, ASCO, BOMBAY METAL, CRESCENT, FLUIDLINE, GM DALUI, LEADER, SANT VALVES, VALVE TECH IND**
2.1.30.	Dampers – (Air and Gas services)	B	**DTL, FOURESS, INTERVALVE, JOSHI JAMPALA, STAFFORD**
2.2.**STEAM SERVICE**			
2.2.1.	Gate and Globe (Cast Steel & Forged Steel)	A	**BHEL, FOURESS, HOPKINSONS-WEIR, HYDRO TECH ENGG., INTERVALVE, KSB, L & T, OSWAL INDUSTRIES, PRUSS(HS), SWIMS TECHNOLOGIES**
2.2.2.	Non-return Valves (Cast Steel & Forged Steel)	A	**BHEL, DEZURIK, FOURESS, INTERVALVE, KSB, L&T , SWIMS TECHNOLOGIES**
2.2.3.	Gate, Globe & Non-return Valves (SS & Alloy Steel)	A	**BHEL, FOURESS, HOPKINSONS-WEIR, KSB, L & T, OSWAL INDUSTRIES**

S No.	ITEMS	CATEGORY	MAKE
2.2.4.	Ball valves (Cast Carbon Steel and alloy Steel)	A	**BHEL, KSB, L & T, OSWAL INDUSTRIES, THERMAX**
3.	**HEAT EXCHANGERS**		
3.1.	Heat Exchanger (Plate Type)	A	**ALFA LAVAL, APV, HRS, IDMC, SWEP, TRANTER, KELVION INDIA**
3.2.	Heat Exchanger (Shell & Tube Types)	B	**AIR CARE EQUIPMENTS, ALFA LAVAL, APV, BHEL, EASTERN EQUIP ENG (EEE), EUREKA ENGG., GODREJ, ING-TECH ENGG. CO., L&T, PRECISION COOLING, REILIENCE, RELIANCE, TEMA INDIA, TEXMACO, THERMAL SYSTEMS, THERMAX**
4.	**COOLING TOWERS**	A	**GAMMON, GEA COOLING TOWERS, PAHARPUR, PALTECH, SHRIRAM TOWER, WET BULB**
5.	**FILTERS / STRAINERS**		
5.1.	Filters /Strainers	A	**AMIAD, FILTRATION ENGINEERS, OTOKLIN, SUPERFLO, SUREFLO PUROLATOR, HYDAC FILTERS**
5.2.	Pressure Filters	A	**DOSHI ION-VEOLIA, DRIPLEX, ING- TECH ENGG. CO., EFFWA, EUREKA ENGG. RESIN INDIA, FILTERATION ENGINEERS, ION EXCHANGE, McLANAHAN, OTOKLIN, PENTAIR WATER, THERMAX, VA TECH, VOLTAS**
5.3.	Activated Carbon Filter	A	**ARUDRA, ION EXCHANGE, OTOKLIN, PENTAIR WATER, RESIN INDIA, SUREFLO, THERMAX, VASMYL, VOLTAS**
5.4.	Iron Removal Filter	A	**ION EXCHANGE, SPARKLE, THERMAX, VOLTAS, ZEOLITE INDIA (P) LTD**

S No.	ITEMS	CATEGORY	MAKE
5.5.	Y-Strainer	B	**CADILLAC, DRAYTON-GREAVES, FILTERATION ENGINEERS, FORBES MARSHALL, OTOKLIN, SUPERFLO, UNIKLINGER**
5.6.	Cyclone Separator	B	**Filtration Engineers India Pvt. Ltd., LAKOS, SUPERFLO, TIMEX (AMIAD)**
6.	**EXPANSION JOINTS/COMPENSATORS (Utility & Services)**		
6.1.	Expansion Joints / Compensators (Metallic)	A	**ATHULYA, DWREN, FLEXICAN, FLEXITHERM, LONE STAR, BD ENGINEERS, METALLIC BELLOWS, PRECISION ENGINEERS, SUR INDUSTRIES**
6.2.	Expansion Joints/Compensators (Rubber)	B	**CORI ENGG., DWREN, GBM , KELD ELLENTOFT INDIA, PRECISION ENGRS., STANDARD PRECISION BELLOWS, SUR INDUSTRIES**
7.	**CENTRIFUGAL GAS BOOSTER (BF/CO/BOF/MIXED FUEL GAS)**	A	**AEROTO BOLDROCCHI, ANDREW YULE, BHEL, HOWDEN, TLT**
8.	**INSULATION MATERIAL AND WORK**	B	**BAKELITE HYLAM, FINLAY INSULATIONS, LLYOD INSULATION, RAYCHEM, UP TWIGA**
9.	**PRESSURE VESSELS / BUFFER VESSELS**	A	**BHEL, L&T, NTPC-ALSTOM, PRESSURE VESSEL INDIA (P) LTD., TEXMACO, TITAN ENGINEERING**
10.	**GAS HOLDER** **(DRY SEAL TYPE)**	A	**MB Engg (CLAYTON WALKER GROUP -UK), LAZARUS & ASSOCIATES**
	GAS HOLDER **(WET SEAL TYPE)**	A	**MB Engg (CLAYTON WALKER GROUP -UK), LAZARUS & ASSOCIATES**
11.	**PIPES**		

S No.	ITEMS	CATEGORY	MAKE
11.1.	Steel Pipes	B	**INDIAN SEAMLESS, JSW, KHANDELWAL, MAHARASHTRA SEAMLESS, SAIL, SURYA TUBES, TATA TUBES, UTKARSH, RATNADEEP METAL & TUBES LTD.**
11.2.	Stainless Steel Pipes	B	**CHOKSY, DIVINE TUBES, JINDAL, MAHARASHTRA SEAMLESS, MEC TUBES, SURAJ LTD., QUALITY STAINLESS, STANDARD (INDIA), STERLING, ZENITH, RATNADEEP METAL & TUBES LTD**
11.3.	Cast Iron Pipes & Specials	B	**KALINGA IRON WORKS, KESORAM INDIA LTD.**
11.4.	DI Pipes	B	**ELECTRO STEEL CASTINGS., JINDAL SAW, TATA METALIKS DI PIPE LTD.**
12.	**WATER TREATMENT AND DM WATER PLANT**		
12.1.	DM , Soft Water Plant, RO PLANT	A	**VEOLIA, DRIPLEX, EFFWA, EUREKA FORBES, GE POWER & WATER, GEA ENERGY SYSTEMS, ION EXCHANGE, ISGEC (Except RO Plant), PENTAIR WATER, RESIN INDIA, SPARKLE, THERMAX, TRIVENI ENGG., VOLTAS**
12.2.	Clarifier	B	**EIMCO-KCP, EUREKA FORBES, HINDUSTAN DORR OLIVER, JORD ENGINEERS, McNALLY SAYAJI, TRIVENI ENGG. Water Systems India Pvt. Ltd.**
12.3.	Thickener	-	**As per makes of Thickener mentioned in MINING & MINERAL PROCESSING AREA**
12.4.	Chemical Dosing	B	**CHEMBOND, GE POWER & WATER, HINDUSTAN DORR OLIVER, NALCO, SJ INDUSTRIES, TELLABS CHEMICALS,** **TRIVENI ENGG**

S No.	ITEMS	CATEGORY	MAKE
12.5.	Filter Press	A	**ANDRITZ, DINSHAW, FILTER MACHINE, FL SMITH, PANAMA, SUREFLO**
13.	**EQUIPMENT & SYSTEM FOR AIR AND GAS**		
13.1.	Turbo Blower	A	**BHEL (For Centrifugal), Howden CKD Compressors (For Centrifugal), KAWASAKI, Mitsui E&S Machinery Co., MAN Energy Solutions, SIEMENS**
13.2.	Compressor (Centrifugal)	A	**ATLAS COPCO, FS-ELLIOTT, INGERSOLL RAND, KAZANCOMPRESSORMASH, KIRLOSKAR, KOBELCO, SIEMENS**
13.3.	Compressors (Screw)	A	**ATLAS COPCO, ELGI, INGERSOLL RAND, KAEZER, KIRLOSKAR PNEUMATIC**
13.4.	Compressors (Reciprocating)	A	**BURCKHARDT COMPRESSION, ELGI, INGERSOL RAND, KIRLOSKAR PNEUMATIC**
13.5.	Portable Air Compressors	B	**ATLAS COPCO, ELGI, HOLMAN CLIMAX, INGERSOLL RAND, KIRLOSKAR**
13.6.	**Centrifugal Blowers & Fans – For all applications except fuel gas**		
	Capacity < 80,000 m3/h	A	**AEROTO BOLDROCCHI, ANDREW YULE, BATLIBOI, BHEL, C.DOCTOR, HOWDEN, MAXFLOW, REITZ, TLT ENGG.**
	Capacity > 80,000 m3/h	A	**AEROTO BOLDROCCHI, ANDREW YULE, BHEL, HOWDEN, MAXFLOW, TLT ENGG**
13.7.	Air Drier	B	**ATLAS COPCO, DELAIR, EXAL, INGERSOL RAND, ROOS TEMPKOOL, SANPAR, TRIDENT**

S No.	ITEMS	CATEGORY	MAKE
13.8.	Air Trap	B	**DRAYTON GREAVES, FORBES MARSHAL, UNI KLINGER**
13.9.	Moisture Separator	B	**DRYTECH ENGINEERS, FESTO CONTROL, HYDAIR, NUCON, ROSS, SCHRADER, SMC, THERMAX, UNIKLINGER, VELJAN**
14.	**POWER PLANT EQUIPMENT**		
14.1.	Boilers (Stoker, Pulverised, AFBC, CFBC)	A	**BHEL, GE, ISGEC, THERMAX, THYSENKRUPP**
	Gas Fired Boiler	A	**BHEL, GE, ISGEC, THERMAX**
	Waste Heat Boilers	A	**BHEL, ISGEC, THERMAL SYSTEM (less than 50 tph capacity), THERMAX**
14.2.	Steam Turbines (For turbo-blower)	A	**BHEL, MAN Energy Solutions, SIEMENS**
14.3.	Steam Turbines (For power generation)	A	**BHEL, MAN Energy Solutions, SIEMENS, SKODA, TRIVENI TURBINE**
14.4.	Auxiliary Steam Turbines (Range less than 1000 kW)	A	**KEPL, FORBES, TRIVENI TURBINE**
14.5.	Gas Turbines	A	**ALFA LAVAL, ALSTOM, BHEL, GE, MITSUBISHI, SIEMENS**
14.6.	Top Pressure recovery Turbine	A	**KAWASAKI, Mitsui E&S Machinery Co., MAN Energy Solutions**
14.7.	Condenser (Water)	A	**ALSTHOM, BHEL, GE GODAVARI, MAZDA, SIEMENS, UNIVERSAL HEAT EXCHANGER**
14.8.	De-aerator	A	**BHEL, ION EXCHANGE, ISGEC, THERMAX**
14.9.	PRDU	A	**BHEL, CHEMTROL, FORBES MARSHAL, THERMAX, KOSO FLUID CONTROL, EMERSON PROCESS MANAGEMENT**

S No.	ITEMS	CATEGORY	MAKE
14.10.	HP / LP Dosing	A	**ASIA LMI, ENPRO, META CHEM, VK PUMPS**
14.11.	Soot Blowers	A	**BERGMAN, BHEL, SISTON**
14.12.	HP Heater & LP Heater	A	**BHEL, ISGEC, SIEMENS, THERMAX**
14.13.	Steam Traps	B	**DRAYTON, FORBES MARSHALL, GREAVES, THERMAX, UNIKLINGER, ESCO, UNISON VALVES, PENANT ENGG, ECON STEEL**
15.	**POLLUTION CONTROL EQUIPMENT**		
15.1.	ESP		------
	Capacity < 5,00,000 m3/h	A	**ANDREW YULE, BATLIBOI ENVIRONMENTAL ENGG, BHEL, ELEX, FL SMIDTH, GEA PROCESSING, HAMON RESEARCH COTTRELL, K. C COTTRELL INDIA, RIECO INDUSTRIES, SOIL & ENVIRO INDUSTRIES, THERMAX INDIA**
	Capacity > 5,00,000 m3/h	A	**BHEL, ELEX, FL SMIDTH, GEA PROCESSING, K. C COTTRELL INDIA, THERMAX**
15.2.	BAG FILTERS		------
	Capacity < 2,50,000 m3/h	A	**ANDREW YULE, APC SYSTEMS, BATLIBOI ENVIRONMENTAL ENGG., BEVCON WAYORS, CK AIRTECH, CLAIR ENGINEERS, F. HARLEY, GLOBAL ENVIRO SYSTEM, RIECO INDUSTRIES, SOIL & ENVIRO INDUSTRIES, THERMAX**
	Capacity > 2,50,000 m3/h	A	**ANDREW YULE, BATLIBOI ENVIRONMENTAL ENGG., BOLDROCCHI, RIECO INDUSTRIES, THERMAX**

S No.	ITEMS	CATEGORY	MAKE
15.3.	DUST SUPPRESSION SYSTEM	B	**CHEMTROL SAMIL, DUST SOLUTION SYSTEM, F. HARLEY, KAVERI ULTRAPOLYMERS, SPRAYING SYSTEMS, TPS INFRASTRUCTURE**
15.4.	CYCLONES AND MULTI CYCLONES	B	**AEROTO BOLDROCCHI, AIR TECHNICO, ANDREW YULE, BATLIBOI ENVIRONMENTAL ENGINEERING, F. HARLEY, RAJDEEP ENGG, RIECO INDUSTRIES, THERMAX**
16.	**AIR CONDITIONING, REFRIGERATION & VENTILATION**		
16.1.	Window/Tower/Split AC/ Ductable Split AC	B	**BLUE STAR, CARRIER, DAIKIN, FEDDERS LLYOD, HITACHI, MITSUBISHI, SAMSUNG, VOLTAS, ZAMIL**
16.2.	Packaged Chillers	A	**BLUE STAR, CARRIER, DAIKIN, DUNHUM BUSH HITACHI, TRANE, VOLTAS, YORK**
16.3.	Package AC	B	**ACCEL, BLUE STAR, DAIKIN, VOLTAS**
16.4.	Precision Air Conditioning	A	**CLIMAVENETA, EMERSON, STULLZ-CHSPL (INDIA)**
16.5.	Cooling Tower (ACVS)	B	**ADVANCE COOLING TOWERS, ARMEC, DBR, FRICK INDIA, GAMMON INDIA, HIMGIRI, MIHIR ENGINEERS, PAHARPUR, SOUTHERN COOLING TOWERS,VOLTAS, WET BULB**
16.6.	Air Handling Unit	B	**DAIKIN, EDGETECH, ETA, ROOTS COOLING, VOLTAS, ZAMIL**
16.7.	Tube Axial Fan	B	**ABLE AIR-O TECH, AEROVENT, ANDREW YULE, CARYAIRE, DUSTVEN, EFE, FLOWLINK, HUMIDIN, KHAITAN, KRUGER, MAXFLOW, MESINA, SH ENGG., TUBOFLOW**

S No.	ITEMS	CATEGORY	MAKE
16.8.	Panel Filter For Air	B	**ABB, ACCO, BHARAT, C.DOCTOR, CADILLAC, EFE, FLOW LINK, FMI, GEC, PUROLATOR, WFI**
16.9.	Air Washer	B	**AIRLINK, EFE , HUMIDIN, MARCO, MESINA, ROOTS COOLING , SYMPHONY**
16.10.	Propeller Fan	B	**ABB, ACCO, AEROVENT, DUVENT, INDVENT FANS, MESINA, SH ENGG., TUBOFLOW, VENTURA**
16.11.	Roof Extractors	B	**AIRLINK, ALMONARD, ANDREW YULE, C. DOCTOR, CARYAIRE, EFE, FLOWLINK, HUMIDIN, KRUGER, VENTURA**
16.12.	Vapor Absorption Machine	A	**BLUE STAR, CARRIER, KIRLOSKAR, THERMAX, VOLTAS**
17.	**OXYGEN & CRYOGENIC SERVICE**		
17.1.	Cryogenic Pump	A	**CRYOPUMP, CRYOSTAR, ICL**
17.2.	Oxygen Filter / Y-Strainer	A	**BEE, BLUESTAR, CARBERN, CLASSIC, Filteration Engineers India Pvt. Ltd., NOVINTEC, ORSEAL, SHIPHAM, VEE**
17.3.	Non Ferrous Control Valves	A	**BLACKHALL, FISHER, LEEDS, METSO, SAMSON, SEVERN GLOCON**
17.4.	Non Ferrous Self-regulating Valves	A	**BALEY BRIKETT, BROADY, FISHER, SAMSON, SEVERN GLOCON, TYCO**
17.5.	Non Ferrous Valves (Gate, Globe, Ball) - < DN50	B	**CRESCENT, FLUIDLINE, LEADER, MICROFINISH**
17.6.	Non Ferrous Valves (Gate, Globe, Ball) - > DN50	A	**BESTOBELL, BROOKSBANK, FISHER, HEROSE, LEEDS, MACK, METSO, SAMSON, SEVERN GLOCON, SHIPHAM**

S No.	ITEMS	CATEGORY	MAKE
17.7.	Safety Relief Valve	A	**ARCA, BAILEY BRIKETT, BROADY,CROSSBY, DARLING MUESEO, FARRIS, IL, JN MARSHALL, KEYSTONE, KUNKLE, SEBIM, SEMPELL, TYCO**
17.8.	Vaporizers	A	**CRYOQUIP, ICL, INOX, IWI CRYOGENICS, SHELL & TUBE**
18.	**FIRE FIGHTING EQUIPMENT**		
18.1.	Portable Fire Extinguishers	B	**DEFLAME, FIRE SHIELD, FIREX, GUNNEBO, INTIME FIRE, KANADIA FYR FYTER, MINIMAX, NITIN, SAFEX, SUPREMEX, ZENITH**
18.2.	Fire hydrant	B	**ASCO, GUNNEBO, MINIMAX, NEWAGE, NITIN,STEELCO, ZENITH**
19.	**REHEATING FURNACE (Pusher/Rotary)**	A	**ANDRITZ, ENCON, FIVESTEIN, HYPERTHERM, TECHNOTHERM, TENOVA, WESMAN**
20.	**MISCELLANEOUS ITEMS**		
20.1.	Surge Tanks	B	**ANUP ENGG., PERFECT ENGG., SAKTHI HITECH, ZENITH ERECTORS**
20.2.	Oil Skimmer	B	**HI-TECH ENGRS, JVM ENG., POTENTIAL ENGG, PREMIER OIL SKIMMER**
20.3.	Traveling Water Screen	B	**MACMET, MAHINDRA ASTECH, McGALE, OTOKLIN, SWAMINA INT., TRIVENI**
20.4.	Electrical Heat Tracer	B	**NICROPAD, RAYCHEM, THERMON, THERMOPAD**

SECTION-G

COMPUTERIZATION & INFORMATION TECHNOLOGY

S No.	ITEMS	CATEGORY	MAKE
1.	**IT EQUIPMENT**		
1.1.	Desktop PC	B	**DELL, HP, LENOVO**
1.2.	Industrial PC / Semi-Rugged Laptop	B	**ADVANTECH, DELL, PANASONIC, SIEMENS**
1.3.	Laptop	B	**DELL, HP, LENOVO**
1.4.	Server	A	**DELL, HPE, FUJITSU, LENOVO/IBM, ORACLE/SUN**
1.5.	Network Switch (IT, Office)	A	**CISCO, DELL, EXTREME, HP/HPE, RUCKUS**
1.6.	Network Switch (Industrial)	A	**ADVANTECH, CISCO, HIRSCHMANN, ROCKWELL, SCHNEIDER, SIEMENS**
1.7.	UTM / Firewall	A	**CHECKPOINT, CISCO, FORTINET, JUNIPER, SOPHOS, PALO ALTO**
1.8.	Passive network components / accessories	B	**DIGILINK/SCHNEIDER, MOLEX, ROSENBERGER, SYSTIMAX, TYCO (AMP)**
1.9.	UTP cable	B	**DIGILINK/SCHNEIDER, ELKAY, MOLEX, SYSTIMAX, TELELINK, TYCO(AMP), UNIVERSAL**
1.10.	FO cable	B	**BELDEN, DIGILINK/SCHNEIDER, FINOLEX, LUCENT, MOLEX, STARLITE, SYSTIMAX, TYCO(AMP), ROSENBERGER**
1.11.	Data storage system	A	**DELL/ EMC, FUJITSU, HP/HPE, HITACHI, IBM, NETAPP, ORACLE**
2.	**CCTV SYSTEM**		
2.1.	CCTV system	B	**BOSCH, CP PLUS, HONEYWELL, PELCO, PANASONIC, SAMSUNG, SEIMENS, SONY, TYCO**
2.2.	Led display (40" or more)	B	**HITACHI, LG, PANASONIC, SAMSUNG, SONY**
2.3.	Video wall	B	**DELTA, HITACHI, LG, PANASONIC, SAMSUNG, SONY**

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