VOLUME-II (TECHNICAL)

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SECTION-I

GENERAL AND MECHANICAL

1.0 **PREAMBLE**

1.1 NMDC Ltd. (NMDC) has planned to enhance production from their Bailadila range of hills (Deposit Nos. 14/11B/11C) at Kirandul to a capacity of 19 MTPA ROM. Further existing screen plant SP-I (for Deposit No. 14) has been operating for 40 years and needs major revamping which calls for major shutdown of the system.

1.2 Keeping the above in view, it has been proposed by NMDC to install third screening plant, SP-III (having provision of wet screening during monsoon) along with storage and tertiary crushing for a capacity of 12 MTPA ROM. Material from Deposits 14 and also from Deposit 11B shall be processed in the proposed screening plant. However, common stock piling facilities for Deposits 14, 11B and 11C for a capacity of 19 MTPA has been proposed. This calls for modification of existing conveyors so as to facilitate stock piling of lumps/CLO from all three sources at one place in the existing stockpile area. The new stockpile having conveying connectivity with the ESSAR system as proposed shall cater to storage of iron ore fines received from all three sources. Finally, iron ore shall be conveyed to the rapid loading system (not part of this package) for loading into the wagons.

2.0 **GENERAL**

2.1 This specification covers design, engineering, manufacture, inspection and testing at Vendor's works, surface treatment and painting, packing, supply, unloading at site, storage, erection, testing, commissioning, carrying out performance and guarantee tests at site and handing over of belt conveyor system including crushing, screening, stacking, reclaiming and feeding of iron ore fines to the rapid loading system (RLS). The scope of work shall cover all associated civil & structural works, electrics, water system, ventilation, instrumentation, control and automation system, maintenance facilities viz. cranes/hoists for maintenance of equipment to be installed inside buildings and transfer towers including modifications/ revamping of existing interfacing conveyors for feeding to new conveyor system. The iron ore fines to be generated from new screening plant (SP-III) shall receive lump ore (-150 mm) from deposits 14 and 11B. All these facilities are required for installation of SP-III to produce calibrated lump ore (CLO: -40mm +10mm)/lump ore and iron ore fines (-10 mm) for despatch to various steel plants through RLS (not part of this package). The specification also covers despatch of ore fines to existing ESSAR belt conveyor.

2.2 This specification is for supply and installation of complete iron ore handling systems including all auxiliary facilities as specified for the system excluding the items listed under Clause No. 6.0 of this section of the specification. All work facilities and services other than those mentioned in Clause No. 6.0

Section-I required for successfully achieving the purpose of installing the complete system including conveying, stacking, reclaiming, crushing, and screening shall be in the scope of work of this specification whether specifically mentioned or not. All miscellaneous items such as mechanical fasteners, foundation bolts, structural fasteners, shims, slings, packing plates, test weights etc. as required for proper installation of the proposed system shall be considered under the scope of this package.

2.3 The following drawings and documents are enclosed for reference of the bidders:

Sl. No.	Drawing No.	Title
1.	TCE.6131B-04-ME-001 P5	Floor plan and typical cross section of primary screening building & conveyor profile for C-3 & C-4
2.	TCE.6131B-04-ME-002 P5	Conveyor profile for C-1, C-2, 205/1 & 128
3.	TCE.6131B-04-ME-003 P6	Floor plan and typical cross section of tertiary crushing and screening building
4.	TCE.6131B-04-ME-004 P6	Conveyor profile for C-13, C-14, C-14A, C-15, C-16, C-17 and C-18
5.	TCE.6131B-04-ME-005 P7	Conveyor profile for C-19, C-29, C-21, C-22, C-23, CDC-2 & CDC-1
6.	TCE.6131B-04-ME-006 P6	Conveyor profile for C-36, C-38
7.	TCE.6131B-04-ME-007 P1	Mass balance diagram
8.	TCE-6131A-04-IC-001 P3 Sheet 1 of 2	PLC and SCADA Configuration for Dry Circuit System (Package IV)
9.	TCE-6131A-04-IC-001 P3 Sheet 2 of 2	PLC and SCADA Configuration for Dry Circuit System (Package IV)
10.	TCE-6131A-04-IC-002 P1	CCTV System Schematic Dry Circuit System (Package IV)
11.	TCE.6131A_IC_SKETCH 4	BATTERY LIMIT DETAILS FOR CCTV SYSTEM
12.	TCE.6131A_IC_SKETCH 1	BATTERY LIMIT DETAILS FOR EPABX SYSTEM
13.	TCE.6131A_IC_SKETCH 2	BATTERY LIMIT DETAILS FOR FIRE DETECTION & ALARM SYSTEM & INTERCONNECTION
14.	TCE.6131A-04-EL-001 P3	Main power distribution – Key single line diagram
15.	TCE.6131A-04-EL-002 P1 Sheet 1 of 2	New sub-station-I – Layout plan & section
16.	TCE.6131A-04-EL-002 P1 Sheet 2 of 2	New sub-station-I – Layout plan & section
17.	TCE.6131A-04-EL-003 P2 Sheet 1 of 2	New sub-station-II – Layout plan & section
18.	TCE.6131A-04-EL-003 P2	New sub-station-II – Layout plan &

Sl. No.	Drawing No.	Title
	Sheet 2 of 2	section
19.	TCE.6131A-04-ME-023 P5	Water system schematic piping layout (make up water and drinking water network)
20.	TCE.6131A-04-ME-026 P1	General arrangement of Settling tank
21.	TCE.6131A-04-ME-027 P1	Schematic water flow diagram for dry circuit system
22.	TCE.6131A-04-ME-028 P0	Typical arrangement of fire water pump house
23.	TCE.6131A-04-ME-029 P0	Typical arrangement of service water pump house
24.	TCE.6131A-04-ME-030 P0	Typical arrangement of sprinkler water pump house
25	TCE.6131A-04-ME-031 P0	Typical arrangement of drinking water pump house
26.	TCE.6131A-04-ME-001 P7	Equipment flow diagram (dry process)
27.	TCE.6131A-04-ME-002 P9	Plant Layout – Dry Circuit System (Package IV)
28.	TCE.6131A-04-ME-003 P4	Profile of conveyor C-25, C-26, C-27, C-28, C-29 and C-30
29.	TCE.6131A-04-ME-004 P5	Profile of conveyor C-32, C-33, C-34 and C-35
30.	TCE.6131A-04-ME-005 P3	Profile of conveyor 20A, 20B and EC-1
31.	TCE.6131A-04-ME-006 P2	Standard gallery cross section
32.	TCE.6131A-00-ME-001 P10	Plant General Layout
33.	TCE.6131A-04-CV-001 P0	Earthwork in Site Levelling-Master Layout Plan
34.	-	Flowability Test Report
35.	-	Bore Log Data

2.4 The bidders shall study the specification and satisfy themselves thoroughly regarding the workability of the system and the equipment duly considering the operational requirements described in this specification and shall take full responsibility for guaranteed operation of the equipment and the system as regards performance and smooth reliable safe working. If the bidders feel that any design data/technical parameters described hereafter for the equipment, are in their opinion unsuitable, they shall indicate the same and submit an alternative proposal on the basis of the design they consider suitable and capable of meeting the operating requirements.

2.5 The bidders are also advised to study the drawings enclosed with the specification. If in the opinion of the bidders, any change in dimension or arrangement is required either to suit equipment offered by them or for proper working of the system incorporating the equipment offered by them, they shall

point out the same and shall submit drawings showing the alternative arrangement/dimensions etc. along with the offer.

2.6 All items of the plant covered under this specification shall be complete in all respects and any item or accessory not specifically covered in this specification, but essential for proper design and reliable safe operation of the individual equipment and system shall be included in the specification by bidders.
All equipment shall have the capability of being isolated physically from all energy sources prior to any access, work or repair being carried out, in order to protect the health and safety of persons.

All sorts of Safety signs / taggings on equipment, structures, passages etc., as applicable, shall be provided appropriately.

Materials and components shall be free of asbestos content.

2.7 In general, no deviations from specification shall be entertained unless the same are required for proper working of the system and the equipment.

2.8 However, deviation from specification, if any, shall be brought out clearly as per format enclosed in Annexure I-5 of this specification. If the deviations from specification are not brought out clearly in the format mentioned above, the same shall not be accepted by the Purchaser at any later date even if the deviations are mentioned in other places of the offer by the bidder.

2.9 This tender is being invited for procurement of the equipment from indigenous and/or foreign sources. However, no foreign exchange or import license for importing equipment, components, raw materials or spares shall be arranged for or provided by the Purchaser. It shall be responsibility of the Contractor to co-ordinate the supply of the equipment or components from all sources including foreign source, if any, and execute the contract within the agreed time schedule.

2.10 All working parts, as far as possible, are to be arranged for convenience of operation, inspection, lubrication and ease of replacement with minimum downtime. All like parts on equipment furnished or on duplicate equipment, are to be interchangeable. Effort shall be made by the bidders to minimise the variety of repetitive items like idlers, pulleys, motors, gear boxes, couplings, brakes, bearings, etc. to minimise inventory.

2.11 All equipment shall be complete with adequate safety devices wherever a potential hazard to personnel exists, and with provision for safe access to and around equipment by personnel for operation and maintenance functions. These items shall include not only those usually furnished with elements of machinery but also the additional covers, guards, handrails etc. which are necessary for safe operation and as desired by the Purchaser. All pulleys shall be protected by wire mesh/expanded metal guards. As a minimum requirement, the Vendor shall ensure international best practices to guarding

design. All houses / towers / buildings shall be provided with adequate numbers of maintenance hoists / crane (as applicable) for handling the equipment safely installed within the particular house. All monorails shall preferably be routed above the centreline of equipment, so that inclined lifts are avoided. Power calculations, system design and selections should be done with future considerations. This shall be done for all the facilities showing future provisions.

2.12 The bidder is advised to visit the site for an on the spot study of the existing installations for examination of present working conditions and to collect all necessary site information/data for the purpose of carrying out the engineering and construction of the proposed system including modification covered in the specification viz. modification work for existing conveyor Nos. 205, 128, 310 and 614. It may be noted that the Purchaser shall furnish additional reference drawings of the existing installations, as available with them, only to the Contractor. Any pending information/data of the existing installations/system, if required for the purpose of engineering and construction work shall be collected by the Contractor from site at their own cost, if any.

2.13 The bidder to note that for the modification work of the existing conveyors/ installations, shut downs of the relevant conveyor/system shall be required. A document covering the detailed procedure and programme for the modification work involved and the shutdown time required for each activity shall be prepared by the Contractor at the appropriate time and mutually agreed upon with the Purchaser. If the shut down is required for any unforeseen activity not mentioned/included in the above document, the Contractor shall intimate the requirement well in advance to the Purchaser. The shutdown period and time shall be mutually agreed upon between Purchaser and the Contractor.

2.14 The list of preferred makes of bought-out items is enclosed in Volume-III. The Purchaser reserves the right of selecting the manufacturer of items/ components or any other item in the interest of standardisation or otherwise. The Contractor shall supply the items or components of particular makes agreed prior to placement of order. The bidders shall ensure regarding the availability of the makes of all items or components offered by them prior to making their offers.

2.15 In case of any discrepancy between the technical specification and Invitation to Tender or General Conditions of Contract, this technical specification shall prevail upon others.

2.16 This specification broadly outlines the requirements, spells out guidelines/ design parameters and shows indicative arrangement of the system. In case, any design changes which are required for betterment of the system or to take care of the existing set up for better integration, shall be suitably incorporated by the successful Bidder during detail engineering without price implication.

3.0 **CODES AND STANDARDS**

3.1 In general, items/components shall conform to the relevant Indian Codes Standards published by the Bureau of Indian Standards (BIS) as listed in Annexure I-3 of this specification wherever applicable. If any item/component is not covered by Indian Standards mentioned in the aforesaid Annex, Standards of International Organisation for Standardisation (ISO), International Electro-Technical Commission (IEC) and/or some other reputed institutions or generally accepted codes of engineering practices shall be followed / adopted.

3.2 Also, the design, materials, construction, manufacture, inspection, testing and performance of all equipment shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed. The equipment shall also conform to the latest applicable Indian or equivalent standards. Nothing in this specification shall be construed to relieve the Bidder of his responsibility.

3.3 All components, equipment and systems shall comply with statutory requirements of the Government of India and the State Government of Chhattisgarh. The Contractor shall be responsible for obtaining approval from concerned local, state or central authorities. In case, such approvals are required to be obtained, the Purchaser (Owner) shall give all necessary assistance to the Contractor for obtaining such approval.

3.4 The relevant equipment shall conform to the Indian Electricity Rules published in the year 1956/latest as regards to safety, earthing and other essential provisions specified therein for installation and operation of electrical in the plant.

3.5 In case of any discrepancy between this technical specification and the standards mentioned above, this technical specification shall prevail upon the standards.

4.0 **OTHER REQUIREMENTS**

4.1 SITE CONDITIONS

4.1.1 Unless otherwise specified, all equipment shall be designed for operation in tropical humid climate subject to heavy rainfall and frequent thunderstorms. The climatic conditions as prevailing in the area are given in Table I-1. However, it is responsibility of the Contractor to verify the site conditions.

TABLE I-1 – SITE CONDITIONS

Sl. No.	Particulars	Details
1.	Project Location	Screening and Loading Plant Area, Kirandul Complex of NMDC, South Bastar Dantewada,

Sl. No.	Particulars	Details
		District Chhattisgarh
2.	Latitude	18^{O} 37' 01" N to 18^{O} 37' 26" N
3.	Longitude	81^{O} 15' 21" E and 81^{O} 16' 04" E
4.	Toposheet No.	65 F/6
5.	Elevation above Mean Sea Level	Between 640 to 700 MRL
6.	Climatic conditions (IMD Jagadalpur)	(i) Annual Max. Temp. 40 ^{O}C (May) (ii) Annual Min. temp. 11 ^{O}C (Jan.) (iii) Annual average total rainfall 2660 mm (max. rainfall occurs from between June to October) (iv) Humidity – Max. 100%; Min. 10% (Relative) Max. Temp. and Max. humidity are not likely to occur simultaneously. (v) Wind: Weather during rainy season is stormy, accompanied by gales and the hill tops are covered with thick clouds and max. wind velocity: 70 km/hr
7.	Nearest Road/Highway	State Highway connecting Visakhapatnam-Jagadalpur – 2.5 km, NE
8.	Nearest Railway Station	Kirandul of East Coast Railway 0.4 km, N
9.	Nearest Airport	Raipur – 430 km (by road); Visakhapatnam – 425 km (by road) Jagadalpur (non-commercial air strip) – 120 km by road.
10.	Seismic zone	Zone-II as per IS:1893 (Part-1)-2002

4.1.2 Painting

4.1.2.1 General: The term 'Painting' referred herein covers rust preventive and decorative organic, inorganic and metallic coating and surface protection of the following:

(a) Structural steelwork

(b) Various equipment inclusive of electric motors, panels, control desk and accessories.

(c) Steel tanks, heat exchangers and vessels

(d) Pipe work including supports, hangers etc.

4.1.2.2 Surface in direct bonded contact with concrete, asbestos, aluminium, brass, bronze, galvanised steel, stainless steel and other corrosion resistant alloys and rubber/synthetic polymers and buried pipe work are not required to be painted unless specified, except for identification bands, where relevant. Except for such surfaces, painting & surface preparation shall be provided to protect all surfaces that shall be subject to atmospheric action and exposed to corrosive media, irrespective of mention in the other.

4.1.2.3 Surface preparation, being a prerequisite for any paint application, shall be such as to clean the surface thoroughly of any materials which shall be conductive to premature failure of the paint sub strata. The surface quality shall be Sa2½ as per Swedish Standard SIS- 0055900.

4.1.2.4 All surfaces shall be cleaned of loose substances and foreign materials such as dirt, rust, scale, oil, grease, welding flux etc., irrespective of whether the same has been spelt out in the standards in order that the prime coat is rigidly anchored to the virgin metal surface.

4.1.2.5 The paint shall be applied in accordance with manufacturer's recommendations. The work shall generally follow IS: 1477. For imported items, relevant standards of International Standard Organisation (ISO) shall be followed, as applicable.

4.1.2.6 Painting system: All fabricated steel structures, vessels, heat exchangers etc., shall have a minimum of two (2) primer coats prior to despatch to site. The paint system shall be alkyd base red-lead (IS: 102) or zinc-chromate (IS 2074) or Zinc-phosphate primer paint of approved make. One (1) finish coat of PVC-copolymer paint on synthetic enamelling oil alkyd resin paint shall be applied at site. The dry film thickness of the three (3) coats shall not be less than 120 microns.

4.1.2.7 Standard bought out items and machines such as pumps, fans, motors, valves, cylinders etc., and imported items, if any, shall generally be painted as per manufacturer's standard and shall meet the requirement of the exposure condition and the specific system of painting thereof. These shall also have a minimum of two (2) prime coats and one (1) finish coat of paint with a total dry film thickness of not less than 105 microns.

4.1.2.8 Painting of mechanical equipment and machineries like crushers, screens, fans, gear boxes, machine housings etc., shall be with two (2) coats of PVC co-polymer alkyd based primer and two (2) coats of finish paint of PVC co polymer alkyd based enamel. The DFT of each coat of primer shall be 70-80 microns and that of finish paint shall be 30-40 microns. The surface quality shall be Sa2½ as per Swedish Standard SIS- 0055900.

4.1.2.9 Over ground pipe work inclusive of pipes, fittings, hangers, cable ducts etc., both insulated and non-insulated, shall be painted with two (2) coats of alkyd based red-oxide or zinc-phosphate pigments as primer paint before despatch. The minimum dry film thickness per coat shall be 40 microns

4.1.2.10 Non-insulated pipes, having a maximum surface temperature of 60 degrees shall be applied with one (1) intermediate coat of single pack high built oil alkyd based paint with micaceous iron oxide and two (2) finish coats of single pack air drying high gloss oil alkyd modified synthetic enamel paint with suitable pigments over & above the primary coats. The minimum dry film thickness per coat shall be 70 microns and 25 microns for intermediate and finish coat respectively.

4.1.2.11 For 415V distribution switch boards, motor control centres, Instrument panels, control desks, the surface preparation shall be by pickling. The clean surface shall be given a phosphate coating consisting of thin layer of zinc, iron or manganese phosphate deposited either by immersion or powder spray. The phosphate coated surface shall have one (1) coat of baking primer of zinc chromate and two (2) coats of stove enamel finish paint.

4.1.2.12 Colour code

The colour codes to be adapted for various structures, mechanical, electrical items and pipe works shall be subject to approval of the end user.

4.1.3 Mechanical machinery

4.1.3.1 Machinery components shall be designed to meet the mechanical properties – hardness, strength, rigidity, wear and heat resistance, resistance to vibration etc. compatible with the operating conditions. All rotating parts shall be properly balanced and due care shall be given to avoid stress concentration by rounding off sharp corners with suitable radius.

4.1.3.2 All steel forgings shall be free from defects such as shrinkage and segregation. The surface defects may be removed, provided the depth of conditioning does not exceed 1 mm for every 15 mm of the dimension concerned upto a maximum depth of 20 mm.

The design of forging must take into consideration of load pattern, stress concentration, operating temperature and service life. Carbon steel forging shall conform to IS: 2004 and alloy steel forging shall conform to IS: 4367.

4.1.3.3 All steel castings shall conform to the following latest editions of Indian Standards:

- IS: 1030 : Steel casting for general engineering purposes.
- IS: 2644 : High tensile steel casting
- IS: 2707 : Carbon steel casting for surface hardening
- IS: 3444 : Corrosion resistance alloy and nickel based steel casting.

- IS: 4522 : Heat resistance alloy steel and nickel based casting

- IS: 4896 : Chromium steel casting for abrasion resistance service

4.1.3.4 While designing welded joints for items subjected to dynamic loading and in other high strength joints, attention shall be given to edge preparation, deep penetration fillets, etc. Welding shall generally conform to the following latest editions of Indian Standards:

- IS: 822 : Code of procedure for inspection of welds

- IS: 3600 : Method of testing fusion welded joints and weld(Part-I, metal in steel.
II, III)

- IS: 4943 : Assessment of butt and fillet fusion welds in steel sheet, plate and pipes

4.1.3.5 The size of normal fillet shall be taken as the minimum leg length. For deep penetration welds, where depth of penetration beyond the root run is 2.4 mm (minimum), the size of fillet should be taken as the minimum leg length of plus 2.4 mm. The size of the fillet weld shall not be less than 3 mm or more than the thickness of the thinner part to be joined.

4.1.3.6 Accurate machining of all parts shall be carried out according to desired dimensions and surface finish conforming to ISO/T-468.

High quality surface finish and close tolerance shall be obtained wherever required and shall conform to IS: 2709.

The permissible machining variation in dimensions without specified tolerances shall conform to IS: 2102. Limits and fits of all types shall conform to IS: 919-1933 (Part-I and Part-II) and IS: 2101.

4.1.3.7 High speed shafts shall be designed for critical speed. The ratio of critical speed of shaft shall be not less than 1.2.

4.1.3.8 All steel shafting 150 mm or less in diameter and not requiring enlarged portions (as for gear and other hubs) shall be hot rolled and turned, forged or turned cold rolled or cold drawn. All shafting above 150 mm in diameter and requiring enlarged portions shall be forged and machined to size. All forged shafting shall be annealed or normalised before machining and heat-treated, if necessary.

4.1.3.9 Deflection in line shaft shall not exceed 0.8 mm per metre length. All shafts above 150 mm in diameter shall be ultrasonically tested.

4.1.3.10 Gearbox shall be totally enclosed type up to last stage of reduction. The gear box housing shall be fabricated/cast steel of minimum 8 mm thickness and

shall be stress relieved. Inspection holes with bolted covers shall be provided at appropriate locations. Dip sticks or indicator shall be provided for indicating oil level. Drain plugs shall be provided on all gear boxes. Lifting lugs shall be provided for handling purposes. All gearboxes shall be air cooled type (without forced cooling).

4.1.3.11 Gear transmission must be properly lubricated. In case of totally enclosed gear boxes, splash system shall be used. All equipment which normally contains lubricant and is dispatched without such lubricant shall have their interior sprayed with a suitable moisture inhibitor, to prevent corrosion during transport and storage. Such equipment shall carry clear legible tagging indicating that it does not contain lubricant.

4.1.3.12 The reducers shall be of cut-tooth, hardened & ground parallel shaft splash lubrication type. The mechanical horsepower rating of the reducers shall be not less than 1.5 times of the motor nameplate rating/horse power; the thermal rating of the reducers shall be equal to or better than the motor horse power for a continuous operation under load.

4.1.3.13 A suitable service factor shall be applied in selection of reducers. For reducers with electric motor as the prime mover, the following service factor shall be considered on motor power:

- Uniform speeds : 1.5
- Moderate shocks : 1.75
- Heavy shocks : 2.0

4.1.3.14 Couplings shall be made of forged materials. Rigid couplings shall be used only for connecting intermediate lengths of long shafts rotating at slow speed. For all other cases, flexible/fluid couplings shall be used.

4.1.3.15 Flexible couplings shall preferably be of spring type resilient couplings unless spelt out elsewhere in this specification.

4.1.3.16 Couplings shall be of modern, compact design for given horse power capacity. Couplings on motor shafts at 100 rpm and over shall be selected with due regard to minimum WR^2 for the capacity. All couplings (except fluid couplings) shall have adequate service factor of minimum 1.5 over motor power. Service factor for fluid couplings shall be as per OEM's recommendations.

4.1.3.17 All plummer blocks shall be adapter-mounted with double row spherical self-aligning roller bearings. They shall be of the split type with removable caps and labyrinth grease seals for operation in a dust-laden atmosphere.

5.0 SCOPE OF WORK

5.1 The scope of work of the bidder shall include, but not limited to, carrying out design, engineering, preparation of designs and drawings, procurement,

manufacture, shop testing, inspection and supply of equipment at site, installation, commissioning and carrying out performance guarantee tests of the complete systems including modification of existing interfacing conveyors, civil & structural work and other auxiliary facilities as stated elsewhere along with enclosures surrounding cone crushers for acoustics but excluding the items listed under Clause No. 6.0 of this specification. The above shall include all materials, consumables, tools & tackle, labour, supervision, construction of plant, temporary works, stores, handling, transportation and every thing necessary whether of temporary or permanent nature to complete the works in all respects including functional, operational, maintenance and safety requirements.

5.2 The battery limits of the system shall be as demarcated in drawing No. TCE.6131A-04-ME-002 Rev P9 and shall be read in conjunction with scope of work, work by others and system description of dry circuit system. The FGL at different locations of the plant shall be as indicated in drawing no. TCE 6131A-00-ME-001-P10 (PLANT GENERAL LAYOUT).

5.3 The auxiliary facilities of the raw material handling systems shall include the following:

(a) All civil and structural works as described in Sections VII and VIII of this specification.

(b) Electrics including automation and control systems as described in Sections IV and V of this specification.

(c) Water system as described in Section-II of this specification.

(d) Ventilation system as described in Section-III of this specification.

(e) Cranes and hoists as described in Section-VI of this specification.

5.4 In addition to the above, the following services and materials are included in the scope of work of the bidder:

5.4.1 <u>Drawings and documents</u>

The following drawings and documents are to be submitted along with the offer:

(a) Dimensioned drawings of all equipment and systems including profile drawings of conveyors and drawings of buildings/transfer towers.

(b) Drawings and documents asked for in various sections of this specification.

(c) Catalogues/technical literatures of important items and components separately for each sub-system.

(d) Bar chart indicating different activities.

Note: For Cone Crusher: Drawings to be submitted along with the offer & shall be as per Annexure I-4 of the specification.

5.4.2 The following drawings and documents are to be submitted by the Contractor after award of contract:

(a) **General**

(i) General layout of the complete plant/system covered by the specification indicating co-ordinates of all buildings, transfer towers, pump/compressor houses, ventilation rooms, electrical buildings including cable tunnel/trench and piping layout of water and compressed air system.

(ii) All battery limits information for power, water and compressed air indicating location of take-off points with quantity of each.

(iii) Procedure for inspection (QAP) and expediting

(iv) Detail schedule of individual activities as follows:

- Design & engineering including preparation of GA drawings and other drawings.
- Submission of civil/structural load data & other information drawings.
- Manufacture and procurement.
- Supply at site
- Fabrication and erection at site.
- Testing and commissioning.

(b) **Mechanical**

(i) Process flow diagram, material, and water balance diagrams.

(ii) Study regarding material flow of surge bins, if felt necessary.

(iii) Design basis for geometrical configuration of surge bins.

(iv) Arrangement of surge bin.

(v) Flow and wear property studies if Bidder feels necessary.

(vi) Sectional elevation drawings of all building and transfer towers indicating the following:

- Size of the buildings and transfer towers
- Equipment disposition indicating access around the equipment located on different floors showing monorail paths
- Floor levels
- Location of cable trays

(vii) General arrangement (GA) drawings of the following equipment with detail specification and BOQ indicating drawing Nos. of individual items/components for approval/ comments:

- Primary screen along with complete trolley arrangement, panels and pulling arrangement
- Secondary screen along with complete trolley arrangement, panels and pulling arrangement
- The schedule of belt conveyors with belt ratings of individual conveyors
- Single boom slewing stacker
- Bucket wheel reclaimer
- Apron feeders
- Vibrating feeders below secondary surge bins
- Vibrating feeders below tertiary crusher surge bins
- Prism gates
- Bi-parting hydraulic slide gates. Separate power packs shall be provided for individual hydraulic operated slide gates
- Rotary actuated type flap gates
- Belt conveyor
- GA of travelling tripper
- Idler and pulley schedules with GA of pulleys
- Drive schedule
- GA of CBMS
- GA of metal detector
- GA of belt scale
- G.A. of chutes with liners.
- Erection, operation, and maintenance manuals

Note: The drawings must also include interconnection between surge bin and hoppers, gate, handling facilities for all equipment, skirt boards, supporting frames & structures, shear beam arrangement (for apron feeders), chutes, dribble conveyors, etc. as applicable for having complete information about the total arrangement of the system.

Over and above the drawings as mentioned, any drawings and/or documents as required for checking above drawings shall also be submitted by the Contractor for approval/comments/information such as.

- Equipment & component selection/sizing calculation, if asked for
- Belt tension calculation and power calculation of all conveyors
- Calculation for selection of belts, pulleys, drive equipment etc.
- Bearing life calculation of idlers
- Coasting time and braking time calculation of belt conveyors
- Screen trolley arrangement/screen panel drawings
- Drive assembly drawings of various drives, viz. LT, slew, boom conveyor, bucket wheel, luffing etc., for stacker and reclaimer
- Belt changing arrangement for the yard belt conveyors and other belt conveyors

(c) **Water system**

Drawings to be submitted shall be as per Section-II of the specification.

(d) **Ventilation system**

Drawings to be submitted shall be as per Section-III of the specification.

(e) **Electrical**

Drawings to be submitted shall be as per Section-IV of the specification.

(f) **Instrumentation, control and automation**

Drawings to be submitted shall be as per Section-V of the specification.

(g) **Cranes and hoists**

Drawings to be submitted shall be as per Section-VI of the specification.

(h) **Civil and structural works**

Drawings to be submitted shall be as per Section-VII of the specification.

(i) **Cone Crusher**

Drawings to be submitted shall be as per Annexure I-4 of the specification.

NOTE: GA of belt conveyors shall indicate reference drawing Nos. of individual chutes and gates.

5.4.3 Classified list along with the schedule for submission of drawings and documents.

5.4.4 Progress monitoring and control and progress reporting as per agreed norms including co-ordination with various agencies.

5.4.5 Operation and maintenance manual.

5.5 SPARES

5.5.1 Commissioning spares are required for erection and commissioning of the equipment until acceptance. The commissioning spares shall be included in the main offer for the equipment and shall be delivered along with the equipment. The bidder shall consider quantity of such commissioning spares based on his past experience and in case of any shortfall in the quantity of commissioning spares, additional quantity, if required, shall have to be supplied by the Contractor at his own cost and in time. Itemised list and quantity of these spares shall be furnished.

5.5.2 The list of indicative operation and maintenance spares with itemised quantities for two years normal operation and maintenance of various equipment has been given in Volume-I (as part of Contract Agreement Form). The Bidders shall be free to add additional spares based on which a consolidated spares list shall be prepared by NMDC/TCE and the same shall be supplied by the successful Bidder (six months before schedule date of commissioning).

5.6 SPECIAL TOOLS AND TACKLES

5.6.1 The bidder shall include in his tender special tools and tackles for normal operation and maintenance of the equipment. Itemised list and quantity of these shall be indicated by the bidder.

5.7 CONSUMABLES AND OPERATING SUPPLIES.

5.7.1 Initial fill and requirement upto Performance Guarantee tests of the system shall be included in the main offer.

5.7.2 Detailed specification and make of recommended consumables and supplies required for two (2) years' operation of the equipment shall be furnished by the bidder along with the tender. The supply of the above consumables and supplies shall be arranged for by the Purchaser.

5.8 TRAINING FOR NMDC PERSONNEL

Training shall be imparted by the successful Bidder to NMDC operating personnel on equipment and systems such as Stacker, Reclaimer, Cone Crusher and other equipment & systems. Modus Operandi for such training shall be discussed and mutually agreed between the successful Bidder and NMDC.

5.9 INSTALLATION OF EQUIPMENT

5.9.1 The Contractor is required to carryout the erection and commissioning of the equipment at site. The Contractor shall, therefore, be responsible for satisfactory erection, testing and commissioning of equipment at site. Erection shall be carried out as per conditions specified in General Conditions of Contract which forms a part of this specification.

5.9.2 Unloading of the equipment at site, transporting the same to storage area, proper storing and all other handling necessary for completion of successful erection shall be the responsibility of the Contractor and included in the scope of installation. All resources for the above shall be arranged by the Contractor.

5.9.3 The Contractor shall be responsible to carry out all necessary co-ordination in proper time with the Purchaser and Engineer, wherever necessary.

6.0 **WORK BY OTHERS**

6.1 The following work facilities shall be arranged by the Purchaser and are excluded from the scope of the Contractor:

6.1.1 Reference grid pillars and benchmarks.

6.1.2 Major site levelling and earth work except micro levelling and dressing of soil upto FGL within battery limits.

6.1.3 Supply of make-up water at three (3) points as mentioned in Section-II of this specification.

6.1.4 All permanent roads, drains and sewers excluding approach road to various buildings/transfer towers. However, lighting of roads shall be under the scope of this package.

6.1.5 Area and indoor lighting for 132/33 KV MRSS.

6.1.6 Supply and laying of railway tracks for despatch of ore fines through rapid loading system.

6.1.7 Rapid Loading System.

6.1.8 Wagons and locomotives for the despatch of ore fines through rapid loading system.

6.1.9 Complete internal railway logistics including signalling systems, traffic control and movement of rakes.

6.1.10 Any mobile equipment viz. front-end loaders, bull dozers etc., except that required for setting up the proposed plant.

6.1.11 Railway siding facility for despatch of material out of site by rail.

6.1.12 Complete wet screening system along with associated equipment, auxiliaries, and launders from secondary screens except for interfacing, if any, with the dry screening system.

6.1.13 Discharge chutes and liners including chute profiles for 315 N2, 316A and BC-3B at TT-11 including TT-11 itself. However, suitable interfacing of conveyors C20A and C20B with these chutes along with minor modifications, if required, shall be under the scope of this specification.

7.0 PERFORMANCE AND GUARANTEE

7.1 All component and equipment supplied by the Contractor in accordance with this specification shall be guaranteed for design, materials, workmanship, and satisfactory performance as required in this specification and in accordance with the General Conditions of Contract (GCC).

7.2 Performance and guarantee tests shall be carried out after completion of erection & commissioning, no-load tests, preliminary load tests and trial run for at least 14 days. This test shall be carried out by the Contractor in presence of Purchaser to establish whether or nor the equipment/ item supplied are performing as specification requirement without any trouble.

7.3 The performance and guarantee tests at site shall be conducted as per GCC. The test shall establish the following:

(a) All belt conveyors covered under Section-I shall operate at rated capacities without spillage, overflow, and jamming.

(b) Required sizing separation by screens and efficiency of the same.

(c) All stockyard equipment shall operate at rated stacking and reclaiming rates.

(d) Dust suppression systems shall effectively suppress dust at all transfer points and stockpiles to contain dust emission level as per statutory regulation.

(e) Required traverse speeds and travel lengths of stackers and reclaimers.

(f) All control and other functions indicated in various sections of the specification shall function as required.

(g) All other parameters of equipment shall be verified wherever feasible.

(h) For each equipment, the load test shall be conducted in stages. The equipment shall be run for 8 to 10 hours continuously at no-load, 25%, 50%, 75% and 100% of the rated capacities or as mutually agreed upon between the successful Bidder and Owner/Consultant or their authorised representative.

7.4 The system shall be considered to have performed satisfactorily when:

(i) The integrated capacity of the Screening Plant is demonstrated to the rated capacity of 4000 TPH at the input of Primary Screens and 4500 TPH at Secondary Screens with 95% screening efficiency. The Cone Crushers (with 3 Nos. working) shall have the capacity to handle 2250 TPH (about 1750 TPH fresh feed along with 500 TPH of re-circulating load) to crush the haematite iron ore (characterstics as specified in TS) of size +40 mm -150 mm to produce calibrated lump ore (CLO) of size +10 mm -40 mm at recommended CSS.

(ii) The Reclaimer performs at the rated capacity of 4000 TPH.

(iii) The system runs successfully for a continuous period of 72 hours (as specified in Clause 7.5 at the rated capacity).

(iv) The system availability during the PG test is minimum 95%.

7.4.1 <u>LD for non-performance</u>

(i) In the event of performance not meeting the guaranteed parameters (Clause 7.4 above) the Owner shall levy LD at the rate of 1.5% of the total Contract Price for every 1% shortfall in the performance or part thereof subject to a maximum of 7.5% of the total Contract Price. The system having shortfall in performance beyond 5% shall be rejected.

(ii) The equipment availability shall be minimum 95% during the warranty period. For every 1% drop in availability, 1.5% of the total Contract Price will be levied as LD subject to a maximum of 7.5% of the total Contract Price.

(iii) The Cone Crushers liners shall be guaranteed for average life of 1.5 lakh tons of haematite ore at the recommended CSS during the warranty period. The Owner shall levy at the rate of 1.5% of the total Contract Price for every 1% shortfall in the guaranteed average life or part thereof subject to a maximum of 7.5% of the total Contract Price.

7.4.2 In case of non-fulfilment of the performance values, the Contractor shall have to bear Liquidated Damages (LD) in case the deficiency cannot be rectified within 90 days from date of notice. Non-performance in respect of the equipment/system means that the equipment considered individually as well as a system comprising all the equipment fail to meet the performance requirement as indicated above that is, shortfall in the performance of individual equipment shall be considered to be shortfall in the performance of the entire system, since it is a turnkey package.

The LD to be levied for non-performance shall be as stipulated in clause No. 27 of GCC and as per Appendix-5 of Contract Agreement (Volume-I).

7.5 During performance guarantee test, each equipment shall be operated on full-load for 72 hours continuously. Wherever continuous 72 hours operation load is not feasible, cumulative operating time shall be considered. Cumulative operating time shall also be considered in the case of stoppage of the system due to the failure of equipment supplied by others.

7.6 In case any of the equipment/item under performance guarantee test stops or fails to operate during performance guarantee test, the defect shall be rectified by the Contractor immediately and performance and guarantee test shall be restarted. In such cases, the hours of operation before the stoppage or failure shall not be considered and the equipment/item shall have to be operated for 72 hours after rectification of defect.

7.7 In case the equipment/item under performance guarantee test operates without stoppage or failure for stipulated time period but the equipment/item fail to fulfil all specification requirement with regard to function and capacity, the equipment shall be rectified by the Contractor and performance guarantee test shall be restarted from beginning after rectification.

7.8 The following steps shall be followed for performance and guarantee test:

7.8.1 The Purchaser shall notify Contractor for a joint inspection of the installation before starting performance and guarantee test.

7.8.2 The defects of erection, if any, shall be listed jointly.

7.8.3 The Contractor shall arrange to rectify the defects of erection.

7.8.4 Performance guarantee test shall be started after rectification of defects mentioned in Clause No. 7.8.3.

7.8.5 If the performance guarantee test fails to show that the plant and equipment supplied do not conform to specification requirement, the relevant clauses of this specification and GCC shall apply for subsequent rectification, replacement, rejection, etc.

7.8.6 In case of non-availability, the owner shall have the right to encash the Performance Bank Guarantee submitted by the Contractor.

7.9 Any other observations/test felt necessary for judging the performance of the equipment and as mutually agreed between the successful Bidder and Owner/Consultant shall be carried out.

8.0 COMPLETION SCHEDULE

8.1 The complete Screening Plant (SP-III) including associated equipment and auxiliary facilities shall be delivered, installed and commissioned within thirty-three (33) months (including monsoon) from the effective date of contract.

The bidders shall have to submit a bar chart showing various activities to complete the system as per schedule.

9.0 **SPECIAL INSTRUCTION TO BIDDER**

The bidders should not repeat the description of the system or individual equipment given in the specification in their offer. The description of the system or equipment can be provided only to further elaborate the matters or to explain the deviations from the specification. However, in case Owner/Consultant desires to know about details of any equipment/system for understanding / approval purpose, the same shall be furnished by the Bidder.

10.0 **DESIGN BASIS**

10.1 The plant & equipment shall be designed and sized based on the following basic parameters including physical characteristics of raw materials and products to be handled.

(i) Annual operating days: 300

(ii) No. of shifts per day : Three (3) shifts of eight (8) hours per shift

(iii) Effective working hrs. per day : 16 hours considering operational delays & maintenance of equipment

(iv) Noise level : 110 dB at a distance of 1m from the source of noise and at a height of 1.2 m above floor level mainly from cone crusher. For other equipment noise level shall be 85 dB.

(v) Codes & Practices : In general, items/components shall be designed as per latest relevant Indian standards published by Bureau of Indian standards (BIS). In absence of relevant Indian standards, International Organisation for Standardisation (ISO), International Electro-technical Commission (IEC) and / or some other reputed institutions or generally accepted codes of engineering practices shall be followed / adopted.

All equipments shall conform to the statutory requirements of Govt. of India and State Govt. of Chhattisgarh. The relevant equipment shall conform to Indian Electricity Rules published in the year 1956 as regards safety, earthing etc. A consolidated list of standards to be followed, as

applicable is indicated in Annexure I-3 enclosed.

(vi) Maximum volumetric loading for conveyors considered : 75% (in general). May go up to 85% max.

(vii) Trough angle considered : 35 deg.

(viii) Belt speed of conveyor: Generally, 3.0 m/sec and maximum 3.5 m/sec. to be applied, if required.

10.2 Indicative physical characteristics of raw material & products are given in Table I-2.

TABLE I-2 – INDICATIVE PHYSICAL CHARACTERISTICS OF RAW MATERIAL AND PRODUCTS

Material	Physical Characteristics	
Haematitic Iron Ore (Feed to plant)	Lump Size (max), mm	(-) 150
	Bulk Density, T/m3	2.2 to 2.8
	Moisture (avg.),%	Upto 8
	Impact Work Index	Up to 19
	Compressive Strength, kg/cm^2	4500
	Abrasiveness	Highly abrasive
Calibrated Lump Iron ore (CLO)	Lump Size (max), mm	(-) 40 ~ (+) 10
	Bulk Density, T/m3	2.2 – 2.4
	Moisture (avg.),%	Upto 8
	Tumbler Index, %	77.3
	Abrasion Index, %	15.3
	Reduction De-gradation index, %	21.0
	Abrasiveness	Highly abrasive
	Angle of Repose, deg	39
Iron ore fines	Lump Size (max), mm	(-) 10
	Bulk Density, T/m3	2.2 ± 0.2
	Moisture,%	Up to 12
	Angle of Repose, deg	35 – 40

10.3 The capacities of conveyors and equipment have been estimated based on sieve analysis (indicative only and some deviations are expected to occur) of composite sample (Deposit 11 B and 14) as given below:

Size fraction	Weight %
(+) 40 mm to (-) 150 mm	43.76
(+) 10 to (-) 40 mm	13.15
(-) 10 mm	43.10

10.4 FUNCTIONAL DESIGN OF BINS

10.4.1 It is proposed to store and handle the iron ore in bins at different stages in the proposed Screening Plant (SP-III). The extraction of the ore from the bins is based on gravity flow. The problems associated with the bins, hoppers and transfer chutes while handling Iron ore are numerous particularly when the bulk solid contain a significant portion of fines (less than 3mm size) at higher moisture levels. The typical flow problems include “No flow”, “Reduced live capacity”, “Segregation” etc., which significantly affect the performance of the plant in general. A properly designed bin system results in better capacity utilization, better flow rate control and an improved uniformity in the extraction of the ore. For this, proper geometrical configuration of bins suitable for specific Iron ore application is important, in order to minimize or avoid the flow problems.

10.4.2 There exists an IS standard (IS 9178-Part 3) for the functional design of bins for reliable gravity flow. The flow properties of Iron ore (fines) proposed to be handled in the bins at different moistures is to be established in the laboratory by using the Jenike shear tester. The parameters like Internal angle of friction, wall angle of friction and flow function thus established form the inputs to arrive at the bin design parameters like minimum slope and outlet dimensions. The minimum slope and outlet dimensions of the bin vary with the geometry and the wall liner used for specified flow regimes like Mass Flow or Expanded Flow. Normally, an abrasive ore like Iron ore shall be stored in a bin designed to promote Expanded Flow (bottom portion Mass Flow and top self emptying Funnel Flow).

10.4.3 It is also required to exercise due care while designing the transfer chutes in order to avoid chute plugging and excessive wear. The minimum chute inclination to initiate flow after impact depends on the ore moisture content as well as the friction between the liner used and ore.

10.4.4 The trouble-free movement (flow) of ore from the bins/bunkers/hoppers and transfer chutes play a vital role in the productivity of the screening plant. Hence, a flow audit of the surge bunkers is generally practiced during the design stage for minimizing flow related problems while put in operation. Design and selection of bins, hoppers, liners and chutes for good flowability shall be established with reports / simulations etc. for review by Client and Consultant.

Based on material characteristics of iron ore of the subject plant and various flowabailty tests conducted, typical configurations of surge bins are depicted in the enclosed sketches for reference. However, it is bidder’s responsibility to ensure trouble free smooth gravity flow of material from surge bins by carrying out flowability tests (if the bidder feels necessary) and by design of bins as per the standard IS 9178/Equivalent International Standards.

10.5 SYSTEM DESCRIPTION

10.5.1 Interfacing with existing system and proposed new system

10.5.1.1 At present, conveyor 128 receives Iron ore (-150 mm) from Deposit 11C & Deposit 11B in future and feeds to conveyor 205. Conveyor 204 receives Iron ore (-150 mm) from Deposit 14 and feeds to conveyor 205.

10.5.1.2 For catering to proposed SP-III, conveyors 128 and 205 need modifications. These two conveyors shall be required to feed a completely new conveying system for feeding Iron ore to the proposed screens and crushers. Conveyor 205 is a swiveling stacker conveyor that has its own structural steel framework mounted on double flanged wheels. The wheels move on rails having a radial shape, thus giving the whole structure a radial movement. Hence, the stockpile made by conveyor 205 is bean shaped.

10.5.1.3 For the proposed SP-III, conveyor 205, shall continue to operate as a swivelling conveyor as it is presently operating and for feeding to new conveyor 205/1 of SP-III, conveyor 205 shall be swivelled to the extreme right end. Transfer tower shall not be there for taking the feed from existing conveyor 205. Instead, some portion of the gallery of new conveyor 205/1 towards tail end shall have to be made cantilever so that no permanent structures are placed on the ground that fall within the zone of the existing bean shaped stockpile and the underneath hoppers. Required chute and skirtboard work will have to be carried out for proper feed of material from Conveyor 205 to new conveyor C 205/1. Conveyor 205/1 shall feed to proposed conveyor C-1 at transfer tower TT-1. Thus, the original arrangement & structure of existing conveyor 205 shall be retained.

10.5.1.4 Conveyor C-128 shall have to be extended further (eliminating its feed to conveyor 205) and shall feed to conveyor C-2 in a new Transfer tower TT-2. New structural and mechanical modifications of Conveyor C-128, existing transfer house including the drive unit and take-up arrangement due to increase in length shall have to be carried out due to the extension. The material so received from conveyors C-1 and C-2 shall be independently conveyed to nine (9) nos. of Square shaped primary surge bins of total capacity 30,000T by either of the tripper conveyors C-3 / C-4 fitted with travelling trippers (MST-1 & MST-2 through prism gates PG-1 and PG-2 at transfer tower TT-3. Bin vibrators shall be provided for all the bins. Each feed surge bin shall have two discharge openings of dimension 2m x 2m. So, total eighteen (18) nos. of openings shall be available. All the openings shall be equipped with bi-parting hydraulic slide gates. Separate power packs shall be provided for individual hydraulic operated slide gates. Eighteen (18) nos. of apron feeders (AF-1 to AF-18) shall be provided below the bins for feeding to eight (8) nos. of screen feed conveyors (C-5 to C-12). All the apron feeders shall be equipped with VVVF drive for achieving desired feed capacity variation. For every two apron feeders, one belt conveyor is provided to feed one screen. For the first and last screens, three apron feeders shall be provided to feed the respective screen feed conveyors. Each apron feeder shall be designed for supplying full capacity of Iron ore to the screen, rendering one of the two apron feeders as standby. Eight (8) Nos. (6W + 2S)

of double deck vibrating screens VSP-1 to VSP-8 (primary) are provided for separation of 60mm and 40mm. The upper deck of 60 mm acts as a relief deck. In other words, (+) 40 to (-) 60 mm and (+) 60 mm shall be fed to the same oversize chute. The rated and design capacities of the screens shall be 670 TPH and 750 TPH respectively. The vibrating screens must be mounted on trolleys with double flanged wheels placed on rails. Springs shall be provided between the screen and the trolley. During operation, the trolley structure (along with the wheels) shall be locked with the screen supporting structure or rails with suitable clamping devices so that the screen does not start rolling over the rails. The trolleys may also be provided with suitable jacking arrangements for lifting the trolley and screen assembly such that during screening operation, the trolley wheels should not come in contact with the rails. During maintenance or breakdown, the trolley shall be lowered and rested on the rails to facilitate the operator to move the screens to the designated maintenance area on the same floor. Under any circumstances, it shall be ensured that carry-over of dynamic forces / vibrations to supporting structures is minimum.

10.5.1.5 The material fraction (+40 mm, -150 mm) shall be conveyed to nine (9) nos. of Square shaped Tertiary Surge Bins of total capacity 11,000T through conveyors CO-1, C-13 and tripper conveyors C-19 / C-20 fitted with travelling trippers (MST-5 and MST-6). The discharge of conveyor C-13 at TT-6 shall be through a 3-leg chute provided with prism gate (PG-3) and a hydraulic flap gate. The prism gate shall be provided for feeding to conveyors C-19/C-20 for having provision of interchangeability or partial feeding to C-19 and C-20. While feeding to C-19, the chute shall be bifurcated by a flap gate to have a future provision of feeding lump ore to future conveyor in case of lump ore (+40 mm to -150 mm) production. Bin vibrators shall be provided for all the bins. Each feed surge bin shall have two discharge openings of dimension 2m x 2m. All the openings shall be equipped with bi-parting hydraulic slide gates and vibrating feeders for feeding to four (4) nos. of tertiary crushers (3W + 1S) through reversible conveyors RC-1, RC-2, RC-3, RC-4, RC-5, RC-6 and crusher feed conveyors CFC-1, CFC-2, CFC-3, CFC-4. The crusher feed conveyors (CFC-1 to 4) shall be provided with metal detectors (MD-1 to MD-4) to detect and remove any metallic substances so that these do not enter into crushers and damage the equipment. The Tripper conveyors C-19 & C-20 shall be provided with cross belt magnetic separators (CBMS-1 to 2) for removal of tramp materials. The vibrating feeders shall be installed in such a way that three (3) nos. of feeders shall be able to feed each reversible conveyor. All the vibrating feeders shall be provided with VVVF drive for achieving desired capacity variation. The crushers shall be rated for 750 TPH each. The crushed material from tertiary crusher shall be fed to secondary Surge Bins at Tertiary Crushing and Screening building by feeding at conveyor C-14/C-14A through conveyors CD-1, CD-2, CDC-1 and CDC-2 at TT-6A. For this purpose, the discharge chute of CDC-2 shall be fitted with a prism gate (PG-4).

10.5.1.6 The material fraction (-40 mm) from primary screening building shall be conveyed to twelve (12) nos. of square shaped secondary surge bins of total

capacity 23,000 T through conveyor conveyors CU-1, C-14 (also getting feed from crusher discharge conveyor CDC-2), and tripper conveyors C-17/C-18 fitted with travelling trippers (MST-3 and MST-4). Prism gates (PG-5 and PG-6) shall be provided at discharge ends of Conveyor C-14 and C-14A before feeding to tripper conveyors C-17/C-18 for having provision of interchangeability or partial feeding to C-17 and C-18 at TT-4. Bin vibrators shall be provided for all the bins. Each feed surge bin shall have two discharge openings of dimension 2m x 2m. So, total twenty four (24) nos. of openings shall be available. All the openings shall be equipped with bi-parting hydraulic slide gates. Twenty four (24) nos. of vibrating feeders (SVF-1 to SVF-12) shall be provided below the bins for feeding to twelve (12) nos. of screen feed conveyors (SFC-1 to SFC-12). All the vibrating feeders shall be equipped with VVVF drive for achieving desired feed capacity variation. For every two vibrating feeders, one belt conveyor is provided to feed one screen. Each vibrating feeder shall be designed for supplying full capacity of Iron ore to the screen, rendering one of the two vibrating feeders as standby. Twelve (12) Nos. (10W + 2S) of triple deck vibrating screens (VSS-1 to VSS-12) (at tertiary crushing and screening building) are provided for separation of fines slurry (-3.15mm), fines (+3.15mm to -10mm), CLO (+10mm to -40mm) and oversized iron ore (+ 40mm). The third deck shall be used only during rainy season for separation of 3.15 mm fines slurry, which shall be sent to the wet circuit through launders. But Screen third deck PU pannels are to be supplied by the successful bidder with all fittings, and if required same are to be fitted which will be discussed mutually and finalized. During rainy season, these screens shall work as wet screens by water spraying over the decks. During other seasons, the third deck shall be removed and a solid PU deck shall be inserted. So, there shall be no separation of -3.15mm. In other words, underflow of second deck (-10mm which includes -3.15mm) shall be conveyed to the fines conveyors. The rated and design capacities of the secondary screens shall be 450 TPH and 550 TPH respectively. The vibrating screens must be mounted on trolleys with double flanged wheels placed on rails. Springs shall be provided between the screen and the trolley. During operation, the trolley structure (along with the wheels) shall be locked with the screen supporting structure or rails with suitable clamping devices so that the screen does not start rolling over the rails. The trolleys may also be provided with suitable jacking arrangements for lifting the trolley and screen assembly such that during screening operation, the trolley wheels should not come in contact with the rails. During maintenance or breakdown, the trolley shall be lowered and rested on the rails to facilitate the operator to move the screens to the designated maintenance area on the same floor. Under any circumstances, it shall be ensured that carry-over of dynamic forces / vibrations to supporting structures is minimum.

10.5.1.7 The + 40mm material from the screens shall be recycled to C-19/C-20 for crushing through conveyors CO-3A, C-21, C-22 and C-23. A prism gate (PG-7) shall be provided before feeding to conveyors C-19/C-20 at TT-6 for having provision of interchangeability or partial feeding to C-19 and C-20. During lump ore (+40 mm to -150 mm) production, the +40 mm fraction from secondary screens shall be conveyed to conveyor C-26 through conveyor

CO-3 and CO-4. A flap gate shall be provided in each secondary screening discharge chute for having provision of feeding +40 mm material either to conveyor CO-3/CO-4 or CO-3A.

10.5.1.8 Calibrated lump ore (CLO) of size +10mm to -40mm shall be conveyed to conveyor C-26 through conveyors CO-3 and CO-4.

10.5.1.9 The – 10mm material shall be conveyed to conveyor C-25 through conveyors CF-3 and CF-4.

10.5.2 Fines transportation to stockpile

10.5.2.1 Ore fines (-)10 mm shall be transported from Tertiary crushing & screening building to transfer tower TT-6C through belt conveyor C-25. Conveyor C-25 shall be fitted with fixed tripper (FT-1) which shall transport ore fines either onto conveyor C-315N2 (to be supplied and installed by others) or onto C-25 itself for transportation of materials to C-28 at TT-7. For this purpose, a prism gate shall be provided at the discharge end of fixed tripper FT-1 for onward transportation onto the existing conveyor BC-614 at TT-8 for storage of fines in existing CLO storage yard, if required. Calibrated lump ore (CLO) shall be carried through belt conveyor C-26. Conveyor C-26 shall be fitted with a fixed tripper (FT-2) for feeding CLO on the same belt for onward transportation to TT-7. FT-2 on C-26 shall be required to provide the two conveyors C-25 and C-26 inside the same gallery. At transfer tower TT-11 (to be supplied and installed by others), conveyor C-315N-2 shall discharge material to either of the two (2) conveyors C-20A & C-20B, which shall feed material to conveyors C-32 and C-33 at TT-12 and TT-13 respectively. Conveyor 315N-2 shall also discharge materials to two new conveyors C-316A and C-3B (to be supplied and installed by others) at TT-11. Chute arrangement including prism gate arrangement of Conveyor C-315N2 for feeding to C-3B and C-316A shall be carried out by others. Bidders shall do suitable interfacing as required. However, the Bidder shall note that final alignment of TT-11, C-20A/C-20B and other interrelated conveyors may undergo minor adjustments which will be provided to the successful Bidder during detail engineering. Bidders shall note that the chutes for feeding to C-20A and C-20B shall not be under the scope of this specification. However, Bidders shall include supply and installation of skirts at the feed points of C-20A and C-20B. Each of the conveyors C-32 and C-33 shall be equipped with one (1) No. stacker and one (1) No. reclaimer. Thus, 2 independent stackers and 2 independent reclaimers shall be available in two tracks for ease of planning and despatch of materials to future as well as proposed system. Four (4) Nos. of Chevron stockpiles each having parameters 380 m long x 33 m base x 11.5 m height shall be created. Total storage capacity of 6 lakh tons shall thus be available. In future, the capacity of stockyard shall be augmented to additional 3 lakh tons for which the discharge chutes of C-20A and C-20B shall have necessary provision for easy conversion to 2-way chutes at TT-12 and TT-13 for feeding to another set of conveyors leading to the new stock yard in future. Stacking rate of each of the machines shall be 3600 tph (rated) and 4000 tph (design). Each stacker shall be provided with stacking by-pass facility for direct

transportation of ore fines to RLS (RLS not in the scope of this package) or to ESSAR conveyor or to future conveyor feeding to proposed beneficiation plant (beneficiation plant not in the scope of this package). For this purpose, flared skirt shall be provided with the central chute of reclaimer for feeding to yard belt conveyor. Reclaiming rate of each of the reclaimers shall be 4000 tph (rated) and 4400 tph (design). Ore fines reclaimed from the stockpiles @ 4000 tph shall be discharged by yard conveyors C-32 and C-33 to the successive conveyors C-34, C-35 and the future conveyor at transfer towers TT-15 and TT-14 respectively, for which discharge chute of C-32 shall have provision for 3-way discharge chute with motorised flap gates with provision of manual operation. Discharge chute of conveyor C-33 shall have provision of 2-way discharge with motorised prism gates with provision of manual operation. Discharge chute including the flap gate for feeding to future conveyor shall be under the scope of this specification. However, skirt arrangement for future conveyor shall not be included in this specification. At transfer tower TT-16, both the conveyors C-34 & C-35 shall discharge material on either to a common conveyor C-36 or to another belt conveyor EC-1 for feeding to ESSAR conveyor BC-4. EC-1 shall feed BC-4 at transfer tower TT-17. Conveyor C-36 shall discharge on to conveyor C-38 at TT-19 for onward transportation to the RLS. Belt conveyor C-38 receiving feed from C-36 at TT-19 shall deliver material to surge bin of the RLS or future conveyor 316L (not part of this package) through 2-way discharge chute with motorised prism gates with provision of manual operation. Although RLS is excluded from this package, all necessary interfacing with the RLS building for installation and operation of conveyor C-38, its pulleys, drive units, chute, prism gate etc. shall be considered under this package.

10.5.3 Calibrated Lump Ore (CLO) Handling System

10.5.3.1 Calibrated lump ore of size (-) 40 mm to (+) 10mm size shall be transported from tertiary crushing and secondary screening house to transfer tower TT-7 by the conveyor C-26 and which, in turn shall discharge material on either of the two (2) conveyors C-28 or C-29 at TT-7 for which a prism gate shall be provided at discharge end of C-26 fitted with fixed tripper (FT-2). Conveyor C-28 and C-29 shall deliver material onto the existing conveyor C-614 or C-30 at TT-8. For this purpose discharge chutes of C-28 and C-29 shall be fitted with prism gates. Conveyor C-30 shall generally cater to lumps only. Conveyor C-30 shall deliver material onto existing conveyor BC-310 as well as future conveyor which would run parallel to BC-310 at a distance of about 5m at TT-9. For this purpose discharge chute of conveyor C-30 shall be fitted with prism gate. The existing conveyor BC-614 is fitted with a stacker & a reclaimer for stacking & reclaiming of CLO. The existing long belt conveyor BC-310 shall receive feed from C-30 at TT-9 for stacking of CLO in the existing yard with the help of an existing stacker fitted with BC-310. The two (2) transfer towers TT-8 on conveyor BC-614 & TT-9 on conveyor BC-310 shall be constructed to stack CLO to be produced from SP-III, for which augmentation of capacity of existing conveyor BC-310 shall be carried out by others, as required.

11.0 MAIN EQUIPMENT SPECIFICATION

11.1 BELT CONVEYORS AND AUXILIARIES

11.1.1 Belt conveyors shall be designed in accordance with relevant Indian Standards taking into account the following factors and considering plant standards for various components:

(i) Artificial friction coefficient 0.023 for uphill conveyors and 0.012 for regenerative conveyors. The above is applicable for total belt conveyors.

(ii) Coefficient of friction between rubber lagged pulley surface and belt to be considered as 0.35 and ceramic lagged pulley surface and belt to be considered as 0.40.

(iii) Coefficient of friction between material & belt to be considered as 0.6.

(iv) Coefficient of friction between material and skirt plates to be considered as 0.6.

(v) Coefficient of friction between belt and belt cleaner to be considered as 0.6.

(vi) All the drive elements like motor, gearbox, couplings, idlers, and pulleys etc. shall be chosen accordingly as indicated in this specification and shall be standardized to the maximum extent possible.

vii) The troughing angle of the belt on the carrying side to considered as 35 degrees.

11.1.2 Technological structure

11.1.2.1 The technological structure for conveyors like drive and tail end framework, stringer and short posts shall be made of joists and / or channels suitably stiffened and braced. The spacing of the short posts shall not exceed 3000mm and the same shall be connected to the floor beams/insert plates by site welding. The head and tail end frames, however, shall be bolted to the floor beams. The size of short posts and stringer members shall not be less than ISMC-125 & ISMC-150 respectively.

11.1.2.2 Deck plates of minimum 3.15mm thickness shall be provided throughout the length of conveyor to avoid spillage of material on return belt.

11.1.2.3 Seal plate (3.15 m thick minimum) arrangement shall be provided below the conveyor gallery structures wherever the conveyors are passing above rail, road and any other facility for avoiding falling of dribbles.

11.1.2.4 A suitable belt changing location in the gallery for each conveyor shall be considered. The belt changing location shall have two numbers of pulleys /

rollers (with supporting frames frames) of minimum 219.7 mm diameter and 65 mm bearing diameter.

11.1.3 Drive

11.1.3.1 Should be of compact type and shall be located conveniently to have accessibility for easy maintenance. Over hanging of the drive shall be avoided to have better stability.

11.1.3.2 The drive unit consisting of motor, gearbox, high speed coupling, low speed coupling and brake (as applicable) shall be suitably mounted on common base frame.

11.1.3.3 While selecting installed motor power, the Bidder shall consider 10% cushion over absorbed power at pulley shaft in addition to generally applicable factors.

11.1.3.4 The conveyor drive pulley shall be coupled directly with the gearbox output shaft through coupling and no V–belt or chain shall be used.

11.1.3.5 All parts requiring replacement, inspection or lubrication shall be easily accessible without the need for dismantling of other equipment. Safe access for maintenance and removal of all parts shall be ensured. Suitable lifting lugs shall be provided in all motors, reducers and drive frames.

11.1.3.6 Worm reducers shall not be used in any equipment unless written approval is obtained from the Owner.

11.1.3.7 Dual drives shall generally be provided above 450 kW. However, bidder shall optimise all drive ratings considering the rating of belts, gear boxes, etc. Calculations/selection procedure of bolts, drive units and pulleys etc. shall be submitted by the successful Bidder for Purchaser's/Consultant's review/ comments. Belt ratings, drive components (motor, coupling, gear box and pulley) including drive frame, pulleys frame and belting shall be standardized for ease of procurement/manufacture and maintaining less inventory.

11.1.4 Skirt boards

11.1.4.1 Skirt boards of minimum 6000 mm length shall be provided at the loading points of all conveyors. Wherever the loading points are nearer to each other, the skirt board shall be made continuous between them. Minimum length of skirt boards from the beginning of loading area in the chute shall be 6000 mm in the direction of belt travel. Skirt boards shall flare out in the direction of belt travel. The thickness of skirt plate shall be minimum 10 mm. Skirt hood plate (top cover) thickness shall be minimum 3.15 mm thick. Skirt plates shall be provided with liner of minimum 6 mm thick chrome carbide overlaid (hard facing) on 10 mm MS plate. Skirt height shall be raised (approximately twice the standard height) for the initial 2m portion. Inside width of the skirt shall be 0.67 times of belt width.

11.1.4.2 The arrangement for fixing rubber on skirt board including back rubber at loading points shall be such as to ensure quick adjustment. Skirt rubber shall be in segments and the design shall ensure automatic flexing of rubber for proper sealing. Shore hardness of rubber shall be minimum 55 degrees A, with tensile strength of 17 Mpa (minimum) & elongation at break 400% (minimum). Skirt rubber shall be minimum 15 mm thick.

11.1.4.3 Modular segmented type skirt board sealing system for effective sealing against spillage and dust shall be provided.

11.1.5 Belt scrapers

11.1.5.1 External scraper

11.1.5.1.1 Multi blade belt scrapers (Primary and Secondary) shall be provided between the discharge end and snub pulley such that belt is effectively cleaned. Scrapers of minimum 30 mm thickness shall be generally placed at negative angles.

11.1.5.1.2 Primary Scraper shall be provided with polyurethane blades in segment which shall be mounted with tube. Facility shall be provided for easy adjustment against belt wear.

11.1.5.1.3 Secondary belt scraper shall be provided with segmented metallic blades of Tungsten carbide tips with stainless steel base. Facility shall be provided against automatic adjustment against belt wear.

11.1.5.2 Internal Scraper

11.1.5.2.1 V-shaped scrapers shall be provided on the upper side of the return belt near the tail end and before bend pulley of take-up to remove spilled materials. The scraper shall be fitted with automatic locking device in order to prevent rigid part coming in contact with belt when the cleaner blade is worn away.

11.1.5.2.2 One no. of additional V-shaped scraper shall also be provided on the conveyers having belt weigh scales before belt scales.

11.1.5.3 Guards

11.1.5.3.1 Safety guards shall be provided for couplings, pulleys, tensioning devices, brakes etc. Vertical take up pulleys shall be effectively guarded against spilled materials. All plates and angles used for guards shall be minimum 5mm thick. Wire mesh guards shall be of minimum 4mm dia. wires.

11.1.6 Gear boxes

11.1.6.1 Gear box shall be selected for a mechanical service factor of minimum 1.5 and thermal service factor of minimum 1.0 on motor kW rating.

11.1.6.2 All gear boxes shall be generally parallel shaft helical type, wherever possible.

11.1.6.3 Overhung or split gears and pinions shall not be used.

11.1.6.4 All gears shall be completely enclosed in oil tight enclosure.

11.1.6.5 All gear shafts shall be supported in anti friction bearings mounted in gear box.

11.1.6.6 Splash lubrication system shall be used.

11.1.6.7 The housing for gear boxes shall be of cast steel or fabricated. Fabricated gear boxes shall be stress relieved.

11.1.6.8 Covers shall be split horizontally at each shaft centre line and fastened and arranged so that the top half can be removed for inspection and repair without disturbing the bottom half.

11.1.6.9 The gear boxes shall be provided with breather vents, oil level indicators and easily accessible drain plugs. Permanent magnet plugs shall also be provided in gearbox.

11.1.6.10 Gearbox shall have machined base.

11.1.6.11 Oil seal arrangement shall be of special design to suit dusty surroundings.

11.1.7 Couplings

11.1.7.1 High Speed coupling

11.1.7.1.1 For motor rating between 55 kW and 160 kW, high speed coupling shall be delayed fill type fluid coupling without resilient plate.

11.1.7.1.2 For motor with rating below 55 kW, spring type resilient flexible coupling shall be used.

11.1.7.1.3 For motor rating above 160 KW, VVVF drive with spring type resilient coupling with LT squirrel cage induction motors shall be used.

11.1.7.1.4 VOID

VOID

VOID

VOID

11.1.7.1.5 Spring type resilient flexible coupling may also be acceptable for motors equipped with VVFDs.

11.1.7.2 Low speed couplings

11.1.7.2.1 Low speed coupling between gearbox output shaft and drive pulley shall be full-geared coupling.

11.1.7.3 All coupling bolts shall be replaceable without shifting the drive components. All couplings shall be provided with sheet metal guards bolted to the base frame. A service factor of 1.5 on motor rating shall be considered for the selection of all couplings. Pin bush couplings shall not be used.

11.1.8 Brakes & Holdback

11.1.8.1 Electro Hydraulic spring applied hydraulically released brakes of approved make shall be provided wherever required. The brakes of all conveyors shall have minimum 1.5 times the maximum calculated torque ratings. However, for the selection of brakes, the successful bidder shall consider & furnish the coasting times for each conveyor considering inertia of all moving and rotating parts. Accumulation of material within chute shall not be considered.

11.1.8.2 All inclined conveyors shall be provided with suitable holdback devices to prevent belt running back in case of conveyor stoppage. Hold back ratings shall be minimum 1.5 times the maximum calculated torque.

11.1.9 Idlers (Refer Annexure I-6 for NMDC Standard for idlers)

11.1.9.1 Shall confirm to IS -8598 (latest edition).

11.1.9.2 Carrying and Impact idlers shall be 3-Roll, 35° trough and transition idlers shall be 3-roll, 10-20 degrees trough.

11.1.9.3 Return idlers shall be V-type, 10° two-roll return idlers.

11.1.9.4 Spacing of conveyor idlers shall be as follows:

Belt width (mm)	Carrying Idler spacing (mm)	Return Idler spacing (mm)	Impact Idler spacing (mm)
1200	1200	3000	400
1400 & above	1500	4500	400

At convex curves, both carrying and return idlers shall be placed at 50% of normal idler spacing.

11.1.9.5 Self-aligning carrying idlers with central pivot and guide rollers shall be provided at a maximum spacing of 40 m intervals.

11.1.9.6 Minimum bearing life of idlers & rollers shall be 60,000 working hours and it shall be grease packed for life.

11.1.9.7 Transition idler shall be similar to troughing carrying idler in construction and set at suitable inclination. The transition idlers shall be generally set at 10-25 degrees inclination and shall be adjustable at site. There shall be minimum two transitional idlers at each side.

11.1.9.8 Idlers shall be made of ERW pipe of shell thickness 5.4 mm. Idler diameter shall be 152.4 mm. Bearing sizes shall be 6206, 6306 and 420207 for 1200 mm, 1400 mm and 1600 mm respectively. The Bidder shall submit bearing life calculation. Spindle material of idlers shall be 45 C8 of IS: 9175 (latest edition).

For impact idlers, pipe diameter shall be 114.3 mm and overall diameter with rubber discs shall be 190 mm. Shell thickness of impact idler shall be 4.85 mm. Shore Hardness of rubber shall be 60 ± 5 Scale A.

11.1.9.9 All bearings shall be protected from ingress of dust and water by suitable sealing arrangement.

11.1.9.10 The minimum thickness of any member in idler supporting brackets shall not be less than 6mm. All supporting brackets shall have slotted bolt holes for

mounting on/under supporting steel works which would generally be rolled channel section. All the outer brackets of the idler frame on carrying side shall have C-cross section. All idlers shall be drop-in type.

11.1.9.11 The eccentricity of the idler shall be such that the total indicator reading shall not exceed 0.8 mm.

11.1.9.12 Self cleaning flat return idlers shall be provided at both end (near drive end & non drive pulley) on the return strand and bend pulleys.

11.1.10 Pulleys (Refer Annexure I-7 for NMDC Standard for Pulleys)

11.1.10.1 The dimensions of pulleys shall be suitable for the specific duty condition to ensure satisfactory performance of the pulleys as a part of respective conveyors.

11.1.10.2 Pulley shall conform to IS: 8531-86 in general and this specification in particular.

11.1.10.3 Pulleys having shaft diameter less than 160 mm at bearing shall have end discs welded to hubs and shell.

11.1.10.4 Pulleys having shaft diameter of 160 mm & above at bearing shall be provided with turbo-diaphragm type of end disc wherein the end disc and hub shall be of integral steel casting.

11.1.10.5 Material of construction of pulley shall be as follows:

Sl. No.	Description	Material of Construction			
		Shaft diameter at bearing & shaft diameter at hub			
		Drive pulley		Non Drive Pulley	
		< 160 mm & < 190 mm	≥ 160 mm & ≥ 190 mm	< 160 mm & < 190 mm	≥ 160 mm & ≥ 190 mm
1	Shell, Hub & Diaphragm	E250 (Fe 410W) Quality 'C' as per IS 2062: 2006	E 250 (Fe 410 W) Quality 'C' as per IS 2062: 2006	E 250 (Fe 410W) Quality 'C' as per IS 2062: 2006	E 250 (Fe 410 W) Quality 'C' as per IS 2062: 2006
2	Shaft	45C8 as per IS: 9175(Part 7) - 1986	40Cr4Mo3 as per IS: 9175 (Part22)-1986	45C8 as per IS: 9175 (Part 7) - 1986	40Cr4Mo3 as per IS: 9175 (Part22)-1986
3	Turbo diaphragm with end disc	-	Cast Steel Gr. 280-520 W as per IS: 1030-1998 or E 250 (Fe 410 W) Quality 'C' as	-	Cast Steel Gr. 280-520W as per IS: 1030-1998 or E 250 (Fe 410 W) Quality 'C' as

Sl. No.	Description	Material of Construction			
		Shaft diameter at bearing & shaft diameter at hub			
		Drive pulley		Non Drive Pulley	
		< 160 mm & < 190 mm	≥ 160 mm & ≥ 190 mm	< 160 mm & < 190 mm	≥ 160 mm & ≥ 190 mm
			per IS 2062: 2006		per IS 2062: 2006
4	High tensile hex. Head bolts	IS: 1367 (PC. 8.8/10.9)	IS: 1367 (PC. 8.8/10.9)	IS: 1367 (PC. 8.8/10.9)	IS: 1367 (PC. 8.8/10.9)

11.1.10.6 Pulley shall be designed and manufactured in such a manner that there would be no relative motion between the hub and the shaft. The shaft shall be easily removable from the pulley when required.

11.1.10.7 Pulleys having shaft diameter of less than 200 mm at bearing may be provided with Gib head key or parallel key with a locking arrangement for preventing axial movement of pulley drum on the shaft.

11.1.10.8 Pulleys having shaft diameter of 200 mm and above at bearing, shall be provided with expandable shaft hub connection (Ring Feder type).

11.1.10.9 Pulley shaft shall be ultrasonically tested.

11.1.10.10 Dye-penetration test shall be done for all welded joints.

11.1.10.11 For non-driving pulleys with shaft diameter less than 160 mm at bearing, the minimum shell thickness after machining shall be 12 mm. The bidder shall ensure adequacy of the shell thickness for the belt tension and wrap angle on the pulley.

11.1.10.12 For all non drive pulleys with shaft diameter greater than or equal to 160 mm at bearing and for all drive pulleys the minimum shell thickness after machining shall be 16 mm. The bidder shall ensure adequacy of the shell thickness for the belt tension and wrap angle on the pulley.

11.1.10.13 Adequate Radius/Fillet shall be provided on the shaft wherever change of diameter takes place to minimise stress concentration.

11.1.10.14 Internal design of the pulley is left to the discretion of the bidder and shall meet the operational requirements.

11.1.10.15 Design parameters

11.1.10.15.1 Pulley shaft for drive pulleys shall be designed with the following minimum service factors:

- Kb (Service factor for bending) = 2.0

- Kt (Service factor for torsion) = 1.5

11.1.10.15.2 Pulley shaft for Non drive pulleys shall be designed with the following minimum service factors:

- Kb (Service factor for bending) = 1.6

11.1.10.15.3 Maximum permissible stresses and other limiting parameters for design of pulleys shall be as given below.

Sl. No.	Description	Value			
		Shaft diameter at bearing & shaft diameter at hub			
		Drive pulley		Non Drive Pulley	
		<160mm & <190mm	≥160mm & ≥190mm	<160mm & <190mm	≥160mm & ≥190mm
1	Bending stress	55 MPa	80 MPa	55 MPa	80 MPa
2	Shear stress	28 MPa	50 MPa	28 MPa	50 MPa
3	Combined stress due to bending and torsion	38 MPa	60 MPa	-	-
4	Angular deflection	6 minutes at Hub	6 minutes at Hub	6 minutes at Hub	6 minutes at Hub
5	Torsional deflection	0.26 Deg. /m	0.26 Deg. /m	-	-
6	Allowable pressure at shaft/hub connection	100 MPa	100 MPa	100 MPa	100 MPa
7	Allowable pressure at key	100 MPa	100 MPa	-	-
8	Shaft deflection	1 mm/m length	1 mm/m length	1 mm/m length	1 mm/m length

11.1.10.16 The pulley drum shall be welded, stress relieved and then machined.

11.1.10.17 No welding shall be done after machining the drum except for fixing of balancing weights.

11.1.10.18 Drive pulleys shall be dynamically balanced and all other pulleys shall be statically balanced along with the shaft.

11.1.10.19 Balancing weights, if used, shall be properly welded to the diaphragm and shall not project beyond the drum face. Balancing weights shall be < 5% of the weight of the pulley (pulley total mass = mass of (shell + end disc + hub + lagging)).

11.1.10.20 Pulley shell concentricity shall be max. ± 1 mm (Total Indicator Reading = 2 mm) over the bare pulley.

11.1.10.21 Tolerance on pulley diameter shall be limited to ± 0.2 % and tolerance on rubber lagging thickness shall be limited to ± 0.5 mm.

11.1.10.22 All pulleys (except drive pulleys) shall have hot vulcanised rubber lagging of 12 mm thickness with grooved Diamond or Herringbone or Chevron pattern. Grooves shall be 6 mm wide & 6 mm deep. The grooves shall be spaced between 30 mm to 40 mm. Drive pulleys shall have ceramic lagging of 12 mm thickness with ceramic tiles size of 25 mm x 25 mm x 6mm. Tiles Alumina content shall be 90% to 92%, with hardness of 9 MOH's Scale. Lagging shall be hot vulcanized.

11.1.10.23 The lagging rubber shall have Durometer hardness of 55 to 65 shore, scale A with minimum tensile strength of 17 MPa and minimum elongation of 400% at break.

11.1.10.24 Crowning shall not be provided on the pulley shell.

11.1.11 Bearings & Plummer Blocks

11.1.11.1 Selection of bearings shall be done for a minimum service life of 60,000 hours.

11.1.11.2 Spherical roller bearings of 222 series with adapter sleeve and lock nut shall only be used for pulleys of shaft diameter at bearing upto and inclusive of 200mm.

11.1.11.3 For pulleys with shaft diameter at bearing above 200mm, 231 series spherical roller bearing with adapter sleeve and lock unit shall be used.

11.1.11.4 All plummer blocks supporting the pulleys shall be horizontally split type with 4-bolt fixing at the base and with proper grease nipple arrangement for lubrication and dust proof sealing.

11.1.11.5 Plummer blocks shall be made of FG 260 cast iron for bearing sizes below 100 mm and for >= 100 mm cast steel plummer blocks shall be used.

11.1.12 Take-Up Arrangement

Each take-up shall be provided with a minimum travel of 2.5% of length of conveyor (along with belt) plus 600 mm for conveyors with nylon-nylon belts and 0.5% for conveyors with steel cord belts.

11.1.12.1 Take-up trolley for HGTU

11.1.12.1.1 The trolley frame shall be made of steel plates and rolled section in welded construction. The trolley frame shall preferably be fabricated in one piece. The trolley shall be fitted with two numbers of rope pulleys in such a way that the axis of the rope and axis of the take-up pulley shall be in same level. The trolley shall be provided with 4 wheels. The wheels shall be treaded to suit the

track fitted for movement of the take-up trolley. The wheels & sheaves shall be mounted on antifriction bearing and shall be of minimum diameter 200 mm and shall have minimum surface hardness of 250BHN. Trolley shall have suitable gripping / guiding arrangement to ensure trolley wheels are always in contact with the rails and trolley shall not de-rail in any case of operation.

11.1.12.2 Counterweight of VGTU & HGTU

Counterweights of cast Iron/cast steel shall be used for VGTU and HGTU. Counterweight shall be maximum 10 to 15-kg weight each. Concrete counterweights of similar design may also be used.

11.1.13 Take-up tower and maintenance platforms for VGTU & HGTU

11.1.13.1 For take-up frames at a height of maximum 9m from ground, cat ladders with cage shall be provided in the take-up tower. For take-up frames more than 9m height from ground, staircases with proper hand railings shall be provided from the conveyor gallery. The opening in the gallery must be provided with doors for accessing the staircase. In case, where take-up tower is adjacent to junction house, a common staircase shall be provided to access both. Take-up tower with maintenance platforms at every 3 m shall be provided for VGTU. The VGTU shall be located inside 4 legged trestles of the gallery and maintenance platforms for the same shall be provided. HGTU shall be provided with cat ladders for maintenance of sheaves. All take-up towers shall be provided with suitable capacity chain pulley blocks for handling take-up weight. Unless otherwise indicated in the tender drawings, suitable capacity monorail beams shall be provided in take up tower and conveyor gallery for handling bend and take up pulleys. However, for handling of take-up weights of more than 10 tons, manual rope winch system shall be considered.

11.1.14 Cage, guides etc. for VGTU & HGTU

11.1.14.1 Safety cage with door and sandpit shall be provided for the suspended counterweight. Sway movement of take up pulley and that of counterweights shall be controlled by adequate guides, supported on independent foundations. Suitable arrangement shall be provided to prevent sudden fall of take-up pulley and counterweight due to belt snapping. Guarding shall also be provided for HGTU arrangements.

11.1.15 Screw take-up and take-up travel

11.1.15.1 For conveyor with screw take-up the pulley shall be supplied with screw & nut for take-up travel. The pulley assembly arrangement shall be made such that the pulley shall move back & forth due to rotation given to the nut. Screw take-up may be provided for conveyors up to length of 30m.

11.1.15.2 Each take-up shall be provided with the minimum travel of 2.5% of length of conveyor plus 600 mm for N-N belt and 0.5% for conveyors with steel cord belts.

11.1.16 Chutes, liners and gates

11.1.16.1 Chutes

11.1.16.1.1 All transfer points shall be provided with non-choking chutes made out of minimum 10 mm thick mild steel plates suitably ribbed and shall be constructed in small segments connected by bolting for easy dismantling.

11.1.16.1.2 There shall not be any top cover in the discharge chute after the pulley. A poking platform shall be provided to enable poking from the top. While designing lengthy chutes, Contractor shall take care of flowability of material and less wear of liners and shall also be provided with poking arrangement for cleaning of jammed materials, if any.

11.1.16.1.3 Chutes shall be designed such that impact of the material on the conveyor is minimum. They shall be designed to ensure continuous flow of material to the centre of succeeding equipment with minimum spillage, noise and dust emission.

11.1.16.1.4 All chutes handling lumps are to be provided with stone boxes (ore boxes) and impact on mother plate shall be avoided. Liners must be provided at stone box areas also. Stone box shall be provided at discharge end of chute wherever possible for limiting the height of fall, to form a natural bed of material for protecting the parent plate and impact of the material on receiving conveyor is minimum.

11.1.16.1.5 Chutes shall be oriented as far as possible so as to ensure discharge of material in the direction of travel of receiving belt / equipment.

11.1.16.1.6 Tips of stone boxes shall be provided with Mn Steel wear bars.

11.1.16.1.7 Liner shall be provided as per as given in clause No. 11.1.16.2 below for which provisions shall be kept in the chute. One face of the chute shall be of bolted type for easy erection and replacement of liners

11.1.16.1.8 Adequate opening shall be provided in the chute for withdrawal and adjustment of belt scrapers and replacing the liners etc.

11.1.16.1.9 Snub pulley near discharge end shall be covered by the chutes for collecting spilled material.

11.1.16.1.10 Minimum valley angle of the chute shall be 60° to the horizontal. Minimum angle of slope of chute plate shall be 65°. The valley angle and slope angle shall be suitably increased for handling wet or sticky material.

11.1.16.1.11 Hinged type sealed inspection doors shall be provided at suitable height and location. The size of doors shall allow replacement of liners without any dismantling.

11.1.16.1.12 Chutes shall be provided with adequate bolted type supporting arrangement.

11.1.16.2 Liners for Chutes/Skirt board

Surface	Liners type
Primary impact type	25 mm Mn Steel (11 – 14% Mn)
Wearing surface (Abrasion)	20 mm Mn Steel liners
Tip of stone boxes (Wear bars)	150 x 100 x 45mm thk. Mn Steel wear bars
Skirt board	Mother plate - 10 mm M.S Liner plate – 16 mm (Minimum 6mm chrome carbide overlaid on 10 mm M.S) or 300x300x25 mm mn liners fitted with 6 no.CSK bolts of 16 mm size)
Below snub pulley / Scraper (for dribbles)	20mm polymer / 5mm SS 409M liners

Steel liners shall be fixed to parent plate / mother plate by stud welding. The back side of the liner plate shall be welded with 4 x M16 threaded rod (4.8 grade) by 4mm alround weld and the same shall be connected with mother plate by using appropriate washers (outer diameter 50mm, inner diameter 18mm and thickness 6mm) and nut. Thus, around 30mm diameter hole must be made in the mother plate for allowing the welded rod to pass through so that the liner plate sits on the mother plate properly. Lock nut shall also be provided for each stud. Each liner plate shall not exceed 35 kg, and shall be made, where ever possible, to the standard dimensions of around 450 mm x 350 mm for having minimum inventory.

11.1.16.3 Gates

All gates provided in discharge chutes to be considered shall be hydraulically operated to ensure better flowability and minimum wear. The gates shall have provision of shifting manually with maximum effort of 15 kg in case of power failure. The gates shall be monitored by position and travel indicators. Limit switches shall be provided for overload protection. Wearing surfaces of gates shall be provided with liners of 10mm thick chrome carbide overlaid (hard facing) on 10 mm thk MS plate. The location and profile of the gates shall be choosen as to avoid jamming or incomplete diversion of materials.

11.1.17 Safety switches

11.1.17.1 Pull cord switches

Pull cord switches shall be provided at each side of conveyor for emergency stoppage of conveyor. The first switch shall be about 4m away from the driving drum and subsequently at not more than 30m intervals. The pull wires shall run along the entire length of conveyor on each side of the conveyor.

Sl. No.	Equipment	Quantity	Rated Capacity (TPH)	Design Capacity (TPH)	Belt Width (m)	Belt Speed (m/sec)	Length Approx. (m)	Lift Approx. (m)	kW approx.
18	Conveyor CF-3	1	2200	2500	1200	3.2	81.0	0	110
19	Conveyor CF-4	1	2200	2500	1200	3.2	810	0	110
20	Conveyor C0-3	1	1650	1800	1200	2.55	78.0	0	75
21	Conveyor CO-4	1	1650	1800	1200	2.55	94.0	0	75
22	Conveyor CO-3A	1	800	900	1200	1.55	174.0	0	55
23	Conveyor C-25	1	3300	3600	1400	3.2	145.0	2.7	150
24	Conveyor C-26	1	3000	3300	1400	3.2	145.0	2.7	150
25	Reversible conveyors RC-1 to RC-6	6	900	1000	1400	2	40.0	0	22 each
26	Conveyors CFC-1 and CFC-2	2	900	1000	1200	1.5	18.0	0	18.5 each
27	Conveyors CFC-3 and CFC-4	2	900	1000	1200	1.5	23.0	0	18.5 each
28	Conveyors CD-1	1	1500	1800	1200	2.85	201.0	0	75
29	Conveyors CD-2	1	2250	2700	1200	3.2	120.0	0	90
30	Conveyor CDC-1	1	3000	3300	1400	3.2	19.0	0	55
31	Conveyor CDC-2	1	3000	3300	1400	3.2	341.4	41.9	675
32	AF-1 to 18	18	750	850	-	-			
33	VSP-1 to 9	8+1	670	750	-	-			
34	SVF- 1 to 24	24	550	650	-	-			
35	TVF- 1 to 18	18	800	900	-	-			
36	VSS-1 to 13	12+1	450	550	-	-			
37	CR- 1 to 4	4	750	900	-	-			
38	Slewing stacker	2	3600	4000	-	-			
39	Boom type reclaimer	2	4000	4400					
40	Conveyor 20A	1	3600	4000	1400	3.5	318.0	20.0	2x250
41	Conveyor 20B	1	3600	4000	1400	3.5	404.0	24.5	2x315
42	Conveyor 32	1	4000	4400	1400	3.5	600.0	12.0+12.0	2x350
43	Conveyor 33	1	4000	4400	1400	3.5	605.0	12.0+10.5	2x350
44	Conveyor 34	1	4000	4400	1400	3.5	62.0	8.0	200

Sl. No.	Equipment	Quantity	Rated Capacity (TPH)	Design Capacity (TPH)	Belt Width (m)	Belt Speed (m/sec)	Length Approx. (m)	Lift Approx. (m)	kW approx.
45	Conveyor 35	1	4000	4400	1400	3.5	151.0	8.0	250
46	Conveyor 28	1	3600	4000	1400	3.2	116.2	8	225
47	Conveyor 29	1	3000	3300	1400	3.2	116.2	8	200
48	Conveyor 30	1	3300	3600	1400	3.2	44.35	0	90
49	Conveyor C-36	1	4000	4400	1400	3.5	387.0	21.5	315 x 2
50	Conveyor C-38	1	4000	4400	1400	3.5	127.0	4.5	200
51	Conveyor EC-1	1	2200	2400	1200	2.85	216.0	0	132

NOTES:

(1) Lengths and lifts are rounded off. Bidders shall finally decide the parameters of belt conveyor including kW rating.

(2) Wherever dual drives are envisaged, the bidders may provide dual pulley drive or a drive arrangement with single pulley drive and two (2) drive motors, whichever fits suitable in the layout meeting necessary requirements like chute slope (65 deg. min.) and conveyor inclination (14 deg. max.). However, conveyor inclination shall be generally restricted to 13 deg. unless the same is absolutely required to be increased to 14 deg.

ANNEXURE I-3

LIST OF INDIAN STANDARDS FOR MECHANICAL EQUIPMENT

IS:1875-1992	:	Carbon Steel Billets, Blooms, Slabs and Bores for Forging
IS:1570-1996	:	Schedule for Wrought Steel for General Engineering purposes
IS:4367-1991	:	Carbon Steel Forgings for General Engineering purposes
IS:4367-1991	:	Alloy Steel Forgings for General Industrial use
IS:1030-1998	:	Carbon Steel Castings for General Engineering purposes
IS:2644-1994	:	High Tensile Steel Casting
IS:2707-1996	:	Carbon Steel Casting for Surface Hardening
IS:3444-1999	:	Corrosion Resistance Alloy & Nickel based Steel Casting
IS:4522-1986	:	Heat Resistance Alloy Steel and Nickel based casting
IS:4896-1992	:	Chromium Steel Casting for Abrasion Resistance Service
IS:822-1970	:	Code of Procedure for Inspection of Welds
IS:3600-1985, 1985, 1984	:	Method of Testing Fusion Welded Joints and Weldment in Steel
(Part-I, II & III) IS:4983-1968	:	Assessment of Butt & Fillet Fusion Welds in Steel Sheets, Plates and Pipes
IS:2102-1993 (Part-I)	:	Tolerances for Linear and Angular Dimensions without Individual Tolerance Indication
IS:2102-1993 (Part-II)	:	Geometrical Tolerances for Features without Individual Tolerance Indication
IS:2709-1982	:	Guide for Selection of Fit
IS:2062-1999	:	Steel for General Structural purposes
IS:919-1993 (Part-I & II)	:	Limits and Fits
IS:875-1987 (Part-III)	:	Code of Practice for Design Loads (Other than Earthquakes) for Buildings & Structures
IS:11592-2000	:	Code of Practice for Selection and Design of Belt Conveyors
IS:8597-1977	:	Specification for flat belt conveyors
IS:8598-1987	:	Idlers and Idler sets for belt conveyors

IS:8531-1986	:	Pulleys for belt conveyors
IS:1239-1990 & 1992 (Part-I & Part-II)	:	Mild steel tubes
IS:1893-1984	:	Criteria for Eathquake Resistant Design of Structures
IS:4692-1985	:	Degrees of protection provided by enclosure for Rotating Electric Machinery
IS:2074-1992	:	Zinc Chromate
IS:102-1962	:	Read lead
IS:1477 (Part-I - 2000; Part-II - 1971)	:	Painting of Ferrous Metal in Building
IS:1891-1993 (Part-2)	:	Specification for rubber conveyor and elevator textile belting – Heat resistant belting
IS:1891-1993 (Part-3)	:	Specification for rubber conveyor and elevator textile belting – Oil resistant belting
IS:1891-1993 (Part-4)	:	Specification for rubber conveyor and elevator textile belting – Hygienic belting
IS:4776-1977 (Part-1)	:	Specification for troughed belt conveyors – Troughed belt conveyors for surface installation
IS:4776-1977 (Part-2)	:	Specification for troughed belt conveyors – Troughed belt conveyors for underground installation
IS:8593-1977 (Part-1)	:	Recommendations for centralised lubrication as applied to plant and machinery – Oil lubrication
IS:8593-1977	:	Recommendations for centralised lubrication as (Part-2) applied to plant and machinery – Grease lubrication
IS:8593-1977	:	Recommendations for centralised lubrication as (Part-3) applied to plant and machinery – Aerosol lubrication
IS:8646-1994	:	Conveyors-scrapper general requirements
IS:8730-1978	:	Classification of bulk material handled by continuous mechanical handling equipment
IS:9295-1953	:	Specification for steel tubes for idlers for belt conveyors

IS:6687-1972	:	Code of practice for selection, storage, installation and maintenance of conveyor belting
IS:7403-1974	:	Code of practice for selection of standard worm and helical gear boxes
IS:10463-1993	:	Glossary of terms for bulk handling equipment (Part-6) – Cycling loose bulk handling equipment (non-stationary)
IS:10463-1993	:	Glossary of terms for bulk handling equipment (Part-2) – Stacking, loading and reclaiming equipment
IS:13148-1991	:	Bulk handling equipment – mobile continuous type – Rules for design of structures
ISO:5049/FEM	:	Stability of mobile equipment
ISO; 5049/FEM	:	Structural design of mobile equipment
IS:31777/IS:807	:	EOT cranes
IS:3938	:	Hoists
IS:12401	:	Code and practice for selection of mechanical vibrating feeder
IS;12213	:	Vibrating screen
IS:9168/equivalent International standard	:	Design of bins/silos
IS:14665-2000 (Part-I, Part-II and Part-III)	:	Guide lines for design of elevator

NOTE: Latest revision of all standards, as mentioned above or mentioned elsewhere shall be followed. Any latest standard found to supersede any previous corresponding standard shall also be followed.

ANNEXURE I-4

DATA/DRAWINGS TO BE SUPPLIED BY THE VENDORS/SUCCESSFUL VENDOR FOR CONE CRUSHER.

1.0 **DATA/DRAWINGS TO BE FURNISHED WITH THE OFFER**

1.1 The Bid shall be accompanied by general arrangement drawing for crushers, auxiliaries,lubrication system etc. showing to scale the elevation, side view and plan along with information such as clearances and arrangement of all equipment installed on and with the crusher. Total crusher weight, load data, weight of the heaviest component, motor rating, drive arrangement, control system write-up and other technical features associated with the crushers offered.

1.2 Details of springs and damping pad arrangement shall be submitted with catalogues of other references.

1.3 List of operational spares recommended for two years normal operation and list of tools and tackles to be supplied with the equipment.

1.4 Part list of all the components, liners with materials and codes of construction.

1.5 List of imported component in the crushers.

1.6 Duly filled-in data sheets.

2.0 **DATA/DRAWINGS TO BE SUBMITTED FOR APPROVAL/COMMENTS BYSUCCESSFUL BIDDER**

2.1 General arrangement drawings drawn to the scale containing all information as described elsewhere along with civil load data.

2.2 Assembly drawings of drives.

2.3 Technical characteristics of the crushers in tabulated form and characteristics curves.

2.4 In addition to the above, the Owner/Consultant reserves the right to insist on submission of calculations, drawings/documents related to mechanical, electrical, instrumentation, civil and structural as required for the crushers.

2.5 Submission of detailed design and power calculations and drawings for Owner's acceptance and approval. All calculations must be submitted in sets.

3.0 **DATA / DRAWINGS TO BE FURNISHED BY THE VENDOR ALONG WITH SUPPLY OF CONE CRUSHER**

3.1 Erection drawings, erection specifications and erection instructions
.

3.2 Performance data, test charts and inspection certificates.

3.3 Operation, maintenance and safety manuals.

3.4 Bill of quantities

ANNEXURE I-5

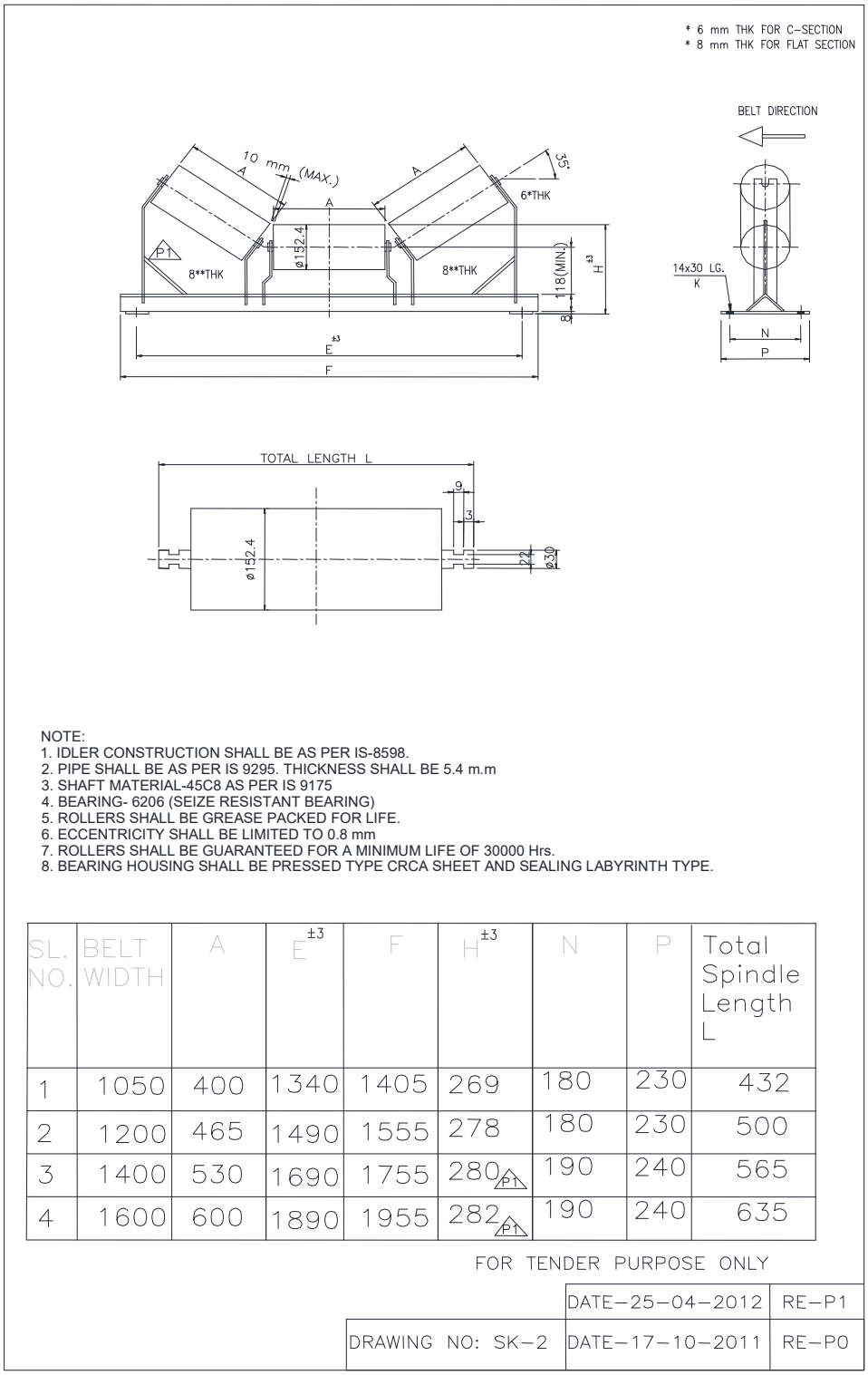
DEVIATION SCHEDULE TO TECHNICAL SPECIFICATION

All deviations from the Technical Specification TS No: TCE.6131A-04-TS-001 shall be filled in by the Bidder (Section-wise) as per format given below.

Sl. No.	Specification Clause No.	Details of deviations proposed	Reasons for deviation

ANNEXURE I-6

NMDC's STANDARD IDLER DRAWING

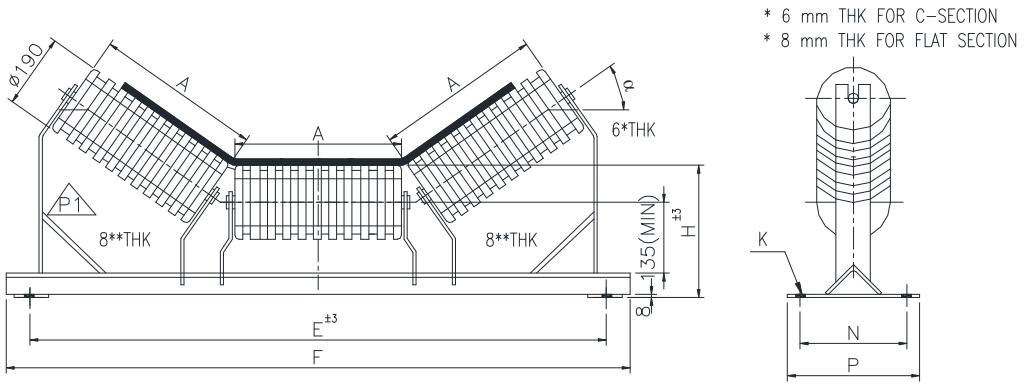


NOTE:
1. IDLER CONSTRUCTION SHALL BE AS PER IS-8598.
2. PIPE SHALL BE AS PER IS 9295. THICKNESS SHALL BE 5.4 m.m
3. SHAFT MATERIAL-45C8 AS PER IS 9175
4. BEARING- 6206 (SEIZE RESISTANT BEARING)
5. ROLLERS SHALL BE GREASE PACKED FOR LIFE.
6. ECCENTRICITY SHALL BE LIMITED TO 0.8 mm
7. ROLLERS SHALL BE GUARANTEED FOR A MINIMUM LIFE OF 30000 Hrs.
8. BEARING HOUSING SHALL BE PRESSED TYPE CRCA SHEET AND SEALING LABYRINTH TYPE.

SL. NO.	BELT WIDTH	A	E±3	F	H±3	N	P	Total Spindle Length L
1	1050	400	1340	1405	269	180	230	432
2	1200	465	1490	1555	278	180	230	500
3	1400	530	1690	1755	280 P1	190	240	565
4	1600	600	1890	1955	282 P1	190	240	635

FOR TENDER PURPOSE ONLY

	DATE–25–04–2012	RE–P1
DRAWING NO: SK–2	DATE–17–10–2011	RE–P0

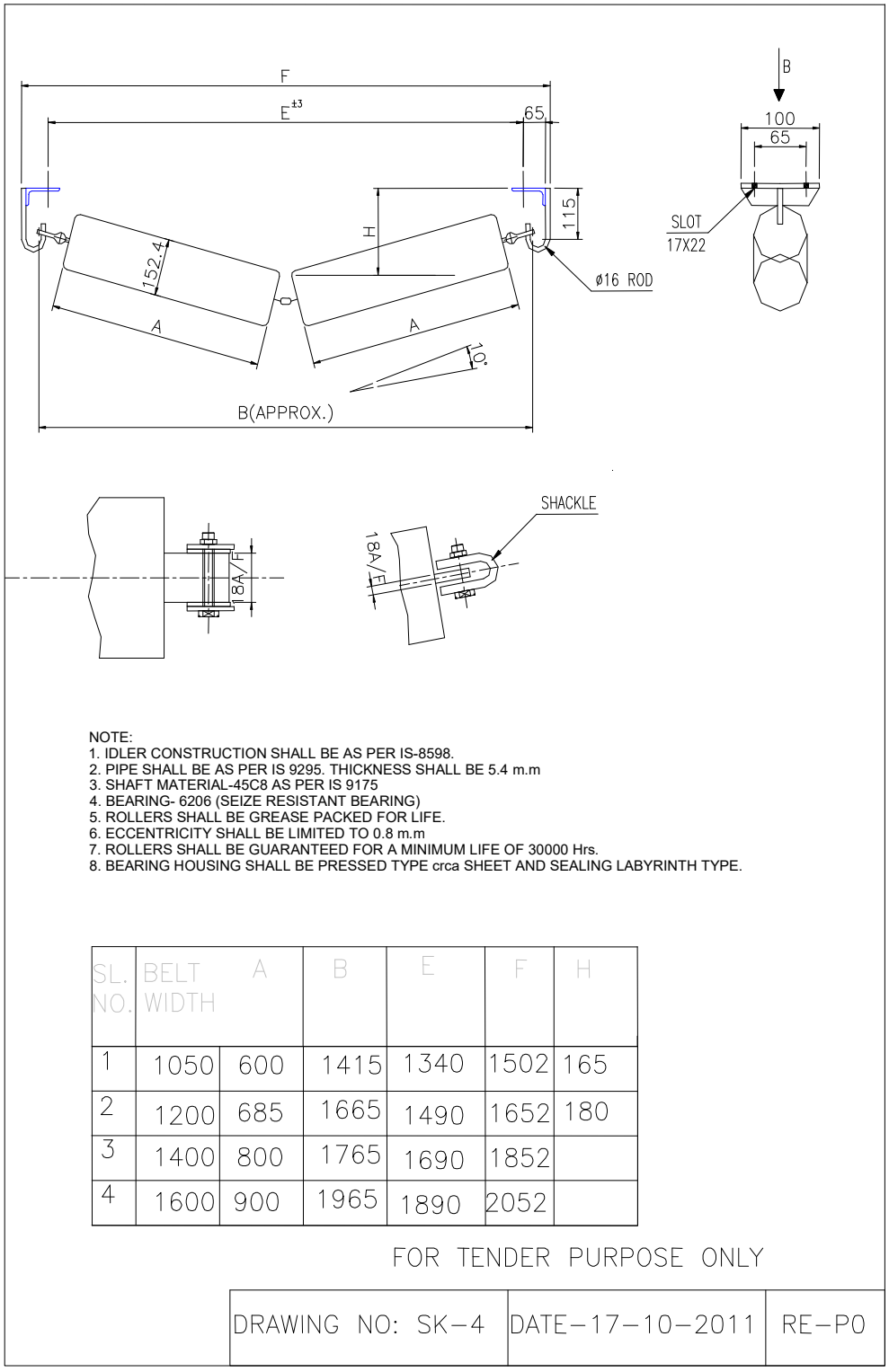


NOTE:
1. IDLER CONSTRUCTION SHALL BE AS PER IS-8598.
2. PIPE SHALL BE AS PER IS 9295. THICKNESS SHALL BE 5.4 m.m
3. SHAFT MATERIAL-45C8 AS PER IS 9175
4. BEARING- 6206 & 6306 (SEIZE RESISTANT BEARING)
5. ROLLERS SHALL BE GREASE PACKED FOR LIFE.
6. ECCENTRICITY SHALL BE LIMITED TO 0.8 m.m
7. ROLLERS SHALL BE GUARANTEED FOR A MINIMUM LIFE OF 30000 Hrs.
8. RUBBER RING 190Ø O.D SHORE HARDNESS 60 ON SCALE 'A'
9. BEARING HOUSING SHALL BE PRESSED TYPE crca SHEET AND SEALING LABYRINTH TYPE.

SL. NO.	BELT WIDTH	A	$E^{\pm 3}$	F	H	K	N	P	α
1									
2	1050	400	1340	1405	305	14x30	180	230	35°
3	1200	465	1490	1555	314	14x30	180	230	35°
4	1400	530	1690	1800	314	14x30	190	240	35°
5	1600	600	1890	2000	314	14x30	190	240	35°

FOR TENDER PURPOSE ONLY

	DATE–25–04–2012	RE–P1
DRAWING NO: SK–3	DATE–17–10–2011	RE–P0



NOTE:
1. IDLER CONSTRUCTION SHALL BE AS PER IS-8598.
2. PIPE SHALL BE AS PER IS 9295. THICKNESS SHALL BE 5.4 m.m
3. SHAFT MATERIAL-45C8 AS PER IS 9175
4. BEARING- 6206 (SEIZE RESISTANT BEARING)
5. ROLLERS SHALL BE GREASE PACKED FOR LIFE.
6. ECCENTRICITY SHALL BE LIMITED TO 0.8 m.m
7. ROLLERS SHALL BE GUARANTEED FOR A MINIMUM LIFE OF 30000 Hrs.
8. BEARING HOUSING SHALL BE PRESSED TYPE crca SHEET AND SEALING LABYRINTH TYPE.

SL. NO.	BELT WIDTH	A	B	E	F	H
1	1050	600	1415	1340	1502	165
2	1200	685	1665	1490	1652	180
3	1400	800	1765	1690	1852	
4	1600	900	1965	1890	2052	

FOR TENDER PURPOSE ONLY

DRAWING NO: SK–4	DATE–17–10–2011	RE–P0