REF : 77-08-6028

PRE TENDER TIE UP

TECHNICAL SPECIFICATION
FOR
YARD MACHINES
FOR
RAW MATERIAL HANDLING SYSTEM
OF
BOKARO STEEL PLANT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

(भारत सरकार का उपक्रम)

Bharat Heavy Electricals Limited

(A Government of India Undertaking)

इण्डस्ट्रियल सिस्टम्स ग्रुप

INDUSTRIAL SYSTEMS GROUP

CONTENT

1 General

1.1 Site Conditions

1.1.1 Location

Bokaro Steel Plant (BSL), SAIL is located at Bokaro Steel City in the state of Jharkhand in the eastern region of India. The site lies between 23.290 North latitude and 86.090 East longitude.

The location of Bokaro Steel City is as follows:

From New Delhi, the national capital	- 1209 kms
From Kolkata	- 220 kms
From Chennai	- 1900 kms
From Mumbai	- 1782 kms

The distance from State Capital Ranchi to Bokaro Steel City is 140 kms. The Steel Plant is well connected by rail and road network. The nearest railway station is Bokaro Steel City Station of the SE Railway.

1.1.2 Meteorological Data

The meteorological details are given below:

1.1.3 Ambient Temperature

Absolute maximum	: 46.1 ^{0} C
Absolute minimum	: 1.8^{0} C
Highest of mean monthly	: 43.8^{0} C
Ambient Air	
Ambient air quality	: Industrial
Relative Humidity	
Maximum	: 100%
Climate	: Tropical Humid
Rainfall	
Heaviest rainfall in 24 hours	: 272 mm
Annual Average	: 1197.3 mm
Wind	
Predominant wind direction	: NW to SE
Mean wind speed	: 7.8 kmph
Maximum wind speed	: 108 kmph
Altitude	

Average altitude of the land is 210 m above MSL

Temperature inside shop premises is generally taken as 5^0 C above ambient, unless otherwise specified.

1.1.4 General Rules and Regulations

All plant units with respect to their location, layout, general arrangement and design of equipment, structural design, etc. shall be safe to the personnel and conform to the relevant statutory requirements issued by Jharkhand Government and the Government of India but not limited to the following.

- Jharkhand State Factory Rules/Acts.
- Indian Electricity Rules/Acts
- Electricity Regulatory Commission Act
- Indian Petroleum Regulations/Acts
- Indian Boiler Regulations/Acts
- Indian Explosives Acts
- Gas Cylinders Rules/Acts
- Carbide of Calcium Rules/Acts
- Static and mobile Pressure Vessels Codes (unifired) Rules/Acts
- Fire Protection Manual issued by Tariff Advisory Committee (India)
- Pollution Control Regulations/Acts

Pollution control measures shall be provided considering the latest norms and international standards. These should satisfy the stipulations of Central Pollution Control Board and Department of Environment and Forest, Government of India.

In the event the requirements of this specification exceeds the requirement stipulated in the corresponding standards, regulation, safety code, the specification shall govern.

In the event of conflict between the standard, regulations and codes, the most stringent one shall govern and the decision of the Purchaser shall be final.

1.2 Brief System Description

The Expansion of Raw Material Handling System comprises of the following sub-systems:

- Preparation of six nos. new beds for storing iron ore fines and flux materials
- Material receipt at Wagon Tippler WT # 5 and onward transport to the six(6) nos. new Ore fines and flux material storage bed for Stacking.
- Interconnectivity with WT #1,2,3 &4 to the new beds.
- Reclaiming from new beds & transportation to existing conveyor system for onward transmission to Sinter Plant ,Blast Furnace.
- Reclaiming flux material from new beds & transportation to new Lime/Dolo Plant of SMS-III.
- Receiving Lump Iron Ore from conv. KD1-3 and store in Intermediate Storage Bunker Building and feed back to conv KD1-3 near BF Stock House.
- Provision of DRI shed and iron ore storage near Lime/Dolo plant for feeding to SMS-III.
- 4^{TH} Series Of Reclaiming Conveyor In Raw Material & Materialhandling Plant (RM & MHP)
-

The raw material to be handled by the proposed system are mainly, Iron Ore Lump, Iron Ore Fines, Lime Stone (BF grade), Lime Stone (SMS grade), Dolomite (BF grade), Dolomite (SMS grade), Quartzite, DRI and Ferro-alloys. These raw materials are mainly required for Blast Furnace, Sinter Plant, Lime-Dolomite Plant and Steel Melting Shop etc. All the raw materials will be received at the plant boundary by rail. The type of Wagon will be BOX,BOXN,BOXN MARK-II, BOXNHA, BOY,BOBX,BOBS,BKC,BOBRN, BOST, which will transport the raw materials depending upon the location of loading and type of raw materials.

2 Design Considerations

The Raw Material Handling System (RMHS) systems have been planned based on the following assumption:

2.1 Size of Raw Material

1. Lump Iron Ore : (+) 8 to (-) 30 mm
3. Iron ore fines : (-) 8 mm
4. Lime Stone (BF/SP grade) : (+) 15 to (-) 50 mm
5. Dolomite (BF/SP grade) : (+) 25 to (-) 50 mm
6. Quartzite : (+) 25 to (-) 50 mm
7. Lime Stone (SMS grade) : (+) 25 to (-) 50 mm
8. Dolomite (SMS grade) : (+) 10 to (-) 25 mm
9. Pellets : (+)9 to (-) 16mm
10. DRI (By Truck to SMS-III) : (+)4 to (-) 20mm

2.2 No of Days of Working per year: 330 days

To handle raw materials required for 7.4 MT expansion of BSL, Bokaro from its present production capacity, additional wagon tippler for receipt of raw material and 6 nos additional beds in the preparation plant have been envisaged. This plant shall deal with receipt, storage, handling of raw materials required to process / consumer plants like Blast furnace, Lime and Dolomite plant, Steel Melting Shop, etc.

The Raw materials requirement for l for 7.4 Mt expansion is shown in Table-05.01 with daily consumption, number of stock piles and storage capacities etc. including handling losses as envisaged.

Sl.	Material	Bulk nsity, 3	Annual quirement with % losses, t	Daily nsumptio n	Selected ck Pile	Storage Capacity	
				t		m3	Days
	I/O (Lump) (8-25mm) BF Plant	2.2	4,84,330	1384	1	18000	28
	Coke (BF Plant)	0.5	3,169,320	9055	-	-	-
	I/O (Fines) Sinter Plant	2.4	7,649,070	23179	10	230000	23
	Sinter BF Plant	1.7	9,791,430	27976	-	-	-
	Quartz BF Plant	1.5	1,24,520	356	1	23000	97
	Lime Stone for Sinter Plant	1.5	l,304,270	3952	2	46000	17
	Dolomite for Sinter Plant	1.6	6,080,80	1843	1	23000	19

	Lime Stone for Lime Plant (SMS)	1.5	4,61,120	1317	1	23000	26
	Dolomite for Lime Plant (SMS)	1.6	2,03,610	582	1	23000	63
	L/D Slag, Mn Ore etc.	-	As required	-	1	-	-
	Pellet	2.2	4,325,530	12359	6	123000	21
	Coke breeze	0.8	6,25,680	1896	-	-	-
TOTAL			2,93,49,760	85,668	24		

The estimation of stockpile/storage capacities have been made based on the following assumption.

A. Iron Ore Lump, Iron Ore Fines, Fluxes, Pellets :
- Stock pile length available = 230m
- Stock pile width = 25m
- Height of stock pile = 8.5m
- Each stock pile volume = 23,000m3

B. No. of Days of working per year :
For Blast Furnace = 350 days
For Sinter Plant = 330 days

Material carrying capacity of each wagon shall be 70t (considering high sided wagon) with gross weight of wagon 100t. All material will be received in Wagon Tipplers. Wagon tippler with pusher car has been considered for unloading the materials received in BOXN/BOST/ BOXNHA/BOY wagons. DRI, Iron ore for SMS-III will be transported by road.

The facilities required for achieving the targeted productions additional handling facilities has been envisaged. The scheme has been described hereunder.

2.2.1 UNLOADING AND STACKING OF IRON ORE AND FLUX

- One number Wagon tippler WT no.5 along with a Pusher Car in addition to 4 numbers existing Wagon Tipplers has been envisaged for unloading Iron ore (lump and fines), Limestone & Dolomite (both SMS grade and Sinter Plant grade), Mn-ore, Quartzite etc.
- The Wagon Tipplers shall be of Rotaside Type capable of unloading BOXN and proposed BOXNHA and BOY wagons upto a gross weight of 120t and an axle load of 23 t. The rated unloading capacity shall be 20 Tips/hour.
- The placement of rakes shall be done by 7000t Wagon Pusher Car capable of handling a full rake BOXN, BOXNHA and BOY wagons.
- Two belt feeders below each Wagon Tippler shall convey the raw material on conveyor P1C1 upto Jn House JNA1. From Jn House JNA1, which has been connected to Jn House JNA2,JNA3 and JNA4 by a conveyor P2C1 & P2C2 to stack material in the new six numbers beds through conveyor P3C1,P4C1,P5C1 and twin boom stacker ST1,ST2,ST3. It shall be possible (in the case of exigency) to stack material in new beds after unloading material in WT no.1,2,3 & 4 and transfer the same in Junction House JNB1 &JNB2, to conveyor P2C1,P2C2.
- In the Raw material handling yard, 6 nos. of additional stock pile of length 230m and 25m width each have been considered to accommodate additional requirement of Iron Ore Fines, flux (LDP), Pellet and Iron ore Lump along with transfer car, stacker and barrel reclaimers adjacent to existing LDP (Flux) storage area. The new stockpile arrangements have been shown in the Layout drawing. For 7.0Mt expansion in the existing yard no. of beds for Pellets to be increased to 6 nos and Iron Ore lump and Flux beds has been

reduced. Brief descriptions of the various sub-systems are given below and are also reflected in the drawings enclosed. However the Tenderer shall consider the Tender drawings only as indicative and for tender purpose only and any changes for completeness and improvement shall be finalized during submission of basic engineering document for approval by the successful tenderer.

3 Safety

3.1 Safety Regulations

- The Contractor shall comply with the, relevant Safety Rules and Regulations but not limited to the following:
  - Jharkhand State Factory Rules/Acts.
  - Indian Electricity Rules/Acts
  - Electricity Regulatory Commission Acts
  - Indian Petroleum Regulations/Acts
  - Indian Boiler Regulations/Acts.
  - Indian Explosive Acts
  - Gas Cylinder Rules/Acts
  - Carbide of calcium Rules/Acts.
  - Static and Mobile Pressure Vessels codes(Unfired) Rules/Acts
  - Fire protection manual issued by Tariff advisory committee (India)
  - Pollution Control Regulations/Acts
- Strict attention shall be paid to all statutory regulations and safety rules for prevention of accidents.
- The safety posters/regulations for prevention of accidents shall be displayed by the Contractor at appropriate places. Notices and warning signs shall be displayed for all sources of dangers.
- The Contractor is not permitted to construct any temporary road crossing on the rail tracks for the sake of their convenience at work site.
- When the work is carried out at night or in the obscure day light, adequate arrangements for flood lighting in the working area shall be made by the Contractor at his own cost and got approved by the Purchaser.
- All handling/transport and rigging equipment including lifting tools and tackles shall be checked at regular intervals and kept in good and safe working condition. A register is to be maintained regarding the results of periodical tests/checks and other particulars in respect of each and every such equipment.
- The Contractor must take sufficient care in moving his construction plant and equipment from one place to another, so that those do not cause any damage to the property of the Purchaser or obstruct construction activities of other Contractors.
- 05.01.08 The Contractor shall depute a full time safety engineer who will exclusively look after all the jobs pertaining to safety at site and keep close liaison with Purchaser/Consultant. He will be responsible for maintaining safe working conditions at site, promoting safety consciousness among the workmen and reporting to concerned authorities in case of accident/dangerous occurrences.
- Before execution of work in hazardous area like
  - Gas contamination
  - Working at height.
  - Storage of inflammable materials
  - Danger of electric shocks
  - Explosion risks
  - Excavations more than 2 m deep, etc.

A protocol should be prepared in association with the concerned agencies of the Purchaser/Consultant.

3.2 Safety while Working with Explosives.

- Explosives shall not be used on the work site by the Contractor without the written permission of the Purchaser and that too only in the manner and to the extent to which it has been prescribed.
- Explosives shall be stored in special premises approved by the Purchaser and at the cost of the Contractor who shall be liable for all damages, loss or injury to any person or property and shall be responsible for complying with all statutory obligations in these respects.

3.3 Safety Appliances

- The Contractor shall provide the safety appliances conforming to the relevant Indian standards to all their workmen and supervisors engaged by them as well as by the sub contractors.
- The Contractor shall ensure that all the workmen and supervisors, are using the safety appliances regularly during work at site.
- Any form of compensation in lieu of safety appliances shall not be permitted. Any violation in safety provisions or failure to maintain safe working conditions will lead to serious penalty on the Contractor and finally may lead to termination of the Contract.
- The workmen of the Contractor deployed for construction and erection in hazardous areas shall be provided with personnel protective safety appliances of special nature suitable for hazardous working conditions.

3.4 Safety during Construction/Execution

- The Contractor shall be responsible for the safety of his workmen and employees. The Contractor shall ensure that safety practices are followed so as to prevent personal injury to his workmen and also to other persons working/passing by in that area.
- The Contractor shall ensure that in case of any accidents, the same are reported without delay to the Purchaser/Statutory Authorities as per Rules. In case of any injury/accident the Contractor shall bear all the expenditure for medical treatment and shall pay the compensation in case of permanent disability or death.
- The Contractor shall ensure that all personnel employed do not stray into other areas. Any injury caused due to this shall be the sole responsibility of the Contractor.
- The Contractor shall ensure that skilled labours required for specific works have necessary trade certificates and adequate experience of the job. This is likely to be checked by the Purchaser. The concerned operator, mechanics, electricians, fitters, riggers, etc. must be fully conversant with the hazards associated in operation/maintenance of their relevant equipment.
- Safer Working Platforms
    - Contractor shall use strong and secured planks and boards of the right sizes.
    - These planks shall be painted at the edges brightly to warn the workers for any misuse (usually zebra paint)
    - Barricades should be put-up to prevent them from falling.
    - Contractors shall make sure that scaffolds are erected by trained scaffolders.
    - Supervisors must inspect scaffolds once every week.
- Falling Objects and Debris
    - No loose materials which can fall down should be kept on the working platforms.

- Overhead shelters should be provided to minimize damage from falling objects.
- Strong nets to be provided to catch these objects or debris.
- Nets must envelop all sides of the building.

- Personal Safety Equipment
  - Workers must wear approved safety helmets and shoes.
  - For those working in high places safety belts shall be provided.
  - The safety belts must be attached to strong anchorage points.
- Operating Construction Machine
  - Contractors shall make sure that those operating the construction machinery are well trained for their jobs.
  - The keys of such machinery shall be kept with the authorized persons.
  - The keys shall be removed after use of the machine.
- Safer Electrical Installations
  - Contractor shall use approved types of electrical sockets and plugs.
  - Proper insulators for all electrical wirings shall be provided.
  - Wiring should not be allowed to lie on the floor or on the ground.

3.5 Safety in Designing of Equipment

- All machinery and equipment must be equipped with safety devices. The safety provisions shall conform to the recognised standards, safety codes and statutes.
- All safety measures as required to be adopted as per the statutory regulations and the safety rules of the plant shall be strictly followed by the Contractor during the execution of the Contract.

4 Scope of Work And Battery Limits

4.1 Scope of Work

The broad turnkey scope of work shall be as per the following:

- Design, manufacture, inspection, shop & primary coat of paint & supply of complete plant & equipment, fabrication (shop & site) of building structures & technological structures, power distribution, electrics, instrumentation & automation, as required, for complete & trouble free operation of Raw Material Handling System in an integrated manner.
- Basic engineering, detail engineering and reference category of drawings, operating software and documents, in requisite copies, for approval of BSL / MECON. Further, the Tenderer will furnish final basic & detail engineering drawings, manufacturing drawings of fast wearing items and non-standard items, as built drawings, erection drawings/ documents, operating software, operation and maintenance manuals in soft editable format.
- Receipt of material, loading / unloading, storage, civil construction, complete erection, testing, commissioning, handing over of plant to Purchaser, demonstration of performance guarantee and post commissioning services for a period of six months after commissioning. Preparation and approval of erection survey / alignment schemes, grouting clearances, painting clearances, testing of welds, pressure testing protocols and other related site protocols.
- Deputation of representatives of equipment suppliers and technology suppliers to site for supervision of erection, testing and commissioning.
- Applying final finish coat of paint as per approved procedure & shades before handing over, first fill of lubricant & oil, special tools & tackles, mobile equipment, handling & hoisting equipment etc.
- Supply of all commissioning spares and insurance spares. A list of such commissioning spares & insurance spares shall be indicated separately as indicated in schedule chapter 12. Tenderer shall quote separately for two years spares along with the main offer.
- Progress reporting as per agreed formats, providing documentary evidence of purchase orders on sub vendors with addresses of contact persons, attending all site progress review / engineering review meetings at BSL, Bokaro or at MECON, Ranchi, opening an equipped site office with coordinator over seeing all activities.
- Arrangement of all erection equipment viz. cranes, hoists, winches, etc, and safety appliances as required for erection of plant & equipment. Appointment of safety officer by the contractor shall be included.
- Specialised training of Purchaser's / Consultant's personnel for operation, maintenance, for smooth handing over the plant.
- Testing and cold trial run of systems/ sub - systems and integrated testing shall be carried out by the successful Tenderer on continuous basis for complete Raw Material Handling System alongwith associated facilities followed by commissioning. On successful commissioning of the various sub-systems of the RMHS, PG test of the entire plant shall be carried out as elaborated in the relevant chapter.
- Receiving delivery of items at site, their proper storage, and handling at site, watch and ward services, removal of debris to a location specified by the Purchaser etc.
- Site shall be handed over to the Purchaser in clean and orderly manner to the satisfaction of the site engineers after commissioning of the project.

- Getting Purchaser's/ consultant's approval for the drawings prepared by the successful Tenderer, obtaining required approval from statutory authorities, providing adequate personnel, equipment, tools & tackles for timely completion of the project.

This is a turnkey project for additional Raw Material Handling System and all the facilities required for proper functioning of the plant and achieving the rated production shall be deemed to be covered in the tender specification, unless specifically excluded from the Tenderer's scope.

4.2 Delivery

The project is schedule up to handing over to Purchaser shall be within 24 months from the date of placement of LOI on successful contractor to handing over. The delivery of plant & equipment shall be FOR, BSL site/ stores at Bokaro, Jharkhand.

4.3 Obligations of Purchaser

- Purchaser shall allot leveled land with an undulation of about +500mm from the predetermined level as per the layout drawing for installation of the Raw Material Handling System.
- Purchaser shall provide construction power, drinking water during construction and space for storage and site office as per GTS. The Tenderer shall indicate the details required by them in the prescribed format.

4.4 Additional Points

- The requirement of construction power and water shall be indicated.
- Supply of the initial fill is in the Tenderer's scope.
- The Tenderer shall confirm the supply of all consumables required for erection, testing and successful commissioning of the system.
- The Tenderer shall also confirm the provision of commissioning spares required for all equipment.
- The Tenderer shall confirm the supply of all special tools and tackles required for erection, testing and successful commissioning of the system.
- The Tenderer shall furnish spares for two years normal operation/ maintenance of the offered equipment to ensure availability of the equipment. Price of such spares shall be quoted separately.

5 List of Equipment

5.1 RMHP Area

UNLOADING AND STACKING OF IRON ORE AND FLUX

Handling system from receiving of material at Wagon Tippler , conveying and stacking in the Six nos. new Beds shall be considered as rated capacity of 1650TPH.(Design cap approx. 2000TPH)

SL. NO	DESCRIPTION	LOCATION	Qty	REMARKS
1	Pusher car (cap to pull 7000t)	Near WT-5	1	
2	Wagon Tippler-5	Wt Bldg.-5	1	Will received 20tippling per hour of wagon of pay loads of 80 t
33A	STACKER CAP: **1650TPH** (Rated)	STOCK YARD	3	NEW BED
33B	STACKER CAP: 1200 TPH	STOCK YARD	1	OLD BED AREA
34	BUCKET WHEEL RECLAIMER CAP: 500 TPH	STOCK YARD	1	
35	BARREL RECLAIMER CAP: 1000 TPH	STOCK YARD	3	
36	TRANSFER CAR	-do-	1+1	1 IN OLD BED

6 Technical Specification

6.1 Technological

6.1.1 General

Technical specifications for major technological equipments are furnished in this chapter. However, most of the common Material Handling equipment are covered in the "General Technical Specification(MEC/S/E24F/11/38/0/00/00/F1874/R0) – Material Handling Equipment chapter-06".

This chapter shall cover other equipment envisaged in this RMHS Package only, and are:-

1. Wagon Tippler with Pusher car
2. Twin Boom Stacker
3. Bucket Wheel Reclaimer
4. Barrel Reclaimer
5. Transfer Car

The Tenderer may please note that the plant shall be complete with all equipment & facilities. Further, some of the equipment whether specifically mentioned or not in this TS, but which the Tenderer feels it necessary to be included in this TS for successful and trouble free operation of the plant shall also be included in the offer. Technical parameters furnished against each equipment are broad in nature. However, the Tenderer shall confirm the same & furnish various technical parameters and capacity of each equipment in his offer.

Any deviation/ exclusion from TS shall be clearly spelt out with justification

6.2 Wagon Tippler With Pusher Car

6.2.1 Scope of Work

The scope of work of the Tenderer includes design, engineering, manufacture, inspection, assembly, shop testing, painting at manufacturer's shop as well as at site after erection, supply at site including dismantling for transportation, packing, loading and transportation, receipt at site, unloading, storage and reconservation at site, erection, testing and commissioning of the following items at plant site.

1. **One no. Rotaside Hydraulic Wagon Tipplers for guaranteed 20 tips/hr. complete with.**
2. **One no Pusher car to push a rake of 58 loaded wagons of 135t (each) Gross capacity.**

6.2.2 Electric Pusher Car

Equipment	***No.***	***Type of Wagons handled***	***Pushing Force***	***Travel Speed***
Pusher Car	1	BOX / BOXN / BOXNHA / BOXN MKD-II / BKC / BOY / BOBS / BOBX	40t	Full loaded rake: 0.5m/s (variable) Empty Run : 2m/s

6.2.2.1 General

One no.Pusher Car shall be used for wagon positioning at the wagon tippler no. 5 for unloading of materials. It shall be used for pushing a rake of 58 wagons of 135t gross weight each and locating wagons one by one on tippler.

On the out haul side the empties form a new train ready for collection by a locomotive.

All equipment shall be designed for out door duty and shall be complete with mechanical, structural, power supply, drives, controls etc.

The Pusher car shall be suitable for running on standard wide gauge railway track of 1876mm track gauge. It shall be equipped with cabin on both sides for control, searchlights on both sides, hooters and other standard safety features. The equipment shall also be controlled from control station near wagon tippler.

Easy access, adequate maintenance spaces, working platforms, inspection covers shall be provided for all the equipment located in the pusher car for safe and quick maintenance. All edges and openings shall be provided with guards. Chequered plates on floor shall be provided to prevent slipping.

Centralised system of lubrication shall be provided for the equipment. However, all parts of the equipment needing manual lubrication shall be easily accessible. All oil pipes and grease nipples shall be well covered to prevent damage from materials from falling on them.

Spares for two years trouble free operation of each equipment. Lists of such spares along with item wise prices shall be furnished.

Required quantity of initial fill of transformer oil, grease, lubricants, hydraulic fluid etc. and other consumables which are necessary for cleaning/ flushing including erection, testing and commissioning the machines.

Necessary tools and tackles for each machine required for maintenance, testing or inspection of the machines or any of the installations on it. List of such spares shall be furnished along with the quotation.

All miscellaneous items and spares required for commissioning of the equipment. The list of such spares shall be furnished along with the quotation.

Supply of insurance spares along with their list for each equipment.

6.2.2.2 Body

The body shall be of fabricated construction suitably stiffened and strengthened against twisting and buckling. It shall be of rugged and robust construction and there shall not be vibration which is harmful to the equipment.

6.2.2.3 Elastic Suspension

The Car shall be provided with suitable designed elastic suspension arrangement.

6.2.2.4 Drive Unit

The equipment shall be supported on wheels mounted in bogies and shall be driven by electric motors through reduction gears. Chain drives shall not be used.

The car shall be provided with eight drive units one each for the eight drive axles. The drive unit shall be designed in such a way that even with One drives declutched, the TCP shall be able to handle a rake of 58 loaded wagons in emergency.

Each of the axles shall be driven independently set of driving arrangement and each set of drive arrangement shall be complete with electric motor, reduction gear unit, coupling, brake, etc., together with a base frame to support the drive arrangement for each driving axle. The drive unit

shall be suitably suspended from the main frame to absorb the shocks on the main frame. Seats for gearbox, motor, bearing pedestal, brake etc., shall be machined. Shock absorbers shall be provided for the drive units to take care of vibration.

The drive shall be variable type achieved through AC Squirrel Cage motor with control through VVVF. The travel speed shall be 0.5m/s with loaded rake and 2m/s in empty condition in both forward and reverse direction.

6.2.2.5 Wheel & Axle Set

The Car shall be provided with wheel and axles sets fitted with anti friction bearing as used in Indian Railways.

6.2.2.6 Gearing And Gear Box

All gears shall be completely enclosed in gear casing, which shall be firmly attached to a rigid frame. Gear shall be of carbon or alloy steel having machine cut teeth. Installation of gearboxes shall be such that there is sufficient space available for their maintenance.

6.2.2.7 Coupling

Gear coupling with crowned teeth/ any other suitable coupling should be used and the coupling shall be designed to withstand the torque of the drive motor encountered during operation of the TCP. Couplings shall be suitable for quick reversal of the TCP.

6.2.2.8 Brake

D.C. electromagnetic brake/ Double shoe disc brakes shall be provided for all the drives. In addition to the above brakes a hand-operated brake shall be provided for parking and emergency use. The brake shall be suitable for stopping the machine within short distance.

6.2.2.9 Machinery Compartment

Machinery Compartment shall be of fabricated construction and shall be located on the main frame. This cabin shall house all the electrical equipments, components and pneumatic equipment, if any. This should also be fitted with ventilation louvers of adequate size.

6.2.2.10 Buffers

The TCP shall be provided with buffers suitable to match with standard IRS buffers.

6.2.2.11 Couplers

The TCP shall be provided with couplers suitable to match with AAR type IRS couplers. It shall be suitable for all type of railway wagons mentioned in scope of work.

6.2.2.12 Access Platform

One access platform and ladder shall be provide on the rear side of the TCP. The ladder shall be provided on both the sides of the access platform and from both ends of the TCP so that approach to the equipment can be made from both ends and both sides of the TCP.

6.2.2.13 Parking Zone

Pusher Car parking zone shall be properly covered and welding sockets and power supply along with one no.heavy duty welding machine shall be provided.

6.2.2.14 Current Collection System

The current collection system shall be fed through Pantograph mounted on the car from overhead electric power line and the pusher car will run on the same rail track. Alternatively power may be considered through DSL system.

6.2.2.15 Design Parameters

The electric pusher car shall be designed based on the following technical requirements/ data. The track layout drawing on which the EPC shall operate is enclosed with the T.S.

1	Total weight of loaded rake of 58 railway wagons to be pulled/ pushed by Pusher Car	:	7000T
2	Type of wagons to be handled by Car	:	Wagons mentioned under Cl.03.02.01
3	Travel speed	:	2m/s
4	Pushing/ pulling speed with loaded wagons	:	0.5 M/sec (Infinitely variable)
5	Range of travel on track	:	700 M approx. (for each track)
6	Inclination of track	:	1 m in 1000m and assisting the movement of Pusher Car towards wagon tippler
7	Radius of curvature of the track	:	400 m
8	Rail size	:	52 kg rail on pre stressed concrete sleepers
9	Turn out	:	1 in 8.5 over steel sleeper
10	Track gauge	:	1676 mm
11	No. of axles/ drives	:	8- Each axle shall be provided with independent drive. Capacity of the drives shall be such that Car shall be able to handle rake of 58 loaded wagons in emergency even when one drive is declutched.
12	No. of wagons to be positioned inside the wagon tippler for tippling	:	20 wagons/ hr.
13	Type of drive	:	415V, 3 phase, AC Squirrel Cage motor.
14	Current collection	:	Through Pantograph /DSL
15	Brake	:	DC electromagnetic
16	Control	:	VVVF control for Sq.Cage motor.
17	Duty	:	Heavy

6.2.3 Wagon Tippler

1 (one) no. Rotaside Wagon Tippler with hydraulic clamping for guaranteed 20 tips/hr. complete with.

- Tippler Table with rails, end frame with necessary rack segments, side beam with rubber pads.
- Wagon Tippler hydraulic drive with cylinders, power pack, necessary hoses etc.
- Hydraulic clamping system with cylinders, power pack, necessary hoses etc.
- Vibrator assembly mounted on tippler.
- All foundation bolts.
- Control Cabin wherefrom the Wagon tippler and Pusher Car can be operated jointly or independently.
- Separate water spray system shall be provided for sprinkling water on the material in the wagon just before entering the wagon tippler.
- Any other item / accessory / fixtures to complete supply of the equipment.
- Emergency stopper for inhaul wagon rake
- Dust suppression system.
- All related electrics and electrical equipment.
- Supply of Wagon Tippler shall be complete with its structural, mechanical and electrical components and standard accessories mentioned in the T.S.
- Tippler Table with rails, end frame with necessary rack segments, side beam with rubber pads.

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Supply of a tool box with the Wagon Tippler, necessary tools like torque wrench, a set of spanners, screw drivers, hand grease gun, portable hydraulic jack etc. A list of all such tools shall be furnished along with the quotation.

Supply of all the commissioning spares required for successful commissioning of the equipment. The list of such spares shall be furnished along with the quotation.

Supply of initial requirement of oil, lubricants & cleaning/flushing fluid including replenishment during erection, testing and commissioning of the equipment.

Supply of spares for two years normal operation and maintenance of the side arm charger and wagon tippler. The list of such spares along with their item wise price shall be furnished.

Supply of Insurance spares along with their list.

Statutory approval shall be taken by the Supplier for the equipment being supplied by them from relevant state/Central authorities.

6.2.3.1 Application

Rotaside Wagon Tippler shall be used for mechanised unloading of broad gauge wagons as described in chapter 05 carrying raw materials such as lump iron ore, iron ore fines, Mn ore, Quartzite, limestone, Dolomite etc.

The wagon tippler shall be fed with loaded wagons one by one by a Pusher Car. Tippled empty wagons shall be collected on the empty side by ejection while placing loaded wagons on the tippler. The wagon tippler shall unload the materials into receiving hoppers for onward transportation to stock yard.

6.2.3.2 Specification

The Wagon Tippler shall be of robust construction and designed for continuous duty. Wagons shall be clamped automatically by a hydraulic actuated system, and shall be suitable for all types of wagons envisaged in Chapter 05. The geometry of the clamping system shall be designed to accommodate dimensions of full range of wagons mentioned above.

The tippler shall consist of the following:

- A cradle consisting of a pair of heavy welded steel plate and sector rigidly connected by a large torsion box girder fitted at each end with pivot shafts. The whole cradle shall be carried on these pivot shafts mounted in spherical bronze bearings, in turn mounted on fabricated steel pedestals.
- A rail table carried on a roller in a slotted bearing supported from an extension of the end sectors.
- Four transverse top clamp beams which shall be carried on arms pivoted from the main torsion box girder. These arms shall be connected at their lower end to a ballast box which shall carry pawls for mechanical locking.
- Drive unit with hydraulic power pack etc.
- To cope with occasional jamming of sticky material, the top clamps shall be automatically locked while the wagon is in inverted position, and disengage automatically as the tippler returns the wagons to its normal upright position.
- The drive design shall incorporate controlled hydraulic drive and shall be controlled from remote control post.
- The bearing shall be of antifriction type and equipped with dust seal. Adequate platforms shall be provided around tippler for ease of maintenance.
- The arrangement of the equipment shall offer convenient access for inspection and maintenance of all parts. Access ladders, working platforms, safety hand railings of min 1000 mm height shall be provided wherever required. All edges and openings shall be provided with toe-guards. Safety devices such as limit switches and mechanical stops shall be incorporated so as to ensure rotation of tippler with in limits.
- shall be provided for the tippler. However, all parts of the equipment needing manual lubrication shall be easily accessible. All oil pipes and grease nipples shall be well covered to prevent damage from materials from falling on them.
- The tippler shall be interlocked electrically with Pusher Car and succeeding equipment (feeders, conveyers etc.) with respect to operational and safety requirements.

Technical Paramenter

Quantity	:	01 (for Ore/fines,Limestone, Quartzite, Mn Ore etc.)
Type	:	Hydraulic Rotaside, indoor type
Type of wagon	:	As described in Chapter 05
Capacity	:	135 t gross with axle load=30t
No. of tips/hour	:	20
Rail gauge	:	1676 mm
Angle of tippling	:	Minimum 175 deg. anti clockwise looking from wagon entry side.
Duty	:	24 hrs/day (continuous)
Type of clamping	:	Hydraulic
Type of drive	:	Hydraulic motor
Vibrators	:	Electro magnetic type 2 nos

6.3 Twin Boom Stacker

6.3.1 Scope of Work

The scope of work of the Tenderer shall consist of design, engineering, manufacture, inspection, assembly shop testing, painting at manufacturer's shop as well as at site after erection, supply at site including dismantling for transportation, packing, loading and transportation, receipt at site, erection testing and commissioning of the

following items at Plant site.

The equipment supply shall be complete in all respects including its structural, mechanical and electrical components and standard accessories such as electricals, flexible trailing power and control cables with cable reeling drum etc.

All items essential for the desired operation of these equipment whether specifically mentioned in this specification or not, shall be included in the scope of work of the Tenderer.

The scope of work shall stand supplemented by such details as are given in this specification, tender drawing, or any other part of the tender document.

All electrics/ electrical equipment as indicated under relevant clauses.

6.3.2 Technical Specification

6.3.2.1 General

The equipment covered in this specification, 3 nos. shall be installed in the Raw material handling system (RMHS) new yards and one in the existing yard.

All equipment shall be designed for out door duty and shall be complete with mechanical, structural, power supply, conveyors, chutes, drives, controls etc.

6.3.2.2 Stacker

The stacker shall be of Twin boom, luffing type and shall be provided in the storage yard. Boom conveyor shall be generally at right angle to stacker travel while stacking. The stacker shall receive the material from on- ground yard conveyor through a tripper. The tripper shall be an integral part of yard conveyor and when attached with stacker it will be moving to and fro with the movement of stacker.Height of tripper shall be considered for free flow of material. Boom conveyor shall be provided with luffing motion through a hydraulic gear/winch rope arrangement. It shall be possible to form centrally located stockpile in any boom position. Position indicator shall be provided for luffing.

All motions of the stacker shall be synchronised so that the material is stacked at a uniform rate irrespective of direction of travel of the stacker

Necessary automation in stacker to be made to avoid layer missing and have uniform layer to achieve the targeted composition.

The equipment shall be controlled and operated from an operator's cabin suitably located to give operator a full view of the operating zone in either direction of travel and optimum vision all round. The cabin shall be of totally enclosed type having shatter proof glasses with electrically driven wind shield wipers. Windows shall be moving on hinges to facilitate its cleaning. The cabin shall be provided with adequate lighting, switches, controllers with operator's chair, telephone, air conditioner and circulating fan and two adequately sized Co2 fire extinguishers. A hooter whose sound can be heard from a distance of 300m shall be provided outside the cabin.

6.3.2.3 Mechanical Specification

1. The stacker covered in this specification shall be complete with bogie mounted tripper. The tripper shall have minimum possible height to reduce belt tension and power requirement of the conveyor, on which the machine is mounted. The stacker shall be four corner support type.

2. The design of the bogie and carriages of the equipment shall be such that differential movement of the wheel sets of the machine on two rail tracks resulting in skewing effects does not occur. The traverse bogies shall be provided with material removing guard plate as well as rail cleaners at both ends so that the machine can travel even if there is spillage or overflow of material on rail track and the L.T. drives shall be selected accordingly.

3. Adequate no. of locating pins etc. shall be provided to ensure easy assembly after dismantling of equipment or mechanism etc.

4. All matching parts shall be given identifiable marking for easy erection of the machine.

5. Materials used for equipment's structures shall be of good quality and shall be free from fracture, cracks, blow holes, lamination, pittings etc.

6. Stability of these mobile equipment shall conform to the norms laid down in relevant International Standards.

7. Safe and adequate access with approach for repairs, handling, maintenance and removal of all mechanical and electrical parts shall be ensured without recourse to additional scaffolding. Adequate clearances between the floors shall be provided to facilitate easy maintenance. Also, the clearance between ground and undercarriage shall be kept min. 0.3 m for maintenance purpose.

8. All parts requiring replacement or inspection or lubrication shall be easily accessible without the need for dismantling of other equipment or structures. All electrical cables shall be laid so that they are not liable to damage and can be easily inspected and easily accessible for repair and maintenance.

9. Suitable handling facilities or provisions such as eye bolts, lifting lugs, ladders etc. of adequate capacities shall be provided on the machine at all necessary locations for maintenance of various mechanisms.

10. The boom conveyor shall be designed such that no spillage occurs when the stacker moves opposite to the direction of material flow of yard conveyor.

11. Adequate working space on the platform around all machinery parts shall be provided for personnel working for maintenance or inspection.

12. Safety hand railing preferably of tubular constructions shall be provided around all walk ways. Railing shall not be less than 1000 mm in height with an intermediate member at a height of 500 mm. The minimum size of handrail be 32NB.

13. All edges or openings shall be provided with toe guards. Toe angles or bent plates shall be minimum 100 mm in height.

14. Essential openings, on the platforms or walk - ways shall be covered with removable covers.

15. All moving parts, wherever required from the safety point of view, except long travel gear wheels, shall be provided with covers opening on strong hinges. These covers shall preferably be made of minimum 3 mm thick plate. All heavy covers shall be provided with inspection windows.

16. Sufficient number of power points/outlets shall be provided at suitable places on the equipment to plug in welding transformers and hand tools for maintenance purposes.

17. Standardisation of assemblies shall be carried out to the maximum extent possible.

18. Sizes for all equipment viz. wheels, brakes etc. shall be selected from preferred number series and shall be of reputed make.

19. The design of the equipment shall ensure that there is no spillage of material on any part of the equipment. Dust covers shall be provided for all motors, gear boxes, drums etc.

20. End limit switches and over run limit switches shall be provided at both the ends of the travels for all machines. The corresponding strikers shall also be supplied by the supplier.

21. The machines shall be provided with adequate nos of buffers

6.3.2.4 Drives

1. The long travel mechanism drive shall be provided with multiple drives on each side. In the event of failure, any drive motor, the corresponding motor on the other side shall be automatically disconnected. However, the machine shall be operatable with the remaining drives.

2. Protection against overloads shall be provided through suitable control system. The control system shall ensure smooth acceleration for all motions and variable speeds.

3. The equipment shall be supported on wheels mounted in bogies and shall be driven by electric motors through reduction gears. Chain drives and open gears shall not be used.

4. For long travel motion individual wheel drive shall be provided. Minimum 50% of the long travel wheels shall be positively driven.

5. For travel motion, rotating axle drive arrangement with 'L' type supports shall be provided.

6. The under carriages shall be fitted with substantial number of safety stops to prevent the equipment from falling more than 25 mm in the event of breakage of a track wheel, bogie or axle. These safety stops shall not interfere with the removal of wheels.

7. At suitable points, built in arrangement shall be provided for easy replacement of heavy electrical equipment and boom conveyor belts. Built in jacking up arrangement for bogie, frame etc. for changing of wheels and lifting provision for cable reeling drums and other heavy parts shall also be provided.

8. The under carriage shall have statically determinate support system to ensure its stability and to afford an evenly distributed load over the entire travel assemblies and to cater to any unevenness in the level of the rails.

6.3.2.5 Gears and Gear Boxes

1. Straight and helical, spur gearing shall be used. Worm gears shall not be used unless specified otherwise All spur gears shall have 20 degree pressure angle with involute teeth profile.

2. First and high speed reductions shall be through helical gears only.

3. All first reduction pinions and also other pinions, if feasible, shall be integral with the shafts.

4. Overhung or split gears and pinions shall not be used unless specifically called for.

5. All gears shall be of hardened and tempered alloy or carbon steel with machine cut teeth. Surface hardness for pinion shall be 255 to 300 BHN and for gear it shall be 220 to 225 BHN. Difference in hardness of pinion and gear shall not be less than 20 BHN. The gear teeth shall be ground and finished to suit the service conditions.

6. Gear teeth shall be cut in metric module system only.

7. All gears shall be completely enclosed in oil tight designs or guarded by covers firmly attached to rigid supports where complete enclosure is not possible.

8. All gear shafts shall be supported in bearings mounted in gear box.

9. In case of totally enclosed gear boxes splash or automatic lubrication system shall be used.

10. The housing for Gear boxes shall be of cast steel or fabricated. Fabricated gear boxes shall be made of minimum 8 mm thick steel plate and shall be stress relieved.

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

12. Directly above the mesh line of teeth, hand-holes with bolted covers be provided in the gear box body for inspection of the teeth.

13. The gear boxes shall be provided with breather vents, oil level indications, dip sticks and easily accessible drain plugs.

14. Radial clearance between the gear box inner surface and the outside diameter of the gear shall be at least 1.25 times the depth of the largest gear tooth inside the gear box or 20 mm whichever is higher. The facial or side clearance between the inner surface of the gear box and the face of the gear or pinion shall be at least 20 mm.

15. Bearings shall be housed in gear box/bosses or shall be mounted in cartridges held in place by top bolts and flanges. Suitable oil seals shall be provided at all required places in the gear box.

16. Oil pumps with filters etc. shall be used if vertical gearing exceeds two reductions. On horizontal gearing, the oil level shall be above the smallest gear.

17. All gear boxes shall be mounted on machined surfaces and shall have machined feet. Shims shall not be used.

18. Gear boxes shall be provided with lugs or other means for lifting purposes.

19. Interior of all gear box housing shall be sand blasted. Suitable resistance paint matching to the lubricant used shall be applied inside the gear box.

20. External cooling arrangement shall be provided wherever required to dissipate the heat generated inside the gear box. However, external cooling coils shall be avoided.

6.3.2.6 Bearings and Plummer Blocks

1. All bearing housings shall be made cast or wrought steel. Housings shall be of split type constructions to permit easy removal of shaft. The underside of the base of each pedestal shall be machined and shall bear upon machined surface.

2. Rated life of ball and roller bearings shall be designed for B -10 life of not less than 40,000 hours.

3. Plummer block housings shall be oriented on the supporting structure in such a manner that no shaft loads are transmitted to the housing cap.

4. Plummer block shall have provision for lubrication. Suitable oil seals shall be provided wherever necessary.

5. Anti friction ball or roller bearings of specified make only shall be used throughout.

6. Heavy caps shall be provided with means for lifting.

6.3.2.7 Couplings

1. Couplings shall be designed to suit the maximum torque required to be transmitted or to suit the total braking torque of the mechanism whichever is greater.

2. Fluid couplings shall be provided on input shafts of the motor of 30 KW & higher ratings. Geared coupling with crowned teeth or resilient type coupling shall be used on input shaft of motor of less than 30 KW and also on the output shaft of gear boxes. Any other special coupling which can give better and more reliable service may be used after obtaining the specific approval of the purchaser.

3. High speed couplings shall be selected of a natural frequency such that no resonance can occur at any operational speed.

6.3.2.8 Brakes

1. Only D.C. Electro magnetic brakes shall be used unless specified otherwise.

2. Double shoe brake shall be provided for each drive and shall be mounted on the input pinion of the gear train. The brake shoes shall be of hinged type. Brake levers shall be forged or fabricated or of cast steel. Hinge pins shall be of hardened alloy steel and shall be lubricated. These hinge pins shall be provided with steel bushes at bearing points.

3. Brake drums shall be forged or of cast steel and shall be completely machined and dynamically balanced. Width of the brake drum selected shall be 10 mm more than the width of the brake shoes on each side. Hardness of the brake drum shall be 300 to 350 BHN.

4. Rating of brakes for all mechanisms shall be selected as per required braking moment necessary for each mechanism with factor of safety and the required heat dissipation capacity.

5. Brakes shall be installed such that these are easily approachable for servicing.

6. In order to obtain low deceleration, the brakes of long travel drives of the machines shall close successively.

7. The service factor shall be 1.5 on motor (mechanical output) for selection of all gear-boxes/ couplings, brakes etc.

6.3.2.9 Long Travel Wheels

1. The wheels shall be double flanged with straight tread, and shall be either of forged, rolled or cast steel. Clearances between rail head and wheel flanges shall be suitable to the tolerances as given in clause no. 02.06 of this tender document.

2. Wheels shall be heat treated to have a hardness of BHN-300 to 350 on the rolling surface and flanges to a depth of not less than 10 mm with a smooth pass to the non hardness zone.

3. Minimum diameter of the wheels shall be 630 mm. Complete wheel bogies shall be interchangeable with each other.

6.3.2.10 Rail Clamps and Anemometer System

a) The machines shall be protected against drift due to wind by means of two electric/ hydraulic operated (one on each rail) rail clamps and two hand operated rail clamps.

b) Wind anemometer with suitable controls shall be provided to warn the operator of high wind velocities and stormy conditions. (The equipment shall be built to withstand wind velocity upto 180 km/hr., when not operating).

c) The electrical/ hydraulic operated rail clamps shall be designed to operate automatically when the machine is switched off. These rail clamps shall also be designed to be operatable remotely from the operator's cabin.

d) The automatic rail clamps shall be such that when wind velocity is higher than a predetermined value, the machine will be automatically shut down and the rail clamps applied.

e) The automatic and manual rail clamps shall be equipped with limit switches to monitor their operations. The long travel shall not be possible to start until and unless these clamps are in released position.

6.3.2.11 Luffing System

1. Hydraulic/Winch rope luffing of the booms shall be provided for stacker with following respective ranges luffing : (+) 14 to (-) 10 deg.

2. Two pumps, two electric motors with dual line system shall be provided to ensure that in the event of one of the drive unit failing, full operation can be maintained without interruption. Failure of any drive unit shall produce audio visual alarm in the operator's cabin.

3. The acceleration and deceleration or raising and lowering the boom shall be smooth and operation shall be without giving any jerk to the boom.

4. The design and construction of hydraulic system shall be suitable to operate in the atmospheric conditions and dusty operating environment of the plant. The system shall be complete and consist of hydraulic fluid, various kinds of valves, accumulators, hydraulic motors/ hydraulic pumps, various accessories such as filters, strainers, magnet and restructures, hydraulic pipe work, fittings and fluid passages, flexible pipe work, sealing devices, instruments for indicating various parameters such as pressure, temperature etc., control devices for local and automatic operation of the system, safety devices and alarm for abnormal operating conditions, interlocks for sequencing and safe operations.

5. The hydraulic system/ components shall be designed / selected so that the working pressure shall not exceed 180 bars.

6. The hydraulic circuit shall be designed to minimise surge pressure. Suitable accumulators of adequate size shall be used to withstand maximum rate of surge pressure rise as well as the back surge pressure. All components shall be capable of withstanding the peak pressure.

7. Necessary connections, valves, outlines and apparatus shall be provided to facilitate testing, flushing, drainage, fluid sampling and repair & maintenance.

8. A suitable capacity reservoir with provisions for oil filling, air breathing, drawing, and inspection shall be provided.

9. The reservoir shall be designed to prevent the ingress of any foreign materials including water and dust.

10. Inner face of the reservoir shall be sand blasted and shall be suitably painted, so that it does not have any adverse effect on hydraulic fluid used.

11. Suitable level indicators shall be provided in the reservoir. Low level of the fluid in the reservoir shall produce warning alarm in the operator's cabin and switch off the hydraulic pumping unit.

12. Pump and pump motor shall be designed to operate under load conditions at a minimum of 125% of system operating pressure and give a flow rate of 125% of system operating flow rate.

13. Lockable type valves shall be provided to prevent tampering.

14. All hydraulic valves, accessories and devices shall be provided with identification metal tags.

15. Necessary relief valve shall be provided to protect the hydraulic system from excessive pressure. The fluid leaked through the relief valve shall be suitably carried to the reservoir. The overload of the system in raising or lowering of the boom shall give necessary warning signal in the operator's cabin.

6.3.2.12 Belt Conveyor

For Detailed Specification of Belt Conveyors and related equipment,
refer General Technical Specification GTS

6.3.2.13 Lubrication

Centralised system of lubrication shall be provided for the equipment. However, all parts of the equipment needing manual lubrication shall be easily accessible. All oil pipes and grease nipples shall be well covered to prevent damage from materials from falling on them.

6.3.2.14 Safety Provisions

1. Machines included under this specification shall be equipped with adequate safety devices and provided with adequate working clearances all around the equipment fitted on the machines to comply with the purchaser's specific requirements, safety codes and statutory regulations prevalent at the place of installation.

2. Adequate numbers of fire extinguishers and fire extinguishing systems suitable for prevention of electrical fire as per safety rules shall be provided in the operator's cabins, electrical rooms and in other areas considered necessary.

3. Adequate numbers of fire extinguishers and sand buckets shall be provided at suitable locations for preventing fire hazards.

4. Suitable fire alarm with fire detectors shall be provided for the electrical premises.

5. The fire protection systems shall comply with provisions made by tariff advisory committee, a statutory body under Insurance Act 1938, and also conform to Indian Explosives Act, Indian Factories Act etc.

6.3.2.15 Steel Structures

The structures shall be designed and fabricated in accordance with IS: 800-2000 taking the following additions/ deviations into account.

1. All steel structures and the portal frames shall be of box construction with double web plate girder. The span to depth ratio shall not exceed

18. For box plate girders, all diaphragms shall bear against the top flanges.

2. The box girder shall be so constructed as to eliminate accumulation of water or oil inside it.

3. Structural steel conforming to IS: 2062-1992 only shall be used.

4. Electrodes of low hydrogen type only shall be used for welding of steel structures which are subject to dynamic loading.

5. Parts of steel frame carrying machinery shall be provided with doubling plates of adequate thickness welded and machined to true surface.

6. All bolts except those with nylon nuts shall be provided with grip lock nuts and/or spring washers.

7. For side alignments of motors, strong adjustable screws with lock nuts and sliding blocks shall be provided.

8. Welded snugs shall be fitted at pedestals, gear boxes etc. for alignment.

9. Stud or body bolts shall not be used as fasteners for mechanical items except for fixing inspection covers.

10. Design of the structures for these equipment shall take into account the following factors and shall have ample precautions taken to withstand the following.

i) Reinforcement of the natural sway of the structure due to unbalanced dynamic oscillations of the machines.

ii) Fatigue produced in the members due to frequent stress reversals.

iii) All impact loads, super-imposed loads and loads due to wind.

Boom and tripper conveyors shall be provided with guards to prevent belt warp in windy conditions.

6.3.2.16 Technical Parameter of Twin Booms Stacker

Rail mounted self propelled, twin boom, luffing stacker complete with electrics etc. shall be supplied as per the given specification. The main characteristics of the stackers shall be as follows.

1)	Type	:	Rail mounted, self propelled twin boom type.
2)	Nos.	:	03 (New Beds) + one no.in exist bed
3)	Capacity, tph		
	New Beds:		Rated : 1400 (Ore & Flux) Designed : 1680
	Exist Beds:		Rated : 1200 (Ore & Flux) Designed : 1440
4)	Boom length,m	:	To suit the stock-pile width
5)	Track centres. m	:	. 8.0 m
6)	Duty	:	Continuous, 20 hrs/day 350 days a year.
9)	Length of travel	:	To suit the stock-pile width/ length
10)	Travel speed	:	Forward 15 m/ min. Reverse 18.75 m/min
11)	Hoisting speed /Luffing Range (With respect to discharge pulley)	:	2 m/min (approx) To suit the stock-pile width/ length
12)	Cross section of the stock file	:	Triangular/ Trapezoidal
13)	Bottom width of stock pile	:	25.0 m
14a)	Height of stock Pile w.r.t. to rail level.	:	9.0 m
b)	Length of stock pile	:	230.0 m (Ore/Flux)
15)	Material to be handled	:	Iron ore, Iron Ore fines, Lime stone, Dolomite, etc.

16) The height of the boom end shall be automatically adjusted to limit the height of the free fall of the discharge materials. The boom hoist shall automatically get so adjusted that the height of free fall shall not exceed 2m and shall not be less than 1m. However, at the start of pile formation on the ground, the initial height of free fall may be up to 4m.

17) The technical characteristics of yard conveyor. Refer Flow sheet (Drg NoMEC/S/E24F/11/17/K/01/55/02101)

18) Type of belting and idlers shall be interchangeable with yard conveyor.

19) Before the stacking of material reaches to its topmost height in a particular position, an audio visual signal shall be provided in the cabin to warn the operator to plan for shifting of the machine to the next location.

20) The boom's hoisting movement upwards shall be restricted to maximum limit to prevent it from damaging the stacker structure. However, the provision shall be made to enable the boom end brought to ground for repairs and maintenance by by-passing the operational limit switch that restricts its downward movement.

21) Walkway of minimum 800 mm width grating floor and hand railing shall be provided on both the sides of the conveyor in the tripper car and in the stacking boom, for maintenance purpose.

22) The tripper attached to the stacker shall be of adequate length so as to support maximum possible length of the yard conveyor belt. The maximum inclination shall be 12 degrees.

23) The working inclination of the stacker boom conveyor w.r.t. horizontal shall be within -12 degree to +14 degree. However, it shall be designed such that the boom may be lowered to touch the ground or raised upto +20 degree.

24) Electrical room shall be Air Conditoned type

25) Press to talk system shall be provided.

26) Over travel device (non contact type) shall be provided

27) Auto tension trip device shall be provided for cables.

6.3.2.17 Codes and Standards

_ The equipment shall be designed and selected keeping in view the facility for inspection, cleaning, replacement and repair and for use where continuity of operation and safety are first considerations.

_ The equipment shall conform to the latest Indian Electricity Rules and Regulations as regards safety requirements, earthing and other essential provisions specified therein. They shall also comply with the statutory requirements.

_ The design, manufacture, testing as well as performance of the equipment covered in this specification shall comply with the latest editions of the following standards and safety codes.

a) Mechanical

IS:11592-2000	:	Code of practice for selection and design of belt conveyors.
IS:4776(Part-I) Reaffirmed 1991)	:	Specification for Troughed 1977 belt conveyors.
IS:1891(Part - I) 1994	:	Specification for Rubber Conveyor and Elevator Belting
IS:7403-1974 (Reaffirmed 1991)	:	Code of practice for selection of standard worm and helical gear boxes.
IS:8531-1986 (Reaffirmed 1993)	:	Specification for pulleys for Belt Conveyors.
IS:9295-1983 (Reaffirmed 1990)	:	Specification for Steel Tubes for Idlers for Belt Conveyors.
IS:1570-1961	:	Specification for schedules for wrought steels for general engineering purposes.
IS:8598-1987 (Reaffirmed 1993	:	Specification for Idlers and Idler sets for belt conveyors.
IS:2266-1989	:	Specification for steel wire ropes for general engineering purposes.
IS:2365-1977 (Reaffirmed 1991)	:	Specification for steel wire suspension ropes for lifts, elevators and hoists.
IS:3459-1977 (Reaffirmed 1991)	:	Specification for small wire ropes.
IS:210-1993	:	Specification for gray iron castings.
IS:1030-1989	:	Specification for carbon steel castings for general engineering purposes.
IS:2062-1992	:	Weldable structural steel
IS:7155-1986	:	Code of practice for conveyor safety
IS:3443-1980	:	Specification for rails
IS:3181-1992	:	Specification for fire resistant conveyor belting for underground use in coal mines.
IS:8535-1987	:	Specification for Flat Counter Sunk Nib Bolts
IS:7423-1974	:	Dimensions for Apron Conveyors
IS:5895-1985	:	Specification for steel roller conveyors

In the event the requirements of this specification exceeds the requirement stipulated in the corresponding standards, regulation, safety code, the specification shall govern.

In the event of conflict between the standard, regulations and codes, the most stringent one shall govern and the decision of the Purchaser shall be final.

The equipment may be designed as per any other international standard also after prior approval of the Purchaser.

6.4 Bucket Wheel Reclaimer

6.4.1 Scope Of Work (Including Battery Limit)

The scope of work of the Tenderer shall consist of design, engineering, manufacture, inspection, assembly shop testing, painting at manufacturer's shop as well as at site after erection, supply at site including dismantling for transportation, packing, loading and transportation, receipt at site, erection testing and commissioning of the following items at Plant at site.

Supply and installation of resting pads for the boom in the parking zone.

The equipment supply shall be complete in all respects including its structural, mechanical and electrical components and standard accessories such as electricals, flexible trailing power and control cables with cable reeling drum etc.

All items essential for the desired operation of these equipment whether specifically mentioned in this specification or not, shall be included in the scope of work of the Tenderer.

The scope of work shall stand supplemented by such details as are given in this specification, tender drawing, Instructions to the Tenderer, general conditions of contract or any other part of the tender document.

All electrics/ electrical equipment as indicated under relevant clauses.

6.4.2 Technical Specification

6.4.2.1 General

- The equipment covered in this specification shall be installed in the Raw Material Handling System (RMHS) Yard .

- All equipment shall be designed for out door duty and shall be complete with mechanical, structural, power supply, conveyors, chutes, drives, controls etc.

6.4.2.2 Bucket Wheel Reclaimer

1. One number bucket wheel reclaimer will be provided for Limestone, Mn Ore and dolomite. The reclaimer shall be bucket wheel type. The material received from the bucket wheel shall be discharged on the ground conveyor (through the boom conveyor and chutes) for onward supply to consumer shops. The slewing mass of the machine shall be balanced to contain the centre of gravity well within the slew bearing diameter.

2. The equipment shall be controlled and operated from an operator's cabin suitably located on the boom to give operator an full view of the operating zone in either direction of travel and optimum vision all round. The cabin mounted on boom shall have automatic leveling device i.e. the cabin shall always be horizontal irrespective of boom inclination. The cabin shall be of totally enclosed type having shatter proof glasses with electrically driven wind shield wipers. Windows shall be moving on hinges to facilitate its cleaning. The cabin shall be provided with adequate lighting, switches, controllers with operator's chair, telephone, air conditioner and circulating fan and two adequately sized Co2 fire extinguishers. A hooter whose sound can be heard from a distance of 300m shall be provided outside the cabin.

6.4.2.3 Mechanical Specification

1. The design of the bogie and carriages of the equipment shall be such that differential movement of the wheel sets of the machine on two rail tracks resulting in skewing effects does not occur. The traverse bogies shall be provided with material removing guard plate as well as rail

cleaners at both ends so that the machine can travel even if there is spillage or overflow of material on rail track and the LT drives shall be selected accordingly.

2. Adequate no. of locating pins etc. shall be provided to ensure easy assembly after dismantling of equipment or mechanism etc.

3. All matching parts shall be given identifiable marking for easy erection of the machine.

4. Materials used for equipment's structures shall be of good quality shall be free from fracture, cracks, blow holes, lamination, pittings etc.

5. Stability of these mobile equipment shall conform to the norms laid down in relevant International Standards.

6. Safe and adequate access with approach for repairs, handling, maintenance and removal of all mechanical and electrical parts shall be ensured without recourse to additional scaffolding. Adequate clearances between the floors shall be provided to facilitate easy maintenance. Also, the clearance between ground and undercarriage shall be kept min. 0.3 m for maintenance purpose.

7. All parts requiring replacement or inspection or lubrication shall be easily accessible without the need for dismantling of other equipment or structures. All electrical cables shall be laid so that they are not liable to damage and can be easily inspected and easily accessible for repair and maintenance.

8. Suitable handling facilities or provisions such as eye bolts, lifting lugs, ladders etc. of adequate capacities shall be provided on the machine at all necessary locations for maintenance of various mechanisms.

9. Adequate working space on the platform around all machinery parts shall be provided for personnel working for maintenance or inspection.

10. Safety hand railing preferably of tubular constructions shall be provided around all walk ways. Railing shall not be less than 1000 mm in height with an intermediate member at a height of 500 mm. The minimum size of handrail be 32NB.

11. All edges or openings shall be provided with toe guards. Toe angles or bent plates shall be minimum 100 mm in height.

12. Essential openings, on the platforms or walk- ways shall be covered with removable covers.

13. All moving parts, wherever required from the safety point of view, except long travel gear wheels, shall be provided with covers opening on strong hinges. These covers shall preferably be made of minimum 3 mm thick plate. All heavy covers shall be provided with inspection windows.

14. Sufficient number of power points/outlets shall be provided at suitable places on the equipment to plug in welding transformers and hand tools for maintenance purposes.

15. Standardisation of assemblies shall be carried out to the maximum extent possible.

16. Sizes for all equipment viz. wheels, brakes etc. shall be selected from preferred number series and shall be of reputed make.

17. The design of the equipment shall ensure that there is no spillage of material on any part of the equipment. Dust covers shall be provided for all motors, gear boxes, drums etc.

18. End limit switches and over run limit switches shall be provided at both the ends of the travels for all machines. The corresponding strikers shall also be supplied by the supplier.

19. The speed of the boom conveyor shall be in line with the speed of the yard conveyor.

20. The machines shall be provided with adequate nos of buffers

6.4.2.4 Drives

1. The long travel mechanism drive shall be provided with multiple drives on each side. In the event of failure, any drive motor, the corresponding motor on the other side shall be automatically disconnected. However, the machine shall be operable with the remaining drives.

2. Protection against overloads shall be provided through suitable control system. The control system shall ensure smooth acceleration for all motions and variable speeds.

3. The equipment shall be supported on wheels mounted in bogies and shall be driven by electric motors through reduction gears. Chain drives and open gears shall not be used.

4. For long travel motion individual wheel drive shall be provided. Minimum 50% of the long travel wheels shall be positively driven.

5. For travel motion, rotating axle drive arrangement with 'L' type supports shall be provided.

6. The under carriages shall be fitted with substantial number of safety stops to prevent the equipment from falling more than 25 mm in the event of breakage of a track wheel, bogie or axle. These safety stops shall not interfere with the removal of wheels.

7. At suitable points, built in arrangement shall be provided for easy replacement of heavy electrical equipment. Built in jacking up arrangement for bogie, frame etc. for changing of wheels and lifting provision for cable reeling drums and other heavy parts shall also be provided.

8. The under carriage shall have statically determinate support system to ensure its stability and to afford an evenly distributed load over the entire travel assemblies and to cater to any unevenness in the level of the rails.

9. The reclaimer platform shall be supported on the turn table by a ball race slewing bearing with an external toothed rim. The slewing drive shall be of hydraulic type with integral hydraulically operated brake and prortioning valve to ensure smooth motion of the turn table during stoppage and reversal.

10. The output shaft of the hydraulic drive shall be equipped with a pinion, meshing with the toothed rim of the slewing bearing.

6.4.2.5 Gears and Gear Boxes

1. Straight and helical, spur gearing shall be used. Worm gears shall not be used unless specified otherwise All spur gears shall have 20 degree pressure angle with involute teeth profile.

2. First and high speed reductions shall be through helical gears only.

3. All first reduction pinions and also other pinions, if feasible, shall be integral with the shafts.

4. Overhung or split gears and pinions shall not be used unless specifically called for.

5. All gears shall be of hardened and tempered alloy or carbon steel with machine cut teeth. Surface hardness for pinion shall be 255 to 300 BHN and for gear it shall be 220 to 225 BHN. Difference in hardness of pinion and gear shall not be less than 20 BHN. The gear teeth shall be ground and finished to suit the service conditions.

6. Gear teeth shall be cut in metric module system only.

7. All gears shall be completely enclosed in oil tight designs or guarded by covers firmly attached to rigid supports where complete enclosure is not possible.

8. All gear shafts shall be supported in bearings mounted in gear box.

9. In case of totally enclosed gear boxes splash or automatic lubrication system shall be used.

10. The housing for Gear boxes shall be of cast steel or fabricated. Fabricated gear boxes shall be made of minimum 8 mm thick steel plate and shall be stress relieved.

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

12. Directly above the mesh line of teeth, hand-holes with bolted covers be provided in the gear box body for inspection of the teeth.

13. The gear boxes shall be provided with breather vents, oil level indications, dip sticks and easily accessible drain plugs.

14. Radial clearance between the gear box inner surface and the outside diameter of the gear shall be at least 1.25 times the depth of the largest gear tooth inside the gear box or 20 mm whichever is higher. The facial or side clearance between the inner surface of the gear box and the face of the gear or pinion shall be at least 20 mm.

15. Bearings shall be housed in gear box/bosses or shall be mounted in cartridges held in place by top bolts and flanges. Suitable oil seals shall be provided at all required places in the gear box.

16. Oil pumps with filters etc. shall be used if vertical gearing exceeds two reductions. On horizontal gearing, the oil level shall be above the smallest gear.

17. All gear boxes shall be mounted on machined surfaces and shall have machined feet. Shims shall not be used.

18. Gear boxes shall be provided with lugs or other means for lifting purposes.

19. Interior of all gear box housing shall be sand blasted. Suitable resistance paint matching to the lubricant used shall be applied inside the gear box.

20. External cooling arrangement shall be provided wherever required to dissipate the heat generated inside the gear box. However, external cooling coils shall be avoided.

6.4.2.6 Bearings and Plummer Blocks

1 All bearing housings shall be made cast or wrought steel. Housings shall be of split type constructions to permit easy removal of shaft. The underside of the base of each pedestal shall be machined and shall bear upon machined surface.

2 Rated life of ball and roller bearings shall be designed for B-10 life of not less than 40,000 hours.

3 Plummer block housings shall be oriented on the supporting structure in such a manner that no shaft loads are transmitted to the housing cap.

4 Plummer block shall have provision for lubrication. Suitable oil seals shall be provided wherever necessary.

5 Anti friction ball or roller bearings of specified make only shall be used throughout.

6 Heavy caps shall be provided with means for lifting.

6.4.2.7 Couplings

1 Couplings shall be designed to suit the maximum torque required to be transmitted or to suit the total braking torque of the mechanism whichever is greater.

2 Fluid couplings shall be provided on input shafts of the motor of 30 KW & higher ratings. Geared coupling with crowned teeth or resilient type coupling shall be used on input shaft of motor of less than 30 KW and also on the output shaft of gear boxes. Any other special coupling which can give better and more reliable service may be used after obtaining the specific approval of the Purchaser.

3 High speed couplings shall be selected of a natural frequency such that no resonance can occur at any operational speed.

6.4.2.8 Brakes

1 Only DC Electro magnetic brakes shall be used unless specified otherwise.

2 Double shoe brake shall be provided for each drive and shall be mounted on the input pinion of the gear train. The brake shoes shall be of hinged type. Brake levers shall be forged or fabricated or of cast steel. Hinge pins shall be of hardened alloy steel and shall be lubricated. These hinge pins shall be provided with steel bushes at bearing points.

3 Brake drums shall be forged or of cast steel and shall be completely machined and dynamically balanced. Width of the brake drum selected shall be 10 mm more than the width of the brake shoes on each side. Hardness of the brake drum shall be 300 to 350 BHN.

4 Rating of brakes for all mechanisms shall be selected as per required braking moment necessary for each mechanism with factor of safety and the required heat dissipation capacity.

5 Brakes shall be installed such that these are easily approachable for servicing.

6 In order to obtain low deceleration, the brakes of long travel drives of the machines shall close successively.

7 The service factor shall be 1.5 on motor (mechanical output) for selection of all gear-boxes/ couplings, brakes etc.

6.4.2.9 Long Travel Wheels

1 The wheels shall be double flanged with straight tread, and shall be either of forged, rolled or cast steel.

2 Wheels shall be heat treated to have a hardness of BHN-300 to 350 on the rolling surface and flanges to a depth of not less than 10 mm with a smooth pass to the non hardness zone.

3 Minimum diameter of the wheels shall be 630 mm. Complete wheel bogies shall be interchangeable with each other.

6.4.2.10 Rail Clamps and Anemometer System

a) The machines shall be protected against drift due to wind by means of two electric/ hydraulic operated (one on each rail) rail clamps and two hand operated rail clamps.

b) Wind anemometer with suitable controls shall be provided to warn the operator of high wind velocities and stormy conditions. (The equipment shall be built to withstand wind velocity upto 180 km/hr., when not operating).

c) The electrical/ hydraulic operated rail clamps shall be designed to operate automatically when the machine is switched off. These rail clamps shall also be designed to be operatable remotely from the operator's cabin.

d) The automatic rail clamps shall be such that when wind velocity is higher than a predetermined value, the machine will be automatically shut down and the rail clamps applied.

e) The automatic and manual rail clamps shall be equipped with limit switches to monitor their operations. The long travel shall not be possible to start until and unless these clamps are in released position.

6.4.2.11 Luffing and slewing Hydraulic System

1. Hydraulic luffing and slewing of the boom shall be provided for reclaimer with following respective ranges

luffing : (+) 7 to (-) 12 deg.

Slewing : 300 deg. (150 deg. On either side of the track)

2. Two pumps, two electric motors with dual line system shall be provided to ensure that in the event of one of the drive unit failing, full operation can be maintained without interruption. Failure of any drive unit shall produce audio visual alarm in the operator’s cabin.

3. The acceleration and deceleration or raising and lowering the boom shall be smooth and operation shall be without giving any jerk to the boom.

4. The design and construction of hydraulic system shall be suitable to operate in the atmospheric conditions and dusty operating environment of the plant. The system shall be complete and consist of hydraulic fluid, various kinds of valves, accumulators, hydraulic motors/ hydraulic pumps, various accessories such as filters, strainers, magnet and restructures, hydraulic pipe work, fittings and fluid passages, flexible pipe work, sealing devices, instruments for indicating various parameters such as pressure, temperature etc., control devices for local and automatic operation of the system, safety devices and alarm for abnormal operating conditions, interlocks for sequencing and safe operations.

5. The hydraulic system/ components shall be designed/selected so that the working pressure shall not exceed 180 bars.

6. The hydraulic circuit shall be designed to ıinimize surge pressure. Suitable accumulators of adequate size shall be used to withstand maximum rate of surge pressure rise as well as the back surge pressure. All components shall be capable of withstanding the peak pressure.

7. Necessary connections, valves, outlines and apparatus shall be provided to facilitate testing, flushing, drainage, fluid sampling and repair & maintenance.

8. A suitable capacity reservoir with provisions for oil filling, air breathing, drawing, inspection shall be provided.

9. The reservoir shall be designed to prevent the ingress of any foreign materials including water and dust.

10. Inner face of the reservoir shall be sand blasted and shall be suitably painted, so that it does not have any adverse effect on hydraulic fluid used.

15 Suitable level indicators shall be provided in the reservoir. Low level of the fluid in the reservoir shall produce warning alarm in the operator’s cabin and switch off the hydraulic pumping unit.

16 Pump and pump motor shall be designed to operate under load conditions at a minimum of 125% of system operating pressure and give a flow rate of 125% of system operating flow rate.

17 Lockable type valves shall be provided to prevent tampering.

18 All hydraulic valves, accessories and devices shall be provided with identification metal tags.

19 Necessary relief valve shall be provided to protect the hydraulic system from excessive pressure. The fluid leaked through the relief valve shall be suitably carried to the reservoir. The overload of the system in raising or lowering of the boom shall give necessary warning signal in the operator’s cabin.

6.4.2.12 Belt Conveyor and belt weigh scale

For Detailed Specification of Belt Conveyor System Refer General Technical Specification.

6.4.2.13 Lubrication

1 The machines shall be supplied with two separate central lubrication systems:

i) Central lubrication system for the under carriage.

ii) Central lubrication system for the super structure.

2 The lubrication systems shall be complete with grease pumps, double supply lines, direction control valves, the distributors etc.

3 The level of grease in the grease tanks shall be monitored electrically and low level of the grease shall give the audio warning signal in the operator's cabins.

6.4.2.14 Safety Provisions

1. Machines included under this specification shall be equipped with adequate safety devices and provided with adequate working clearances all around the equipment fitted on the machines to comply with the purchaser's specific requirements, safety codes and statutory regulations prevalent at the place of installation.

2. Adequate numbers of fire extinguishers and fire extinguishing systems suitable for prevention of electrical fire as per safety rules shall be provided in the operator's cabins, electrical rooms and in other areas considered necessary.

3. Adequate numbers of fire extinguishers and sand buckets shall be provided at suitable locations for preventing fire hazards.

4. Suitable fire alarm with fire detectors shall be provided for the electrical premises.

5. The fire protection systems shall comply with provisions made by tariff advisory committee, a statutory body under Insurance Act 1938, and also conform to Indian Explosives Act, Indian Factories Act etc.

6.4.2.15 Steel Structures

The structures shall be designed and fabricated in accordance with IS: 800-1984 taking the following additions/ deviations into account.

1 All steel structures and the portal frames shall be of box construction with double web plate girder. The span to depth ratio shall not exceed 18. For box plate girders, all diaphragms shall bear against the top flanges.

2 The box girder shall be so constructed as to eliminate accumulation of water or oil inside it.

3 Structural steel conforming to IS: 2062-1992 only shall be used.

4 Electrodes of low hydrogen type only shall be used for welding of steel structures which are subject to dynamic loading.

5 Parts of steel frame carrying machinery shall be provided with doubling plates of adequate thickness welded and machined to true surface.

6 All bolts except those with nylon nuts shall be provided with grip lock nuts and/or spring washers.

7 For side alignments of motors, strong adjustable screws with lock nuts and sliding blocks shall be provided.

8 Welded snugs shall be fitted at pedestals, gear boxes etc. for alignment.

9 Stud or body bolts shall not be used as fasteners for mechanical items except for fixing inspection covers.

10 Design of the structures for these equipment shall take into account the following factors and shall have ample precautions taken to withstand the following.

i) Reinforcement of the natural sway of the structure due to unbalanced dynamic oscillations of the machines.

ii) Fatigue produced in the members due to frequent stress reversals.

iii) All impact loads, super-imposed loads and loads due to wind.

Boom conveyor shall be provided with guards to prevent belt warp in windy conditions.

6.4.2.16 Technical Parameter Of Bucket Wheel Reclaimer

Rail mounted self propelled, boom type luffable, slewable and mobile boom type bucket wheel reclaimer, complete with electrics etc. shall be supplied as per the given specification. The main characteristics of the machine shall be as follows.

1) Type : Rail mounted, self propelled boom type luffable, slewable bucket wheel reclaimer to be mounted on rail.

2) Nos. : One (Existing Flux Yard)

3) Capacity, tph : Rated : 600 t/h for Flux
: Designed : 720 t/h for Flux

4) Boom lenth, m : To suit the stockpile of given cross section

5) Track centres : Existing Bin Trolley rail to be used
6) Track rail size : To suit equipment kg/m

7) Duty : Continuous, 20 hrs a day 350 days a year.

9) Length of travel : Approx.230.0 m

10) Travel speed : 18.75 m/min

11) Slew speed/ Range : 0.09 to 0.2 rpm (approx.)
100 deg on either side

12) Luffing mechanism
a) Speed : 2 m/min at boom tip
b) Range : +7.0°, - 12°
[Range shall be suitable for making the specified pile cross section. However inclination of more than ±12° is not acceptable]

13) Stockpile Cross section of :Triangular/ trapezoidal

14) Bottom width of : 25.0 m
stock pile

15) a)Height of stock Pile :9.0 m
w.r.t. to rail level.

b) Length of stock pile : 230m (Flux)

16) The technical characteristics of yard conveyers -
Conv.name: KP13-4
Cap:1000tph
BW:1400mm
Lg: 326m
Speed:1.6m/s

17) Type of belting and idlers of the machine shall be interchangeable with yard conveyor. The belting and type of idlers to be provided will be indicated to the successful tenderer.

18) Walkway of minimum 800 mm width grating floor and hand railing shall be provided on both the sides of the boom conveyor maintenance purpose.

19) The boom's hoisting movement upwards shall be restricted to maximum limit to prevent it from damaging the Reclaimer structure. However, the provision shall be made to enable the boom end brought to ground for repair and maintenance by bypassing the operational limit switch that restrict its down ward movement.

20) The machine shall be suitable for relciaming material from the stock pile of the given cross section with full capacity by operating from one side of the stock pile leaving a maximum 2% as dead stock.

21) The electrical room shall be pressurized type.

22) Press to talk system shall be provided.

23) Over travel device (non contact type) shall be provided.

24) Auto tension trip device shall be provided for cables.

6.4.2.17 Codes and Standards

Same as that stipulated under clause for "Codes & Standards" of Twin Boom stacker

In the event the requirement of this specification exceeds the requirement stipulated in the corresponding standards, regulation, safety code, the specification shall govern.

In the event of conflict between the standard, regulations and codes, the most stringent one shall govern and the decision of the Purchaser shall be final.

The equipment may be designed as per any other international standard also after prior approval of the Purchaser.

6.4.2.18 Erection Plan

The Tenderer shall submit an erection plan along with the tender for the plant & equipment under his scope of supply.

The plan will outline:

a. The erection techniques to be employed.

b. Resources planning :

c. Requirement of construction power, water and storage needs.

d. Deployment of erection machineries.

e. Deployment of manpower of specific trade and requisite skill.

f. Equipment delivery planning

g. Erection material planning

h. Sequencing of erection to avoid accumulation / under utilization of resource & to achieve better progress.

i. Action plan for completing critical work

6.4.2.19 Deployment of erection machineries

The Tenderer shall submit along with the tender the following:

a. List of various erection equipment such as cranes, winches etc. planned to be mobilised and indicate specification and quantity of each item.

b. List of machinery, tools and tackles such as welding transformers, welding generators / sets, gas cutting sets, drilling machines, chain pulley blocks, survey instruments, etc. and indicate specification and quantity of each item.

6.4.2.20 Deployment of manpower

The Tenderer shall submit along with the tender a list showing deployment of manpower of the following categories indicating number of personnel, schedule and duration of their posting at site, educational background, experience etc.

a. Engineers to be engaged for design and engineering, coordination, follow-up and expediting.

b. Engineers and supervisory personnel directly attached to site work i.e. erection, testing, commissioning and demonstration of performance guarantee values.

c. Project organisation set-up, preferably with job responsibility

d. Organisation (proposed) for implementation of the package.

6.5 Barrel Type Blender Reclaimer

6.5.1 Scope of Work (Including Battery Limit)

The scope of work of the Tenderer shall consist of design, engineering, manufacture, inspection, assembly shop testing, painting at manufacturer's shop as well as at site after erection, supply at site including dismantling for transportation, packing, loading and transportation, receipt at site, erection testing and commissioning of the following items at Plant at site.

The equipment supply shall be complete in all respects including its structural, mechanical and electrical components and standard accessories such as electricals, flexible trailing power and control cables with cable reeling drum etc.

All items essential for the desired operation of these equipment whether specifically mentioned in this specification or not, shall be included in the scope of work of the Tenderer.

The scope of work shall stand supplemented by such details as are given in this specification, tender drawing, Instructions to the Tenderer, general conditions of contract or any other part of the tender document.

All electrics/ electrical equipment as indicated under relevant clauses.

6.5.2 Technical Specification/ Design Data

6.5.2.1 General

The equipment covered in this specification shall be installed in the Raw material handling system (RMHS) yard.

All equipment shall be designed for out door duty and shall be complete with mechanical, structural, power supply, conveyors, chutes, drives, controls etc.

6.5.2.2 Barrel Type Blender - Reclaimer

1. The barrel reclaimer shall be used for reclaiming from the stockpile formed by the stacker. The reclamation shall be from the entire cross section of the pile in such a way as to give a homogeneous out-put. The harrow shall be made of wear resistance material. Harrow inclination shall be controlled from operator's cabin. The reclamation of the material shall be through buckets and bridge conveyor which will discharge onto reclaiming conveyor in the yard. The machine shall be provided with control to automatically correct any skew during its long travel movement.

2. The equipment shall be controlled and operated from an operator's cabin suitably located to give operator an full view of the operating zone in either direction of travel and optimum vision all round. The cabin shall be of totally enclosed type having shatter proof glasses with electrically driven wind shield wipers. Windows shall be moving on hinges to facilitate its cleaning. The cabin shall be provided with adequate lighting, switches, controllers with operator's chair, telephone, air conditioner and circulating fan and two adequately sized Co2 fire extinguishers. A hooter whose sound can be heard from a distance of 300m shall be provided outside the cabin.

3. Supplier shall visit the existing barrel reclaimer working at site and maintain similarity to the extent possible.

6.5.2.3 Mechanical Specification

1. The design of the bogie and carriages of the equipment shall be such that differential movement of the wheel sets of the machine on two rail tracks resulting in skewing effects does not occur. The traverse bogies shall be provided with material removing guard plate as well as rail cleaners at both ends so that the machine can travel even if there is spillage or overflow of material on rail track and the L.T. drives shall be selected accordingly.

2. Adequate no. of locating pins etc. shall be provided to ensure easy assembly after dismantling of equipment or mechanism etc.

3. All matching parts shall be given identifiable marking for easy erection of the machine.

4. Materials used for equipment's structures shall be of good quality shall be free from fracture, cracks, blow holes, lamination, pittings etc.

5. Stability of these mobile equipment shall conform to the norms laid down in relevant International Standards.

6. Safe and adequate access with approach for repairs, handling, maintenance and removal of all mechanical and electrical parts shall be ensured without recourse to additional scaffolding. Adequate clearances between the floors shall be provided to facilitate easy maintenance. Also, the clearance between ground and undercarriage shall be kept min. 0.3 m for maintenance purpose.

7. All parts requiring replacement or inspection or lubrication shall be easily accessible without the need for dismantling of other equipment or structures. All electrical cables shall be laid so that they are not liable to damage and can be easily inspected and easily accessible for repair and maintenance.

8. Suitable handling facilities or provisions such as eye bolts, lifting lugs, ladders etc. of adequate capacities shall be provided on the machine at all necessary locations for maintenance of various mechanisms.

9. Adequate working space on the platform around all machinery parts shall be provided for personnel working for maintenance or inspection.

10. Safety hand railing preferably of tubular constructions shall be provided around all walk ways. Railing shall not be less than 1000 mm in height with an intermediate member at a height of 500 mm. The minimum size of handrail is 32NB.

11. All edges or openings shall be provided with toe guards. Toe angles or bent plates shall be minimum 100 mm in height.

12. Essential openings, on the platforms or walk- ways shall be covered with removable covers.

13. All moving parts, wherever required from the safety point of view, except long travel gear wheels, shall be provided with covers opening on strong hinges. These covers shall preferably be made of minimum 3 mm thick plate. All heavy covers shall be provided with inspection windows.

14. Sufficient number of power points/outlets shall be provided at suitable places on the equipment to plug in welding transformers and hand tools for maintenance purposes.

15. Standardisation of assemblies shall be carried out to the maximum extent possible.

16. Sizes for all equipment viz. wheels, brakes etc. shall be selected from preferred number series and shall be of reputed make.

17. The design of the equipment shall ensure that there is no spillage of material on any part of the equipment. Dust covers shall be provided for all motors, gear boxes, drums etc.

18. End limit switches and over run limit switches shall be provided at both the ends of the travels for all machines. The corresponding strikers shall also be supplied by the supplier.

19. The cross conveyor shall be min. 1400mm width so that no spillage takes place in side the barrel.

20. The machines shall be provided with adequate nos of buffers

6.5.2.4 Drives

1. The long travel mechanism drive shall be provided with multiple drives on each side. In the event of failure, any drive motor, the corresponding motor on the other side shall be automatically disconnected. However, the machine shall be operable with the remaining drives.

2. Protection against overloads shall be provided through suitable control system. The control system shall ensure smooth acceleration for all motions and variable speeds.

3. The equipment shall be supported on wheels mounted in bogies and shall be driven by electric motors through reduction gears. Chain drives and open gears shall not be used.

4. For long travel motion individual wheel drive shall be provided. Minimum 50% of the long travel wheels shall be positively driven.

5. For travel motion, rotating axle drive arrangement with 'L' type supports shall be provided.

6. The under carriages shall be fitted with substantial number of safety stops to prevent the equipment from falling more than 25 mm in the event of breakage of a track wheel, bogie or axle. These safety stops shall not interfere with the removal of wheels.

7. At suitable points, built in arrangement shall be provided for easy replacement of heavy electrical equipment. Built in jacking up arrangement for bogie, frame etc. for changing of wheels and lifting provision for cable reeling drums and other heavy parts shall also be provided.

8. The under carriage shall have statically determinate support system to ensure its stability and to afford an evenly distributed load over the entire travel assemblies and to cater to any unevenness in the level of the rails.

6.5.2.5 Gears and Gear Boxes

1. Straight and helical, spur gearing shall be used. Worm gears shall not be used unless specified otherwise All spur gears shall have 20 degree pressure angle with involute teeth profile.

2. First and high speed reductions shall be through helical gears only.

3. All first reduction pinions and also other pinions, if feasible, shall be integral with the shafts.

4. Overhung or split gears and pinions shall not be used unless specifically called for.

5. All gears shall be of hardened and tempered alloy or carbon steel with machine cut teeth. Surface hardness for pinion shall be 255 to 300 BHN and for gear it shall be 220 to 225 BHN. Difference in hardness of pinion and gear shall not be less than 20 BHN. The gear teeth shall be ground and finished to suit the service conditions.

6. Gear teeth shall be cut in metric module system only.

7. All gears shall be completely enclosed in oil tight designs or guarded by covers firmly attached to rigid supports where complete enclosure is not possible.

8. All gear shafts shall be supported in bearings mounted in gear box.

9. In case of totally enclosed gear boxes splash or automatic lubrication system shall be used.

10. The housing for Gear boxes shall be of cast steel or fabricated. Fabricated gear boxes shall be made of minimum 8 mm thick steel plate and shall be stress relieved.

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

12. Directly above the mesh line of teeth, hand-holes with bolted covers be provided in the gear box body for inspection of the teeth.

13. The gear boxes shall be provided with breather vents, oil level indications, dip sticks and easily accessible drain plugs.

14. Radial clearance between the gear box inner surface and the outside diameter of the gear shall be at least 1.25 times the depth of the largest gear tooth inside the gear box or 20 mm whichever is higher. The facial or side clearance between the inner surface of the gear box and the face of the gear or pinion shall be at least 20 mm.

15. Bearings shall be housed in gear box/bosses or shall be mounted in cartridges held in place by top bolts and flanges. Suitable oil seals shall be provided at all required places in the gear box.

16. Oil pumps with filters etc. shall be used if vertical gearing exceeds two reductions. On horizontal gearing, the oil level shall be above the smallest gear.

17. All gear boxes shall be mounted on machined surfaces and shall have machined feet. Shims shall not be used.

18. Gear boxes shall be provided with lugs or other means for lifting purposes.

19. Interior of all gear box housing shall be sand blasted. Suitable resistance paint matching to the lubricant used shall be applied inside the gear box.

20. External cooling arrangement shall be provided wherever required to dissipate the heat generated inside the gear box. However, external cooling coils shall be avoided.

6.5.2.6 Bearings and Plummer Blocks

1. All bearing housings shall be made cast or wrought steel. Housings shall be of split type constructions to permit easy removal of shaft. The underside of the base of each pedestal shall be machined and shall bear upon machined surface.

2. Rated life of ball and roller bearings shall be designed for B-10 life of not less than 40,000 hours.

3. Plummer block housings shall be oriented on the supporting structure in such a manner that no shaft loads are transmitted to the housing cap.

4. Plummer block shall have provision for lubrication. Suitable oil seals shall be provided wherever necessary.

5. Anti friction ball or roller bearings of specified make only shall be used throughout.

6. Heavy caps shall be provided with means for lifting.

6.5.2.7 Couplings

1. Couplings shall be designed to suit the maximum torque required to be transmitted or to suit the total braking torque of the mechanism whichever is greater.

2. Fluid couplings shall be provided on input shafts of the motor of 30 KW & higher ratings. Geared coupling with crowned teeth or resilient type coupling shall be used on input shaft of motor of less than 30 KW and Gear Coupling on the output shaft of gear boxes. Any other special coupling which can give better and more reliable service may be used after obtaining the specific approval of the Purchaser.

3. High speed couplings shall be selected of a natural frequency such that no resonance can occur at any operational speed.

6.5.2.8 Brakes

1. Only D.C. Electro magnetic brakes shall be used unless specified otherwise.

2. Double shoe brake shall be provided for each drive and shall be mounted on the input pinion of the gear train. The brake shoes shall be of hinged type. Brake levers shall be forged or fabricated or of cast steel. Hinge pins shall be of hardened alloy steel and shall be lubricated. These hinge pins shall be provided with steel bushes at bearing points.

3. Brake drums shall be forged or of cast steel and shall be completely machined and dynamically balanced. Width of the brake drum selected shall be 10 mm more than the width of the brake shoes on each side. Hardness of the brake drum shall be 300 to 350 BHN.

4. Rating of brakes for all mechanisms shall be selected as per required braking moment necessary for each mechanism with factor of safety and the required heat dissipation capacity.

5. Brakes shall be installed such that these are easily approachable for servicing.

6. In order to obtain low deceleration, the brakes of long travel drives of the machines shall close successively.

7. The service factor shall be 1.5 on motor (mechanical output) for selection of all gear-boxes/ couplings, brakes etc.

6.5.2.9 Long Travel Wheels

1. The wheels shall be double flanged with straight tread, and shall be either of forged, rolled or cast steel.

2. Wheels shall be heat treated to have a hardness of BHN-300 to 350 on the rolling surface and flanges to a depth of not less than 10 mm with a smooth pass to the non hardness zone.

3. Minimum diameter of the wheels shall be 630 mm. Complete wheel bogies shall be interchangeable with each other.

6.5.2.10 Rail Clamps

1. The machines shall be protected against drift due to wind by means of two electric/ hydraulic operated (one on each rail) rail clamps and two hand operated rail clamps.

6.5.2.11 Belt Conveyor

For Detailed Specification of Yard Belt Conveyor System Refer General Technical Specification.

6.5.2.12 Lubrication

The machines shall be supplied with two separate central lubrication systems:

i) Central lubrication system for the under carriage.

ii) Central lubrication system for the super structure

The lubrication systems shall be complete with grease pumps, double supply lines, direction control valves, the distributors etc.

The level of grease in the grease tanks shall be monitored electrically and low level of the grease shall give the audio warning signal in the operator's cabins.

6.5.2.13 Safety Provisions

Machines included under this specification shall be equipped with adequate safety devices and provided with adequate working clearances all around the equipment fitted on the machines to

comply with the purchaser's specific requirements, safety codes and statutory regulations prevalent at the place of installation.

Adequate numbers of fire extinguishers and fire extinguishing systems suitable for prevention of electrical fire as per safety rules shall be provided in the operator's cabins, electrical rooms and in other areas considered necessary.

Adequate numbers of fire extinguishers and sand buckets shall be provided at suitable locations for preventing fire hazards.

Suitable fire alarm with fire detectors shall be provided for the electrical premises.

The fire protection systems shall comply with provisions made by tariff advisory committee, a statutory body under Insurance Act 1938, and also conform to Indian Explosives Act, Indian Factories Act etc.

6.5.2.14 Steel Structures

The structures shall be designed and fabricated in accordance with IS: 800-2000 taking the following additions/ deviations into account.

All steel structures and the portal frames shall be of box construction with double web plate girder. The span to depth ratio shall not exceed 18. For box plate girders, all diaphragms shall bear against the top flanges.

The box girder shall be so constructed as to eliminate accumulation of water or oil inside it.

Structural steel conforming to IS: 2062-1992 only shall be used.

Electrodes of low hydrogen type only shall be used for welding of steel structures which are subject to dynamic loading.

Parts of steel frame carrying machinery shall be provided with doubling plates of adequate thickness welded and machined to true surface.

All bolts except those with nylon nuts shall be provided with grip lock nuts and/or spring washers.

For side alignments of motors, strong adjustable screws with lock nuts and sliding blocks shall be provided.

Welded snug shall be fitted at pedestals, gear boxes etc. for alignment.

Stud or body bolts shall not be used as fasteners for mechanical items except for fixing inspection covers.

Design of the structures for these equipment shall take into account the following factors and shall have ample precautions taken to withstand the following.

i) Reinforcement of the natural sway of the structure due to unbalanced dynamic oscillations of the machines.

ii) Fatigue produced in the members due to frequent stress reversals.

iii) All impact loads, super-imposed loads and loads due to wind.

Boom shall be provided with guards to prevent belt warp in windy conditions.

6.5.2.15 Technical Parameter Of Barrel Reclaimer

Rail mounted self propelled, bridge type barrel reclaimer, complete with electrics etc. shall be supplied as per the given specification. The main characteristics of the machine shall be as follows.

1)	Type	:	Rail mounted, self propelled multi-bucket type barrel reclaimer to be mounted on rail fixed on either side of the stock pile.
2)	Nos.	:	03 (New Beds)
3)	Capacity, tph	:	Rated :1000t/h (Ore fines/Flux Matl.) Designed: 1.2 time Rated Capacity
4)a	Bridge span, m	:	27.5m(To suit the stockpile of given cross section)
4)b	Cross conveyor	:	Rated :1000t/h (Ore fines/Flux Matl.) Designed: 1.2 time Rated Capacity Reversible,Min.1600mm BW
5)	Track rail size	:	To suit equipment kg/m
6)	Duty	:	Continuous
7)	Power supply	:	Ref. chap 06.10(Electrical)
8)	Length of travel	:	240m
9)	Travel speed	:	Forward 15 m/ min. Reverse 18.75 m/min
10)	Cross section of the stock file	:	Triangular
11)	Bottom width of stock pile	:	25m
12a)	Height of stock Pile w.r.t. to rail level.	:	9m
b)	Length of stock pile	:	230m (Ore / Flux)
13)	Material to be handled	:	Ore fines/Lump ore/Flux

15) Type of belting and idlers of the machine shall be interchangeable with yard conveyor. The belting and type of idlers to be provided will be indicated to the successful tenderer.

16) Walkway of minimum 800 mm width grating floor and hand railing shall be provided on both the sides of the conveyor on the bridge for maintenance purpose.

6.5.2.16 Codes and Standards

Same as that stipulated under clause for “Codes & Standards” of Twin Boom stacker

In the event the requirements of this specification exceeds the requirement stipulated in the corresponding standards, regulation, safety code, the specification shall govern.

In the event of conflict between the standard, regulations and codes, the most stringent one shall govern and the decision of the Purchaser shall be final.

The equipment may be designed as per any other international standard also after prior approval of the Purchaser.

6.6 Transfer Car

One no Transfer Car for transferring the Barrel Reclaimer and Stacker from one bed to another shall be considered. For Detailed Specification of Transfer Car refer General Technical Specification.(GS-06)

1.	Load carrying capacity	:	To transfer Barrel Reclaimer and Stacker
2.	Qty.	:	one in New Bed + one in Existing Bed
3.	Speed	:	5m/min
4.	Rail	:	52 Kg/m
5.	Travel Length	:	200m in new bed 400m in old bed
6.	Power supply	:	Ref. Electrical (6.10)

7 Deviations (To be filled by the tenderer)

Tenderer shall clearly indicate the deviation from the tender specificaiton

Sl. No.	Deviations	Clause reference & Details	Remarks

8 Exclusions (To be filled by the tenderer)

Tenderer shall clearly indicate the exclusions from the tender specificaiton

Sl. No.	Deviations	Clause reference & Details	Remarks

9 List of Drawings enclosed

Sl.	TS Drawing Number	REV	Description of Drawing
A	RMHS		
1	MEC/S/E24F/11/17/K/01/55/02101	0	RMHS Layout
2	MEC/S/E24F/11/17/K/01/55/02102	0	RMHS Flow Diagram
3			BSL General Layout

10 Project Schedule

The indicative implementation schedule of this project is given below. The tenderer shall submit the bar chart along with the offer, in line with this schedule.

ID	Task Name	Dur(w)	Year 1												Year 2												
			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	BSL Expansion – Raw Material Handling System	104 w																										
2	Effective Date of Contract (zero date)	0 w																										
3	Basic Engineering and Approval	22 w																										
4	Tendering & Ordering on sub vendors	30 w																										
5	Detailed Engg & Approval	56 w																										
6	Civil Work	65 w																										
7	Fabrication & Erection of Structures (incl Tech	69 w																										
8	Delivery of Equipment	52 w																										
9	Erection of Equipment	56 w																										
10	Testing & Commissioning – Utilities & Services	9 w																										
11	Testing & Commissioning – RMHS	13 w																										