TENDER DOCUMENT

NIT No.: DLI/C&E/WI-665/277

FOR

Tender for ‘Design, Engineering, Supply, installation, testing & commissioning of DOUBLE GIRDER EOT CRANE AND ASSOCIATED WORKS’ for the project of “Augmentation of Raw Material Handling Receipt and Handling facilities with new OHP Part- B (Package-061) of Bhilai Steel Plant, (SAIL)”. 

VOLUME – 2B

TECHNICAL SPECIFICATION

ENGINEERING PROJECTS (INDIA) LIMITED

(A GOVT. OF INDIA ENTERPRISE)

Core-3, Scope Complex, 7,
Lodhi Road, New Delhi-110003
TEL NO: 011-24361666  FAX NO. 011- 24363426
## CONTENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General, Documents/Information to be furnished alongwith offer</td>
</tr>
<tr>
<td>2.</td>
<td>Scope of Supply</td>
</tr>
<tr>
<td>3.</td>
<td>Technical Specifications – Double Girder EOT Crane</td>
</tr>
<tr>
<td>4.</td>
<td>Spares</td>
</tr>
<tr>
<td>5.</td>
<td>Technical data sheet (to be filled by the vendor)</td>
</tr>
</tbody>
</table>
GENERAL

The following Technical Specification shall be read in conjunction with General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification. If there are any provisions in this Technical Specification, which are at variance with the provisions of General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification, the provisions in this Technical Specification shall take precedence.

1.0 DOCUMENTS / INFORMATION TO BE FURNISHED ALONGWITH OFFER.

(i) Clear Scope of supply.

(ii) List of Commissioning spares and start-up spares with unit rates.

(iii) List with unit rates of special tools and tackles, if any required.

(iv) Price Schedule for supply & erection work as per the format enclosed.

(v) List of recommended spare parts for 3 (Three) years trouble free operation and maintenance alongwith unit rates as per the format enclosed in price schedule.

(vi) Technical data sheets duly filled by the vendor (blank data sheets enclosed).

(vii) Catalogues/ Leaflets and O&M Manuals.

(viii) Reference list of your Customers for the similar supply of items.

(ix) Unpriced Copy. (Furnish unpriced copy of Price Schedule alongwith the Technical Bid.)
2.0 **SCOPE OF SUPPLY**

The scope of the supply includes Design, engineering, manufacture, shop fabrication, assembly, testing and inspection at manufacturer’s works, packing, dispatch, transportation, delivery to site, receipt, required fabrication at site, installation, testing & commissioning completion of facilities, performance guarantee testing, final painting at site and handing over to Bhilai Steel Plant, SAIL/EPI of **ONE NO. DOUBLE GIRDER EOT CRANE AND ASSOCIATED WORKS** as per specifications and scope defined in tender documents complete with all accessories and drive, which are not mentioned specifically but are required for the efficient and trouble free operation of the equipment/system.

**Following items are also included in bidder’s scope.**

(i) Complete EOT Crane including Gantry Girder, Hoists, wheels, DSL arrangement, Cross travel wheels alongwith rails, drive etc. & Long travel wheel alongwith Drive equipment (i.e. motor, gearbox, couplings, guards, brakes etc.), long travel rail with fixing items as per the details given in the specifications.

(ii) Consumables like first fill of lubricating oils etc. for the initial operation of the equipment till handing over.

(iii) Commissioning spares and start-up spare parts.

(iv) Special tools & tackles, if any required.

(v) Recommended spare parts for (3) three years trouble free operation and maintenance.

(vi) Painting of complete equipment (including final painting before handing over to the Employer).

(vii) Installation, testing & commissioning at site.

(viii) All drawings / documents along with operation and maintenance manuals as per requirement mentioned elsewhere in the tender document.

(ix) Getting approval of design/drawings and any other design calculation related to the equipment from BSP/MECON/EPI.

(x) 3 Ph, 415V, 50 Hz power supply at Isolator shall be provided at one point for EOT Crane. Further distribution including supply, laying & termination of cables shall be in Bidder’s scope.

(xi) Trailing / Flexible Cables as required for the crane shall be in bidder’s scope.

(xii) Carrying out any modifications/ deletions /additions / alteration in design / drawings/ documents as required by client & Client’s consultant and EPI for proper execution of works at site till completion and handing over of the project to the client.

**Exclusions:**

(i) Civil works including grouting.

(ii) Long Travel supporting structure is excluded from the scope of supplier.
(ii) Tenderer to note the following:

1) **Makes of gear box shall be Elecon/ NAW/ Flender/ Premium energy transmission/ Shanthi gears.**

2) BSP approved preferred make list shall be followed for Hydraulics & Pneumatics.

3) All HT and LT AC / DC motors, actuators, brakes etc. as per technological and process requirement.

4) Generally Squirrel Cage Induction Motor with DOL starter / VFD / Soft Starter will be provided. Use of Slip ring motor in general will be avoided. Suitable Rotor contactor panels and SS-grid Resistance Boxes will be provided for slip ring motors if inevitable.

5) Soft starter will be provided for LT motors of rating more than 75kW.

6) All LT motors for conveyors will be S6 duty and will have class F insulation with temperature rise limited to class B. Inverter duty motors (used for VFD application) will have class H insulation with temperature rise limited to class F.

7) Equipment selection and dating will generally be based on ambient temperature of +50 Deg.C. For specific areas and shops, the ambient temperature conditions indicated above will be taken into consideration and equipment suitably derated wherever necessary.

8) The equipment should be suitable for smooth, efficient and trouble free service in the tropical humid climate prevailing at plant site and under the ambient temperature conditions indicated above for the different shops and areas. In hot areas of higher temperature conditions, the equipment will be adequately protected against damage from radiant heat and hot air.

9) Roller bearings will be provided at DE end for motor of rating 30KW and above.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Type of Crane</td>
<td>Double Girder EOT Crane</td>
</tr>
<tr>
<td>2.</td>
<td>Capacity (T)</td>
<td>20/5</td>
</tr>
<tr>
<td>3.</td>
<td>Span (M)</td>
<td>16 M</td>
</tr>
<tr>
<td>4.</td>
<td>Lift (M)</td>
<td>25 M</td>
</tr>
<tr>
<td>5.</td>
<td>Long Travel (M)</td>
<td>30 M</td>
</tr>
<tr>
<td>6.</td>
<td>Location</td>
<td>Indoor (in Wagon Tippler Complex WT-B)</td>
</tr>
<tr>
<td>7.</td>
<td>Operating Floor</td>
<td>RL+307.80 (Top of RCC Floor)</td>
</tr>
<tr>
<td>8.</td>
<td>Top of Rail</td>
<td>RL+320.25</td>
</tr>
</tbody>
</table>
3.0 TECHNICAL SPECIFICATIONS OF DOUBLE GIRDER EOT CRANE

3.1 GENERAL

The scope of work covers design, manufacture, fabrication/assembly, shop testing, painting, supply, storage, erection, testing & commissioning of cranes complete with electricals and standard accessories with attachments to be installed as covered in data sheets in Technical Specifications. Relevant codes and practices for the cranes shall be used for SAIL units relevant IPSS shall be used unless otherwise stated.

All the equipment shall be of reputed make and proven quality with regard to their performance. The make shall be as per approved list of Purchaser / Consultant.

The crane shall be inspected and tested during different stages of its manufacture (starting from raw materials till the completion of the crane) by the Purchaser/ his authorized representative at the Supplier's or his sub-supplier's works as per the inspection procedure mutually agreed between the Purchaser or his authorized representative and the Supplier. Inspection shall be regarded as a check up and shall be in no way binding on the Purchaser.

3.2 TECHNICAL SPECIFICATION

EOT cranes shall be designed, manufactured and tested in accordance with the latest revision of IS: 807-1976, 3177-1999, 4137 and IPSS.

The crane components shall be standardized to keep the number of spares to the minimum. 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 so laid that they are not liable to be damaged and can be easily inspected and maintained and when necessary any damaged cable can be accessed and replaced individually.

All components for cranes of identical capacity and duty shall be interchangeable. Cranes of the same capacity and duty shall be identical in all respect unless otherwise required.

No cast iron parts shall be used except for electrical equipment and no wood or other combustible material shall be used unless specifically mentioned otherwise. Deviations, if any, to this clause shall be permitted only with the specific approval of the Purchaser.

All machinery or equipment included under this specification must be equipped with safety devices and clearances to comply with recognized standards and Purchaser's requirements along with safety codes and statutes prevalent at the place of installation of the equipment.

For welded construction such as that of bridge girders, end-carriages, rope drums, gear-boxes etc. steel shall be as per IS: 2062-1992 quality. For welding these members low hydrogen electrodes shall be used.

All wheels, couplings, open gears etc. shall be provided with covers, opening on strong hinges. All heavy covers shall be provided with inspection windows.

Where down shop leads are located below runway rails, guards shall be provided on the crane to prevent the hoist ropes from coming in contact with down shop leads.
All bolts except those with nyloc nuts shall be provided with grip lock nuts or spring washers.

For outdoor cranes all electrical and mechanical equipment which are exposed to weather shall be completely covered or made weather proof. The covers shall be segmental to facilitate easy dismantling and assembly.

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

Fasteners for pedestal blocks, motors, gear-boxes etc. shall be easily removable from the top. Studs or body bound bolts shall not be used as fasteners for mechanical items except for fixing cover.

Power & control cables shall be clamped in-groups separately. All trailing cables shall be clamped with PVC or non-metallic clamps. Group de-rating factor shall be appropriately taken according to the recommendations of the cable manufacturers based on the method of laying and number of cables being laid together.

 Guards of approved design, which will push forward off the track, any object placed across it, shall be attached to each end of the end carriages.

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

Defects in the material like fractures, cracks, blow holes, lamination, pitting etc. are not allowed. Rectification of any such flaw is permissible only with the approval of the Purchaser.

**3.2.2 Tolerances:** The Tenderer / Supplier shall ensure that the crane shall be manufactured as per the tolerances specified below:

<table>
<thead>
<tr>
<th>(i)</th>
<th>Span over LT wheels</th>
<th>± 6 mm up to 40 metres</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ii)</td>
<td>Wheel base</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LT</td>
<td>± 5 mm</td>
</tr>
<tr>
<td></td>
<td>CT</td>
<td>± 3 mm</td>
</tr>
<tr>
<td>(iii)</td>
<td>Difference in diagonal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LT</td>
<td>± 5 mm</td>
</tr>
<tr>
<td></td>
<td>CT</td>
<td>± 3 mm</td>
</tr>
<tr>
<td>(iv)</td>
<td>Long travel wheel alignment</td>
<td>± 1 mm</td>
</tr>
<tr>
<td>(v)</td>
<td>Tilt of wheels or balancer axle</td>
<td>± 1 mm/1000 mm (Horizontal &amp; Vertical)</td>
</tr>
<tr>
<td>(vi)</td>
<td>Trolley wheel gauge</td>
<td>± 3 mm up to 7500 mm span</td>
</tr>
<tr>
<td></td>
<td></td>
<td>± 5 mm above 7500 mm span</td>
</tr>
<tr>
<td>(vii)</td>
<td>Trolley wheel gauge</td>
<td>± 3 mm up to 7500 mm span</td>
</tr>
<tr>
<td></td>
<td></td>
<td>± 5 mm above 7500 mm span</td>
</tr>
<tr>
<td>(viii)</td>
<td>Difference in height between trolley rails (H) in relation to the trolley track gauge (S) shall be within the following tolerances:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>‘S’ (mm)</td>
<td>‘H’ (mm)</td>
</tr>
<tr>
<td></td>
<td>Upto 2500</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Above 2500 and up to 4500 above 4500</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>(ix)</td>
<td>Horizontal bend of girder in plan</td>
<td>Span/ 2000</td>
</tr>
</tbody>
</table>
(x) Shift of the web plates of main & end girders from vertical over height \( H \) measured near the mid span & close to the main diaphragm. \( H / 200 \)

(xi) Twist of the main girder \( \text{Span} / 1500 \)

(xii) Axis of the flange plates from the axis of the beam \( H / 250 \)

(xiii) Tolerances on camber

| Upto 4 mm. | (+) 4 | (-) 0 |
| Above 4 mm and upto 8 mm. | (+) 5 | (-) 0 |
| Above 8 mm and upto 16 mm. | (+) 6.3 | (-) 0 |
| Above 16 mm and upto 31.5 mm. | (+) 8 | (-) 0 |
| Above 31.5 mm and upto 63 mm. | (+) 10 | (-) 0 |

(xiv) Over buffer length \( \pm 5 \text{ mm} \)

(Over buffer dimension on two sides shall be same)

Height of center of buffer \( \pm 5 \text{ mm} \)
(from top of track rail)

3.2.3 The crane after erection shall be tested as follows:

(i) Insulation tests and other tests mentioned in IS: 3177-1999 shall be carried out.

(ii) Deflection Test: The deflection test of the bridge girders shall be carried out as per IS: 3177-1999. After the deflection test with safe working load, the crane shall be tested for deflection with 25% overload and there shall not be any permanent set after the removal of the load.

(iii) Speed Tests:

   a) All motion of the crane shall be tested with rated load on all notches at the time of commissioning of the crane at site and the speeds shall be attained within the tolerance limit.

   b) All motions of the crane shall be tested with 25% overload in which case the specified speeds need not be attained but the crane shall show itself capable of dealing with the overload without difficulty.

(iv) Brake Tests:

   a) The hoist brakes shall be capable of braking the movement with rated as well as overload. However, the braking path with rated load shall not exceed hoisting speed/120 for class 2 duty cranes.

   b) The long travel and cross travel brakes shall be capable of arresting the motion within a distance in meters equal to 10% of the speed in meters/min. and the retardation due to braking shall not exceed the values as given in the table below:
Retardation, according to percentage number of driving wheels,

<table>
<thead>
<tr>
<th>Working condition</th>
<th>Retardation</th>
<th>100</th>
<th>50</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor (When $u = 0.12$)</td>
<td>0.9</td>
<td>0.45</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Indoor (When $u = 0.2$)</td>
<td>1.5</td>
<td>0.75</td>
<td>0.40</td>
<td></td>
</tr>
</tbody>
</table>

Legend $u= Friction Factor$

(v) The crane shall be completely assembled and tested in the Supplier's works for full load and 25% overload on hoisting and cross traverse motion, in presence of Purchaser's representative in addition to other tests as specified in IS:3177-1999.

### 3.2.4 STRUCTURAL DETAILS:

(i) The crane bridges shall be of welded double/single web box construction and shall be designed as per IS: 807-1976 and/or AISE NO. 6. The materials of construction shall be weldable mild steel in compliance with the relevant standard. However, high strength weldable structural steel also may be used wherever required in compliance with the relevant standards.

(ii) The crane bridge girder upto 12-m span shall be in one piece. Girders above 12 m span may be spliced. The number of such splices shall not exceed 2 upto 36 m span. Beyond 36 m span, the number of splices may be 3. Splices shall be designed to resist all the forces and moments to which it is subjected to, plus 50% thereof.

However, in no case the strength developed by the splice shall be less than 50% of the effective strength of the material.

Splices shall be proportioned and arranged so that the gravity axis of the splice is in line with the gravity axis of the members joined so as to avoid eccentricity of the loading.

(iii) Black bolts shall not be used in the main structure of the cranes.

(iv) Cross travel rail shall be fixed to the bridge girders by clamping only and not by welding.

(v) Transverse fillet welding on load carrying members shall be avoided. All butt welds on tensile zone shall be X-rayed.

(vi) Plates, bars, angles and where practicable other rolled sections used in the load bearing members of structures shall not be less than 6 mm in thickness.

(vii) The end-carriages shall be of double web plate box construction and shall be connected to the girders by welding at shop or by large gusset plates and fitted bolts to ensure maximum rigidity. Drop stops and jacking pads shall be built-in features of the cranes. Full length chequered plate platforms shall be provided along both sides of the cranes in order to ensure easy access to crane crab, long travel gears and other parts. Safety railings shall be provided on crane bridges and crab frame. Access to the operator's cabin shall be via staircases only and not through ladders. Platforms to facilitate inspection and dismantling of long travel wheels and main current collectors shall be provided.

(viii) Operator's cabin shall be of welded construction and located below bridge girders. Closed operator's cabin shall be provided with adequate glazing to
ensure good vision in all directions and glazing shall be accessible for cleaning from cabin itself.

Cabin suspension bolts shall be fitted in the reamed holes and the accessibility of these bolts is to be ensured for regular checking.

Easy accessibility is to be ensured for cleaning of cabin glasses of fully closed cabin.

(ix) The closed cabins shall be equipped with circulating and exhaust fans whereas open cabins shall have only circulating fans.

(x) Air-conditioned cabins, if provided, shall be provided with double glazing & heat insulation. The temperature inside the cabin shall be maintained at 25±2°C.

(xi) All the cabin floors shall be covered with heat and electrically insulated material. The cabin shall also be equipped with adjustable swivelling type upholstered chair.

(xii) The crab frame shall be made of steel plates and rolled sections in welded construction. Crab frame shall be fabricated in one piece if there are no transport limitations. If the trolley is fabricated in more than one piece due to transport limitation, the design of the splice shall be such that one unit of mechanism mounted on one part of the trolley, does not come over the other part.

(xiii) Foot-walks shall be of sufficient width to give at least 500 mm clear passage at all points except between railing and bridge girder where this clearance may be reduced to not less than 440 mm.

(xiv) Bottom of the drive mechanism of Bridge, Trolley & hoist shall be covered by the platform to avoid any free fall of the loose components lying near to the reducer.

(xv) The platforms along the bridge girders and over the crab shall allow convenient access for replacement, inspection, lubrication etc. for different mechanical and electrical components.

(xvi) The minimum thickness of chequered plates shall be 6 mm O/P for indoor cranes & 8 mm O/P for outdoor cranes.

3.2.5 MECHANICAL DETAILS:

(i) Rope drums
Rope drums shall be of cast steel or fabricated out of rolled steel plates. Fabricated drums shall be stress relieved before machining. The grooves of the drum shall be smooth finished. Rope drum shall be flanged at both ends.

(ii) Rope sheaves
Rope sheaves shall be of cast steel or fabricated out of rolled steel plates.

(iii) Wire ropes
The wire rope shall be hemp cored for all cranes. Ropes shall be regular right hand lay as per IS : 2266-1989. The construction of the ropes shall be 6 x 37 upto 16 mm diameter and 6 x 36 above 16 mm diameter. Wire rope provided in the hoist mechanism shall be in two pieces. Rope balancers shall be provided on the Trolley frame to accommodate two piece rope system.

(iv) Hook block
The sheaves shall be fully encased in closed fitting guards fabricated out of steel plates. Smooth opening shall be provided in the guards to allow the free movement of rope, and holes shall be provided for drainage of the oil.

(v) Gears & gear-boxes
Straight and helical spur gearing shall be used for all motions. Worm & bevel gearing may be used in exceptional cases with the specific approval of the Purchaser. All first reduction gears shall have helical teeth. All pinions shall be integral with the shaft. All gears shall be hardened and tempered alloy steel having metric module. Overhung gears shall not be used.

Surface hardness for pinion shall be 255 to 300 BHN and for gears it shall be 215 to 260 BHN. Difference in hardness of pinion and gear shall not be less than 20 BHN. All cast steel gear shall be tested by Gamma Ray. All gears shall be enclosed in oil tight gear-boxes. Gearboxes shall be of high grade cast iron/cast steel or fabricated and split at each shaft centrelines. Fabricated gearboxes shall be stress relieved before machining. For Cross-travel and Long-travel motions, vertical gear-boxes with ‘T’ split may be used.

(vi) **Connection between rope drum & gear-box**

One of the following arrangements shall be adopted for connecting the rope drum with the gear-box.

Flexible joint, incorporating flexible geared coupling housed within the drum. Fully flexible geared coupling between the drum and gearbox.

Drive of the drum by means of spur ring mounted on the drum shall be avoided as far as practicable.

(vii) **Wheels**

Crab/crane wheels shall be double flanged. Wheels shall be mounted in anti-friction roller bearing housed in ‘L’ shaped bearing brackets for easy removal during maintenance. Flange- less wheels with guide rollers are also acceptable.

Solid wheels shall be of forged rolled/cast steel. Wheels from 400 mm diameter and above may consist of hardened, rolled / forged steel tyre of not less than 60 mm thickness, shrunk on to cast iron center.

(viii) **Coupling**

Motor shaft shall be connected to the gearbox-input shaft through flexible shock absorbing coupling. Rotating parts shall be suitably covered by 3.15-mm thick sheet steel hinged covers for safety. In case of single motor central drive for Long travel motion, output shaft of the gear-box shall be connected to the line shaft through half geared couplings. Intermediate lengths of the line shaft may be connected through solid flange couplings. Half geared couplings with floating shaft shall be provided between the wheel and the wheel and the line shaft.

(ix) **Bearings & bearing housings**

Anti-friction bearings shall be used throughout except where required otherwise for technical reasons.

(x) **Buffers**

Spring loaded type buffers shall be provided on all the 4 corners of the bridge girders and the end carriages for cross and long travel motions respectively.

(xi) **Brakes**

The brakes shall be provided for all motions on the high-speed pinion shaft of the gear train. For hot metal hoists, two brakes shall be used per motor.

(xii) **Lubrication**

Grouped grease lubrication system shall be used for class M3, M5 and M7 duty cranes. Lubrication of the gears and pinions in the gear-boxes shall be splash fed from the sump. In case of three reductions, vertically mounted gearbox (having
limited motion), an oil pump shall be fitted to ensure lubrication of all gears.

### 3.2.6 ELECTRICAL DETAILS

(i) **Scope of supply**

The scope of supply covers all electrical equipment commencing from Power Distribution Board (PDB), Isolator, cables, complete down shop leads (DSL) system in the shop and main current collectors on the crane and all other electrical items beyond the main current collectors of the crane i.e. DSL main current collectors, power disconnecting switch on bridge platform after main current collectors, protective and control switch gear, motors, control and brake panels, resistors, brakes, limit switches, all power and control cables, socket outlets, lighting distribution panel and lighting fixtures with lamps, festoon cable system for crane trolley magnet/ grab and cable reeling drum, if specified for grab/magnet, master controllers, indicating lamps, push buttons, earthing materials etc. The scope of work also includes complete assembly and wiring and testing of crane at site, erection and testing and commissioning of all electrical equipment, supply of all commissioning spares with minimum quantities as indicated in clause no 04.26, (a) ii of this T.S.

All sundry erection materials required for installation and connecting up of electrical equipment with cable laying and fixing accessories shall be included in scope of supply by Tenderer.

(ii) **Standards**

The design, manufacture, assembly and testing as well as performance of the equipment shall conform to the IPSS in respect of items for which IPSS have been issued; otherwise, to the relevant IS specifications (latest revision). In case the Tenderer is not in a position to comply fully with certain IPSS/BIS specifications, or in respect of certain items for which there are no IPSS/BIS specifications, the Tenderer may base his proposals on IEC recommendations or other reputed national or international standards subject to the approval of the Purchaser.

All equipment supplied and all work done including system design and detailed engineering shall also comply with the statutory requirements of the Government of India and the Government of Chhattisgarh and with the Indian Electricity Rules.

(iii) **Climatic conditions**

The ambient temperature conditions met within the different shops/ units of the steel works complex will be as indicated in General Specification GS-01.

For specific areas and shops, the ambient temperature conditions indicated above shall be taken into consideration and equipment suitably derated where necessary. For areas not covered above, equipment selection and derating shall generally be based on Ambient temperature of +50°C.

The equipment offered shall be suitable for smooth, efficient and trouble free service in the tropical humid climate prevailing at Bhilai, CG and under the ambient temperature conditions indicated above for the different shops and areas. In hot areas of higher temperature conditions, the equipment shall be adequately protected against damage from radiant heat and hot air.

The equipment shall be designed to give efficient and reliable performance under heavy steel mill conditions and shall be such that the risks of accidental short-circuits due to animals, birds or vermins are obviated.

(iv) **Power supply and Standard voltage levels**
The following standardized voltage levels shall be adopted:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>LTAC</td>
<td>415V, 3 phase, 50 Hz, 4 wire solidly earthed system. Power supply be made available at this voltage only.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other voltages shall be obtained by providing transformer/ transformer – rectifier unit with MCBs on both primary and secondary side and ±5% and ±10% taps on transformers secondary</td>
</tr>
<tr>
<td>b)</td>
<td>Control and signaling voltage</td>
<td>240 V, 110 V AC</td>
</tr>
<tr>
<td>c)</td>
<td>Socket outlets for hand lamps</td>
<td>24 V, single phase, 50 Hz, AC obtained through suitable transformers</td>
</tr>
<tr>
<td></td>
<td>Socket outlets for hand tools</td>
<td>240 V, 15A, 2 pin plus earth with plug interlocked switch</td>
</tr>
<tr>
<td>d)</td>
<td>Electromagnetic Brakes</td>
<td>220 V, DC obtained through individual brake control panels.</td>
</tr>
<tr>
<td>e)</td>
<td>Monitoring and signaling in electronic installations, mimic panels</td>
<td>24/48V, DC</td>
</tr>
<tr>
<td>f)</td>
<td>Illumination / Lighting</td>
<td>240V. AC</td>
</tr>
</tbody>
</table>

The three phase symmetrical short-circuit ratings of the switch gear at 415 V shall be 50 kA for 1 second.

The system/ unit/ equipment shall be designed so as to be suitable for the following variations in voltage and frequency:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible variations with rated performance, rated current and control effectiveness maintained</td>
<td>+ 10%</td>
</tr>
<tr>
<td>LT system</td>
<td></td>
</tr>
<tr>
<td>Permissible variations for control and regulation equipment with rated performance and control quality maintained</td>
<td>+ 10%</td>
</tr>
</tbody>
</table>

Voltage dip on the starting of largest LT motor shall be limited to 20% of the nominal voltage at the motor terminals. Total voltage dips on starting of large motors on crane shall be limited to 3% on crane and 8% in DSL system.

**(v) Trolley Lines and Power Supply Arrangements for Cranes (DSL System)**

(a) Trolley power conductors

Crane trolley lines for LRS crane shall be sectionalized with two separate feeding points. Two fully rated MCCB / Isolator shall be provided for each incomer feed point to crane DSL. Sectionaliser MCCB / Isolator shall be provided between the two incoming ACBs with necessary padlocking arrangement. In normal operation
the sectionalising MCCB/ACB shall be OFF. The MCCB/ACB and cables upto trolley lines shall be provided by supplier.

Isolator panels shall be provided for the repair section for maintenance by the Purchaser. Necessary DSL arrangement for repair section shall be provided by Tenderer.

When two or more cranes are fed from the same trolley line, hospital bays (repair sections) shall be provided with sectionalizing isolator so that repair or maintenance of any crane can be carried out without disturbing the operation of the other cranes.

Boarding or access platform shall be arranged within the limits of each repair section for approach to be crane.

The conductors shall be supported at 3000 mm intervals by insulators mounted on brackets welded to crane girders. Typical drawings indicating details of trolley line power conductors, supporting insulators, brackets, expansion joints, parallel aluminum bus, signal lamp assemblies etc. shall be furnished by successful Tenderer.

Trolley power conductors shall be of mild steel angle sections. The section shall be straight, unbranded and smooth on the running surface. Joints between lengths of angles shall be welded and all welds shall be finished flush with parent metal. The conductors shall be painted with anticorrosive paint, except for contact surface. Parallel aluminum buses shall be provided as specified. The maximum continuous length of power conductor section shall not exceed 30 m without an expansion joint in between. The power conductors shall be made from standard rolling length. The jointing of standard lengths shall be made by 100% but welding and top surface finished smooth by grinding to get free movement of the current collectors.

In order to provide electrical continuity across the expansion joints the power conductors on both sides of the joints shall connected by stranded aluminum conductor jumper, fitted with steel Aluminum strap and lugs suitable for the steel angle sections.

b) Insulators and trolley line holders

The insulators used for the manufacture of trolley line holders shall be preferably steatite, tufnol or porcelain insulation material having substantial mechanical strength specifically against blows and vibrations. They shall be capable of withstanding the impact and shocks resulting from operation of the machine. The creepage distance of the insulators shall not be less than 80 mm.

The insulators used shall have flash over values and mechanical strength not less than the following:

- Dry flashover voltage : 25 kV Wet
- flashover voltage : 12 kV
- Ultimate mechanical strength : 1000 kA

The trolley line holders shall generally conform to the design shown in the drawing to be furnished to the successful Tenderer. All sharp edges shall be ground smooth. The porcelain insulators shall be manufactured and tested as per IS: 1445 –1997

c) Supporting brackets

The trolley line conductors shall be mounted on holders. The holders shall be bolted on to brackets which in turn shall be welded on to crane girder at stiffeners at regular intervals. In normal run, intermediate type of brackets shall...
be used, but when sectionalizing gaps or expansion joints are provided, sectionalizing type of brackets shall be provided.

d) Steel to Aluminium straps

These are meant for connecting parallel aluminium bus, at expansion joints, power supply cables from load break switch. They shall be complete with MS cadmium coated bolt nuts, spring washers, lugs etc.

e) Signal lamp assembly

Signal lamp assembly shall be industrial, heavy duty dust tight and water proof in construction suitable for indoor or outdoor locations. The units shall comprise three lamps for three phase with red glass lens and reflectors. The lamp shall be provided with dropper resistance connected in series with the lamp and the resistance shall be rated for continuous inclusion in the circuit. Alternatively, a built-in transformer may be provided to suit the lamp voltage.

f) Aluminium parallel bus

These buses shall be of E.C. grade aluminium. They shall be free from any deformity in profiles.

(vi) Current Collectors

2 nos. per trolley line shall be provided. The collector shoe will be of heavy duty design and chamfered at both ends, each rated for 100% of total crane rating. Double collectors on each earth trolley line shall be provided and these shall be similar to those on power trolley line. Collector shall be multi hinged for self–aligning. Collector will be designed in such a way that load is transmitted not no the insulators but on the insulator stud to avoid damage to insulators.

(vii) Power distribution on crane

One adequately rated load break manual isolator with locking facility shall be provided immediately after current collectors on incoming line on the crane. The isolator shall be capable of carrying current of two largest motors.

Power from the isolator shall be taken to the air circuit breaker to be provided outside the operator's cabin or on the bridge depending on the availability of space. In case of pendant operated cranes, this circuit breaker shall be located in protective panel located at bridge platform.

The breaker shall be provided with under voltage, over load and short circuit releases. The breaker shall also be with earth fault protection The breaker can be closed only when

- All master controller handles are in neutral position.
- One of the stator or directional contactors are in closed positions.
- Emergency corner switches not operated.
- Door/Gate switch are not actuated and gravity limit switch for hoist motion not operated. Power for lighting and magnet circuits shall be tapped from the incoming side of isolators near current collectors.

(viii) Power supply for CT. motion

Flexible trailing cable systems mounted on retracting support system shall be used. The system shall consist of insulated multi-conductor or several single conductor cable with permanent termination on the bridge and on the trolley. The flexible trailing cables shall have ample length and shall be supported by means of
properly designed movable clamps. These clamps shall be fitted with rollers and shall run freely on a guide rail allowing relative movement of bridge and trolley without undue stress or wear on the suspended cable. The flexible cable shall be EPR insulated CSP / PCP sheathed type.

or rotating trolley cranes, power supply shall be through festoon cable arrangement / rotary current collector. Cable reeling drum or cable basket shall be used for power supply to the magnet from the trolley. Two spare turns of cable provided on cable reeling drum. The cable reeling drum shall be directly driven by hoist mechanism, a clutch shall also be provided to disconnect the drum from hoist mechanism.

(ix) **Meters**

Ammeter and voltmeter with selector switches shall be provided on the incoming line in operator’s cabin.

Ammeter and voltmeter shall be provided on DC side for Electromagnets.
(x) **Control features**

All controls shall be fully magnetic, operated through master controllers. All travel motions shall be provided with plain rotor resistance control with plugging. For long travel drives, the electrical control shall be grouped for the individual pair of motors separately in case of four motor drive and each pair of motors shall be able to drive the crane at reduced acceleration and speed. As an anti-skewing measure, out of a pair of motors for LT., if one drive motor trips, the other drive motor shall also be switched off. For pendant control, plugging shall be avoided for travel motion.

Brakes shall not be used for speed control.

Synchronization of separate drives where required shall be done with the used of solid state thyristor control.

For all hoist motions, except where creep speed is required, plain rotor resistance control shall be provided on all master controller notches in the hoisting direction. The rotor resistance shall be cut out gradually when moving from lower to higher notches such that current peak of 2 times the rated current is not exceeded. In the lowering direction of the motion, controlled lowering shall be provided using one/ two plugging notches, one single phasing notch and one/ two super synchronous power lowering notches. For obtaining creep speed, conventional methods like planetary gear system, DC. injection (where requirement calls for creep speed in lowering direction only) etc. may be offered.

Hoist control circuit shall also be provided with anti-drop feature i.e., whenever the master controller is brought back to zero position from higher notches in both directions, the motor shall automatically be connected to hoisting direction for some time (time adjustable through timers) to avoid the downward drift of the load. Brakes shall be clamped in zero position of the master controller.

(xi) **External control of auxiliary hoist and CT of LRS Crane**

Tenderer shall supply one no. of Ground Control Post in Pedestal for installation in PCM control room. The control post shall have following facilities:

a) Control on PB- This shall transfer the control of CT and auxiliary hoist from cabin, master controller to ground control post and will not allow LT motion from cabin.

b) For CT and aux. Hoist 4 push buttons each (total 8 PBs) shall be provided on ground control post for following application:

- 10% speed of hoist & lower
- 30% speed of hoist & lower
- 10% speed of CT forward & reverse
- 30% speed of CT forward & reverse

The control post shall be connected to the main control of cabin on crane through hear resistance flexible cable with copper conductor arrangement and plug and socket system. The socket shall be fixed
to the cabin. The no. of pins for socket, no. of additional aux. Contactor, no. of cores for flexible cable to achieve the above control shall be decided by the Tenderer during detail engineering and shall be included in the scope of supply of Tenderer. Further, Tenderer shall quote radio control system to achieve the above control requirement as an optional feature. Cost for the radio control option shall be indicated separately.

(xii) **Thyristor control drives**

Thyristor control shall be provided for all the cranes operating in areas where ambient temperature is more than 50 deg.C and for Mixer Charging Crane. Control shall be achieved through master controllers for each direction. Rated and creep speeds are to be provided in each direction i.e., hoisting and lowering. Creep speed shall be 10% or lower as per operational requirements of rated speed. The thyristor regulator shall be fully controlled and suitable for four quadrant operation.

Speed control of the slipring motor shall be achieved through regulation of stator voltage with resistance in the rotor circuit, if necessary. The reversal of direction shall be through thyristor/ magnetic contactor which shall open and close at zero current.

The continuous rating of the thyristor shall be atleast 2.0 times the motor rated current at mechanical KW and the converter shall be designed and rated for load requirement taking care of peak currents during acceleration, normal operation and regeneration conditions. The dv/dt and di/dt rating of the thyristors shall be suitably selected.

The repetitive PIV rating of semi conductor devices shall not be less than 2.5 times the peak of normal system voltage. Thyristor bridges shall include R.C. snubber circuits across the thyristor, high speed semi-conductor fuses with micro-switches for monitoring of failure. Closed loop regulation suitable for the system with various feed back such as speed, current etc. shall be provided. Speed feed back shall be through tacho-generator of permanent magnet type mounted on the non-driving end of the motor shaft. The regulation shall include ramp generators, potentiometers for various setting, various regulators, signal conditioners, logic command module sequence, module, trigger module, zero and over speed monitor, torque less protection module etc. as per the requirements. The control and regulation equipment shall be able to maintain their rated performance and control quality even under conditions of variation of +10% and - 15% in voltage and +5% in frequency. A zero current sensing device shall be incorporated. The reversing of stator contactor shall be done at zero current. Braking down to zero speed shall be electrical with mechanical brake setting only at zero speed. Protective features like anti-drop etc. shall be incorporated to prevent load setting. The circuitry shall also provide for the protection against failure of motor torque such that the mechanical brake sets in such cases. All other features of conventional crane controls shall also be built into the scheme. The following shall also be provided on the A.C. side.

- Surge suppressor
- Over current protection
- Overload protection
- Single phase protection
- Phase sequence protection
- Ammeter and voltmeter with selector switches
- Isolating switches

Control and auxiliary supply shall be provided with separate transformer and under voltage protection.

The test shall be performed as per IEC: 146.

Details of the system offered shall be furnished along with necessary single line diagrams and block diagrams.

All the control modules shall be grouped in a sheet steel enclosure. The control module cards shall be made of epoxy glaze and suitable for plugging into the racks. The cards shall be locked into the rack, which carries a sealing bar and assists locking of the cards thereby cutting down on the wear of the printed circuit connector contacts which can be subjected to high rate or vibration and further avoid the disconnection of cards from the connector. The thyristor panel shall be suitably mounted so that little vibrations are reflected to the components and connection.

The cables for the thyristor controller and associated equipment shall be laid and clamped separately on the crane as far as possible.

(xiii) **VFD control drives**

VFD control shall be provided for cranes operating in areas where operating temperature is 50 deg. C. Control shall be achieved through master controllers for each direction. Rated and creep speeds are to be provided in each direction i.e., hoisting and lowering. Creep speed shall be 10% or lower as per operational requirements of rated speed. The VFD shall be fully controlled and suitable for four quadrant operation.

(xiv) **Variable Voltage Variable Frequency (VVVF) Drive**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Basic design particulars</td>
<td>Digital control technology with vector control (with / without PG as per requirement).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- IGBT based with sine coded PWM control.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Industrial and continuous duty.</td>
</tr>
<tr>
<td>2.0</td>
<td>Type of connection</td>
<td>Three phase frequency converters with rectification and inversion i.e. variable voltage and variable frequency output with current source / voltage source (PWM) inverters.</td>
</tr>
<tr>
<td>3.0</td>
<td>Overload capacity</td>
<td>150% of the rated current for 1 minute following 100% load &amp; to meet the drive overload capacity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200 % for 3 Sec.</td>
</tr>
<tr>
<td>4.0</td>
<td>Efficiency</td>
<td>More than 96% at full speed and load.</td>
</tr>
</tbody>
</table>
5.0 Input power supply | 415 V AC+ /- 10%.  
| 3 phase.  
| 50Hz + / -5 %  
| - 4 wire neutral earthed system.  
6.0 Regulated power supply for reference setting | Voltage variation of (+/-) 0.1 % with and input Variation of +10% -15%.  
| Steady state regulation of (+/-) 0.25 % Guaranteed against 100 to 200 % load disturbance and + 3%, -6% input supply frequency variation.  
7.0 Input reference voltage | 10 V DC to 0 V to 10 V DC / 0 -10 V DC / 4 mA to 20 mA.  
8.0 Output frequency | 0.5 – 400 Hz.  
9.0 Output frequency resolution | 0.01 Hz.  
10.0 Started torque | 150 % / 1 Hz. (without PG)  
| 150 % 0 RPM (without PG)  
11.0 Torque accuracy | +/-5%.  
12.0 Speed control accuracy | +/- 0.02 %.  
13.0 Ramp rate | Linear acceleration and deceleration adjustable Independently from 0 to 999.9 seconds.  
14.0 Vibrations | Suitable to withstand vibrations more than 0.5g.  
15.0 Main power components In incoming AC side | Matching input isolation transformer / line reactor for harmonic and noise suppression.  
| AC line surge suppression network.  
| Input contactor.  
16.0 Converter – Inverter | Diode bridge/ Thyristor bridge for AC / DC.  
| Equipment | DC link circuit with reactor / capacitor  
| IGBT bridge for Inverter for DC / AC.  
| Harmonic transformer.  
| Main PLC to take care of interlocking and Sequencing etc.  
| Mimic panel (where drive is HT).  
17.0 Load side components | Filter network  
| Over – load relay for each motor.  
| Output contactor in output side.  
| Output reactor / terminator.  
18.0 Diode Bridge | Minimum ratings of Diode cells  
| PIV rating : 2.5 times the peak value of line voltage  
| Dv/dt rating : 200 V / microsecond for voltage control and 1000 V/ microsecond for inverter control.  
| Dv/dt rating : 100A / microsecond.  
19.0 Protective features | AC line surge suppression network and over voltage protection.  
| Under voltage in DC bus
<table>
<thead>
<tr>
<th></th>
<th>Over voltage in DC bus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over speed monitor</td>
</tr>
<tr>
<td></td>
<td>Over load</td>
</tr>
<tr>
<td></td>
<td>Earth fault</td>
</tr>
<tr>
<td></td>
<td>Instantaneous over current</td>
</tr>
<tr>
<td></td>
<td>Transformer fault, if applicable</td>
</tr>
<tr>
<td></td>
<td>Cooling fan failure – Stall monitor for motor alarms.</td>
</tr>
</tbody>
</table>

20.0 **Annunciations**

Following faults shall be annunciated in keypad of the drive / HMI.

- AC line surge suppression network and Over voltage protection.
- Under voltage in supply network
- Phase sequence protection and monitoring
- Under voltage in DC bus
- Over voltage in DC bus
- Over Speed monitor
- Over load
- Earth fault
- Instantaneous over current
- Transformer fault, If applicable
- Cooling fan failure
- Stall monitor for motor alarms.
- Motor fault (winding / bearing temperature, vibration) as applicable
- Loss of frequency command
- Shall be able to store at least 16 previous faults
  - In memory on FIFO sequence.

21.0 **Meters**

- Output voltmeter and ammeter with selector switches.
- Input voltmeter and ammeter with selector switches.
- Output frequency meter
- KW meter for drive ratings above 200 KW.

22.0 **Selector switches**

- Local / Remote.
- Auto / Manual.
- Main / Bypass.

23.0 **Pushbuttons**

- Trip reset.
- Start.
- Emergency stop

24.0 **Lamps**

- Drive trip.
- R, Y, B phase power ON.
- Control supply ON.

25.0 **Regulation & control facilities**

- Reference speed setter
- Ramp generator
- Speed feed back
- Current feed back
- Trigger module
- Pulse transformers
- Logic control Module
- Sequence module
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.0</td>
<td>Remote control facilities</td>
</tr>
<tr>
<td></td>
<td>Shall have transducer to monitor the outputs like motor speed at remote place / HMI Facility to accept speed reference from HMI / engineering station.</td>
</tr>
<tr>
<td>27.0</td>
<td>Operator panel</td>
</tr>
<tr>
<td></td>
<td>Shall be mounted on the front door of the unit.</td>
</tr>
<tr>
<td>28.0</td>
<td>Membrane keypad</td>
</tr>
<tr>
<td></td>
<td>The keypad shall be logically designed for two operating areas with required number of keys.</td>
</tr>
<tr>
<td></td>
<td>Local operator control like Local start / stop, Jog forward / reverse. Programming.</td>
</tr>
<tr>
<td>29.0</td>
<td>LCD display</td>
</tr>
<tr>
<td></td>
<td>Display shall be black lighted, enabling viewing In extremes of lighting conditions.</td>
</tr>
<tr>
<td></td>
<td>Display shall be in alphanumeric (in English Only) 16 characters, 2 lines.</td>
</tr>
<tr>
<td></td>
<td>All the last 16 faults stored in memory (in FIFO sequence) shall be displayed by scrolling.</td>
</tr>
<tr>
<td>30.0</td>
<td>Construction features</td>
</tr>
<tr>
<td></td>
<td>Floor mounted, free standing Dust and vermin proof Sheet steel clad Minimum 2.5 mm thick for panels.</td>
</tr>
<tr>
<td></td>
<td>Minimum 2.0 thick for doors and side covers.</td>
</tr>
<tr>
<td></td>
<td>Suitable to withstand vibrations to be encountered in steel plant application.</td>
</tr>
<tr>
<td></td>
<td>Cubicles with illumination lamps, door switches, space heaters and adequate sockets for soldering.</td>
</tr>
<tr>
<td></td>
<td>All control blocks plug-in-type with necessary test sockets.</td>
</tr>
<tr>
<td></td>
<td>Unit shall be self contained and serviceable.</td>
</tr>
<tr>
<td>31.0</td>
<td>Enclosure and ventilation</td>
</tr>
<tr>
<td></td>
<td>Enclosure conforming to IP – 52 or better with Weather proof enclosures Units shall be provided with cooling fans and Louvers at the bottom sides.</td>
</tr>
<tr>
<td></td>
<td>All louvers shall have fine mesh behind them.</td>
</tr>
<tr>
<td></td>
<td>Ventilation through individual ventilation ducts, From bottom not acceptable.</td>
</tr>
<tr>
<td></td>
<td>The VVVF shall have a separate module / card for hoisting / lowering motion.</td>
</tr>
</tbody>
</table>
(xv) **Panels**

There will be separate panels for each motion in addition to the protective panels and resistance panels.

All panels shall be of free-standing floor-mounting construction, suitable to withstand vibrations encountered on crane. Hinged doors shall be provided for closed type panels. Panels shall be front wired. Front wired live points of bottom most equipment shall be mounted at least 350 mm above the bottom cover of the panel. Panel shall be fabricated from 2.0 mm thick steel sheet.

Power and control terminals shall be segregated. 10% spare terminals shall be provided in each panel.

Equipment in the panel shall be so mounted that their removal or replacement from the front is easy.

Separate control panel for each motion shall be provided.

Panels shall be of closed type when mounted on bridge platform.

The panels shall be mounted along the girder facing the hand railing. Sufficient clearances shall be provided between the panels. A minimum clearance shall be provided in front of the panels for walkway and approach as per I.E. Rules. The panels shall be supported in the back from the girder to avoid vibrations. Open type panels may be used for installation inside the box girders. In this case, adequate lighting and ventilation shall be provided for the room.

(xvi) **Switchgears**

Each mechanism motor shall be provided with MCCB, contactors on stator and rotor sides, oil dash pot type over load relays and suitably rated rotor resistances. In case of thyristor controlled drive, each mechanism motor shall be provided with breaker / switches, transformer, thyristor, rotor resistances, contactors on stator and rotor side etc. Each motor shall be fitted with a tacho-generator for speed feedback. The overload capacity of thyristors shall be as per IEC. The speed range shall be 0-120% of rated speed.

MCB shall be provided in the control circuit of each motion. Each brake circuit shall be provided with a suitable contactor.

Rating of contactor selected for any mechanism shall be at least 50% higher than the respective motor full load current for the mechanism at 40% duty cycle. The minimum rating of the contactor used shall be 30A and the life of each contactor shall not be less than 10,000 hrs. of operation.

Reversible directional contactors shall be interlocked both mechanically and electrically.
(xvii) **Motors**

Heavy duty reversible crane service, totally enclosed fan cooled, foot mounted, wound rotor motor conforming to latest edition of IS: 325-1996 shall be used for various drives. Class of insulation shall be F/F (Stator/Rotor) with temperature rise limited to that for ‘B’ Pullout torque to the not less than 225% and 275% of full load torque corresponding to 40% CDF for class M3 & M5 and class M7 & M8 duty cranes respectively.

Motor selection shall be done as per IS : 3177 – 1999. The main motor shall have following speed ranges:

a) Class M3 & M5 duty cranes:
   - Main & auxiliary hoist: 750 rpm
   - Long & cross travel: 1000 rpm

b) Class M7 & M8 duty cranes:
   - Main & auxiliary hoist: 600 rpm
   - Long & cross travel: 750 - 1000 rpm

All motors shall have the terminal box at top. Frame sizes shall conform to IEC Standards. Horizontal foot mounted and with tapered shaft extension.

While selecting the motor rating following shall also be taken into consideration:

- Duty type S4 & S5
- Cyclic duty factor
- Number of switchings per hours
- Type of controls used
- Inertia of the motor and mechanism
- Ambient correction factor
- Service factor
- Derating for thyristor control
- Wind pressure

Maximum permissible operating speed shall be 250% of synchronous speed or 2000 rpm whichever is less. Over load capacity 150% of full load current for 2 minutes without damage or permanent deformation.

(xviii) **Brakes**

Brakes shall be D.C. electromagnetic type confirming to AISE Standard. The brake coils shall be made of copper and of insulation class ‘F’.

Brakes shall be designed to fail safe whenever the current is interrupted either intentionally or by failure of the main supply.

Brake circuit forcing shall be provided for D.C. brakes. D.C brake circuit shall be switched off on D.C. circuit for quick operation of brake.

A separate set of parking brake for L.T. motion shall be provided for each out door crane. Power supply for these brakes shall be obtained from protective panel.
(xix) **Limit switches**

Roller lever operated, resetting limit switches shall be provided for all travel motions. For each hoist motion, a rotary cam type over hoist and over lower, self resetting limit switch shall be provided. This limit switch shall have independently adjustable cams for hoisting and lowering motion. The cams shall have adjustability such that end limit can be set to within 100 mm of the hoisting or lowering motion. In addition to this, a back up ultimate limit switch of series/shunt gravity type shall be provided to prevent over hoist. The later shall be of manual reset type. In case of cranes handling hot metal, the gravity limit switch shall preferably be of shunt type. Provision shall be made to bridge the gravity type limit switch contact by push button/switch or any other means to lower the load. An indication shall be provided to the operator whenever this limit switch has operated. Suitable limit switch shall be provided for slack rope, gate/door opening, slew mechanism, grab closing / opening etc. wherever necessary.

(xx) **Anti- Collision Devices**

In cranes where two or more cranes are operating in the same bay (at same or different level) all cranes shall be provided with suitable Anti-collision system. Anti-collision device shall be optical type.

A sound signal shall be provided to the crane operator when they are at certain safe distance apart (preferably distance to be adjusted as a function of speed at site) and crane shall stop. After few seconds, it shall be possible to run the cranes towards each other (or only one crane can move towards the other) till buffers of the cranes meet by providing “by pass” in the operators cabin.

Anti-collision shall also be provided on trolley for twin trolley cranes along with suitable by pass arrangement.

(xxii) **Resistances**

Air cooled, robust, heavy duty, corrosion resistant punched stainless steel (AISI-406) grid type. Resistance shall be in step wise execution. In a particular box the rating of resistances shall be the same to the extent possible. Resistance shall have vibration proof only.

Rated for 10 minutes duty. Continuous duty rating of resistances shall be provided in case of hoist motions controlled by thyristor converters.

Maximum temperature of resistor elements shall be limited to 2750 C at desired duty. Suitable tapping points shall be provided. Resistance boxes shall be mounted in racks that permit independent removal of any selected box.

(xxii) **Master controller**

Cam type master controller with joy stick type lever shall be used.

Separate master controllers for hoist, LT & CT shall be provided.

Duel master controller operated with single handle shall not be used.

Master controller for each motion controls shall have four/five notches
in each direction.
Master controller shall have three positions i.e Lift - Off - Drop. It shall have spring return from drop position to Off position.

(xxiii)**Lighting, socket outlets, bells etc.**

Lighting shall be provided in operator’s cabin, staircases, platforms and working areas.

Minimum 4 nos. 400 watts high pressure sodium vapour flood lights equally spaced (under crane girders) about the crane span shall be provided along with shock absorbing and anti-swing suspension arrangements. More numbers of fittings shall be provided if required for cranes with longer span and/or longer height of lift.

Fluorescent lamps with necessary fittings shall be used for operator’s cabin, staircases, platforms etc.

Adequate number of hand lamp socket outlets (2 Pin, 10A, 24V) and power socket outlets (3 Pin, 20A, 240V) shall be provided along with switches socket & switch shall be interlocked suitably. A hand lamp (160W SLS lamp with enclosed type battery and wire guard) along with sufficient length (15m) of cable with a plug shall also be provided for each crane.

An alarm bell shall be provided on each crane.

(xxiv)**Electromagnets**

All magnets shall be suitable for steel plant application and shall be welded construction.

Magnets shall be rated for 230 V DC and suitable transformer – rectifier units shall be provided for feeding them. Rectifiers shall also be suitable protected by suitable protective device.

Magnets shall be class ‘H’ insulated, at least 50% rated, copper conductor would and shall have surge suppressor box and separate in terminal box for termination of cable. Magnets for production cranes handling hot products shall be 75% rated. Surge suppressor shall be compact, non-linear resistor silicon carbide thyrector, variator or metrosil type.

Each magnet shall be provided with suitable plug socket unit.

One earth terminal on magnet to be connected to spare core in magnet cable.

Wherever specified, a set of batteries, a battery charger, one annunciation system and other accessories shall also be provided along with magnet so that the magnet can hold the full load for at least 20 minutes in case of power failure.

(xxv)**Equipment in operator’s cabin or on pendant unit**

a) In case of pendant controlled crane following shall be included on the pendant unit:
Push button for  | Hoist slow, hoist fast, lower slow, lower fast, left cross traverse, right cross traverse, forward long travel, backward long travel, emergency stop conditions.
--- | ---
Switch for | Lights and bells
Lamps for | Power ‘ON’ indication and emergency corner switch operation.

b) In case of cabin operated cranes:

The operator’s cabin shall contain the following:
- Master controllers for all the motions and magnet (wherever applicable).
- Emergency stop push button.
- Foot switch for alarm or bell.
- Switches for all lighting equipment on crane.
- Switches for air conditioner, exhaust fan and for cabin fan.
- A fire extinguisher.
- Insulating mat and operator’s chair.
- Cabin light.

Annunciation panel with indication lamps for power ‘ON’ control ‘ON’ emergency corner switch operated, ammeter and voltmeter with selector switches.

c) In case of master controller operated cranes:-

In this case there should be the facility of controlling the crane from the control pulpit.

All the control facility available in case of operating from the operator’s cabin is duplicated in the control pulpit through the cable.

d) Radio remote control:-

In this mode of control system, all the 3 motions
- Hoist.
- Cross travel.
- Long travel.

  can be controlled.

The system shall have capability to provide range of 1.5 times the long travel distance of the crane.

In the case of signal failure, all motion shall come to a safe stop. The system shall have facility of controlling speed in two steps:-

Slow speed on the first step of the breaker contact / pushbutton of the radio remote control representing the first or second notch of the master controller.

Full speed on the second step of the breaker contact / pushbutton of the radio remote control representing the final notch of the master controller.
**Transmitter** :-

Transmitter shall have following features:-

- Constructed with sophisticated microprocessor technology and surface mounted electronics.
- Transmission type :- FM FSK
- Transmission speed :- 9.6 Kbps.
- Built in self test for all functions.
- Transmitter shall consist of switching breaker, dial switch and push buttons.
- Switching breaker shall be non locking to zero position or maintained function.
- Indications:-
  - Operation status
  - Battery status
  - Indicators that display information from crane.
- PIN -code (Personal Identification Number)
- Internal antenna.
- Rechargeable battery.
- Battery 7.2 V NiCd
- Operating time :- About 8 hours.
- Different operating frequencies (minimum 16 nos.)
- Two hand upstart.
- Stop push button.
- Operating conditions :- Areas having large temperature variations, dusty, more vibrations, oil and humidity.
- Operating temperature range :- Min. 10 deg.C to Max. 60 deg.C
- Protection class : IP - 54.
- Casing material : Polycarbonate / ABS plastic.

**Receiver** :-

Receiver shall have following features :-

- Upto 20 functions exclusive safety relays (for transmitting preset reference values to VFD in the crane).
- 2 safety relays (for control of main contactor)
- Power supply suitable for 240 V AC, 6 A.
- Minimum 16 different operating frequencies.
- Two redundant microprocessors for monitoring each others.
- Cyclically redundancy checks check for high security of transmitted radio messages.
- Frequency scanning in the receiver.
- Memories last 10 users.
- Interlocking of the relays.
- Momentary or latched relay functions.
- Two hand up start (to avoid unintentional start).
- Protection class: IP - 65.
- Casing material: Aluminium profile for fast mounting on DIN rail.
- Operating temperature range: Min. 10 deg.C to Max. 60 deg.C.

(xxvi) **Enclosure Class**

a) For indoor operations

- Resistance boxes: IP : 11
- Motors: IP : 55
- All other electric equipment: IP : 54

b) For outdoor operations

- Resistance boxes: IP : 33 with canopy
- Motors & panel: IP : 55 with canopy
- All other electrical equipment: IP : 65 with canopy

(xxvii) **Cables**

Power cable suitable for 3 Phase, 4 wire, AC power supply system.

All cables shall have stranded copper conductors. Control wiring shall be with 2.5 mm² copper; minimum size of power cable shall be 4.0 mm². Fixed wiring on cranes shall be carried out with PVC insulated. PVC sheathed armoured cable or HRPVC insulated HRPVC sheathed cable or better.

All flexible cables (i.e. cables for magnet, trolley, feed, pendant unit etc.) shall have copper conductor, EPR insulation and CSP / PCP sheathing or better.

All cable shall be suitably de-rated for grouping and higher ambient temperature.

All cables shall be of 1100 Volts grade.

All accessories like cable glands, clamps, pipes, wire and terminal marks etc. shall also be provided.

Cable laying and terminations shall be such that the chances of cables getting damaged is remote.

Cable sizes shall be selected considering motor rated current.
In all passages and on trolley the cable shall be laid in trays and shall be covered by similar trays and properly clamped & fixed.

a) LT Power Cable

1.1 kV, heavy duty power cable, 4/3 core with stranded sector shaped (sm) or with compact circular stranded (rm/V) or circular stranded (rm) Copper conductors as applicable, PVC insulated suitable for 70°C operation as per IS:5831-1984, core stranded together provided with a common covering of PVC inner sheath, galvanized round steel wire armoured and PVC outer sheathed, multi core conforming to IS:1554 (Part-I – 1988) Type TWY.

b) Control Cables

1.1 kV, circular stranded (rm), annealed copper conductor, PVC insulated suitable for 70°C operation, as per IS:5831-1984, cores stranded together provided with a common covering of PVC inner sheath, galvanized round steel wire armoured and PVC outer sheathed, multi-core similar to IS:1554- (Part-I)-1988, Type YWY.

c) Flexible Trailing Cable


(xxviii) Earthing

A ring earthing system shall be provided on the crane. Each and every electrical equipment shall be connected to this earthing at least at two points. However the electronic circuit insulated earth wire shall run in panel and terminate at main earth connection only at one point. The earthing shall be connected to the fourth trolley line in DSL system through 2 nos of current collector. Additionally current collectors shall also be provided on crane rails for earthing on crane. All these collectors shall be connected to earthing ring.

An earth core shall be provided in trolley feed cable and the magnet. The cable reeling drum shall have a separate slipring for earthing purpose.

It shall conform to general specification for earthing.

Rubber mattings shall be provided in front of the protective and control panels.

All bonds between earth conductors and crane parts shall be welded if possible, or rivetted and soldered. Where screwed bonds are made, care shall be taken that there is satisfactory contact surface and nuts shall be locked to prevent their loosening. Earth connections to equipment shall be made by means of multi strand flexible conductor to adequate section. The earth ring on the crane/ machine shall be connected to the plant earthing system through to gantry rails. Each end of each gantry rail shall be bonded to the plant earthing system.
In addition, intermediate earthing bond shall also be provided on the rails at every 60 m in case of longer tracks.

Flexible copper bonds shall be provided across any gap in the running gantry rail.

For mobile equipment with flexible cables, one separate copper conductor of adequate size shall be provided for earthing.

(29) **Colour code for electrical equipment**

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Description of equipment</th>
<th>Colour</th>
<th>Paint shade No. as per IS : 5-1991</th>
<th>Equivalent RAL Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>MOTOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>6.6 kv motors</td>
<td>Light Gray</td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>2.</td>
<td>Motors (415v or below)</td>
<td>Brilliant Green</td>
<td>221</td>
<td>6010</td>
</tr>
<tr>
<td>3.</td>
<td>Custom Built DC Motors</td>
<td>Light gray</td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>4.</td>
<td>DC 460 V Motors</td>
<td>Azure Blue</td>
<td>104</td>
<td>5000</td>
</tr>
<tr>
<td>5.</td>
<td>DC Motors upto 250 V</td>
<td>Oriental Blue</td>
<td>174</td>
<td>5018</td>
</tr>
<tr>
<td>II</td>
<td>Mounted Electrics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Equipment installed on or along with motor (Viz. Tacho-generators, brake etc.)</td>
<td>Same as that or motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Equipment installed on mechanism but separate from motor (Viz. Limit switches, pull cords, speed switches, load calls, photo elec. relays etc.)</td>
<td>Light Gray</td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>III</td>
<td>Transformers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Outdoor transformers (incl. their associated equipment/panels installed outdoors)</td>
<td>Aluminum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Indoor transformers</td>
<td>Dark Admiralty Gray</td>
<td>632</td>
<td>7012</td>
</tr>
<tr>
<td>IV</td>
<td>Switchgear of substation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>6.6 kv switchgear</td>
<td>Light Gray</td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>2.</td>
<td>415 switch gear (Substation equipment)</td>
<td>Brilliant Green</td>
<td>221</td>
<td>6010</td>
</tr>
<tr>
<td>V</td>
<td>Control Gear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>All control panels (MCCs, PDBs, thyristor panels etc.)</td>
<td>Light Admiralty Gear</td>
<td>697</td>
<td>7001</td>
</tr>
<tr>
<td>2.</td>
<td>Light distribution board</td>
<td>Brilliant Green</td>
<td>221</td>
<td>6010</td>
</tr>
<tr>
<td>3.</td>
<td>Fire fighting panel</td>
<td>Post Office Red</td>
<td>538</td>
<td>3002</td>
</tr>
<tr>
<td>4.</td>
<td>Local control box</td>
<td>Light Gray</td>
<td>631</td>
<td>7042</td>
</tr>
</tbody>
</table>
### 3.3 DOCUMENTATION

(i) **List of drawings/documents to be furnished by the successful Tenderer for approval**

- a) General arrangement drawing of crane showing full details in plan and sections.
- b) General arrangement drawing of trolley/hoist blocks.
- c) Quality Assurance Plan for inspection.
- d) Detail specification of motor indicating type, KW, rpm, starting torque requirement, class of insulation, type of enclosure, frame size etc.
- e) Power requirement, details of motors, control scheme.
- f) List of spares for 3 years normal maintenance.

(ii) **List of drawings/documents to be submitted along with equipment by the successful Tenderer**

- a) GA drawings, complete assembly and sub assembly drawings of the equipment.
- b) Drawings of all equipment/component received from sub supplier.
- c) Test and warranty certificate for each item of equipment.
- d) Test reports and inspection reports.

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Description of equipment</th>
<th>Colour</th>
<th>Paint shade No. as per IS : 5-1991</th>
<th>Equivalent RAL Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>PLC, UPS, Control desk Mimic panel</td>
<td>Light Gray</td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>6.</td>
<td>Pulpit equipment</td>
<td>Light Gray</td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>VI.</td>
<td>Miscellaneous Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Junction boxes</td>
<td></td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>2.</td>
<td>Conduit pull boxes</td>
<td></td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>3.</td>
<td>Light fittings</td>
<td></td>
<td>631</td>
<td>7042</td>
</tr>
<tr>
<td>5.</td>
<td>110 V and 24 V transformer, sockets, lamp sets etc.</td>
<td>Canary yellow</td>
<td>309</td>
<td>1016</td>
</tr>
<tr>
<td>6.</td>
<td>Earthing strip</td>
<td>Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Battery charger</td>
<td>Brilliant Green</td>
<td>221</td>
<td>6010</td>
</tr>
<tr>
<td>8.</td>
<td>DC DB</td>
<td>Oriental Blue</td>
<td>174</td>
<td>5018</td>
</tr>
<tr>
<td>9.</td>
<td>Charger cum DC DB</td>
<td>Brilliant Green</td>
<td>221</td>
<td>6010</td>
</tr>
</tbody>
</table>
e) Instruction manuals for testing and commissioning.

f) Operation, maintenance and safety manuals.

g) Requirement of special tools and tackles.

h) Detail drawing list and specifications of all wearing out parts and parts subject to breakage during normal operating conditions.

i) List of spare parts with drawings, sketches, specifications and manufacturer's catalogue.
4.0 **Spare**

(A) **Commissioning Spares and Insurance Spares**

Supply of commissioning spares and insurance spares as required shall be in scope of supply of the Bidder along with the equipment. The list of commissioning spares and the insurance spares as per the format as given in SBD shall be furnished along with the tender. It shall cover requirements of erection, cold tests, startup and initial operation of the plant till integrated testing & successful commissioning and commencement of commercial production up to a period of six months. Any leftover commissioning spares shall be the property of the Purchaser. Any commissioning spares required over and above the list given by the Bidder shall have to be provided by the Bidder free of cost up to the successful commissioning & commencement of commercial production of the plant and equipment. The Bidder shall supply adequate insurance spares to ensure smooth operation and maintenance of the plant.

(B) **Consumables**

The Bidder shall supply all consumables such as initial fill of lubricants, oils, grease, chemicals, refractories, resins etc. as required to complete the plant till commissioning and shall have a shelf life of minimum one year. The scope of consumables shall include electrodes, shims, packings, bolts, nuts, gaskets, rivets, washers etc. The Bidder shall fulfill the requirement given in SBD.

The Bidder shall also furnish Indian equivalent of oils, lubricants, refractories and other consumables along with necessary specifications, drawings, catalogues etc. to enable the Purchaser to procure them from indigenous sources.

The Bidder shall indicate the annual requirement of all such consumables.

(C) **Operating, Maintenance and Two Years’ Spares:**

(1) The Bidder shall ensure the interchangeability of the parts wherever possible. The Bidder shall furnish an itemized list of interchangeable spares as given in SBD.

(2) The list of spares as necessary and recommended by the respective manufacturer for two years’ of reliable and trouble free operation and maintenance of all equipment under this package shall be in the scope of the Bidder. The same shall be quoted separately. In the event of order the successful Bidder shall furnish complete specification of the same.

(3) Spares list giving complete list of the replaceable parts, fully illustrated, shall be supplied. The list shall include the following information.

- Item designation
- Reference drawings
- Quantity installed
- Quantity recommended for two years’ normal operation including the insurance spares
- Weight of each spare part
- Supplier or sub-supplier’s catalogue number
- Recommended minimum stock
- Expected replacement time
- Installation instruction in detail shall be supplied both for original installation and future, for replacement of major electrical equipment, circuit wiring diagram shall be provided.

(D) Special Erection / Maintenance Tools and Tackles:

(1) The Bidder shall supply a complete and unused set of all the special tools and tackles including required number of tool boxes as required for erection, maintenance, overhaul or complete replacement of the equipment and components required for the plant. The Bidder shall submit a list of such special erection and maintenance tools and tackles.

(2) All the tools shall be supplied in separate containers clearly marked with the name of the equipment for which they are intended.

(3) The Successful Bidder shall indicate list of construction machineries, handling equipment and other facilities including tower crane or equivalent for erection at high elevation required for the execution of work based on their previous experience, considering site conditions and other considerations of work and furnish resource deployment plan. The successful Bidder shall mobilize these equipment at site for the execution of work and this is an important requirement of the project. The availability of required facilities shall be ensured for completeness of the project in time.

(4) For any fabrication / control assembly (necessary for erection) work to be done in the plant premises the plan shall be indicated by the Bidder. The necessary equipment such as plate bending machines, special purpose welding machines, fixtures, tools & tackles and other equipment required for fabrication shall be arranged by the successful Bidder.

(5) The successful Bidder shall carry out the testing of welded joints by radiographic and ultrasonic methods. They must have only qualified / certified welders with them for completing all the welding jobs.

(6) All the measuring instruments shall be calibrated having reference to NPL (National Physics Laboratory).
(7) All tools and tackles, apparatus, special instruments required for erection, testing, commissioning and establishment of the Performance Guarantee Test, measurements required for establishing the pollution control norms and such other instruments, as required, shall be arranged by the successful Bidder. After commissioning, the successful Bidder shall handover all the special tools & tackles to the Purchaser as per the requirement given in SBD.

(8) The successful Bidder shall supply all required consumables, initial fill, oil, lubricants, construction and erection materials including but not limited to shims, packing plates, joining compounds, kerosene, solvents, sealing compounds, tapes, connectors, brazing and soldering materials, welding and brazing gases and rods, electrodes and wires, erection bolts, nuts, rivets, piano wire, packing sheet and packing compounds, temporary supports, spacer templates, jute and cotton waste cloth, sand and emery paper etc. for the commissioning of the plant.

(9) For load testing of handling equipment, loads shall have to be arranged by the successful Bidder. Electrical/operation tests, as per standard practice, shall also be arranged and completed by them.

(10) All materials, equipment, tools, tackles etc. brought at site by the successful Bidder within the plant area shall not be removed without the written permission of the Purchaser. Similarly, all enabling works built/erected and/or acquired by them within the plant premises shall not be dismantled and removed without the written permission of the Purchaser.

(E) Information/Data on Spares and Consumables

The list of Spares & consumables shall be furnished by the successful Bidder as required in SBD. However, the successful Bidder shall furnish various information regarding spares, consumables, tools & tackles etc. as per the schedules indicated in chapter 12 of this Technical Specification.
5.0 **TECHNICAL DATA SHEET**  (To be filled by the vendor)

5.1 **TECHNICAL DATA SHEET (Mechanical)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DPR/TPR/ Crane No.</td>
</tr>
<tr>
<td>2.</td>
<td>No. Off</td>
</tr>
<tr>
<td>3.</td>
<td>Type of Crane</td>
</tr>
<tr>
<td>4.</td>
<td>Supplier/ Make</td>
</tr>
<tr>
<td>5.</td>
<td>Capacity (t)</td>
</tr>
<tr>
<td>6.</td>
<td>Span (m)</td>
</tr>
<tr>
<td>7.</td>
<td>Duty Class</td>
</tr>
<tr>
<td>8.</td>
<td>Speeds (normal &amp; Creep) m/min</td>
</tr>
<tr>
<td>a)</td>
<td>Main hoist &amp; creep</td>
</tr>
<tr>
<td>b)</td>
<td>Aux. Hoist &amp; creep</td>
</tr>
<tr>
<td>c)</td>
<td>Cross travel</td>
</tr>
<tr>
<td>d)</td>
<td>Long travel</td>
</tr>
<tr>
<td>9.</td>
<td>Height of lift (m)</td>
</tr>
<tr>
<td>a)</td>
<td>Main hook - Above floor</td>
</tr>
<tr>
<td></td>
<td>- Below floor</td>
</tr>
<tr>
<td>b)</td>
<td>Aux hook - Above floor</td>
</tr>
<tr>
<td></td>
<td>- Below floor</td>
</tr>
<tr>
<td>10.</td>
<td>Crane rail height above floor (m)</td>
</tr>
<tr>
<td>11.</td>
<td>Max wheel load (t) (without impact)</td>
</tr>
<tr>
<td>12.</td>
<td>Type of cabin</td>
</tr>
<tr>
<td>13.</td>
<td>Type of hook:</td>
</tr>
<tr>
<td>a)</td>
<td>Main hook</td>
</tr>
<tr>
<td>b)</td>
<td>Aux hook</td>
</tr>
<tr>
<td>14.</td>
<td>Location (Indoor/ Outdoor)</td>
</tr>
<tr>
<td>15.</td>
<td>Hook approaches (m)</td>
</tr>
<tr>
<td>a)</td>
<td>Main hook</td>
</tr>
<tr>
<td>b)</td>
<td>Aux hook</td>
</tr>
<tr>
<td>16.</td>
<td>No of rope falls, dia, construction, &amp; breaking strength for</td>
</tr>
<tr>
<td>a)</td>
<td>Main hoist</td>
</tr>
<tr>
<td>b)</td>
<td>Aux hoist</td>
</tr>
<tr>
<td>17.</td>
<td>Gantry rail size</td>
</tr>
<tr>
<td>18.</td>
<td>Crab rail size</td>
</tr>
<tr>
<td>19.</td>
<td>Over buffer dimension (m)</td>
</tr>
<tr>
<td>20.</td>
<td>Wheel base</td>
</tr>
<tr>
<td>21.</td>
<td>Wheel diameter for</td>
</tr>
<tr>
<td>a)</td>
<td>LT wheel</td>
</tr>
<tr>
<td>b)</td>
<td>CT wheel</td>
</tr>
<tr>
<td>22.</td>
<td>Handling attachments</td>
</tr>
<tr>
<td>23.</td>
<td>Special features (weighing device etc)</td>
</tr>
<tr>
<td>24.</td>
<td>Motor: (Type, kW, rpm, starts/hr enclosure etc)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>a) Main hoist</td>
<td></td>
</tr>
<tr>
<td>b) Aux hoist</td>
<td></td>
</tr>
<tr>
<td>c) Cross travel</td>
<td></td>
</tr>
<tr>
<td>d) Long travel</td>
<td></td>
</tr>
<tr>
<td>25. Type of control for each motion with corresponding characteristic curve:</td>
<td></td>
</tr>
<tr>
<td>26. Method of obtaining creep speed:</td>
<td></td>
</tr>
<tr>
<td>27. Power supply</td>
<td></td>
</tr>
<tr>
<td>- Power supply S.L.D:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Electric equipment specification</td>
</tr>
<tr>
<td>28. Control voltage</td>
<td></td>
</tr>
<tr>
<td>29. Ambient temp/ Environment</td>
<td></td>
</tr>
<tr>
<td>30. Total weight of the crane (t)</td>
<td></td>
</tr>
<tr>
<td>31. Break up of crane weight (t)</td>
<td></td>
</tr>
<tr>
<td>a) Structural</td>
<td></td>
</tr>
<tr>
<td>b) Mechanical</td>
<td></td>
</tr>
<tr>
<td>c) Electrical</td>
<td></td>
</tr>
<tr>
<td>32. Total weight of the crab (t)</td>
<td></td>
</tr>
<tr>
<td>33. Code of design</td>
<td></td>
</tr>
<tr>
<td>34. Details of swiveling / rotating arrangement, if any, along with scheme.</td>
<td></td>
</tr>
<tr>
<td>35. Any other information</td>
<td></td>
</tr>
</tbody>
</table>
5.2 TECHNICAL DATA SHEET (Electrical)

**MOTOR**

1. Project : 
2. Make : 
3. Driven Equipment : 
4. Motor Tag No. : 
5. Quantity : 
6. Voltage With Variation : 
7. No. of Phases/Connection/ : No of Terminals
8. Frequency With Variation : 
9. Fault Level (Mva) & Duration : 
10. Motor Type And Duty : 
11. KW RATING/POLE : 
   - At 40 Deg.C. : 
   - At Specified Ambient Temp. : 
   - With Derating. : 
   - BHP/BKW of Driven Eqpt. : At Rated Load
12. Frame Size/Mounting : 
13. Insulation Class With Temp Rise : 
14. Enclosure Type : 
15. Full Load Speed : 
16. Full Load Torque (FLT) : 
17. Starting Torque as % of FLT : 
18. Pullout Torque as % of FLT : 
19. FULL LOAD CURRENT (FLC) : 
20. Starting Current as % of FLC : 
21. Starting Time on Rated Load At : 
   - Rated Voltage : 
   - 85 % of Rated Voltage : 
22. Locked Rotor Withstand Time : 
   - Cold : 
   - Hot : 
23. Rotation Viewed From Driving End
<table>
<thead>
<tr>
<th></th>
<th>Specification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Gd Square of Motor</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>GD Square Of Driven Equipment</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Weight Of Motor</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Power Factor at</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) 50%Load</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) 75%Load</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(iii) 100%Load</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Efficiency at</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) 50%Load</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) 75%Load</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(iii) 100%Load</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Space Heater Watts/Volts</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Terminal Box Type &amp;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. of Terminals</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>No. of Starts Per Hour</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Noise Level at a Distance of 1m</td>
<td>From The Motor</td>
</tr>
<tr>
<td>33</td>
<td>Thermal Withstand Time</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Cooling</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Applicable Standard</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Hazardous Area Classification</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Bearing Details</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) Type of DE/NDE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) Size of DE/NDE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(iii) Make</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Location of Terminal Box</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Position From DE Side</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Lubrication Type</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Cable Size</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Paint Shade</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>G.A., Dimensions &amp; Mounting</td>
<td>YES/NO</td>
</tr>
<tr>
<td></td>
<td>Detail Drawings Enclosed</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Details Drawings for T.B.</td>
<td>YES/NO</td>
</tr>
<tr>
<td>45</td>
<td>Performance Characteristics</td>
<td>YES/NO</td>
</tr>
<tr>
<td></td>
<td>Curves Viz. Speed V/S Current &amp; Speed V/S Torque Enclosed</td>
<td></td>
</tr>
</tbody>
</table>