Bharat Heavy Electricals Limited
Fabrication Plant, Jagdishpur

Specification for EOT Cranes

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SECTION-I: QUALIFICATION CRITERIA

Vendor has to compulsorily meet the following requirements to get qualified for consideration of the technical offer for the SUPPLY OF EOT CRANES

<table>
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<th>S. No.</th>
<th>PARTICULARS</th>
<th>VENDOR’S RESPONSE</th>
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</table>
| 1.0   | Only those vendors, who have supplied and commissioned at least ONE Crane of Rated capacities or more in the past five years and such crane is presently working satisfactorily for more than one year after commissioning (on the date of opening of Tender), should quote.  

However, if such crane has been supplied to BHEL, then it should be presently working satisfactorily for more than six months after its commissioning and acceptance (on the date of opening of Tender) in BHEL.  

Performance certificate from the customers (minimum 2) regarding satisfactory performance of Crane supplied to them should be sent along with technical offer. |                   |
| 2.0   | BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.                                                                                                                                       |                   |
II. GENERAL:

1.0 Scope of Supply

1.1 Scope of supply covers the design, manufacture, supply, erection and commissioning of EOT Cranes as detailed below.

1.2 All the above cranes will be as per IS: 3177 Class M5 (II), IS: 807 and other relevant standards and this Specification and complete with all Electricals, Radio Remote Control, Crane weighing system and standard accessories as per requirement of each crane. Cranes must be rugged and robust in operation as per their nature of work.

2.0 The following should accompany the offer:

a) General Arrangement (GA) drawing to scale (showing elevation, cross section and plan of the crane) indicating clearances, hook approaches, lift, location and direction of view of operator, wheelbase, wheel loads with spacings etc.

b) Information as per Annexure-A.

c) Design calculations for all motions, structure etc., and selection of bought out items for deciding the suitability of offer. In absence of this information, the offer may be ignored.

d) Deviations from this specification, if any.

3.0 Successful Vendor should furnish the following prior to manufacture of the crane for approval by the purchaser.

a) The GA drawings containing all information as described in Clause 2.0 (a).

b) General layout drawing of the trolley.

c) Assembly drawing - inclusive of gearbox details - of individual drives like hoist, long travel and cross travel.

d) Layout of cabin showing location and fixing of all the equipment inside the cabin, such as Driver's seat, protective panel, isolating and control switches, fire extinguishers etc.

e) Circuit diagrams showing the wiring for the complete crane.

f) Final Design calculations for all motions, structure etc., should be submitted at the time of approval of GA drawings.

g) Quality Plan

Note:
The successful Vendor is required to measure all necessary dimensions i.e. Span, Head Room, Power supply system (DSL) and
rail size etc., at site before starting of the crane design / manufacturing.

4.0 The following documents/informations are to be supplied prior to commissioning of the crane.
   a) All the drawings approved by the purchaser along with all workshop drawings for structural and mechanical items containing full information such as tolerance, heat treatment etc.
   b) Operation & Maintenance manuals- 5 Sets, Maintenance Schedule, Lubricating Charts, Electrical circuit diagrams, catalogues of all electrical equipment and drawings mechanical spare part (i.e. Gears, Wheels, drum, drive shafts) etc. along with information on any other specific feature/s. Two sets of CD’s containing the documents / information recorded on it should also be supplied.

5.0 A toolbox containing all necessary tools (e.g., torque wrench, hand grease gun, set of spanners, screwdrivers etc.) required for the maintenance of the crane should be furnished along with the Crane.

6.0 The supplier should furnish material test certificates for all electrical equipment, cables, and parts used in handling loads (e.g. wire ropes, chains, hooks etc.), structural steel, mechanical components such as couplings, gears boxes, rope drums, pulleys, shafts, wheels etc.

7.0 The supplier should ensure that the crane is manufactured as per tolerances specified below.
   a) Span over L.T. Wheels \(65 \text{ mm}\)
   b) Diagonal on Wheels \(63 \text{ mm}\)
   c) Long travel wheel \(61 \text{ mm}\)
   d) Tilt of wheels or balance axle \(62 \text{mm}/1000\text{mm}(\text{Horizontal and vertical})\)
   e) Trolley wheel gauge \(63\text{mm}\)
   f) Trolley track gauge \(63\text{mm}\)
   g) Difference in height between trolley rails \(6H\) depending upon trolley track gauge.

<table>
<thead>
<tr>
<th>Trolley track Gauge S (mm)</th>
<th>Difference in height between trolley rails (6H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2500</td>
<td>4</td>
</tr>
<tr>
<td>2500 to 4500</td>
<td>6</td>
</tr>
<tr>
<td>Above 4500</td>
<td>8</td>
</tr>
</tbody>
</table>
h) Speeds at full notch with rated load, Voltage and frequency should be as follows.
   Traveling and Traversing = +10% /-5%
   Hoisting = +10% /-5% of specified speed
   Lowering = +25% /-5%

8.0 Assembly at site is to be kept as minimum as possible to enable early commissioning of the crane. Welding at site is to be avoided as far as possible. The supplier should satisfy himself about the site condition beforehand to avoid any difficulty during erection and commissioning of the crane.

9.0 The supplier should quote separately for spares (Optional) as considered necessary for two years of normal operation of the crane. However, the purchaser may use his discretion in selecting the spares.

10.0 In addition to the tests specified in the IS tests as under should also be done after erection.
   a) Speed Test
      I. Rated load Test: All the motions should be tested with rated load and the rated speeds should be attained within the tolerance limits indicated under clause 7 (h).
      II. Overload Test
          All motions of the crane should be tested with 25% overload in which case the geared speeds need not be attained but the crane should show itself capable of dealing with the overload without any difficulty.
   b) Brake Test
      I. The hoist brakes should be capable of braking the movement under conditions a (I) and a (II) of speed tests.
      II. The long travel and cross travel brakes should be capable of arresting the motion within a distance in Meters equal to 10% of the speed in M/Min.

12.0 After the load test has been performed, the wheel loads should be checked. The wheel load measurement should not deviate from the values mentioned in the static calculations by more than +3% for maximum and -3% for minimum wheel loads. Load for job proving at B.H.E.L. Fabrication Plant, Jagdishpur shall have to be arranged by the vendor, on returnable basis.
13.0 Guarantee shall be provided for 18 months after the date of commissioning of cranes.

III. REQUIREMENTS:

A) TECHNICAL:

1.0 The crane should be designed in accordance with the latest editions of IS: 807, IS: 3177, other relevant standards referred to therein and also in accordance with the requirements specified herein after.

2.0 Safe access for maintenance and removal of all mechanical and electrical parts must be ensured without any additional scaffolding. All parts requiring periodic inspection/ lubrication/ replacement should be easily accessible without the need for dismantling other equipment or structures. All electrical cables should be so laid that they are not liable to be damaged and can be easily inspected and maintained.

3.0 All machinery or equipment included in this specification must be provided with safety devices and clearances as per standards and purchaser's requirements.

4.0 No cast iron part should be used on the crane except for electrical equipment. Similarly wood or combustible material and Bush bearing should not be used in any part of the crane. Open gears should not be used in any drive/motion.

5.0 Full length and full width chequered plate platforms should be provided on the top for both the bridge girders in order to have access to operator's cabin, long travel drive, current collectors, trolley etc. Access to the cabin from the bridge girder platform should be via a staircase unless specified otherwise. Minimum width of the staircase should be 600 mm and inclined to the horizontal at an angle not more than 45°. Passage through staircase should be fully protected to prevent any accident/ fear of accident.

6.0 Foot-walk should be of sufficient width to give at least 500 mm clear passage at all points, except between railings and bridge drive where this clearance may be reduced to not less than 400 mm.

7.0 All openings in foot walk flooring for access to bottom chord platforms and inspection platform should be provided with strong hinged covers. These covers in the maximum open position should be inclined at an angle slightly
more than 90° to the horizontal and should be provided with a locking device both for the closed and fully opened position. They should be so located that in their open position, they should not foul with any moving part of the crane. Minimum size of hatch opening should be 600 X 600 mm. Any other opening in foot-walk or end carriage should be provided with bolted removable plate covers.

8.0 Suitable Guards to push away any object lying on the rails should be provided at the ends of the end carriages.

9.0 All wheels, couplings etc. should be provided with covers opening on strong hinges. These covers should be preferably be made of minimum 5 thick plates. All heavy covers should be provided with inspection windows.

10.0 Guards should be provided on the crane to prevent the hoist ropes from coming into contact with the down-shop leads.

11.0 All bolts except those with Nyloc nuts should be provided with grip lock nuts or spring washers.

11.1 For side alignment of motors, strong adjustable screws with lock nuts should be provided. However for IEC frame size motors this is not considered necessary.

11.2 Welded lugs should be fitted against the feet of all pedestals, gearboxes etc. except motors. Motors should be provided with alignment screws for side alignment.

11.3 Fasteners for pedestal blocks, motors, gear boxes etc. should be easily removable from the top of platform. Studs or body bound bolts should not be used as fasteners for mechanical items except for fixing covers.

12.0 All cables should be clamped individually. All trailing cables should be clamped with PVC or nonmetallic clamps. Deviations are permissible only with purchaser's specific approval.

13.0 Safety hand railings preferably of tubular construction should be provided on bridge foot-walks, end carriages, stair cases, landing in cabin, trolley and in any other place where access has been provided. Railings should not be less than 1000 mm high with an intermediate member at a height of 500 mm. All edges or openings should be provided with toe guards, toe angles or bent plates wherever required and should be of height 100 mm (Minimum).
14.0 Parts of steel frames carrying machinery should be provided with doubling plates of adequate thickness riveted or welded and machined to true surface.

15.0 Defects in materials like fractures, cracks, blowholes, laminations, pitting etc. are not allowed. Rectification of any such flaw is permissible only with the approval of the purchaser.

16.0 Spring buffers for both LT & CT, Anti-Collision system to be provided.

17.0 All the components should be in metric sizes only.

18.0 Wheels should be made of C55 Mn75 Carbon steel, Hardened to BHN 300-325.

B) STRUCTURAL:

1.0 GENERAL:

In addition to the latest edition of IS-807, following additions/deviations are applicable.

1.1 Welded joints should be used unless otherwise specified.

1.2 Not less than four turned, fitted bolts or equivalent length of welding at each joint should be used for connections.

1.3 Black bolts should not be used in the main structures of the crane and high tensile steel bolts should not be used unless approved by the purchaser.

1.4 Bolts used in shear should be fitted into reamed holes.

1.5 Transverse fillet welding on load carrying members should be avoided.

1.6 100% of top & bottom flange, 40% of web plate of box girder and 25% of circular joints should be radio-graphed to ensure freedom from defects. Rest of the weld joints of Girder and Hoist Drum should be tested ultrasonically.

1.7 Plates, bars, angles and where practicable other rolled sections used in the load bearing members of the structure should be not less than 8 mm thick. Minimum thickness of chequered plates for platforms should be 6 mm over plain. Chequered plates should not be considered in computing strength of load carrying members.

2.0 BRIDGE GIRDERS:
2.1 The crane should be double girdered. The bridge girder should be of box construction and in one piece. Each girder should have double web plate. Girder should be sufficiently strong and rigid to withstand the most sever combination of loads that may develop under different working conditions.

Top flange of the girder should not be considered as giving support to the rail, in computing the rail size.

2.2 Trolley rail section should not be considered in the design of the bridge girders.

2.3 Full length wearing plate should be provided under the trolley rails. The wearing plates should be 10mm thick and welded in place to the flange with minimum 5mm continuous welds. The wear plates should be 10 to 12mm lesser in width than the rail base such that the welds of the wear plates do not project beyond the rail base. Wearing plate should not be considered in the strength calculations of the bridge girders.

2.4 Box girders should be so constructed as to eliminate accumulation of water or oil inside them. Squaring marks should be provided on each girder to facilitate erection and squaring of the bridge.

3.0 END CARRIAGES:

End carriages should be fabricated from plates welded together to form a box except for essential openings, which should be reinforced. If more than two wheels are required, bogies should be provided or articulated end carriages should be used. Wherever possible, the end carriages should be in two halves. Each half should be fitted to the respective bridge girder in the fabrication shop.

End carriages should be of ample strength to resist all stresses likely to be imposed on them under service conditions including collision with the cranes or stops. The length of end carriages should be such that no other part of the crane is damaged in collision.

On the end carriages with more than two wheels, the wheelbase should be taken as the distance between the centers of the outside wheels.

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

Suitable jacking pads at a height of 300mm from rail level should be provided on each end carriage for jacking up the crane when changing track wheels. Jacking pads should not interfere with the replacement of wheels.

4.0 TROLLEY FRAME:

Trolley frame should be produced in one piece. Drum bearings and supports for upper sheaves should be located so as to equalize the load on the trolley wheels as nearly as possible.

The trolley frame should be built up of rolled sections and plates to form a rigid structure capable of withstanding all stresses that will develop during the working of the crane and should be arranged to afford maximum accessibility to mechanical and electrical parts placed on it. It should be designed such that at the highest position of hook there should be clear distance of 700mm between the lowest point of bottom block. Deviation should be made only with specific approval of purchaser.

The top of trolley frame should be covered with plates all over except for openings required for the ropes and flexible cable for bottom block etc, to pass. The openings in the trolley frame should be such as to keep the ropes or cables at least 125mm away from any part of the trolley frame. The equipment should be placed above the trolley top plates as far as practicable.

For any parts placed below the trolley top plate, access for maintenance, repair and replacement should be provided. Hand rails should be provided on all the four sides of the trolley (except in case where protective guard is fitted on the trolley conductor side, hand rails on the three sides only should be provided) with openings on the platform side opposite to the trolley conductor side.

The trolley should be fitted with substantial safety stops to prevent the trolley from falling more than 25mm in the event of breakage of a wheel, bogies or an axle. This safety stops should not interfere with removal of wheels.

The trolley should be provided with lifting pads for jacking up the trolley on all Four Corners for wheel removal. The jacking pads should be at a height
of about 300mm from the rail level and should not interfere with the removal of wheels.

5.0 TROLLEY RAIL:
Trolley track rails made of rail steel should be clamped to the girders with double bolt clamping plates spaced not more than 900mm apart with welded alignment blocks between every 2 clamps such that the distance of a clamp from any adjacent alignment block should not be more than 450mm. Rails should be prevented from creeping in the longitudinal direction by rail stops, riveted or welded. Rails should be made continuous by welding standard lengths. At splice joints, rails may be welded at site and as such, edge preparation of the rails should be done in the supplier's work.

6.0 REPAIR CAGES:
Repair cage should be provided on the inside of the end carriage for attending to the current collectors. Repair cage should also be provided at the corners of the crane to facilitate removal of Long Travel wheels. The repair cages should be minimum 1000 mm wide and should be such that two persons can work comfortably in the space provided. The floor of Repair cage should be about 1500mm below the LT wheel centers. The cages should be of structural steel and should be made substantially rigid by gusset plates and brace welded or riveted. Repair cages should be provided with railings on all sides except for the repair cages on the down shop lead, which should be provided with easily removable type protection guards on three sides for safety reasons.

7.0 OPERATOR’S CABIN:
Cabin should be open type.
Following provisions should be made in the Cabin.
   a) Cabin floor should be covered with heat and electric insulating carpet, made of material which can be cleaned easily.
   b) Heat Convector / Cabin Fan.
   c) Siren operated by Footswitch and also from a Push Button of Radio Remote Control, audible from a distance of 50 Meter minimum.
C) **MECHANICAL:**

The following features are required in addition to those specified in relevant standards.

1.0 **DRIVE MECHANISM:**

1.1 Long Travel

- One brake for each drive.
- Total no. of wheels should not be more than 4 – (two on each side)
- LT Drive should be 2 motor drive, driving not less than 50% of wheels provided. If any one motor fails, the other motor should be able to operate the crane.

1.2 CT Drive -

- One brake for each drive.
- Total no. of wheels should not be more than 4
- LT Drive should be single motor drive, (driving two wheels on same axis) is acceptable.

1.3 Main Hoist -

- Total no. of falls should not be more than 8 for 50T hoist and should not be more than 4 for other main hoists.

1.4 Auxiliary Hoist Two brakes should be provided. Total No of falls should be restricted to 4 (max).

2.0 **GEARING:**

Straight and helical spur gearing should normally be used for all motions. Worm, reducer and bevel gears should not be used. First and high speed reductions should be through helical gears. All first reduction pinions and also the other pinions if feasible should be integral with the shafts. All gears should be of hardened and tempered alloy or carbon steel with machine cut teeth. Gear tooth should be cut in metric module system. Surface hardening of teeth is not allowed. Material of gears should be EN8 or equivalent.

Please note & ensure that only Metric system is adopted everywhere.

3.0 **GEARBOX:**

Totally enclosed gear boxes with splash or automatic lubrication system should be used. The gearboxes should be fabricated using steel plate of
thickness 8 mm (min). Covers should be split horizontally at each shaft center line and fastened so that the top half can be removed for inspection and repair without disturbing the bottom half.

Please note that open type gearing is not acceptable.

4.0 BEARINGS:
Ball and roller anti-friction bearings of FAG, SKF make should only be used throughout except where specified otherwise. Grouped grease lubrication system for bearings may be provided wherever possible. Automatic centralised lubrication is preferred.

5.0 COUPLINGS:
Motor shafts should be connected to gear extension shafts through flexible shock absorbing couplings. Geared or universal couplings should be used between gear box output shaft and intermediate shaft and wheel axle. Any other special coupling which can give better and more reliable service may be used after obtaining specific approval of the purchaser. Pin Bush coupling should not be used.

6.0 LIFTING HOOKS:
Standard shank type plain hook for the Main Hoist and for Auxiliary Hoist should be used. These hooks should conform to the latest edition of IS: 5749 and IS: 15560 or any other relevant Indian / International.

7.0 BRAKES:
Double shoe brakes should be provided for each drive. Brakes should be mounted on the input pinion shaft of the gear train. The brake shoes should be of hinged type. Brake levers should be of steel. Hinge pins should be of hardened alloy steel and should be lubricated. These hinge pins should be provided with steel bushes at bearing points. Brake drums should be of forged or cast steel. Drums should be completely machined and dynamically balanced. Width of the brake drum should be 5 to 10 mm more than the width of the brake shoes. Hardness of brake drum should be 38-43 Rc.

D) ELECTRICAL:
1.0 SCOPE OF SUPPLY:
Scope of supply covers all items of electrical equipment commencing from the main current collector gear on the crane. The crane electrics include, power disconnecting switch on the crane bridge walkway immediately after
the main current collector gear, protective switch gear, motor control panels, resistors, Electro Hydraulic thruster operated brakes (alternatively disc brakes), limit switches, power and control cables, socket outlets, lighting distribution panel and lighting fixture with lamps, Bridge current collector system, joystick controllers, indication lamps, push buttons and equipment earthing material. All sundry erection materials required for installation and connection of electrical equipment with cable laying and fixing accessories should be in the scope of supply. Preferred make for basic electricals like contactors, MPCBs, ACBs, MCCBs, etc is to be Siemens. All timers are to be pneumatic type and BCH make. The protective and power panels are to be fuseless. ACBs are to be used at incomer, everywhere else; MPCBs must be used for protection of motors / thrustors / circuits, etc. Only thyristor drives to use thyristor protection fuses wherever applicable. All indicators to be LED type. All equipment should be of robust construction. All cables to have bottom entry into panels. Power and control terminals to be grouped separately with 10% extra terminals in each group. In general, the control voltage to be 220V AC, single phase, 50Hz. All trailing cables to be of reputed make EPR cables. Good quality junction box to be used for connecting EPR and PVC cables.

2.0 CLIMATIC CONDITIONS:

The equipment offered should be suitable for tropical and humid climate. For the purpose of equipment selection and specially for derating the capacities of drive motors and power cables, the ambient temperature 55°C should be taken as the basis. The equipment on the crane should be suitably protected against damage from radiant heat and should be rendered proof against ingress of dust and vermin.

3.0 STANDARDS:

The equipment should be selected, assembled and tested as per guide lines provided in the latest edition of Indian Standard Specification Nos. IS: 3177 for Class-II (M5) duty. The equipment should also conform to the latest Indian Electricity Rules and regulations as regards Safety requirements, earthing and other essential provisions specified therein. The equipment should be designed and selected to facilitate inspection, cleaning, replacement and repair and for use where continuity of operation
and safety are first considerations. Wherever power cables having aluminum conductors are used for connecting up the electrical equipment on cranes, ample internal space for easy termination of these cables in the terminal boxes of the machines should be ensured.

4.0 POWER SUPPLY CONDITIONS:
The power available at existing down shop leads is 415V, 3 phase, 3 wire, 50 Hz. The equipment selected should be suitable for operation on 415V±10%V.

The following voltages should be used in the cranes.

4.1 400/415 + 10% V, 3 ph, 50hz, AC For motors and electro-hydraulic thrustors
4.2 415/220V, single phase Isolating Transformer For control circuit, lighting and fan
4.3 24V, single phase, 50hz, AC For hand lamp socket outlets
4.4 220 V, AC, 1- ph, 50 Hz. For control circuits as applicable
4.5 24V, DC For disc brakes as applicable

The different voltages mentioned above other than 415V, 3 ph, 50Hz, AC should be obtained through individual separate transformers and transformer rectifier units connected to 415 V, AC. Each transformer should be provided with tapping at ±2 1/2 and ±5% of secondary voltage.

5.0 CURRENT COLLECTION:
The supplier should arrange for main current collector system as per existing system.

5.1 BRIDGE CONDUCTORS:
The bridge conductors should be accessible for service. Bare copper wires should not be used as bridge conductors. Flexible trailing cable system mounted on retracting supporting system should be used. The conductors should consist of insulated multi conductor (or several single conductors) cables with permanent termination on the bridge and on the trolley. The flexible trailing cables should have ample length and should be supported by means of properly designed movable clamps. These clamps should be fitted with rollers and should run freely on guide rails allowing relative movement of bridge and trolley without undue stress or
on the wear on the suspended cables. Consideration should be given to the inclusion of spare conductors to make provision for the later addition of additional conductors. The crane handles liquid steel for which the festoon cables should be selected accordingly and should be of reputed manufacturer.

5.2 COLLECTOR SHOES:
The main current collectors should be of cast iron gravity type and double collectors should be provided for all the three phases. The collectors should have adequate current carrying capacity. The design of collector should be such as to minimize the chance of binding at the hinge points due to dust or corrosion.

5.3 COLLECTOR SHUNTS:
Current carrying shunts on all the collectors should be designed so that there is no danger of contact with adjacent collectors. The shunts should be easily replaceable.

5.4 MOUNTING:
All the collectors should be mounted on rigid steel shafts and suitably insulated there from. Electrical clearance between live parts of adjacent shoes should be at least 25mm. Flexible shunts in their least favorable position should not reduce this clearance. Collectors should be designed for ease of maintenance and so mounted that they are readily accessible for this purpose.

6.0 MOTORS AND DRIVE CONTROL THROUGH VVVF SYSTEM:

6.1 GENERAL:
The crane should be provided with crane duty Squirrel Cage induction motors. Zero interlock of joysticks and gravity limit switches to be incorporated with line contactors.

The supplier should furnish test certificates at the specified duty cycle for the individual motor. All the motors offered should be suitable for heavy-duty reversible crane service. The supplier should be responsible for selecting ratings that will meet the specified duty with the type of control specified. Ambient correction factors depending upon ambient temperature should be applied to derate the motor.

Note: - Copy of catalogue referred in selection of motors detailing against each,
the rated capacity and frame sizes should be attached with the offer.

All electrical equipment associated with the crane including motors push buttons, switches, control panels, starters, control transformers, relays, shall be in accordance with relevant Indian and International standards. A 3-phase, 3 wire power supply at 415 V, 50 Hz shall be provided by the BHEL for the runway conductors through suitable L.T. Panel arranged at suitable location in the power house. All equipment and devices required thereafter shall be supplied by the vendor. Allowable temperature rise of the equipment shall be as prescribed in the relevant Indian Standards or the corresponding International Standards and shall be based on maximum ambient temperature.

The motor shall be capable of delivering rated output under following variation in voltage and frequency.

i) Voltage variation +/- 10%

ii) Frequency variation +/- 5%

iii) Any combination of (i) & (ii)

All motors shall be suitable for reversing frequent acceleration and mechanical braking. Motor shall be so located that brush gear and terminals are accessible for inspection and maintenance and normal ventilation is not restricted.

**All motors shall be 60 minutes (40% CDF) rating**

Electrical equipment mounted on bridge platform shall be enclosed type in sheet metal enclosure, with a provision for easy access to parts inside.

The control panel shall be so spaced that efficient maintenance is possible and shall withstand the mechanical forces imposed by the crane under service condition.

**FREQUENCY CONVERTER DRIVE FOR THE CRANE**

**DESCRIPTION**

The type of equipment shall be a multi drive system, with inverters in one cabinet, one common rectifier with a common DC – bus, with inverters connected. This system will in case braking energy is being supplied from one motor, supply the energy to the next motor connected to the DC- bus. If the braking energy exceeds the energy used by the other inverters, a braking chopper will open, and supply the energy to a braking resistor.

It is a vector controlled frequency converter. To achieve this, a pulse encoder shall be used at the motor to control the flux and phase shift, in order to obtain exact position of the rotor.

All frequency converters are connected to control unit, called APC. APC is an “Application process controller”, where all control of the frequency converters are done.

The control shall be closed loop vector control system.
DETAILED SPECIFICATIONS OF INDIVIDUAL EQUIPMENT MOTORS FOR VARIOUS MOTIONS:

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<tbody>
<tr>
<td>a)</td>
<td>Motor standards</td>
<td>As per IS: 325 and IS: 3177</td>
</tr>
<tr>
<td>b)</td>
<td>Capacity</td>
<td>Of adequate capacity to suit respective duties. Full load torque of motors to be higher than the Maximum load torque.</td>
</tr>
<tr>
<td>c)</td>
<td>Type and enclosures</td>
<td>All motors will be of squirrel cage type to suit 415 V AC, 3 phase, 50Hz, four wire power supply, totally enclosed. The motors shall be suitable for direct on line starting any hoisting/lowering rated load even in event of frequency control system being out of order, protection IP 54, with fan cooling arrangement.</td>
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<tr>
<td>d)</td>
<td>Voltage &amp; frequency variation</td>
<td>Voltage: ± 10%, Frequency: ± 5%, any combination values of Voltage &amp; frequency variations within the above limits.</td>
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<tr>
<td>e)</td>
<td>Pull out torque</td>
<td>Not less than 2.25 (Two point two five) times the full load torque of motors at rated voltage and frequency.</td>
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<tr>
<td>f)</td>
<td>Insulation</td>
<td>class -F</td>
</tr>
<tr>
<td>g)</td>
<td>Time rating</td>
<td>one hour for all motors</td>
</tr>
<tr>
<td>h)</td>
<td>Temperature rating</td>
<td>Temperature rating - Max. Temp. rise at full load measured by resistance method shall not exceed 50 deg C. over the average ambient temp. of 45 deg C.</td>
</tr>
<tr>
<td>i)</td>
<td>Rated syn. Speed</td>
<td>To suit duty for various motions.</td>
</tr>
<tr>
<td>j)</td>
<td>Over speed with stand capacity</td>
<td>2.5 (two point five) times rated speed or 2000 rpm which ever is less.</td>
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<tr>
<td>l)</td>
<td>Motor bearings</td>
<td>Roller type, sealed to prevent grease leakage &amp; entry to of dust of ample strength to with stand heavy shocks and vibration to which subjected under all conditions of operation.</td>
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<tr>
<td>m)</td>
<td>Tests :</td>
<td>Type and routine tests as per IS: 325. copies of test reports to be furnished by the contractor.</td>
</tr>
<tr>
<td>n)</td>
<td>Temp. rise measurement</td>
<td>By resistance method.</td>
</tr>
<tr>
<td>o)</td>
<td>Climate:</td>
<td>To be located indoor in tropical climate, to be provided with protection against fungus, vermin, and corrosion.</td>
</tr>
<tr>
<td>p)</td>
<td>Terminal:</td>
<td>To be arranged such that terminals are easily accessible for inspection and maintenance and natural ventilation is not restricted.</td>
</tr>
<tr>
<td>q)</td>
<td>General :</td>
<td>Sturdy and strong to withstand shocks and vibrations to which they get subjected.</td>
</tr>
</tbody>
</table>
ELECTRICAL CONTROLS & PROTECTION FOR OPERATION OF CRANES

Each crane shall be provided with control panel located in the operator’s cabin from where it shall be normally operated by the operator. The controls shall be provided for:

(a) Individual independent control of the crane for all motions and various speeds up to normal speeds.

SPEED REGULATION

Speed regulation shall be accomplished utilising a static step-less control system for all crane motions. The hoist and travel motions shall be provided with step-less speed-regulation from 5 to 100% of rated speed. Speed control shall be achieved by adjusting the frequency of the motor electrical supply. (Combination of power Rectifier Bridge and inverter).

The maximum acceleration produced by the control system shall be independent of the rate of change of the control lever position. The speed in the first lowering position shall not exceed 5% of the synchronous hoist speed when lowering any load up to rated load. The speed in the first hoisting position when lifting any load up to 125% of rated hoist capacity shall not exceed 5% of the synchronous hoist speed.

The Vendor shall offer stepless frequency converter and digital control system for various crane drives. Full details of the system along with specification of components such as drive motors, brakes, limit switches, electrical control and protection of the cranes shall be furnished.

The trolley travel controllers shall be provided with drift points in both directions of travel.

6.2 TORQUE:

The pull out torque of the motors at rated voltage and frequency should be not less than 2.75 times of the nominal torque.

6.3 CLASS OF INSULATION:

All motors should preferably be class 'H' insulated and the maximum permissible temperature measured by contact thermometer should not exceed 160° C. In the event of non availability of class 'H' insulated motors, class B/F insulated motors(class B for stator and class 'F' for the Rotor) with maximum permissible temperature measured by contact thermometer not exceeding 115° C and 130° C respectively may be offered.
6.4 OTHER FEATURES:
The terminal boxes should be large enough to accommodate aluminum conductor cables which may have derating factor as low as 0.4 on account of high ambient temperature and grouping factor.
The motors should be in IEC frame sizes. The terminal boxes should be located on top of the motor with facility to be rotated by 90° and 180° on horizontal plane.

6.5 RADIO REMOTE CONTROL
To be provided as specified in Part E

7.0 FUNCTIONAL DESCRIPTION OF MASTER CONTROLLERS:
Motors are controlled by the APC in the frequency converter cubicle. The APC gets the direction/speed signals from the joystick IN CABIN CONTROL / Remote control. The APC calculates the speed and torque, in order to secure correct speed.

When stopping hoisting or lowering operations, the APC performs commands to the frequency converter for lowering the speed to Zero, and keeping it to zero speed before giving order to turn on the brake. When starting lowering or hoisting the APC controls the frequency converter with a certain torque before releasing the brake, in order to avoid any drop. If the braking energy exceeds the energy used of all the frequency converters, the braking chopper will open and use the braking resistor.

8.0 CONTROL PANELS:
All power and auxiliary contactors, thermal overload relays, time relays etc. should be mounted in sheet steel cubicles with lockable hinged doors. The door hinges should be such that during repair works inside the panel, the entire door can be lifted out and placed away enabling better access inside the panel. Each motion should preferably have its individual panel. All ventilating openings should have screen protection. Interior of the panel should be dust and vermin proof.

Panels should be front wired with readily accessible terminal blocks for making connection to the external equipment. All equipment is to be mounted in the front of the panel. Rear panel mounting is not permitted. All cable entry should be from bottom only. Removable plate is to be provided at the bottom of the panels for marking holes, providing cable gland for cables. Panels should be pre-wired up to terminal strip.

All contactors etc. should be mounted securely in a vertical arrangement with due consideration to the vibration encountered in the operation of the
crane. The bottom most row of equipment mounted inside the panel excepting terminal strip should be at least 350mm above the panel bottom cover to facilitate inspection and repair. Terminal strip should be fixed inside the panel preferably in horizontal manner leaving enough space underneath the panel for termination of cables in a convenient manner. Power and control terminals should be segregated. Power terminal blocks should be separated from each other by means of replaceable insulated spacers. Terminal blocks should have enough clearance to avoid tracking. At least 10% extra terminals in each of power and control groups must be provided. All equipment inside the panel should have permanent identification labels in accordance with circuit diagram as also the power and control terminals. Terminal blocks should be robust and of such construction as to preclude possibility of cable connections getting loose due to vibration on crane. Sheet steel used for fabrication of panel should have minimum thickness of 1.6mm. Panels should be mounted such that bottom of panel is at least 200 mm above the floor.

Clearance and creepage distance for the control gear should be 10mm and 12mm respectively. The electrical clearance in air between all live parts of different polarity and voltage and between live parts and earth should be not less than 75mm.

Contactor panels should be well braced to the crane structure and each panel should be provided with adequate number of lifting lugs.

9.0 **CONTACTORS:**

The current rating of all contactors should be at least 50% higher than the respective motor full load current at the specified duty cycle.

The minimum size of contactors on the power circuit should be as given for high currents that may be encountered on account of single-phase brake lowering, plugging and DC injection as per the control scheme chosen.

10.0 **ELETRICAL INTERLOCKS:**

An isolator fitted on the crane bridge which can not be operated from the Floor shall be provided to prevent inadvertent operation of the crane from the floor while maintenance work is being carried on the crane.

Power supply (415V AC, 3 phase, 4 wire, 50 Hz) to the crane shall be provided by the Owner at centre of DSL (Down Shop Lead arrangement).
11.0 CIRCUIT PROTECTIVE SWITCH GEAR:

The protective switchgear should consist of following:

11.1 One triple-pole air circuit breaker, serving as main incoming protective switch fitted with automatic reset bimetal overload releases for protection against sustained overload and magnetic type instantaneous releases for protection under short circuit conditions, on all three phases.

The breaker should have adequate rupturing capacity to withstand and clear fault current of the order of 40KA. Further, the circuit breaker should have rating to carry combined full load current of two motions of the crane having largest horsepower. The setting of the over current release should be such as to trip the breaker instantaneously when current raises to 250% of the normal value. The incoming circuit breaker will be located inside driver cabin or nearby in such a way that enough clearance is provided as per IE rules.

To indicate whether power and control sources are ON, pilot LED indication lamps should be provided inside the driver's cabin.

11.2 In addition to incoming circuit breaker, following protective equipment should be provided inside the Driver's cabin.

   a) MPCBs as appropriate to be used.

   b) Complete panel must be fuse-less, except thyristor drives.

12.0 AUXILIARY SWITCH GEAR:

A main iron clad pole isolating switch should be provided on the long travel bridge walkway as close as possible to the main current collectors. This switch should be without any fuse and of load isolating type.

This should isolate all circuit except the lighting circuit, magnet circuits and the circuit to the transformer supplying the portable lighting socket outlets.

Each of the above mentioned main isolating switches should be rated to carry at least combined full load current of two motions of crane having the largest horse powers and should be provided with means of locking the switch operating handle in the 'OFF' position. The switch cover should be interlocked with operating handle so that it can not be removed or opened unless the operating handle is turned to the 'OFF' position. The live contacts inside the switch should be shielded to prevent accidental contact.
MPCBs are to be used. No fuses to be used.

13.0 LIMIT SWITCHES:
All hoist motions should be provided with rotary and extra Counterweight Limit Switch for over hoisting. For CT and LT, Cam operated limit switches should be provided. The limit switches should be provided for proper back up protection. The first limit switch to act in the event of over hoisting and over lowering, should be rotary type with self resetting feature, and be incorporated in the control circuit of the respective drive motor and the second one should be gravity operated switch (Push button bypass) connected in the trip circuit of the Line Contactor. Limit switch incorporated in the motor control circuit should act first, but in case this limit switch fails to operate the second limit switch should operate and trip the line contactor.

14.0 EMERGENCY STOP PUSH BUTTONS:
Safety switches of sustained contact type should be provided at the entrances to the crane bridge so that under any emergency conditions, operating any one of the switches, the incoming circuit breaker is tripped thus cutting off power to all the motions. Cabin door-interlocking switch, interlocked with the main incoming ACB should be provided. A pilot lamp incorporated in the control circuit will glow up when any of these switches is operated. Further a mushroom headed type OFF push button should be provided in the operator's cabin so that the main incoming breaker can be tripped under any emergency condition, by pressing the operating head.

15.0 CONTROL CHARACTERISTICS:
The hoist control gear should be designed so as to limit control the accelerating torque/current for hoisting with 185% of full load torque/current for changing the controller from one notch position to another higher notch position. Similarly peak decelerating torque/current should be limited to 200% of full load value for changing the controller from highest position to the first lowering position. Bridge and trolley of the crane should have revising plugging control circuit for rapid deceleration and stopping. The control circuit should be designed such that the brakes provided should not come into action simultaneously with plugging.
The control circuit should be designed such that the brakes provided should come into action immediately on controller coming to zero position.
16.0 **BRAKES FOR VARIOUS DRIVES / MOTORS:**

The brakes for various motion drives shall be as per the IS: 3177. The following type of brakes shall be provided for the various crane drives.

(a) **Bridge Travel**

(i) Main braking by means of frequency speed control of motor down to 0 (regenerative braking).

(ii) Automatic DC electro-magnetic brake for each motor drive.

(iii) Double (2) brake discs.

(b) **Trolley Travel**

(i) Main braking by means of frequency speed control of motor down to 0 (regenerative braking).

(ii) Automatic DC electro-magnetic brake for each motor drive.

(iii) Double (2) brake discs.

(c) **Hoisting Motion**

1) **Main Hoist**

   (i) Main braking by means of frequency speed control of motors down to 0 (regenerative breaking).

   (ii) Automatic DC electro-magnetic brake

   (iii) Automatic electro hydraulic thrusters brake

2) **Auxiliary Hoist**

   (i) Main braking by means of frequency speed control of motors down to 0 (regenerative breaking).

   (ii) Automatic DC electro-magnetic brake

   (iii) Automatic electro hydraulic thrusters brake

The electromagnetic brakes shall be of DC type complete with rectifier equipment to convert the available AC 50Hz supply. The electro-hydraulic Thruster brakes shall be AC type.

The operating solenoids of the EM DC brakes shall reverse the brakes on energisation and shall automatically apply all the brakes immediately in the event of stoppage, interruption or failure of electrical power supply. The brakes shall also apply immediately in operating the emergency stop push button of switch irrespective of controller position.

The EM DC brakes shall be of spring set shoe type equally effective in both directions of rotation. The springs for the EM brakes shall be of compression type and shall have adequate factor of safety.

The brake system shall have the following provisions.

   (a) Locking device in the brake lever.

   (b) Means for adjustment to compensate for wear of the shoes.

   (c) Emergency stop push buttons.

All the brakes shall have adequate capacity. The brakes for hoisting when applied shall arrest the motion and sustain the load up to the test load at any position of the lift. Provision shall be made to control with safety the lowering of any load up to the test load.
Brakes in other motions shall be capable of bringing the relevant motions of the fully loaded crane safely to rest in the shortest possible time with least possible shock and shall arrest the motion under all other service conditions.

The various brakes shall be designed to exert a torque equal to 1.5 times the full load torque of motors.

The brake torque may be increased if considered necessary by the manufacturer in order to ensure proper and safe application of the brakes. All EM brake coils shall have continuous rating.

**HOIST DRIVE FOR NORMAL SPEED**

The hoist shall be driven by a motor through speed reduction gear unit for normal speed of the hoist and shall be complete with brakes and retarding devices.

The hoist shall have provision of Very slow, accurate and controlled operation by means of step less, frequency converter speed control system, enabling control of vertical motion of the hoist within 1 mm, will be required to place the generator rotor.

17.0 **DISPOSITION OF ELECTRICAL EQUIPMENTS:**

In case of fixed cabin cranes, the electric panels should be located as follows. For box girder cranes within the box if possible or on the walkway. In case equipment is located inside the box adequate lighting and ventilation should be provided.

18.0 **LIGHTING:**

Lighting should be provided in the driver's cabin, staircases and areas where control panels, resistors and transformers are installed. Bulkhead fitting with dust proof covers should only be used for the above areas. Four number underbridge lights of 400 W mercury vapour lamps complete fitting with reflector to be used. Lighting transformers should have 50% reserve capacity. The lighting distribution board and metalclad switches incorporating MPCBs / MCBs / MCCBs in every line of each circuit should be provided in the driver's cabin for the Crane lighting including underbridge lighting and Air conditioning or fans.

19.0 **SOCKET OUTLETS:**

Minimum of four socket outlets for hand lamps should be provided each at driver's cabin, long travel Side Bridge and in the area where control panels, resistors and transformers are installed. Hand lamps should operate at 24V AC supply. Industrial type metal clad plug and sockets should be provided.

20.0 **CABLING:**
All wiring for power, control, lighting etc should be carried out with 1.1KV grade PVC armored cables except flexible cables where armour should not be provided. All control cables should be minimum 2.5mm² Copper. All flexible cables should be multistranded copper. Single strand cables should not be used anywhere inside the crane. All cables exposed to direct heat radiation should be of special insulation or should be run in formed steel channels provided with heat resistant material. Cables laid on open racks should be adequately clamped.

Cable selection and routing on the crane should form part of the crane design. Conduits and conduit fittings if used on crane for running cables should be of standard design and should be supplied with complete accessories. Each motor should be wired through separate conduits. All cables, remaining live in open position of isolator should be installed separately.

21.0 IDENTIFICATION OF CIRCUITS / CABLES ETC:

Labels of permanent nature should be provided on supports of all switches, fuses, motors, brakes, contactors, relays etc. to facilitate identification of circuits and replacement. All panels, controllers, resistors etc. are to be properly marked for each motion. All power control cables, lighting and other cables are to be tagged at both ends as per cable number indicated in the supplier's drawing. All equipment terminals are also to be marked likewise.

22.0 SAFETY SCREEN:

Safety screen should be provided with crane near the Down Shop Leads.

23.0 EARTHING:

Earthing to the crane should be effected through track rails and crane structure. As such, all the electrical equipment mounted on crane should be connected to the crane structure by means of earthing links. The crane structure in turn should be made electrically continuous by proving jumpers over riveted or bolted joints. Equipment fed by flexible cables should be earthed by means of spare core provided in the flexible cable.

24.0 AUTOMATIC ELECTRICAL PROTECTION

The electrical equipment and circuitry shall be provided with automatic protection against various faults and mal-operation of the equipment as detailed below:
Protective relays for protection against instantaneous over-current, over-load, single phasing and under voltage for all motors. The over current relay to be adjustable between 2 to 3 times the full load motor current.

Protective relays of motors to trip the main power supply circuit breaker in case of their operation due to fault.

MCCB’s for control and protection of all motor circuits.

Air circuit breaker located in operators cabin, of 3-Pole, 415V, AC, totally enclosed type for power supply tapping from the main collectors, with interrupting capacity not less than 50 KA, and equipped with short circuit, over-load and under voltage trip devices, shunt trip coil, single phase prevention device, 3 timer relays and other necessary devices/ items.

Protection against over speed of the hoist motors which shall cut off the power supply and apply the brake in case any hoist motor speed increases to 105% of the rated synchronous speed.

Operation of any protective relays of motors shall trip the motor supply circuits.

25. INCHING OPERATION

Inching operation for all motion shall be provided for the purpose of erection, lowering centring, and alignment etc. of the generating units. The inching operation shall be achieved by VVVF control.

26. WIRING:

All electrical wiring shall conform to latest revision of IS: 1554 (part-I) “PVC insulated (heavy duty) electric cables, for working voltage upto and including 1100 volts”. All conductors for primary power, lighting and control circuits shall be stranded type and insulated for not less than 1100 Volts and shall have standard moisture resisting double braid coverings. All conductors between the secondaries of the motor contactors and resistors shall have sufficient current carrying capacity in accordance with the standard specifications and shall be insulated with 1100 V class, high temperature type tropical insulation with moisture resisting impregnation. The primary conductors to the motors shall have standard, continuous current carrying capacity of not less than 100% of the rated full load primary current of the motor.

Only copper cables shall be used for power wiring. All control and lighting conductors shall be of copper and of suitable sizes. All the wiring shall be subject to approval of the BHEL. All wiring shall be laid in hot dip galvanised metal conduits or laid on perforated cable trays or clipped on the crane structure by suitable device. Alternately armoured cables can be used. Conductor having nominal equivalent copper area of cross section less than 2.5 sq. mm shall not be used for wiring.

E) RADIO REMOTE CONTROL:

1.0 Radio Remote Control conforming to IS: 3177 alongwith the following features should be provided. Preferred make is SNT make.

2.0 Technical Requirement:

2.1 The transmitter should be hand held Push Button type.
The crane should be operative either through Radio Remote Control or through Cabin Control. Cabin Control and Radio Remote Control should be interlocked and change over system should be manual located at the entry of the cabin.

2.2 There should be a common push button for siren and START and a separate push button for under-bridge lights.

2.3 Operating range should be 100 meters approx. for Radio Remote.

2.4 Isolation transformer and surge suppressor for the receiver supply to be provided.

2.5 Limit Switches should be provided & wired by the party for avoiding collision of two adjacent cranes.

2.6 The wiring should be connected to terminals/equipment with proper size copper cable, wire lugs.

2.7 Supplier must give circuit diagrams of the entire RRC. All panel wires, cables should be ferruled, numbered and the same should appear on electrical drawings.

2.8 Three sets of long life Nickel Cadmium batteries for the transmitter along with a battery charger are to be provided.

3.0 Supplier should obtain frequency allocation letter for the RRC system from the Dept. of Telecommunication, Govt. of India, New Delhi on behalf of FABRICATION PLANT, JAGDISHPUR free of cost. For this purpose frequency allocation forms should be sent to FABRICATION PLANT, JAGDISHPUR after receipt of the purchase order for filling. These forms along with an authority letter from the Factory Manager shall be sent back to the supplier for further necessary action. After the system is dispatched, necessary operating license/permission for the RRC system on the crane should be arranged by the supplier from statutory bodies as per the detail given in the frequency allocation letter. License fee, if any, should be borne by the supplier for the first time on behalf of FABRICATION PLANT, JAGDISHPUR.

4.0 Five copies of Operation & Maintenance Manual, safety provisions, photographs, schematic diagram, and details of PCBs etc. should be provided. A set of CD’s containing the documents / information recorded on it should also be provided.
General:

1. Erection and commissioning charges should be separately quoted. Erection commissioning and job proving by supplier with his own tools tackles and machinery.
2. Load Testing as per IS at 125% of rated load shall be conducted at site. Test certificates in respect of B.O.I. & Hooks shall have to be submitted by the supplier. Load for the same is to be arranged by the vendor.
3. Supplier to quote essential recommended spares (optional) for 2 years trouble free maintenance along with cards of Radio remote system (PCB’s, fuses etc.) separately with quantity and price of each item.
4. Submission of drawings for approval within two months of the placement of order.
5. All the moving parts should be duly covered with guards as per safety norm. Proper guard / cover / tray to prevent falling of bolts from coupling etc should also be provided, wherever required.
6. In the design of Crane, all safety regulations as applicable under provision of factory Act, Indian Electricity rules etc. as prevailing in the country / State of UP (site of installation) shall be taken into consideration and provided for.
### G. SPECIFIC DATA FOR EOT CRANES:

<table>
<thead>
<tr>
<th>S No.</th>
<th>Description</th>
<th>50/10T</th>
<th>20/5T</th>
<th>10/5T</th>
</tr>
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<tbody>
<tr>
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<td>Compliance with IS and Class</td>
<td>3177 M-5</td>
<td>3177 M-5</td>
<td>3177 M-5</td>
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<tr>
<td>2</td>
<td>Lifting Capacity (MT)</td>
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<tr>
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<td>- Main hoist</td>
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<td>10</td>
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<td>- Aux Hoist</td>
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<td>20/5T</td>
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<tr>
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<td>– Cabin end</td>
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<td>1200</td>
</tr>
<tr>
<td></td>
<td>– Opp. End</td>
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<td>1000</td>
<td>1200</td>
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<td>– Cabin end</td>
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<td>– Opp. End</td>
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<td>Cabin + Radio Remote control</td>
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<td>45 Kg/M (As per Table 5 at Page 8 &amp; Fig. 3 at Page 11 of IS 3443)</td>
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<td>Remarks</td>
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Note: These hook approaches are as indicative only. Better hook approaches shall be preferred. Please quote your best dimensions.

**Important:**

- **DUPLICATE COPY OF TECHNICAL OFFER MUST BE SUBMITTED.**
- **Supplier must submit point wise reply to specifications. Deviations if any must be separately submitted with reasons for each.**
<table>
<thead>
<tr>
<th>SNo.</th>
<th>Description</th>
<th>Details to be filled</th>
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<tr>
<td>1</td>
<td>Specification of the crane offered</td>
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<tr>
<td>2</td>
<td>Deviations, if any</td>
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</tr>
<tr>
<td>3</td>
<td>Time – Supply / E &amp; C</td>
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</tr>
<tr>
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<td>Total weight of crane in MT</td>
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</tr>
<tr>
<td></td>
<td>4.1 Total wt. of crane (MT)</td>
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<td></td>
<td>4.2 Wt. of Trolley/ Crab (MT)</td>
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<td>4.3 Wt of each girder (MT)</td>
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<tr>
<td></td>
<td>4.4 Wt. of each end carriage (MT)</td>
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<td></td>
<td>4.5 Wt. of cabin (MT)</td>
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</tr>
<tr>
<td></td>
<td>4.6 Wt. of electricals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.7 Wt. of platforms</td>
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<td>4.8 Wt. of LT drive</td>
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<tr>
<td></td>
<td>4.9 Wt. of other components (specify the component name)</td>
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<td></td>
<td>Note: Total wt. of crane should match the other break-up weights.</td>
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<tr>
<td>5</td>
<td>Hoist: (Main &amp; Auxiliary)</td>
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<tr>
<td></td>
<td>Speed in M/min</td>
<td></td>
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<tr>
<td></td>
<td>With maximum working load</td>
<td></td>
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<tr>
<td></td>
<td>With empty hook</td>
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<tr>
<td></td>
<td>Rope size and construction details</td>
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<tr>
<td></td>
<td>No. of rope falls supporting the load</td>
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<tr>
<td></td>
<td>Dia of Drum</td>
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<tr>
<td></td>
<td>Material of Drum</td>
<td></td>
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<tr>
<td></td>
<td>Material of Sheaves</td>
<td></td>
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<tr>
<td></td>
<td>Lift of hook above floor level (exclusive of travel required to operate limit switch)</td>
<td></td>
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<tr>
<td></td>
<td>Drop of hook below floor level</td>
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<tr>
<td>6</td>
<td>Trolley</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speed M/min with maximum load</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wheel span</td>
<td></td>
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<tr>
<td></td>
<td>Material &amp; Diameter of wheels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Size of trolley runway rails</td>
<td></td>
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<tr>
<td>7</td>
<td>Bridge</td>
<td></td>
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<tr>
<td></td>
<td>Speed M/min with maximum working load</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wheel base</td>
<td></td>
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<tr>
<td></td>
<td>Material &amp; Diameter of wheels</td>
<td></td>
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<tr>
<td></td>
<td>Make, Type &amp; Size of Bearings for gears</td>
<td></td>
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<tr>
<td></td>
<td>Number of wheels on each end of crane</td>
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<tr>
<td></td>
<td>Maximum wheel load &amp; spacing</td>
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<tr>
<td></td>
<td>Clear width of foot walk</td>
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<tr>
<td>9</td>
<td>Make of Control,</td>
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<tr>
<td>10</td>
<td>Hook approach (MH)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cab end</td>
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<tr>
<td></td>
<td>Opposite cab end</td>
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<tr>
<td>11</td>
<td>Distance between Main &amp; Auxiliary hook</td>
<td></td>
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<tr>
<td></td>
<td>Distance centerline between girders to extreme outside of crane</td>
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<tr>
<td></td>
<td>Cab side</td>
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<td></td>
<td>Opposite cab side</td>
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<tr>
<td>12</td>
<td>Distance bottom of cabin to floor</td>
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<tr>
<td></td>
<td>Clearances</td>
<td></td>
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<tr>
<td></td>
<td>Bridge truck &amp; building column</td>
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<tr>
<td></td>
<td>Trolley &amp; roof chord</td>
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<tr>
<td>13</td>
<td>Maximum deflection of girders under maximum working load</td>
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<tr>
<td>14</td>
<td>Wiring trade name and classification of wire insulation</td>
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<tr>
<td>15</td>
<td>Make, Kw &amp; NO of Motors</td>
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<td></td>
<td>MH</td>
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<td>LT</td>
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<tr>
<td>16</td>
<td>Make, Rating and configuration of VVVF drives</td>
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<tr>
<td>17</td>
<td>Make, Type &amp; NO of Brakes</td>
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<tr>
<td>18</td>
<td>Make, Type &amp; NO of Lt. Switch</td>
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<td>MH</td>
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<td>LT</td>
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<tr>
<td>19</td>
<td>Material of Gears / Pinion &amp; Wheel, Type</td>
<td></td>
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<tr>
<td>20</td>
<td>Material of Gear Boxes</td>
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<tr>
<td>21</td>
<td>Radio Remote Control: Make, Type, Range, Provision for Siren, Lights etc</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** If above clauses are found inadequate for furnishing all necessary information of the crane offered, the supplier may append further information separately. Other information as per Annexure A of IS: 3177 may also be submitted, if asked for during technical discussion.