

- 1.12.1. All hoist motions shall be provided with limit switches to prevent crane from over hoisting and over lowering. Two limit switches shall be provided for proper back up protection. The first limit switch shall act in the event of over hoisting and over lowering shall be of snap action/pin type self resetting feature and incorporated in the control circuit of respective drive motor. It can also be of Proximity non-contact type. The second one shall be of gravity operated hand resetting type switch connected in the trip circuit of main incoming breaker. The second limit switch connected in the main incoming circuit breaker's control circuit shall operate and trip the breaker.
- 1.12.2. Any other limit switch viz. for slewing, skewing of crane etc. shall be provided if required.
- 1.12.3. Limit switch for hoist cross and long travel motion shall be supplied installed and wired by the manufacturer.

1.13. EMERGENCY STOP PUSH BUTTONS

- 1.13.1. Safety switches of sustained contact type shall be provided at each end of crane bridge so that under any emergency conditions, by operating anyone of the switches, the incoming circuit breaker is tripped thus cutting power to all motions. Further a mushroom head type of push button shall be provided in the operator's cabin in cabin operated crane so that the main incoming circuit breaker can be tripped under any emergency conditions by pressing the operating head. A pilot lamp incorporated in the control circuit shall glow when any of the switches is operated.
- 1.13.2. Pendant controls shall be provided with mushroom head type push button having in built key so that main incoming circuit breaker can be tripped under any emergency condition by pressing the push button (Applicable for Pendant Control cranes).

1.14. CONTROL PANEL

- 1.14.1. All power and auxiliary contactors, individual overload relay shall be mounted in a sheet steel cubical with lockable hinged doors. The door hinges shall be of such type that during the repair works inside the panel the entire door can be lifted out and placed away enabling better access inside the panel. Each motion shall have its individual Panel and the provision shall be confirmed in the bid. However, common panel with separate compartment for each motion shall be acceptable. Interiors of panel shall be dust and vermin proof. For cranes working in open yards, all control panels shall be fully weather proof type.
- 1.14.2. Panels shall be front wired with readily accessible terminal blocks for making connections in the external equipment. Panels shall be pre wired into terminal strip. Single core, copper conductor shall be used for control circuit wiring in the panel.
- 1.14.3. All contactors etc. shall be mounted securely in a vertical arrangement with the consideration of the vibrations encountered in the operation of cranes. The bottom most row of the equipment mounted inside the panel except terminals strips shall be at least 150 mm above the panel bottom cover to facilitate inspection and repairs.
- 1.14.4. All the equipments shall be so mounted in panel as to enable its easy

removal/replacement from the front.

- 1.14.5. The terminal strips shall be fixed inside the panel preferably in a horizontal manner leaving enough space underneath the strip for termination of cables in a convenient manner. Power and control terminals shall be segregated. Power terminals blocks shall be separated from each other by means of replaceable insulated spacers. Terminal block shall have adequate clearance to avoid tracking. A minimum of 20% spare terminals block shall be provided in terminals strips.
- 1.14.6. All equipments inside the panel shall have permanent identification labels in accordance with circuit diagram as also the power and control terminals. Terminal blocks shall be of robust and of such construction as to preclude possibility of cable connections getting loose during vibration on crane.
- 1.14.7. Sheet steel used for fabrication of panels shall have a minimum thickness of 2.0 mm. Panels shall be mounted such that bottom of panel is at least 150mm above the floor.
- 1.14.8. The electrical clearance in air between all live parts of different polarity and voltage and between live parts and earth shall be not less than 75mm.
- 1.14.9. Contactor panels shall be well braced to the crane structure and each panel shall be provided with adequate number of lifting lugs.
- 1.14.10. The control system should include operating hour meter for crane, Mechanical load sensing device (for cranes up to 30T capacity), Electronic overload protection device (for cranes above 30 T capacity) and motor over current protection system (in case of VVVF drives cranes. Torque based protection is also acceptable).

1.15. LIGHTING

- 1.15.1. 10 Watt LED Lighting shall be provided in the driver's cabin and staircase. Bulk head fittings with dust proof coves shall be used for the above areas. 06 nos. underslung LED lights of minimum 80 watts with steel cage with shock absorbing and anti-swing suspension arrangement shall be provided for uniform floor illumination for the cranes having span upto 15mtrs and 02 nos. underslung LED lights of minimum 80 watts with steel cage with shock absorbing and anti-swing suspension arrangement for every 5mtrs span thereafter. e.g if span is 20 metres, LED bulbs = $6 + 2 = 8$ nos., however if span is 22 meters, then still LED bulbs = 8 nos. but if span is 23 metres, then no. of LED bulbs = $8 + 2 = 10$ nos. and so on. Lighting transformers shall have 50% reserve capacity. However, if required, the same arrangement shall be able to take load of LED bulbs of upto 120 Watts also.
- 1.15.2. Toggle Switches: Industrial toggle switches shall be used for lighting distribution

1.16. SOCKET OUTLETS.

- 1.16.1. Minimum of one socket outlets for hand lamps shall be provided at each driver's cabin, long travel side and in the area where control panel, resistors and transformers shall be installed. Hand lamps shall operate at 24 volts AC supply. Industrial type metal clad plug and socket which are easy to assemble and disassemble shall be provided.

1.17. CABLING

- 1.17.1. All wiring for power control & lighting circuit shall be carried out with 1.1KV grade Flame Retardant Low Smoke (FRLS) PVC insulated copper cables as per IS:694 and IS:1554 Pt-I with smoke index and typical index corresponding to ASTM-2843 & IEC332-I.
- 1.17.2. Minimum size of power & control cables shall be 4mm² & 2.5mm² respectively.
- 1.17.3. All cables shall be systematically laid on G.I. trays & fixed with adequate number of G.I. clamps.
- 1.17.4. All cables shall be weather proof and shall be either of LAPP/SIEMENS/POLYCAB/FINOLEX/UNIVERSAL/ICC make.

1.18. IDENTIFICATION OF CIRCUIT CABLES ETC.

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

1.19. EARTHING

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

1.20. DEAD MAN'S HANDLE

- 1.20.1. For cabin operated crane suitable dead man's handle shall be provided which will stop the crane movement in case the operator neglects proper handling. Pendant control shall have spring loaded push buttons to return to off position to stop the crane movements as soon as the operator releases the thumb pressure on the button.

1.21. ALARMS

- 1.21.1. Sufficient provision shall be made for alarm during the crane working. A foot operated alarm bell shall be provided to caution to the workers in cabin operated cranes. A continuous ringing bell shall be provided for all motions of the crane. In case of pendant operated crane, alarm shall be provided for any of the motions operated from the pendant. Details of alarm system provided shall be explained in the offer.

1.22. FEATURES OF AC DRIVE

- 1.22.1. Inverter offered should be suitable for crane application for all motion.
- 1.22.2. Inverter rated O/P current should be at 45 °C ambient and maximum over temperature shall be 55 °C.

- 1.22.3. Drive sizing should be done accurately after considering the ambient temperature, type of panel, environment condition, etc. and deration on any account viz temperature/carrier frequency, or other factors should be considered and should not exceed 15% of rated O/P current of inverter offered.
- 1.22.4. The drive should be capable of taking 125% overload for one minute at the creep speed of 20% and at full speed as per crane IS standard for crane.
- 1.22.5. Inverter offered should have slip compensation feature in both up/down motions (even during regeneration).
- 1.22.6. Inverter offered should be with built in modes of control strategies viz standard V/F, OPEN LOOP VECTOR (REAL SENSORLESS VECTOR) AND MAGNETIC FLUX VECTOR so that the same inverter is used for all motions selecting the control mode. This should minimize spares inventory and training costs. However for hoisting the drive should be operated in Magnetic flux vector control and open loop brake sequence system. Brake release should be through torque base sensing.
- 1.22.7. Inverter offered should be provided with accurate brake coordination signals.

In addition to above crane specific features the inverter shall offer for the following.

- 1.22.7.1. Overload current capacity : 150% of rated output current for one minute.
- 1.22.7.2. Maximum output voltage : 3 phase, 380/400/440/460V
(Proportional to input voltage)
- 1.22.7.3. Maximum O/P frequency : 400 Hz (programmable)
- 1.22.7.4. Rated input voltage and frequency: 3Phase, 380 - 460V, 50/60 Hz.
- 1.22.7.5. Allowable voltage fluctuation : +10% to -15%
- 1.22.7.6. Allowable frequency fluctuation: +5% to -5%
- 1.22.7.7. Control Method : High carried freq. (low noise) sine wave PWM technique.
- 1.22.7.8. Starting torque : 150% below 1 Hz. (150% at 0 RPM with PG)
- 1.22.7.9. Speed control range : 100:1 (1000:1 with PG)
- 1.22.7.10. Speed control accuracy : +/-0.2% (+/-0.02% with PG)
- 1.22.7.11. Speed response : 20 to 30 rad. per sec.
- 1.22.7.12. Torque limit : Settable through programme (parameter)
- 1.22.7.13. Output freq. Resolution : 0.01 Hz.
- 1.22.7.14. Freq. Setting signal : +10 to -10 V, 0 to 10 , 4-20 mA, INC/DCR through PB (Programmable).
- 1.22.7.15. Acceleration/deceleration time: 1.1 to 6000 sec (Can be set independently) Four rates should be possible.

- 1.22.7.16. Braking torque : Approx. 20% (approx. 125% when using braking resistor)
- 1.22.7.17. Main control functions : Auto tuning
Drop control
DC injection braking
Slip compensation
S-curves
Speed search
Excess torque detection
Torque limit
Full range auto torque boost
Multi step speed operation
Accl/Decl time changeover operational
3 wire sequence Speed/torque control
switch operation Fault log.
- 1.22.7.18. Protective functions : Motor overload
Instantaneous over current
Fuse protection
Over voltage
Under voltage
Power loss ride through FIN overheat
O/P short circuit protection
I/P & O/P open circuit protection
Stall prevention
Ground fault
- 1.22.7.19. Type of Enclosure : **IP:21** or better

1.23. RADIO REMOTE CONTROL

1.23.1. For Radio Remote Control operated EOT crane tenderers should quote in accordance with the following parameters: -

1.23.1.1. The wireless control facility shall incorporate control of movements in all directions, with speeds identical to those provided for the cabin/pendant control. The facilities shall be provided in the set for Radio Frequency adjustments within 335-336 M Hz or 865-866 M Hz range which are to be advised to the supplier by consignee on allotment of such frequency by the Department of Communications.

1.23.1.2. The facilities to be provided shall incorporate but need not be limited to the operations features listed below:

- i. Emergency stop.
- ii. Emergency Alarm.
- iii. Normal ON / OFF control.
- iv. Micro / Normal speed switches.
- v. Directional movement control switches.
- vi. Radio / Normal control selection switch.
- vii. Overall weight of equipment to be carried by operator not to exceed 2.5 kgs.

The system shall be so designed that in the event of its mal functioning it should be possible for the user to switch over to conventional cabin/pendant control through suitable bypass switch facility

- 1.23.1.3. The general scope of supply of Radio Remote Control equipment shall be as per clause 2.23.2. The leading parameters of the crane are as per relevant Annexure
- 1.23.1.4. The equipment should incorporate all necessary interlocks to ensure safety under all conceivable operating conditions, including safeguards against independent operation while in tandem mode and vice-versa.
- 1.23.1.5. The supplier shall undertake to coordinate with Department of Communications for allotment of required radio frequencies, duly getting all actual user applications etc. filled in by the consignee and conducting all necessary liaison with (other than Railways) agencies for this purpose.

1.23.2. SCOPE OF RADIO REMOTE CONTROL

- 1.23.2.1. Scope includes supply and installation of Radio Remote Control system suitable to operate EOT crane as per particulars given in relevant schedule
- 1.23.2.2. The scope of supply shall consist of
 - i. Radio Remote Control
 - ii. 1 no. Transmitter-Joy stick type or Push button type.
 - iii. 1 no. Receiver.
 - iv. 1 no. Antenna and cable.
 - v. Two sets of Ni-Ah rechargeable batteries
- 1.23.2.3. 1 no. Battery Charger (suitable to charge one set of batteries at a time).
- 1.23.2.4. The remote control UNITS shall have following features for following motion :-

i.	MAIN POWER	ON / OFF
ii.	MAIN HOIST	ONE SET
iii.	AUXILIARY HOIST	ONE SET
iv.	LONG TRAVEL	ONE SET
v.	CROSS TRAVEL	ONE SET
vi.	EMERGENCY STOP	ON / OFF CONTROL
- 1.23.2.5. Each transmitter shall not weigh more than 2.5 kg and shall be provided with a shoulder belt and shall be in IP65 enclosure.
- 1.23.2.6. The system shall be microprocessor based.
- 1.23.2.7. The system shall have self-diagnostic feature with LED display.
- 1.23.2.8. For ease of maintenance the cards should be easily replaceable type.
- 1.23.2.9. The transmitter shall have indication for low battery. The battery should not be get discharged, have longer life and before reaching discharge level it should give visual indication.
- 1.23.2.10. The system shall be suitable for operation of 335-336 M Hz or 865-866 M Hz frequency range with a provision of fine adjustment.
- 1.23.2.11. The range of operation should be adjustable from 0 to 100 meters.

- 1.23.2.12. Frequency of operation of the Remote Control Units shall be indicated in the offer.
- 1.23.2.13. Tenderer shall ensure adequate supply of spares and availability of maintenance support within country.
- 1.23.2.14. The tenderer shall be responsible for commissioning the above system.
- 1.23.2.15. Equipment supplied should be certified by internationally recognised international inspection agency.

2. GENERAL CHARACTERISTIC: Covered under para-1 above.

3. TECHNICAL LITERATURE:

- 3.1. One copy of the printed illustrative catalogue showing features of the machine and its elements must be enclosed with each copy of the bid.
- 3.2. The technical literature shall be provided for the complete machine, including imported and indigenously purchased components/sub- assemblies. The successful tenderer will have to furnish 4 (four) copies each of the following manuals directly to the consignee along with the machine. Out of these **04** sets, the bidder shall be required to submit one set of all documents in best available condition one month prior to the training for the machine. One set of technical literature should cover the following details:
 - i) Operational & Maintenance manual of the Crane.
 - ii) Instruction & Maintenance manual for Hydraulic Oil Cooling Unit.
 - iii) Technical & Maintenance manual for Lubrication System.
 - iv) **Electric Circuit diagram, in which length of wires must be mentioned, hard copies in A-II size as well as soft copy in PDF format.** (which clearly shows the position of all type of electrical components in Crane).
 - v) Mechanical drawings, hard copies in A-1 size as well as soft copy in PDF format.
 - vi) Spare part manual including part lists no., hard copies in A-4 size as well as in PDF format.
 - vii) Repair and trouble shooting guide.

Note: All manual and literature should be in English.

4. SPARES & MAINTENANCE TOOLS

- 4.1. Maintenance spares as per Schedule-IV.
- 4.2. Maintenance Tools as per schedule-V

5. CONSUMABLES: Not Applicable.

6. SPECIAL FEATURES:

- 6.1. Special features incorporated in the machine, if any, shall be indicated separately in the bid clearly indicating the advantages.

7. DEVIATIONS:

- 7.1. The tenderer shall certify that the offered machine fully meets the

specification. Various design features incorporated in the machine to fulfill different technical performance requirements shall be fully explained in the offer. However, minor deviations from these specifications which do not affect or in any way interfere with the stipulated performance standards or would result in improved safety/ reliability or would reduce recurring maintenance/operating cost of the machine, can be considered for acceptance. The tenderer in such eventuality shall clearly indicate the details of these deviations and their implications as per the following format given in Annexure-A at Section-III.

8. INSPECTION AND TESTING AT MANUFACTURER'S WORKS:

- 8.1. 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 or his authorized representative at the supplier's or his sub-supplier's works. The Quality Assurance programme will be as per Annexure-K. However, the purchaser or his authorized representative is free to institute any further checks also, if he so desires, and shall be in no way binding on the Purchaser.
- 8.2. All electrical and mechanical equipment shall be tested in accordance with the appropriate Indian Standard at either the crane maker's or equipment manufacturer's works and test certificates provided if required by the Purchaser or his representative.
- 8.3. Railway reserves the right for surveillance inspection of firm after placement of order to assess the ongoing process of manufacturing and facilities available with them. In case the inspection team observes the deficiencies/deterioration in infrastructure/manufacturing capability at the firm's premises, the action can be initiated as considered appropriate on merit.
- 8.4. The complete machine shall be inspected at manufacturer's premises as per approved GA drawing. Inspecting authority shall not carry out the final inspection in case GA Drawing is not approved by the consignee
- 8.5. The Manufacturer shall produce invoices of bought out items/sub-assemblies to ensure genuineness of such products/verification by the Inspecting agency.

9. TRAINING:

- 9.1. Technical experts from manufacturer will fully and adequately provide training to operation and maintenance staff nominated by consignee at the time of commissioning of crane. Minimum 04 man days of training at consignee premises will be provided. This training shall include crane architecture, systematic methods for quick diagnosis of problems and quicker methods to solve them, domain knowledge and safety procedures to be followed while working with crane.

10. GENERAL ARRANGEMENT & RELATED DRAWINGS

10.1. SUBMISSION OF GENERAL ARRANGEMENT & RELATED DRAWINGS FOR APPROVAL:

- 10.1.1. The contractor shall depute their engineer to take accurate measurement of span and other fixed dimensions of gantry at site jointly with consignee before

submission of GA drawing and incorporate the dimensions measured at site in the GA drawing to be submitted to consignee for approval.

10.1.2. The Contactor will be required to submit the following drawings in 2 copies to consignee as per time schedule after issuance of LOA/PO

i) The general arrangement drawings containing all information as described at item 24 of Schedule -II.

ii) General lay out drawing of the trolley.

iii) Assembly drawings of individual drives like hoists, long travel, cross travel.

iv) Sub assembly drawings for wheels. Hook blocks and hoist drum.

v) Wiring diagram showing the wiring for the complete crane including the following:

a) Electrical equipment layout drawings along with rating of items used.

b) Current collection arrangement for the crane.

c) Power supply arrangement to the trolley and attachments

vi) Lubrication system for the complete crane.

vii) In addition to the above, the contactor will submit detailed calculations for selection of Motor, Reducer, Brake coupling, Bridge girder, End carriage and their connection to Consignee with their detailed drawings.

The drawings mentioned at (i), (ii) and (iv) shall be got approved by the contractor from the consignee and cranes supplied by them shall conform to said approved drawings. The drawings should be legible and is minimum A3 size.

10.1.3. The supplier shall furnish to the consignee five prints of all erection drawings showing the marked numbers with weights of various items to be assembled at site, schedule of site bolts, rivets and special welding electrodes, welding techniques and erection instructions.

10.1.4. Supplier shall give to the consignee the breakup of weights of different consignments of crane for the purpose of unloading at site.

10.2. APPROVAL OF GA DRAWING

10.2.1. To be governed by Time Schedule in clause 7 of section-I and following stipulations. General Arrangement Drawings will be sent by the 'Contractor' to the Consignee as per Time Schedule. The 'Contractor' should ensure that drawings sent to consignee are complete in all respects as specified in technical specification. The GA drawings shall be approved by the consignee and given back to the contractor.

10.2.2. **Delays in submission of drawings by Contractor will be added to the delay in supply of machine** in case submission of GA drawing is delayed beyond stipulated time as per time schedule and LD will be levied **as per Stores condition**. Thus the number of days delay in submission of GA drawing plus the number of days delay in supply of machine together will be taken as the delay in supply of machine, However if the contractor supply the machine before original delivery period as per PO the number of days by

which machine has been supplied earlier than original delivery period that many days will be subtracted from the delay in submission of GA drawings and LD will be levied accordingly. Delays in approval of the drawings by consignee will not be because of Contractor, except as detailed below.

- 10.2.3. In case Consignee finds some deficiencies in the Drawings and returns the same for rectification to the 'Contractor', the contractor must return the rectified drawings within 30 days from the date of issue of letter by Consignee. This period will not be counted towards LD calculation. The consignee shall ensure that all deficiencies in the Drawings shall be pointed for clarifications to the firm together at one time only instead of piecemeal multiple reference.
- 10.2.4. A repeat back reference(s) by Consignee to Contractor pointing out further defects/deficiencies in the Drawings, will be considered a delay on account of the contractor, unless and until clearly certified by consignee as being on their own account, for special circumstances like change in location, review of arrangement etc. Thus, Contractors must take utmost care in ensuring completeness as per requirements of the Consignee.
- 10.2.5. Where GA Drawing cannot be prepared due to clear site not being available etc., the Consignee must inform Contractor, explaining the exact delay. However, initiative must be taken by Contractor to obtain such a certificate from Consignee.
- 10.2.6. In their own interest, contractor must maintain a log of events in this respect with clear dates and get this countersigned by consignee for submission along with his bills to avoid wrong levy of LD. Consignees must cooperate with Contractors by providing all assistance, including clear information about any expected delays in site availability, promptly and in writing.
- 10.2.7. If an order has been placed on the firm, the firm will have to advise the consignee well in advance regarding requirement of road permit and assistance required from the consignee, if any, so that delay on this account is avoided. Firm should also visit the site before dispatch of crane to assess the condition of path to be used for movement of trailer.

10.3. DISPATCH OF CRANE FROM MANUFACTURER'S WORKS

- 10.3.1. The supplier and consignee will ensure that facilities as defined in PO necessary at site for commissioning of crane e.g. clear site with gantry, electrical power from mains to DSL are ready before dispatch of crane. The crane shall be dispatched by the supplier only after all the on-site requirements from supplier side as well as consignee side, for commissioning the crane on arrival, have been made ready. The supplier and consignee shall record a joint note certifying this.
- 10.3.2. The packing of crane with all components, accessories should be supplied suitably packed.

11. INSTALLATION, COMMISSIONING AND PROVING TESTS:

- 11.1. **Joint Check** – The contractor or his agent would be required to carry out a joint check at consignee's end, along with the consignee, before unpacking is done, to avoid subsequent complaints regarding short shipment/transit damages. It is necessary that this joint receipt inspection be done immediately