

## Section-IV

### IMPORTANT FEATURES OF THE TENDER

#### 1 INSTRUCTIONS TO TENDERERS FOR FILLING TECHNICAL BID

- 1.1 Unless otherwise stated, latest alterations/ revisions of specifications/ standards/ drawings shall be applicable. In respect of safety standards and environmental standards relevant to the machine, the machine manufacturers shall ensure compliance with international (CE/ISO/DIN/JIS) /National standards (IS) (wherever applicable).
- 1.2 Tenderers should offer and quote for all the specified concomitant accessories, as these are considered essential for commissioning and utilization of the machine. Even if bidder does not recommend the purchase of any of these accessories, the price must be quoted for comparison purposes and their recommendation/suggestion to be indicated in the offer. Tenderers should also quote for optional accessories, spares and consumable spares as asked in the specifications.
- 1.3 In case, any item is required in sets, please specify nos./pieces per set. This is essential for proper technical evaluation of the offer. Offers received without this may be considered as incomplete and liable to be rejected.
- 1.4 The bidder should quote only for the specified make of sub-assemblies and equipment wherever specified. In case, some other make is quoted, specific reasons for the same including its features/ advantages over specified makes should be submitted. Past performance of a same/similar machine from two or more end users may be submitted to evaluate performance of other items offered. Details of industries/entities/Customers/products using the offered brand, details of manufacturer, should be submitted to evaluate the market presence of the make quoted; in case details are not submitted alternate brand/ item will not be considered & offer will be evaluated accordingly.
- 1.5 In case there is a contradiction in any information provided (some parametric values given in the specification and those given in the brochure or some other document enclosed by the tenderer), unless specifically mentioned in the deviation cum confirmation statement under Annexure A of Section VI, the values as given in Bid Document Part-II shall be taken as confirmed by the tenderer and offer evaluated accordingly.
- 1.6 Bidder or his authorized agent, in their own interest, should visit the consignees listed in clause 3 Section-IV with prior appointment with Controlling Officer and acquaint themselves with existing process of manufacturing/remanufacturing, site conditions, availability of crane facility etc.
- 1.7 The Purchaser may accept internationally accepted alternative specifications which ensure equal or higher quality than the specifications mentioned in the Technical Specification. However, the decision of the Purchaser in this regard shall be final. A copy of the alternative specifications offered should be sent along with the offer. The Tenderer should also furnish "Statement of Deviations" from tender specifications (as per Annexure A, Section-VI) along with the offer.
- 1.8 The bidder who has not been placed with any order through COFMOW for the tendered machine (any capacity) shall be considered as New Vendor. Whenever, technically & commercially responsive bid is received from a New Vendor, a technical team from COFMOW shall carry out the Capability Assessment of the premises of the bidder to assess their capability to design and manufacture the tendered machine as per COFMOW Specifications. Based on the report of Capability Assessment the bidder will be considered as Suitable/ Unsuitable for placement of any order through COFMOW. The bidder shall submit the information on Annexure-H of Section-VI in the original offer.
- 1.9 Bidder shall furnish Clause wise comments and information asked for against various clauses, wherever specified.

## **2 DESCRIPTION:**

2.1 Electric Overhead Traveling Crane as per parameters specified in schedule-I conforming to specification no. **COFMOW / IR/ EOTC-2022, Rev-2** given in section V. The crane shall be single girder / Double girder / Under slung single girder as specified in Schedule-I (1,2.... n)

### **2.2.1 Leading parameters**

2.2.1.1 Leading parameters and type of Crane have been specified in Schedule – I (1, 2....n)

### **2.2.2 Prove out at firm's premises:**

2.2.2.1 The crane shall be proved out at the firm's premises as per QAP enclosed as Annexure-I. 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 authorised representative at the supplier's or his sub-supplier's works. The Quality Assurance programme will be as per Annexure-I. However, the purchaser or his authorised representative is free to institute any further checks also, if he so desires, and shall be in no way binding on the Purchaser.

### **2.2.3 Prove out at consignee's works:**

2.2.3.1 Start up and trial Operations Test (Commissioning Test)

2.2.3.2 The contractor shall carry out the start up and trial operation tests (commissioning test) on receipt of authorization from the Purchaser. In addition to tests indicated in IS: 3177(latest), the following shall also be shown:

- i] The earthing of the crane and control equipment, to be tested as per Indian Electricity Rules.
- ii] The operation of brakes on long travel, cross traverse and hoisting motions.
- iii] Inching control and creep speed as called for in technical specification.
- iv] There is no skew ness in crane during long travel and cross travel motions, presence of vibrations and unusual noise in operation.

2.2.3.3 The trials shall be carried out initially under no load conditions and on satisfactory completion of these, trials shall be repeated for various loads until the full rated load and operating range are covered.

2.2.3.4 During the trial operation, all necessary adjustments shall be made so as to ensure compliance with the operating characteristics for the complete equipment as stipulated in the technical specifications.

## **3 QUANTITY & CONSIGNEE**

**3.3.1 Quantity and consignee shall be as per Sch-I (1, 2..... n)**

## **4 SCOPE OF SUPPLY.**

4.1 The specifications cover the design, manufacture, supply, installation, testing and commissioning of Electric Overhead Traveling cranes of Capacity as per parameters specified in Schedule-I (1, 2.... n)

4.1.1 The Scope of supply shall include but not be limited to the following along with necessary fittings, fixtures and ancillaries.

- (i) Bridge structure with platform and hand railing **(DG)**
- (ii) I-beam / Box type bridge without platform and hand railing **(SG)**.
- (iii) Track wheels for longitudinal and cross travel
- (iv) Travelling mechanism for longitudinal and cross travel
- (v) Hoisting mechanism.
- (vi) Brake Mechanism separately for long travel, cross traverse and hoisting.
- (vii) Trolley **(DG)**.
- (viii) Hoist with cross travel arrangement **(SG)**.
- (ix) Service Platform **(DG)**.
- (x) Cabin/Pendant/Remote Control, or combination as per details at Schedule-I (1, 2 ..n)
- (xi) Electrical motors, control gear and equipment.

- 4.1.2 Spares as per schedule-IV and other additional spares, Slings/Chains/Lifting tackles as specified in schedule-I. Any other items of spares considered essential by the tenderer for two years normal maintenance, to cover the complete range of mechanical, hydraulic and electrical equipment, shall also be quoted for separately. Item-wise cost of spares as indicated in Schedule-IV shall be separately quoted.
- 4.1.3 A tool box containing all tools required for the maintenance of the crane should be supplied with the crane as per enclosed list at Schedule-V.

**4.2 CONCOMITANT ACCESSORIES:**  
**The crane shall be conforming to schedule-I (1, 2.. ..n)**

**4.3 OPTIONAL ACCESSORIES**

- 4.3.1** Any other accessory/ equipment which in the opinion of the tenderer can contribute to better performance/operation shall be clearly indicated and quoted separately as optional accessory. The advantages should be clearly explained.

**5 EVALUATION CRITERIA**

**5.1 Total value of the offer will be calculated based on**

- (i) The cost of basic EOT Crane.
- (ii) Cost of DSL (type and length of DSL as specified in schedule-I).
- (iii) Cost of spares as per schedule-IV and additional spares and items viz slings/lifting tackles as specified in schedule-I.
- (iv) Cost of maintenance tools as per schedule-V
- (v) Cost of any other accessory treated as concomitant accessory.
- (vi) Cost of Installation & commissioning of crane and DSL (length of DSL as specified in schedule-I).
- (vii) Duties, taxes, insurance, freight and packing charges.

- 5.2 All related erection material required for inspection and commissioning of crane and connecting up to electrical equipments with cable laying and fixing accessories shall be included in the cost of basic EOT crane.

**6.0 OTHER ITEMS TO BE QUOTED**

The following items will need to be quoted additionally though will not be part of commercial evaluation.

- (i) Cost of Comprehensive AMC for five years after the warranty as per clause 17 of section-V.
- (ii) Break up of individual items as per Schedule-IV and additional spares and items viz sling/lifting tackles as specified in Schedule-I

7

**DELIVERY SCHEDULE CHART:**

In the event of acceptance of the offer, the machine(s) shall be supplied as per the following

Milestone Chart:

Name of Machine : Electric Overhead Travelling Crane

Specification no. : **COFMOW/IR/EOTC/2022, Rev-2**

S. No.	Activity	Activity Code	Outer Limit of Time Schedule expected by COFMOW
1.	Issue of LOA by COFMOW	D1	-
2.	Submission of PBG by successful bidder	D2	D1 + 30 days
3.	Issue of AT / Contract by COFMOW (after verification of PBG)	D3	D2+30 days
4.	Submission of GA drawings to consignee by successful bidder/supplier along with information on power & other utilities required for machine (to be governed by clause 11 of Section-V)	D4	D3 + 45 days (for the first four cranes under order thereafter subsequent cranes @ 2 cranes per week)
5.	Approval of GA drawings by consignee. (to be governed by clause 11.2 of Section-V) *	D5	D4 + 45 days
6.	Handing over of crane site with gantry by consignee and joint note confirming readiness of site.	D6	By D5 ( at the time of approval of GA drawing)
7.	Delivery of crane at site by supplier	D7	D5 + 180 days for the first one cranes under order thereafter subsequent cranes @ 2 cranes per month
8.	Power connection for the machine and other on site requirement to be provided by Railway	D8	D7 + 7 Days
9.	Railway to give call to supplier for the commissioning	D9	D7 + 7 days
10.	Installation and Commissioning and Prove out of Crane by supplier	D10	D7 + 120 days
11.	Issue of PTC by consignee	D11	D10 + 30 days
12.	Warranty	D12	D10 + 2 years
13.	Submission of performance appraisal report in form E by consignee	D13	D12 + 60 days

\* In case drawing is returned unapproved by consignee, it shall be resubmitted within 30 days (refer clause 11.2.3 of section V)

Signature of Bidder

NOTE: Notwithstanding the delivery period indicated elsewhere in the tender document, the delivery indicated in this schedule shall be taken as over ridding and final.

**Section-V**  
**TECHNICAL SPECIFICATION ABBREVIATIONS**

A-1,A-2, A-3, A-4	Standard paper sizes
AC	Alternating Current
AMC	Annual Maintenance Contract
AT	Acceptance of Tender
BG	Bank Guarantee
CME	Chief Mechanical Engineer
CME/PCM	Chief Mechanical Engineer/Post Contract Management
CNC	Computer Numeric Control
COFMOW	Central Organisation for Modernisation of Workshops
COS	Controller of Stores
Db	Decibel
DC	Direct Current
FA&CAO	Financial Advisor & Chief Accounts Officer
GA (Drawing)	General Arrangement (Drawing)
HRC	Hardness Rockwell 'C' Scale (value)
Hz	Hertz
IEC-Pub	International Electro technical Commission - Publication
JCN	Joint Commissioning Note
JRI	Joint Receipt Inspection
kW	Kilo Watt
LC	Letter of Credit
LD	Liquidated Damages
LOA	Letter of Acceptance
NC	Numeric Control
NIT	Notice Inviting Tenders
PBG	Performance Bank Guarantee
PDF	Portable Document Format
PLC	Programmable Logic Controller
PTC	Proving Test Certificate
PU	Production Unit (Any of the six Railway Production Units e.g. RCF, ICF etc.)
RDSO	Research Design & Standards Organization
SS	Stainless Steel
WBG	Warranty Bank Guarantee
SG	Single Girder
DG	Double Girder
VVVF	Variable Voltage Variable Frequency
LT	Long Travel
CT	Cross Traverse

**NOTE**

- (i) **These specifications cover double box girder and single girder EOT cranes. The clauses pertaining to single girder either gantry or underslung have been marked as (SG) and double girder as (DG). Those common to both are unmarked. Tenderer should offer clause wise comments separately for single girder and double girder EOT cranes.**
- (ii) **The Specification also covers VVVF and Non VVVF Drive Cranes. The clauses specifically pertaining to VVVF Drive Cranes and Non VVVF Drive cranes have been marked as (Applicable for VVVF Drive Crane) and (Applicable for Non VVVF Drive Crane). Those common to both are unmarked. Tenderer should offer comments separately for VVVF and Non VVVF drive cranes.**
- (iii) The bidders are required to submit the quotations of cranes considering classifications and design wherever duty factors are involved as per IS-3177-1977. The mention of IS-3177-1999 (or latest) elsewhere in technical specs. Should be considered for general mechanism and components as applicable where duty factor as per old classification are not involved.

**1. BASIC DESIGN FEATURES:**

**1.1 GENERAL MECHANICAL DESIGN**

1.1.1 The cranes shall be designed, manufactured, erected and tested generally in accordance with the following specifications:

- i) IS: 3177-1999 (or latest) - Indian Standard Code of Practice for electric overhead travelling cranes.
- (ii) IS: 807-2006 (or latest) - Indian Standard Code of Practice for design, manufacture, erection and testing (structural portion) of cranes and hoists.
- (iii) IS: 3938-1983 (or latest)-Indian Standard specification for Electric wire rope hoists **(SG)**.
- iv) IS: 800-2007 (or latest) – Indian Standard code of practice for General Construction in steel.**

The design of various components of the mechanism is dealt in detail in subsequent paragraphs.

1.1.2 The design of the crane structure as well as all the component parts of the crane mechanism shall conform to class of duty indicated in Schedule-I. The class of duty is based on design parameters stipulated in IS807-2006 (or latest).

1.1.3 The stipulations in these specifications are complementary to those set out in the Indian Standards Specifications IS: 3177, 807 & 3938 mentioned above. If any of the conditions mentioned in these specifications is at variance with that of the ISS, the technical specifications here under shall prevail.

1.1.4 The cranes shall be supplied complete in all respects. The tenderer shall furnish complete details regarding type, material of construction, specifications and special features, if any, for the main items. Any variations from the specifications shall be brought out with reasons for the same. Any variations involving lower standards of design, performance and rating are not acceptable.

1.1.5 Necessary information regarding the conditions under which the crane is to be used, together with other particulars necessary for manufacture and erection of the crane, are given in Schedule-I. The successful bidders should visit the actual site to assess local conditions that often affect manufacturer's programme for commissioning and installation and to ensure that various structural requirements are incorporated in the final design of the crane. Unfamiliarity with, or ignorance of, local conditions, will not be accepted later as adequate reason for delays in commissioning by successful bidder.

- 1.1.6 Manufacturer should supply with the offer, information regarding the construction of the crane according to the proforma laid down in Schedules-II & III. Separate Schedules II & III should be submitted for each crane.
- 1.1.7 The bidders should also submit details of structural calculations along with thickness of plate/sheet for girders, end carriage, crab and other load bearing structural members along with offer and got it duly approved by reputed organizations such as NPL, IIT, NIT or govt. approved engineering colleges or a Chartered Engineer along with breakup of weights of major assemblies/components before submission of GA drawings to consignee for approval.
- 1.1.8 Preferred number series should be used, as far as possible, at all stages of the design process. In particular, the hoisting and travel speeds as indicated at Schedule-I, if not already so indicated, should be rounded off while making the offer to the nearest figure in the R-10 Preferred Number Series, as given below for ready reference:
- Approx. 1.00, 1.25, 1.60, 2.00, 3.15, 4.00, 5.00, 6.30, 8.00 and 10.00.

## 1.2 **PURPOSE FOR WHICH REQUIRED**

- 1.2.1 Capability. The crane should be capable of:
- (i) Hoisting, i.e. lifting and lowering of all loads up to the maximum specified limits of load and distance at different specified speeds
  - (ii) Traveling and traversing at specified speeds in both loaded and unloaded conditions.
  - (iii) Working in the hot, humid and dusty atmosphere of Railway Workshops, Sheds and Depots.

## 1.3 **ATMOSPHERIC CONDITIONS**

- 1.3.1 The ambient temperature at the site at which the crane will be installed may vary from -5<sup>o</sup> C to + 50<sup>o</sup> C over the year. The relative humidity may be as high as 100%. The atmosphere is expected to be dusty. The crane offered shall be suitably tropicalised to work under these ambient conditions without any adverse effect on its performance.

## 1.4 **RIGIDITY, CONTROL AND SAFETY**

- 1.4.1 The crane should be rigid, robust and of sturdy construction
- 1.4.2 Crane controls should be conveniently located. Various controls should be suitably interlocked to prevent accidental movement of the crane.
- 1.4.3 Suitable limit switches, one each for long and cross travel and two each for main and auxiliary hoists, should be provided to stop the crane and prevent over-travel of various moving parts of the crane.
- 1.4.4 A speed sensing switch set for 1.5 times the maximum lowering speeds shall be fitted along with a separate brake caliper disc type on the main hoist drum, in order to cater to the unlikely but fatal eventuality should it occur, of the load falling due to a mishap beyond the motor output shaft on which the regular hoist brake is fitted. This would be required only in specially critical cases, such as cranes carrying molten metal, where additional safety is to be built into the crane apart from the twin hoist brakes referred to as at Clause 1.17.3. Such requirement, if any, will be indicated at item 6.3 of Schedule-I.
- 1.4.5 Electrical interlocks should be so provided that the two operations of traversing and traveling can be performed simultaneously, but while hoisting it is not possible to undertake either traversing or traveling.
- 1.4.6 Suitable buffers should be provided to prevent over travel of the crane mechanism in both longitudinal and cross traverse directions.
- 1.4.7 Suitable guards or enclosures should be provided on the crane to prevent inadvertent contact with down shop leads, or any other exposed electrical conductors and cables.
- 1.4.8 Suitable isolation switches and stop buttons should be provided to isolate the electric supply for maintenance, or in the event of an emergency. Dead man's handle must also be provided in cabin operated cranes (DG).
- 1.4.9 A safety hand railing of tubular construction should be provided on bridge foot walks, end carriages, staircases, the landing in the cabin, trolley and at 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 around 500mm.(DG).

- 1.4.10 Sheaves shall be provided with rigid guards to retain the wire ropes in the grooves. The guards shall fit close to the flange having a clearance not more than one-fourth of the diameter of the wire rope between the sheave and the inside of the guard. Bottom block sheaves shall be enclosed except for wire rope openings.
- 1.4.11 For outdoor cranes all electrical and mechanical equipment should be protected from the weather. All weather-proof covers should be easily removable. Details of protection provided should be indicated in the offer.
- 1.4.12 The fully commissioned crane should be rigid and robust to withstand the workshop environment of Indian Railway repair workshop with an ambient temperature ranging up to 50 degree centigrade and relative humidity of 100 %. I**

#### **1.5 MAINTAINABILITY**

- 1.5.1 Safe accesses for maintenance and easy removal of all mechanical, electrical and structural components to carry out repair and maintenance must be ensured. All parts requiring replacement, inspection and lubrication should be easily accessible without the need of dismantling other equipment or structures. Arrangements for access to important components must include a cradle for inspection and maintenance of DSL, such cradle being conveniently accessible from the cabin or, for pendant operated cranes, by step ladder attached to the gantry at one end of the bay. (DG).
- 1.5.2 All electrical cables should be so laid that they are not liable to damage and can be easily inspected and maintained. The cables should be weatherproof.
- 1.5.3 All components for cranes of identical capacity and duty shall be interchangeable unless otherwise required.
- 1.5.4 In order to have access to the operator's cabin (if provided), long travel drive, current collectors, trolleys, etc., full length chequered plate platforms should be provided alongside both bridge girders. Access to the cabin from the bridge girder platform should be via a staircase. Minimum width of such staircase should be 600mm. Footwalks should be of sufficient width to give at least 500 mm clear passage at all points except between railing and bridge drive, where this clearance may be reduced to not less than 400 mm. (DG).
- 1.5.5 Materials used for equipment and structural members should be free from cracks, blow holes, laminations, pitting etc. Except for areas where a superior grade of materials is required, steel used throughout shall be conforming to IS: 2062 (latest) Grade E-250 BR or B0. The supplier should submit material test certificates for structural steel and mechanical component such as couplings, gears, gear boxes, rope drums, brake drums, shafts, wheels etc.
- 1.5.6 A tool box containing all tools required for the maintenance of the crane should be supplied with the crane as per enclosed list at Schedule-V.
- 1.5.7 Fasteners for pedestal blocks, gear boxes, etc., should be easily removable from the top of the platform.
- 1.5.8 Standardization and unification shall be carried out to the maximum extent for the various sub-assemblies constituting the mechanism of various cranes. Units shall be designed such that they can be dismantled quickly without disturbing the installation of the neighboring units with which they are connected. Units as a whole, such as wheel assembly gear box, brake, rope drum assembly, etc., shall be replaceable and interchangeable with other identical units. In design care shall be taken to see that spare parts inventory is kept low and up time of 95% will have to be guaranteed.

#### **1.6 STRUCTURAL DETAILS**

- 1.6.1 The crane bridge should comprise of double girders of the plate box type. (DG).
- 1.6.1.1 In the case of single girder crane, the bridge should be rolled I-beam / welded box type (SG).
- 1.6.2 In the main bridge girders, in addition to the required full length diaphragms, short diaphragms should be inserted wherever required to transmit the trolley wheel load to the web plates and to limit the maximum stress in the trolley rail to safe permissible limits. All diaphragms must bear against the top flange. Steel plates used for bridge girders and diaphragms shall be conforming to IS: 2062 (latest) Grade E-250 BR or B0.(DG and for SG in case of box type girder).



- 1.6.3 Connections in general should be as per Section 10 of IS: 800-2007 (or latest). Black bolts should not be used in the main structure of the crane, only bright bolts with ground stems are permissible. Bolts used which are under shear forces should be fitted into reamed holes.
- 1.6.4 The bridge girders should be connected to the end carriages by large gusset plates. Ground tight fit bolts in reamed holes should be used for bolted connections.
- 1.6.5 The calculated strength of riveted joints, or joints made by High Strength Friction Grip (HSFG) bolts should not be less than calculated net strength of the member. The calculated strength of other bolted joints in structural members should not be less than the net strength of the member plus 25%.
- 1.6.6 The supplier should have sound infrastructural facilities, good working system and practice for fabrication and machining of various structural components of EOT cranes. Some of the important requirements are listed below:
  - 1.6.6.1 All welding shall be carried out under the overall supervision of a welding Engineer/Supervisor specially trained in welding. The welding engineer/supervisor shall prepare the welding procedure in accordance with IS: 9595-1996 (or latest) "Recommendation for Metal Arc welding of Carbon and Carbon Manganese steels". In addition, the correct welding sequence should be followed for typical locations. The welding engineer/supervisor shall obtain design engineer's approval to the same. The welding Engineer/Supervisor shall also be responsible for actual implementation of the above mentioned approved welding procedure.
  - 1.6.6.2 Welding Supervisor shall have received formal training from recognised institutions having specialized courses for welding Supervisor.
  - 1.6.6.3 Details of edge preparation for welding shall be in accordance with IS:9595-1996 (or latest) "Recommendation for Metal Arc welding of carbon steel and carbon manganese steels.
  - 1.6.6.4 Automatic/Semi Automatic submerged Arc/Gas shielding shall be carried out according to IS or other International Specification.
  - 1.6.6.5 Welders engaged in fabrication should have passed welder approval tests in accordance with IS specification no. 7318 (part –I) "Approval tests for welders when welding procedure approval is not required-Part I fusion welding of steel"
  - 1.6.6.6 All welding equipment and accessories should meet the requirements of the corresponding Indian Standard specification (or International Specifications where IS specification do not exist). The contractor shall be responsible for satisfying the Inspecting officer that all welding equipments and accessories being used meet these requirements.
  - 1.6.6.7 Electrodes and wire flux combination used for fabrication should be from reputed makes of ESAB, Advani Orlikon, Philips and Modi.
  - 1.6.6.8 Welding shall be performed in an approved and workman like manner. All welds shall be homogenous and show physical properties similar to those of parent metal. Finished welds shall be perfectly free from all defects such as porosity, burnt metal, inclusion etc. and shall present a smooth appearance.
  - 1.6.6.9 When the welded joints are inspected no defects specially due to use of equipment and /or filler material shall be accepted. After welding the welded parts or assemblies should correspond to the dimensions required as mentioned in drawings.
- 1.6.7 All butt welds on structural members should be radiographically tested. All other welds should be subjected to Magnaflux or Dye Penetration Test.
- 1.6.8 The box girders should be so constructed as to eliminate any possibility of accumulation of water or oil inside them. Special care should be taken with cranes for outdoor use to eliminate depressed areas or openings where water may accumulate and lead to corrosion.
- 1.7 **END CARRIAGES**
  - 1.7.1 The crane bridge should be carried on end trolleys with double flanged solid forged wheels. The minimum end clearance on each side of the long travel wheels should be 10 mm. The wheels should be mounted on fixed axle or suitable anti-friction spherical roller bearings which can be conveniently removed for maintenance.
  - 1.7.2 End carriages should be designed to be strong enough to resist all stresses likely to be imposed upon them under varied service conditions, including collision with other cranes or

stops. The length of the end carriages should be such that no other part of the crane is damaged in the event of a collision.

- 1.7.3 End carriages should be fabricated from rolled steel sections or plates, welded together to form a box. Suitable stiffening diaphragms should be provided wherever required. The material used shall be steel conforming to IS: 2062 (latest). Grade E-250 BR or B0. If more than two wheels are required, either compensating end carriage or suitable link and pin arrangement should be provided for connecting the two bogies.
- 1.7.4 Suitable jacking pads should be provided on each end carriage for jacking up the crane while changing track wheels. These jacking pads should not interfere with replacement of track wheels.
- 1.7.5 The end carriages should be fitted with suitable safety stops to prevent the crane from falling more than 25mm in the event of breakage of track wheel, bogie or axle. These safety stops should not interfere with the removal of track wheels.

## 1.8 BRIDGE RAILS (TROLLEY RUNWAY RAILS)

- 1.8.1 New standard rail shall be used as bridge rail and should be fastened by suitable clamps spaced not more than 1000mm apart, with welded alignment blocks between every two clamps such that the distance of a clamp from any adjacent alignment block is not more than 500mm. Rail stops riveted or bolted or welded should be provided to prevent creep in the longitudinal direction.
- 1.8.2 Solid square bar of appropriate steel which can be directly welded are also accepted as an alternative only for cranes up to 10 T capacity. For higher capacity cranes only new standard rail should be used. Bidder should indicate size of standard rails in the offer (DG)

## 1.9 TROLLEY FRAME

- 1.9.1 The trolley frame should be welded rolled steel box section, designed to transmit the load to the bridge rails without undue deflection. It should be made rigid by providing suitable diaphragms. The material used shall be conforming to steel IS: 2062 (latest) Grade E-250 BR or B0 (DG).
- 1.9.1.1 In case of single girder crane, hoist should be used (SG).
- 1.9.2 The drum bearings and supports for upper sheaves should be located so as to equalize the load on the trolley wheels as nearly as possible (DG).
- 1.9.3 The trolley wheels should be double flanged. The axle bearings should be of spherical roller type. The bearing housing should be designed for easy removal of wheels and bearings for maintenance (DG).
- 1.9.3.1 The cross travel wheels shall be single flanged in case of single girder crane. The axle bearings should be of spherical roller type or ball bearing. The bearing housing should be designed for easy removal of wheels and bearings for maintenance. The wheels should be manufactured from material C<sub>55</sub>Mn<sub>75</sub> and shall be solid forged and heat treated to have minimum hardness of 25 HRC (250 BHN) on the tread and flange. The method of heat treatment shall be described in the offer (SG).
- 1.9.4 The top of the trolley frame should be plated with chequered plate 5/6 mm thick all over, either at the top or bottom, except for opening(s) required for the ropes to pass through. The opening in the trolley frame should be such as to keep the ropes at a safe distance from any part of the trolley frame or equipment, to prevent damage at any position of the bottom block.
- 1.9.5 All the mechanical and electrical equipment should be placed above the trolley top plate as far as practicable. For any parts placed below the trolley top plate, access for maintenance, repairs and replacement should be provided. Where the clearance between bottom member of trolley frame and the CT rail is over 25mm, the trolley should be fitted with substantial safety stops to prevent the trolley from falling more than 25mm in the event of breakage of track wheel, bogie or axle.

These safety stops should not interfere with the removal of wheel. Details of the arrangement should be explained in the offer (DG).

## 1.10 RAIL WHEELS

- 1.10.1 The rail wheels shall be double-flanged with straight tread. They shall be capable of taking misalignments in span as specified at clause 1.24 of these Specifications.
- 1.10.2 The wheels shall be of material C<sub>55</sub>Mn<sub>75</sub>, and shall be solid forged and heat treated to have minimum hardness of 300 to 350 BHN on the tread and flanges to minimum depth of 10 mm. The method of heat treatment shall be described in the offer.
- 1.10.3 The LT wheel shall be single flanged in case of Under Slung Single Girder crane. The axle bearing should be spherical roller type or ball bearing type. The bearing housing should be designed for easy removal of wheels and bearings for maintenance. The wheel should be manufactured from medium carbon alloy steel and shall be solid forged and heat treated to have minimum hardness of 25 HRC (250 BHN) on the tread & flange (Applicable for **Under Slung Single Girder**).
- 1.10.4 The wheels should be shrink-fit on the axles, rather than being keyed on.
- 1.10.5 Wheels diameter should be selected strictly as per IS: 3177-99 (or latest).

## 1.11 OPERATOR'S CABIN (Applicable for DG Crane)

- 1.11.1 The operator's cabin should be sufficiently rigid metal frame construction and should be connected to the bridge girder by means of bolts or rivets in shear.
- 1.11.2 The cabin should be fixed type, built from rolled steel angles, plates and M.S. Sheets welded together. Unless otherwise specified it should be fitted at one end of the crane opposite the down shop lead side, and shall be so placed that the operator has an unobstructed view of the load and surroundings.
- 1.11.3 The cabin should have sufficient space for easy movement of the operator, with minimum dimensions of 1.5 m x 1.5 m. Unless otherwise specified in Schedule-I, it should be of the open type.
- 1.11.4 The closed type cabin, where specified, should have hinged or sliding windows Arrangements should be made to ensure that the whole exterior of the cab glazing can be of toughened plate glasses of at least 6mm thickness which should be installed from inside.
- 1.11.5 The cabin floor should be extended to form a landing platform with a steel stairway to provide access to the foot-walk above.
- 1.11.6 The layout of controls should be such that the crane can be operated from a seated position. The controller handles should be conveniently located within easy reach of the operator.
- 1.11.7 Fully adjustable padded seat, rubber matting, suitable fan and lighting arrangement should be provided inside the driver's cabin. One fire extinguisher for extinguishing any electrical fire should be provided in the operator's cabin, or at a suitable location in the case of pendant control.

## 1.12 ROPE DRUMS

- 1.12.1 The rope drum shall be designed to withstand the compressive stresses caused by the wound on rope and the bending stress due to beam action of the drum.
- 1.12.2 Seamless Pipes will be an acceptable alternative. The steel used shall be to IS:2062-2011 (or latest) The rope drum shall be stress relieved after fabrication. T-joints shall be radiographically checked.
- 1.12.3 The drum shall be designed to take the entire length of the rope in a single layer. Free extra turns as specified in IS: 3177:1999 ( or latest) shall also be provided. The drum shall be flanged at both ends with adequate collar size as per IS to avoid slipping of wire rope outside the drum.
- 1.12.4 Cranes shall be designed with number of rope falls varying with lifting capacity as per details given below :

Up to 10.0 tonnes - 4 falls	Up to 75.0 tonnes - 12 falls
Up to 40.0 tonnes - 8 falls	Above 75.0 tonnes - 16 falls

### 1.13 WIRE ROPES

- 1.13.1 Hoisting ropes, if of the conventional type, should be of 6x36 construction and made out of the best plough steel having tensile strength of 180 Kg/sq. mm. Ropes should be parallel right hand lay as per IS:2266-2002 (or latest). **The wire rope shall comply to clause 8.3 of IS:3177-1999 (or latest). Tenderers should offer wire ropes of Usha Martin/Bombay wire rope/Mahadev makes.**

### 1.14 GEARING

- 1.14.1 The gear units in all motions should be light weight with silent running and made of case-carburising low carbon alloy steels 20MnCr5 / 16MnCr5 / 17Mn1Cr95 / EN353 / SAE 8620 and should conform to relevant Indian/International standards. They shall generally be in accordance with AGMA or IS:4460-1995 (or latest). All gears and pinions must be made from forged blanks only. All gears should be hardened and profile ground for longer life and silent operation. The minimum surface hardness of pinions shall be between 50 to 60 HRC and shall be 2-3 HRC higher than hardness of gears.
- 1.14.2 Worm wheels and bevel gears must not be used. At all stages only helical gears should be used, except in planetary gearboxes, which can be spur type. Overhung or split gears and pinions should not be used.

### 1.15 GEAR BOXES

- 1.15.1 General: All gear boxes shall be compact, light weight completely enclosed and of splash lubricated type. All gear boxes shall be oil tight and sealed with compound or gasket. All gear shafts shall be supported in antifriction bearings mounted in the gear boxes. Gear boxes shall be cast or forged from low/medium carbon alloy steel or cast iron and suitably heat treated or fabricated. The fabricated gear boxes shall be stress relieved before machining and the method of doing so shall be explained in details in the offer. The internal surfaces of the gear box shall be painted with oil and rust resisting paint. Gear boxes shall be provided with breather vents, easily accessible drain plugs, and a suitable oil level inspection glass or indicator such as a dip stick. Adequate radial clearances between the gear box inner surface and outside diameter of the gears shall be ensured and clearance proposed to be provided shall be indicated in the offer. The facial clearance between the inner surface of the gear box and the face of the nearest gear/pinions shall be at least 10mm.
- 1.15.2 **MH/AH LT and CT Gear boxes** : The motors shall be foot mounted. The foot mounted motors shall have split type gear boxes. These shall be of the conventional split type, designed to split horizontally at the shaft center line and fitted so that the top half can be removed for inspection and repair without disturbing the bottom half.
- 1.15.3 In case of single girder crane for MH, gear box of enclosed type with provision of inspection cover shall be acceptable **(SG)**.

### 1.16 DRIVE MOTORS:

- 1.16.1 The wheels of each end carriage should be driven by independent synchronized drive motors mounted near each end carriage.
- 1.16.2 A separate cross traverse motor should be used for cross traverse drive through a suitable gear box.

### 1.17 BRAKES

- 1.17.1 The hoisting, LT and CT motions shall be provided with fail safe Electro Hydraulic Thrustor brakes. For creep motion of hoist wherever this is specified as per schedule –I an independent brake must be provided.
- 1.17.1.1 In case of single girder cranes, the hoisting, Long Travel & Cross Travel motion shall be provided with AC/DC Electromagnetic Disc Brakes **(SG)**.
- 1.17.2 Any crane working outdoors should be provided with an additional storm brake for anchoring when it is left unattended under stormy conditions. The storm brake together with the service brakes should be capable of holding the crane in position during stormy conditions. Wherever crane is working outdoor, the storm brake should be electro hydraulic thrustor type.

- 1.17.3 The maximum braking torque to arrest long travel and cross traverse motions should not be less than 100% of full load torque for each brake. For hoist motion, two brakes should be used and the braking torque for each brake should not be less than 125% of full load torque. One of the two hoist brakes shall be applied with a time lag of 3 seconds in relation to the first **(DG)**.
- 1.17.3.1 The maximum braking torque to arrest long travel and cross traverse motion should not be less than 100% of full load torque for each brake. For hoist motion, in single girder crane hoist with single brake should be used and the braking torque for brake should not be less than 150% of full load torque **(SG)**.
- 1.17.4 Double shoe brakes should be used for each drive. Brakes should be mounted on the input pinion shaft of all gear boxes. The brake shoe should be of hinged type. Brake levers should be forged and hinge pins should be provided with steel bushes at the bearing points.
- 1.17.5 Brake drums should be of forged or cast steel and should be completely machined. Brake drum diameter should be selected from preferred number series. Width of brake drum should be about 10 mm more than the width of brake shoe on each side. The brake lining should be environmentally sound.
- 1.17.6 The cabin operated crane shall be provided with an additional foot operated brake for long travel wheels.

## 1.18 COUPLINGS

- 1.18.1 Motor shafts for MH/AH shall be connected to gear box input extension shaft through flexible gear coupling of low GD<sup>2</sup> value. For driving the hoist drum gear type flexible coupling shall be used between the rope drum and hoist gear box, where the hub should not be integral with the output shaft, so as to avoid replacement of the whole shaft whenever there is wear and tear in the coupling **(DG)**.
- 1.18.1.1 In case of single girder crane for driving the MH drum, bull gear should be used which shall be mounted directly on rope drum **(SG)**.
- 1.18.2 All couplings shall be of medium carbon steel and shall be designed to suit the maximum torque that can be developed. Hardness of geared portion in the gear coupling shall be more than 250 BHN. Bolted connections shall be easily accessible for inspection and tightening.

## 1.19 ROPE SHEAVES

- 1.19.1 All sheaves should be of cast/forged steel or Blackheart malleable iron castings. They should be identical, with the exception of the equaliser sheave. The equaliser sheave should be mounted above the trolley floor and should be easily accessible and removable from the trolley floor level. The equaliser sheave should be arranged to turn and swivel in order to maintain rope alignment under all circumstances. Sheave grooves should be smooth finished for getting increased rope life. The supplier should further ensure that wire ropes are parallel with each other **(DG)**.
- 1.19.1.1 All sheaves should be of cast/forged steel or blackheart malleable iron castings. They should be identical, with the exception of equaliser sheave. In case of hoist in single girder crane, the equaliser pulley shall be mounted below CT wheel **(SG)**.
- 1.19.2 A resilient low friction rope guide fixed around the grooves of the designed drum as an expanding ring to provide positive guidance to the rope may be provided to ensure correct rope lay.

## 1.20 BEARINGS

- 1.20.1 Ball and roller anti-friction bearings shall be of reputed make. The acceptable makes will be NBC, SKF, FAG, NORMA, NRB, NTN and KOYO. In view of widespread use of spurious and reconditioned bearings, tenderers should explain in the offer how it is proposed to ensure that only new and genuine bearings of acceptable make are procured and fitted. Preferably, tenderers should confirm that they will submit, to the inspection agency, invoices from OEMs' or their authorized representative as proof of the use of genuine material.
- 1.20.2 For long and cross traverse wheels, spherical roller bearings shall be used. Bush bearings should not be used at any location **(DG)**.
- 1.20.2.1 In case of single girder crane long travel wheel spherical roller bearing and for cross travel ball bearings should be used. Bush bearings should not be used on any location **(SG)**.

- 1.20.3 Rated life of ball and roller bearings should not be less than the total life in working hours given in the IS Specification for a particular class of duty. Life of bearings should be calculated in accordance with manufacturer's recommendations.
- 1.20.4 Independent bearing housings on long shafts be split on the shaft center line to permit easy removal of the shaft. The bottom surface of all bearing pedestals should be machined, and should bear upon a machined surface **(DG)**.

## 1.21 **LIFTING HOOK**

- 1.21.1 Standard plain shank type trapezoidal section hooks should be used unless otherwise specified. These hooks should conform to the relevant Indian Standard Specifications IS:15560 (latest), while the Ramshorn Hook (wherever specified) shall conform to the relevant Indian Standard Specification IS:5749 (latest).
- 1.21.2 Hooks should be mounted on grease lubricated anti-friction thrust bearings and a protective skirt should be fitted to prevent rotation of the hook. Proof load test as per Indian Standard Specification shall be conducted, either in-house or from a recognised test house. The certificate of proof load test shall be furnished. The bottom block should have protective edging around the wire rope openings.

## 1.22 **BUFFERS**

- 1.22.1 Spring loaded or other suitable buffers should be fitted on the four corners of the crane also at the four ends of the bridge girders. Buffers should be rigidly bolted in place, preferably along the center line of the crane rail or trolley rail as the case may be. All buffers should have sufficient energy absorbing capacity to stop the bridge or trolley in either direction when traveling at a speed of at least 50% of the rated speed at full load. Bridge buffers should have a contact surface of not less than 125mm diameter.

## 1.23 **LUBRICATION**

- 1.23.1 Grease nipples one for each of the end carriage and one for the trolley platform, should be provided for all grease lubricated bearings, parts of the hoist and wheels for cross traverse and long travel. The grease battery nipples should be located to facilitate regular greasing by the operator with standard equipment.
- 1.23.2 Bottom blocks and pedestal bearings should have independent greasing points. All lubricating nipples should be protected from damage, and be accessible throughout.
- 1.23.3 A lubricating chart should be provided in the manual, indicating all lubrication points, the type of lubricants required and the recommended frequency of lubrication. These details should be repeated, and amplified if necessary, in the Maintenance Manual, which is to be supplied as per requirement indicated elsewhere in the specification.

## 1.24 **DIMENSIONAL TOLERANCES**

- 1.24.1 The contractor should ensure that the crane manufactured and erected to take the tolerances specified below:

- |  |  |
|--|--|
| (i) Variation in Span  | $\pm 6\text{mm}$                                       |
| (ii) Diagonal on wheels  | $\pm 5\text{mm}$                                       |
| (iii) Long travel wheel alignment  | $\pm 1\text{mm}$                                       |
| (iv) Tilt of wheels or Balance Axle  | $\pm 1\text{mm}/1000\text{mm}$ (Horizontal & Vertical) |
| (v) Trolley wheel gauge  | $\pm 3\text{mm}$                                       |
| (vi) Trolley track gauge   | $\pm 3\text{mm}$                                       |
| (vii) Difference in height between trolley rails [H] for different trolley track gauges shall be within the following limits |  |

'S' (mm)	'H' (mm)
Upto 2500	4
2500 to 4500	6
Above 4500	8

## **2.0 GENERAL ELECTRICAL SPECIFICATIONS**

### **2.1 SCOPE OF SUPPLY**

2.1.1 The scope of supply relating to electrical portion shall cover the following components

2.1.1.1 Down shop leads (wherever required see clause 11 of Schedule - I (1, 2 ... n) of technical specification)

2.1.1.2 Main current Collection

2.1.1.3 Power disconnecting switch on the crane bridge walk way, to be provided, immediately after the main current collection gears.

2.1.1.4 Motors

2.1.1.5 Protective Switch gears

2.1.1.6 Motor control panels.

2.1.1.7 Resistors (For slipping motors only)

2.1.1.8 Brakes

2.1.1.9 Limit Switches

2.1.1.10 Socket outlets

2.1.1.11 Power and control cables

2.1.1.12 Lighting distribution panels.

2.1.1.13 Lighting fixtures and lamps

2.1.1.14. Cross traverse flexible trailing unarmoured cables mounted on roller clamps travelling over bottom flange of R.S. Joist provided for the purpose. Alternatively, drag link cable system is also acceptable.

2.1.1.15 Indicating lamps

2.1.1.16 Push Buttons

2.1.1.17 Master Controllers/single step jockey switches with timers for cutting resistance steps through contactors (ref.cl. 2.8.2.1 & 2.8.2.6) **(DG Non VVVF Drive Crane)**

2.1.1.17.1 Two step jockey switches or push button (ref clause 2.8.2.2) **(DG VVVF Drive Crane)**

2.1.1.18 Earth wire on crane portion.

2.1.1.19 Dead Man's Handle **(DG)**

2.1.1.20 Alarms

### **2.2 STANDARDS**

2.2.1 All equipment and material shall comply with appropriate Indian standards (latest). The equipment shall also comply with latest Indian Electricity Rules, as regards safety requirement and other essential provisions of the act applicable to the installation and operation of EOT cranes. All latest standards indicated in Annexure-F of IS:3177-1999 (or latest) shall be applicable in general..

2.2.2 The equipment shall be designed and selected to facilitate inspection, cleaning replacement and repair and for use where continuity of operation and safety are important considerations.

### **2.3 ATMOSPHERIC CONDITIONS**

2.3.1 The ambient temperature at the site at which the crane will be installed may vary from -5<sup>o</sup> C to + 50<sup>o</sup> C over the year. The relative humidity may be as high as 100%. The atmosphere is expected to be dusty. The crane offered shall be suitably tropicalised to work under these ambient conditions without any adverse effect on its performance.

## **2.4 POWER SUPPLY CONDITIONS**

### **2.4.1 Power shall be available at 415 volts, 3 phase, 50 Hz**

#### **2.4.1.1 The following voltages shall be used in the crane**

1. 415  $\pm$  10% volts. 3 phase 50  $\pm$ 3%Hz, A.C For drive motors.
2. 230  $\pm$  10% volts. single phase 50  $\pm$ 3% Hz, A.C For lighting
3. 24 volts  $\pm$  10%, single phase 50 Hz  $\pm$ 3% A.C For hand lamp socket outlets
4. 110 volts  $\pm$  10% single phase 50Hz  $\pm$ 3% A.C For control circuit and for floor operated crane as required by the consignee.

The voltage 2, 3 & 4 above shall be obtained through individual separate transformer units connected to 3 phase, 415 volts A.C. supply.

## **2.5 DOWN SHOP LEADS AND CURRENT COLLECTION GEAR**

### **2.5.1 M.S ANGLE CONDUCTOR**

2.5.1.1 MS angle down shop leads shall consist of 4 conductors 3 for three phases and one for earth conductor supported on existing structure with suitable brackets and insulators. The leads shall be adequate size so that the current density in the lead does not exceed 0.42 amp. per sq. mm. Minimum size of M.S. angle iron shall be 50x50x6mm. Phase color code should be used i.e. red, yellow and blue. The earth shall be marked green. The calculations of current density in the leads shall be given with the offer.

2.5.1.2 The DSL shall be at suitable height to allow free movement of crane for all required motions. The leads shall have uniform even contact surface throughout its length. The DSL shall be at safe clearance from electric lines and structure members and shall be adequately insulated as required. Successful tenderer shall visit the site for installation for study of local conditions and designing of DSL suitable for the place.

2.5.1.3 The current collectors shall be graphitic cast iron having self lubricating and good contact conductivity to suit DSL as provided or as existing. The conductors shall be of self aligning type having full face contact to collect the current to meet maximum electrical load of the crane. The collectors shall be mounted on a suitable brackets on the crane on DSL side and it should not infringe with any adjoining members. Collectors shall be designed for ease of maintenance and replacement so that they are readily accessible. Calculations to show that section of collector is adequate shall be furnished along with the offer.

2.5.1.4 The current carrying shunts on all collectors shall be designed so that there is no danger of contact with adjacent collectors and it shall be suitable for rainy season also. Armoured weather proof 1.1 KV grade copper cable of adequate size shall carry current from collectors to the isolating switch on the control panel of crane. All electrical connections shall be through crimped sockets/thimbles of adequate size. The cables shall be of reputed make and its size and current carrying capacity shall be indicated.

2.5.1.5 The crane for which DSL are not included against clause 10, Schedule-I in the Scope of Supply suitable collectors to suit existing DSL should be provided in the crane during erection. The provision should be confirmed in the offer.

2.5.1.6 Bare conductors shall not be mounted on the crane bridge. Only flexible Festoon type cable made of copper multi stranded conductor of adequate size, elastomer grade insulation in flat/round configurations shall be used as bridge conductors. Well designed trolleys and supporting cable clamps shall be used. Festoon cables for free movement for longer lift. This is applicable for each type of current collection system.

### **2.5.2 SHROUDED BUS BAR CONDUCTOR**

2.5.2.1 Insulated Shrouded Bus Bar Conductor shall be of M/s.INSUL-8 UK make or safe track brand of M/s.Sushil Engg. Corporation Mumbai or "Safeline" brand of M/s Stromag Engineers Limited, Mumbai or Silverline brand of M/s Sliver line Metal Engg. Pvt. Ltd., and shall conform to the following:

2.5.2.2 The conductor system shall be finger safe to IP-21 with necessary supporting technical evidence of same and the conductor and material shall be of suitable metal (Galvanized Iron up



to 100Amps & copper above 100Amps) insulated by a high impact gloss finish VR 935/2 PVC compound which shall have a step/groove shrouded all along its length for effective moulding of the conductor system.

- 2.5.2.3 The conductor shall be in minimum 4 mtrs. Length to be jointed with moulded joint of the same material as the conductor and these conductors shall be supported by way of a single piece moulding, four pole hanger with single bolt fixing.
- 2.5.2.4 The current collector arm should be aluminum die cast totally insulated and the connection cable shall be fully enclosed and double insulated within the collector arm with a proven performance supported by documentary evidence.
- 2.5.2.5 The Voltage drop in full length of DSL should not be more than **2%**.

## **2.6 MOTORS**

### **2.6.1 FOR SINGLE GIRDER CRANES (UPTO 5T CAPACITY ONLY)**

- 2.6.1.1 All crane motors shall be of ABB, Crompton, BBL, Marathon, Siemens, Kirloskar make and with totally enclosed fan cooled squirrel cage type designed for 150 starts per hour. The motors shall be suitable for heavy duty crane hoisting service having cyclic duty factor not less than 40% for class III cranes and 60% for class IV cranes. The type of enclosure shall be IP-55 for terminal box. The motors shall be suitable for 50 deg. C ambient temperature and 415V +/- 10%, 50 cycle per second +/- 3%, 3 phase, 3 wire AC supply. The motor shall generally confirm to IS:325 (latest) and shall be of 6 or 8 pole type. However, where IS specification is at variance with this specification, the provision made in this specification shall prevail.
- 2.6.1.2 The motor shall be of adequate power, motor power requirement being computed as per Annexure 'C' of IS:3177-1999 (or latest). Detailed motor power calculations shall be given in the offer. The motor should be rated for class S-4 duty. Derating factor for temperature and voltage variation if any shall be taken into consideration as per recommendations of the motor manufacturers. Technical details of motors along with control gear and electrical accessories shall be given as per schedule-III.
- 2.6.1.3 The winding shall be of copper wire specially insulated and impregnated to with stand moist tropical climate and class of insulation shall not be less than 'B' class.
- 2.6.1.4 Type and routine test chart of motor selected shall be submitted to the inspecting authority during inspection.
- 2.6.1.5 **Horse Power**  
The torque factor of longitudinal travel and cross traverse motors should be of the range of 1.3 to 1.5. The frame size of motor should be indicated in the offer. For selection of LT & CT motor sizes, longitudinal and cross traverse acceleration will be taken as 15 cm/sec.<sup>2</sup> and 8cm/sec<sup>2</sup> respectively.
- 2.6.1.6 The pull out torque of the motors at rated voltage and frequency range shall be as per IS:3177:1999 (or latest).
- 2.6.1.7 Type and routine test charts of the motors selected shall be submitted to the inspecting authority during inspection.

### **2.6.2 FOR DOUBLE GIRDER CRANES ONLY:-**

- 2.6.2.1 All crane motors should be of ABB, Crompton, BBL, Marathon, Siemens, Kirloskar make and with the exception of creep speed motor shall be totally enclosed slip ring type and designed for 150 starts per hour. The creep speed motor should be totally enclosed squirrel cage type designed for 150 starts per hour. The motors shall be suitable for heavy duty crane hoisting service having cyclic duty factor not less than 40% for class III cranes and 60% for class IV cranes. The type of enclosure shall be IP 55 for terminal box. The motors shall be suitable for 50 deg. C ambient temperature and 415V +/- 10%, 50 cycle/second +/- 3%, 3 phase, 3 wire AC supply. The motors shall generally confirm to IS 325 (latest) and shall be of 6 or 8 pole type. However, where IS specification is at variance with this specification, the provision made in this specification shall prevail. **(Applicable for Non VVVF Drive Cranes)**

- 2.6.2.1.1 All crane motors should be of ABB, Crompton, BBL, Marathon, Siemens, Kirloskar make and totally enclosed fan cooled (TEFC) squirrel cage type and designed for 150 starts / hour. The motor shall be suitable for heavy duty crane hoisting service having cyclic duty factor not less than 40 % for class III and 60 % for class IV cranes. The motors shall be suitable for 50 degree C ambient temperature and 415 +/- 10% 50 Hz +/- 3%, 3 phase, 3 wire AC supply. The motor shall be generally conform to IS 325 (latest) and shall be 6 or 4 pole type. However, where IS specification is at variance with this specification, the provision made in this specification shall prevail. **(Applicable for VVVF Drive Cranes)**
- 2.6.2.2 The winding shall be of copper wire specially insulated and impregnated to withstand moist tropical climate and class of insulation shall not be less than 'B' class.
- 2.6.2.3 The motor shall be of adequate power, motor power requirement being computed as per Annexure 'C' of IS 3177-1999 (or latest). Detailed motor power calculations shall be given in the offer. The motor should be rated for class S-4 duty. Derating factor for temperature and voltage variation if any shall be taken into consideration as per recommendations of the motor manufacturers. Technical details of motors along with control gear and electrical accessories shall be given as per schedule-III.
- 2.6.2.4 Type and routine test chart of motor selected shall be submitted to the inspecting authority during inspection.
- 2.6.2.5 Forced cooling shall be arranged by mounting suitably continuously run fan on all the motors for all motions. **(Applicable for VVVF Drive Cranes)**
- 2.6.2.5 **Horse Power**  
The torque factor of longitudinal travel and cross traverse motors should be of the range of 1.3 to 1.5. The frame size of motor should be indicated in the offer. For selection of LT & CT motor sizes, longitudinal and cross traverse acceleration will be taken as 15 cm/sec.<sup>2</sup> and 8cm/sec<sup>2</sup> respectively.
- 2.6.2.6 All motors should be provided with insulation of class 'B' for stator and class 'F' for rotor. The maximum permissible winding temperatures measured by thermometer and resistance method shall not exceed 120 deg. C and 130 deg. C respectively for class 'B' and 155 deg. C and 165 deg. C for class 'F' insulation. **(Applicable Non VVVF Drive Cranes)**
- 2.6.2.7 All motors should be provided with insulation of class 'B'. The maximum permissible winding temperatures measured by thermometer and resistance method shall not exceed 120 deg. C and 130 deg. C respectively **(SG and Applicable for VVVF Drive Cranes)**.
- 2.6.2.8 The pull out torque of the motors at rated voltage and frequency range shall be as per IS: 3177-1999 (or latest).
- 2.6.2.9 Brush holder assembly shall be complete unit which can be easily replaced as a whole. **(Applicable for Non VVVF Drive Cranes)**.

## 2.7 **TERMINAL BOX**

The terminal box shall be provided on the top or front of the motor for easy accessibility. The cable sizes should be decided after considering derating due to grouping and ambient temperature of 50 degree C etc.

## 2.8 **CRANE CONTROL**

### 2.8.1 **FOR PENDANT CONTROL CRANES ONLY:-**

- 2.8.1.1 Pendant push button control station will be used for long travel, cross travel and hoist motions, for switching ON and OFF the motor of a particular motion. The supply voltage to the pendant control shall be 110V AC which shall be obtained through a suitable transformer. Necessary flexible multicore cable with sufficient length shall be supplied to enable the crane to be operated from floor level. Pendant shall be moving type and the movement of pendant will be independent of trolley.
- 2.8.1.2 On all the motions the circuit shall be so designed that brakes come into operation immediately in the event of tripping of motor main circuit breaker.
- 2.8.1.3 The pendant control station shall be capable of withstanding rough handling without being damaged. The cover shall be firmly secured.

- 2.8.1.4 The mass of the pendant shall be supported independently of the electric cable by means of wire rope/chain. If the pendant is of metal, it should be effectively earthed.
- 2.8.1.5 On all pendant cranes safety means shall be provided to prevent inadvertent operation from floor while maintenance work is being carried out on the crane.
- 2.8.1.6 Adequate guards shall be provided to prevent accidental contact of pendant ropes or holding wire rope/chain with cross traverse.
- 2.8.1.7 Suitable arrangements shall be provided for automatically cutting off the resistances after a pre-selected time. The bidders shall explain the details in the offer.
- 2.8.2. **FOR CABIN OPERATED CRANES:-**
- 2.8.2.1 Fully magnetic, cabin operated master controller/Jockey switches controlling through contactors, time delay relays and rotor resistances shall be provided for all the three motions. The operating levers shall be arranged so as to have movement in longitudinal direction. Micro speed motor coupled to the main motor shaft through sun and planet gear should be used to provide hoisting and lowering creep speed. The micro speed shall be used only to the main hoist motions. Push button for main hoist/aux. hoist shall be provided for inching operation in addition to creep speed as indicated in schedule-I. **(Applicable for Non VVVF Drive Cranes)**
- 2.8.2.2 For all the motions spring return jockey switches or push button shall be used. **(Applicable for VVVF Drive Cranes)**
- 2.8.3 Two step two direction jockey switches in case of cabin control shall be used for all the motion.
- a) The rest position of jockey shall conform to zero position or off position.
  - b) During running the rest position, means de-acceleration to stop.
  - c) Step one at preset minimum speed of upto 10% of the maximum speed.
  - d) Second step speed gradually accelerate to maximum speed.
- Should a speed between minimum and maximum is desired, the operator shall return to step one and the same speed shall be maintained.
- With the above system stepless speed shall be obtained.
- Alternatively above features can be achieved by use of two push button control for each direction for all the motions. Tenderers to indicate the details of the proposed arrangement. **(Applicable for VVVF Drive Cranes)**.
- 2.8.4 On all motions the circuit shall be so designed that brakes come into operation immediately in the event of tripping of motor main circuit breaks.
- 2.8.5 All controllers shall be so designed that the contacts and terminal arrangements are readily accessible for inspection and maintenance purpose.
- 2.8.6 Each controller shall be fitted with
- (i) Necessary notches for the forward and reverse motion to give smooth acceleration. **(Applicable for Non VVVF Drive Cranes)**
  - (ii) Necessary steps for the forward and reverse motion to give smooth and stepless acceleration between each position. **(Applicable for VVVF Drive Cranes)**
  - (iii) Auxiliary contacts to provide an interlock between the controller and circuit breaker, so that the circuit breaker cannot be closed unless the controller is in off position.
  - (iv) Auxiliary contacts to provide an interlock with the limit switches, so that when the travel exceeds the safety limits, the motor circuit will be broken and the motor can only be allowed to reverse.
- 2.8.7 Controller in off position shall open all supply lines of the respective motors.
- 2.8.8 A minimum of four speed steps shall be provided and suitable control shall be provided to automatically cut off the resistance steps after pre-selected time. The bidders shall explain the details in the offer. **(Applicable for Non VVVF Drive Cranes)**
- 2.8.9 AC variable frequency control (VVVF) of adequate capacity for all the motions shall be used. Independent AC variable frequency control for main hoist, Aux. Hoist, CT & LT shall be used by using independent variable voltage variable frequency drives. However common controller for both the motors of LT may be used. Tenderer shall submit necessary details of the offered

model as well as make confirmation for compliance as per clause 2.22 shall be submitted along with the bid. **(Applicable for VVVF Drive Cranes)**

- 2.8.10 Bidders shall submit the layout scheme of the operator's cabin showing the positions of various controls with respect to operator's seat.

## 2.9 CONTACTORS

- 2.9.1 All contactors shall be of AC-4 Class of duty or **AC-3 Class duty suitably derated for AC-4 class duty** with rating sufficiently higher than the full load current of the respective motors at the specified duty cycle. The directional contactors of all motions shall be suitably interlocked for correct sequence of operation. Electrical & mechanical life of the contactors shall be indicated. For AC 4 Class of duty or AC 3 Class duty suitably derated for AC-4 class duty, Electrical life shall be minimum 2, 00,000 cycles of operations.

- 2.9.2 The contactors shall have high contact reliability with preferably double break parallel bridge contact and facility of time saving termination.

- 2.9.3 All contactors shall be of L&T, Schneider, C&S, Siemens and Cutler Hammer make. Test certificate of the manufacturers shall be submitted in support of life and rating of the contactors.

## 2.10 RESISTORS (for slipring motors)

- 2.10.1 Resistors shall be adequately protected to prevent accidental contact.

- 2.10.2 The resistors shall be air-cooled, robust, heavy duty, Corrosion resistant stainless steel punched grid type. The resistance boxes shall be placed in racks or on the platform and shall be capable of independent removal of any selected box. Spacing recommended by the resistor manufacturer shall be maintained. The racks shall be robust in construction to withstand vibration due to crane operation. Wire wound resistors shall not be used on any motion of the crane.

- 2.10.3 All resistors shall be rated for 10 minutes continuous loading.

- 2.10.4 Resistors housing on cranes working in open yards shall be weather proof and on all cranes they shall be adequately protected. The electrical clearance between resistors and earthed metal shall not be less than 100mm. Cable terminal arrangement shall be such that cable cores do not get loose due to vibration.

- 2.10.5 The temperature of resistors shall not exceed 275 degree C at specified duty.

## 2.11 CIRCUIT PROTECTIVE SWITCH GEAR

- 2.11.1 One triple pole manually operated moulded case circuit breaker (MCCB) make

L&T, Schneider, C&S, Siemens, Havell's, Cutler Hammer and ABB serving as main incoming protective device, fitted with no volt, short circuit and overload releases and rated to carry at least combined full load currents of the two motions of the crane having largest power should be provided. The circuit breaker shall have adequate rupturing capacity to withstand and clear fault current of the order of 30 KA. The circuit breaker shall have adequate rupturing capacity to withstand and clear fault near the protective panel, in such a way that adequate clearance is provided as per Indian Electricity Rules. In case of floor operated cranes instead of MCCB, push button operated contactor shall be provided, other provisions remaining unchanged.

- 2.11.2 The trip circuit of the circuit breaker shall be so designed such that it will prevent the circuit breaker from being enclosed when main contactor of any of the motions has failed to open, although the corresponding controller has been brought to OFF position. Suitable protective features to trip the circuit breaker with the operation of limit switches and emergency push buttons shall also be provided.

- 2.11.3 To indicate whether power and control sources are ON and whether any emergency switch has been operated, indicating lamps shall be provided in operator's cabin, in case of cabin operated cranes.

- 2.11.4 For protection of each drive motor against over loads adjustable inverse time lag manually reset electro-magnetic type relays shall be provided for each motor. Alternatively, electronic type relays shall be acceptable. These relays shall be mounted in respective contactor panels and shall be set to trip the circuit of motion being controlled when current exceeds 200% of normal value for more than 10 seconds. The control circuit of individual motions shall have off position interlock with respective master controllers.

- 2.11.5 Each motor feeder shall be protected with no volt trip device, HRC fuses against short circuit, and with instantaneous trip current sensitive type single phasing cum phase reversal preventor.
- 2.11.6 Isolating switches fitted with HRC fuses shall be provided for the following branch circuits:
- (a) Lighting and hand lamp socket outlets
  - (b) Control circuit.
- Both of the above mentioned isolators shall be installed in driver's cabin in case of cabin operated cranes.
- 2.11.7 Each control circuit branch to every contactor panel shall be provided with facility for isolation and protection against short circuits and sustained high overloads by means of appropriately rated miniature circuit breaker.
- 2.11.8 A triple pole isolating switch without fuse shall be provided on the long travel bridge walkway,, as close as possible to the main current collectors. This shall isolate all the circuits except the crane lighting circuit. **(DG)**.
- 2.12 LIMIT SWITCHES**
- 2.12.1 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.
- 2.12.2 Any other limit switch viz. for slewing, skewing of crane etc. shall be provided if required.
- 2.12.3 Limit switch for hoist cross and long travel motion shall be supplied installed and wired by the manufacturer.
- 2.13 EMERGENCY STOP PUSH BUTTONS**
- 2.13.1 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.
- 2.13.1.1 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 Pendent Control cranes).
- 2.14 CONTROL PANEL**
- 2.14.1 All power and aux. 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.
- 2.14.2 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.
- 2.14.3 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.

- 2.14.4 All the equipments shall be so mounted in panel as to enable its easy removal / replacement from the front.
- 2.14.5 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.
- 2.14.6 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.
- 2.14.7 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.
- 2.14.8 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.
- 2.14.9 Contactor panels shall be well braced to the crane structure and each panel shall be provided with adequate number of lifting lugs.
- 2.14.10 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).

## 2.15 LIGHTING

- 2.15.1 *10 Watt LED Lighting shall be provided in the driver's cabin and staircase. Bulk head fittings with dust proof covers shall be used for the above areas. Six numbers 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 15 metres and 02 nos. underslung LED lights of minimum 80 watts with steel cage with shock absorbing and anti-swing suspension arrangement for every 5 metres 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, (DG). However, if required, the same arrangement shall be able to take load of LED bulbs of upto 120 Watts also.*
- 2.15.2 In case of single girder crane, four nos. underslung LED light of minimum 80 watts with steel cage with shock absorbing and anti-swing suspension arrangement shall be provided for uniform floor illumination. Lighting transformers shall have 50% reserve capacity. (SG) However, if required, the same arrangement shall be able to take load of LED bulbs of 120 Watts also.

### 2.15.3 Toggle Switches.

- 2.15.3.1 Industrial toggle switches shall be used for lighting distribution

## 2.16 SOCKET OUTLETS.

- 2.16.1 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.

## 2.17 CABLING

- 2.17.1 All wiring for power control & lighting circuit shall be carried out with 1.1 KV 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.
- 2.17.2 Minimum size of power & control cables shall be 4 mm<sup>2</sup> & 2.5 mm<sup>2</sup> respectively.

- 2.17.3 All cables shall be systematically laid on G.I. trays & fixed with adequate number of G.I. clamps.
- 2.17.4 All cables shall be weather proof and shall be either of LAPP/SIEMENS/POLYCAB/FINOLEX/UNIVERSAL/ICC make.
- 2.18 IDENTIFICATION OF CIRCUIT CABLES ETC.**
- 2.18.1 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.
- 2.19 EARTHING**
- 2.19.1 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.
- 2.20 DEAD MAN' HANDLE**
- 2.20.1 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.
- 2.21 ALARMS**
- 2.21.1 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(**DG**) .
- 2.21.1.1 In case of single girder crane, alarm shall be operated through separate push button from pendant. Details of alarm system provided shall be explained in the offer (**SG**).
- 2.22 FEATURES OF AC DRIVE (APPLICABLE FOR VVVF DRIVE CRANES)**
- 2.22.1 Inverter offered should be suitable for crane application for all motion.
- 2.22.2 Inverter rated O/P current should be at 45 degree centigrade ambient and maximum over temperature shall be 55 degree centigrade.
- 2.22.3 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.
- 2.22.4. 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.
- 2.22.5 Inverter offered should have slip compensation feature in both up/down motions (even during regeneration).
- 2.22.6. 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.
- 2.22.7. Inverter offered should be provided with accurate brake coordination signals.
- In addition to above crane specific features the inverter shall offer for the following.
- 2.22.7.1 Overload current capacity 150% of rated output current for one minute.
- 2.22.7.2 Maximum output voltage 3 phase, 380/400/440/460V (Proportional to input voltage)
- 2.22.7.3 Maximum O/P frequency 400 Hz (programmable)

2.22.7.4	Rated input voltage and frequency	3 Phase, 380 to 460V, 50/60 Hz.
2.22.7.5	Allowable voltage fluctuation	+10% to –15%
2.22.7.6	Allowable frequency fluctuation	+5% to –5%
2.22.7.7	Control Method	High carried freq. (low noise) sine wave PWM technique.
2.22.7.8	Starting torque	150% below 1 Hz. (150% at 0 RPM with PG)
2.22.7.9	Speed control range	100:1 (1000:1 with PG)
2.22.7.10	Speed control accuracy	+/-0.2% (+/-0.02% with PG)
2.22.7.11	Speed response	20 to 30 rad. per sec.
2.22.7.12	Torque limit	Settable through programme (parameter)
2.22.7.13	Output freq. Resolution	0.01 Hz.
2.22.7.14	Freq. Setting signal	+10 to –10 V, 0 to 10 , 4-20 mA, INC/DCR through PB (Programmable).
2.22.7.15	Acceleration/deceleration time	1.1 to 6000 sec. (Can be set independently). Four rates should be possible.
2.22.7.16	Braking torque	Approx. 20% (approx 125% when using braking resistor)
2.22.7.17	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.
2.22.7.18	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
2.22.7.19	Type of Enclosure	<b>IP:21</b> or better



**2.23 RADIO REMOTE CONTROL (APPLICABLE WHEREVER RADIO REMOTE CONTROL SPECIFIED UNDER ITEM 8 OF SCHEDULE –I )**

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

2.23.1.1 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.

2.23.1.2 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.

2.23.1.3 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.

2.23.1.4 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.

2.23.1.5 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.

**2.23.2 SCOPE OF RADIO REMOTE CONTROL**

2.23.2.1 Scope includes supply and installation of Radio Remote Control system suitable to operate EOT crane as per particulars given in relevant schedule.

2.23.2.2 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

2.23.2.3. 1 no. Battery Charger (suitable to charge one set of batteries at a time).

2.23.2.4. 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

- 2.23.2.5. Each transmitter shall not weigh more than 2.5 kg and shall be provided with a shoulder belt and shall be in IP65 enclosure.
- 2.23.2.6. The system shall be microprocessor based.
- 2.23.2.7. The system shall have self-diagnostic feature with LED display.
- 2.23.2.8. For ease of maintenance the cards should be easily replaceable type.
- 2.23.2.9. 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.
- 2.23.2.10. 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.
- 2.23.2.11. The range of operation should be adjustable from 0 to 100 meters.
- 2.23.2.12. Frequency of operation of the Remote Control Units shall be indicated in the offer.
- 2.23.2.13. Tenderer shall ensure adequate supply of spares and availability of maintenance support within country.
- 2.23.2.14. The tenderer shall be responsible for commissioning the above system.
- 2.23.2.15. Equipment supplied should be certified by internationally recognised international inspection agency.

**3. GENERAL CHARACTERISTIC: Covered under para-1 above.**

**4.0 TECHNICAL LITERATURE:**

- 4.1 One copy of the printed illustrative catalogue showing features of the machine and its elements must be enclosed with each copy of the bid.
- 4.2 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/Hindi.**

**5.0 SPARES & MAINTENANCE TOOLS**

- 5.1 Maintenance spares as per Schedule IV.
- 5.2 Maintenance Tools as per schedule-V

**6.0 CONSUMABLES: Not Applicable.**

**7.0 SPECIAL FEATURES:**

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

**8.0 DEVIATIONS:**

- 8.1 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:

- 8.2 All Deviations shall be clearly indicated in the deviation statement as per the format of submission of technical bid Annexure–A.

**9. INSPECTION AND TESTING AT MANUFACTURER'S WORKS:**

- 9.1 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 authorised representative at the supplier's or his sub-supplier's works. The Quality Assurance programme will be as per Annexure-I. However, the purchaser or his authorised representative is free to institute any further checks also, if he so desires, and shall be in no way binding on the Purchaser.
- 9.2 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.
- 9.3 COFMOW 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.
- 9.4 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 the consignee does not approve GA Drawing.
- 9.5 The Manufacturer shall produce invoices of bought out items/sub-assemblies to ensure genuineness of such products / verification by the Inspecting agency.

**10. TRAINING:**

- 10.1 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 4 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.

**11. GENERAL ARRANGEMENT & RELATED DRAWINGS**

**11.1 SUBMISSION OF GENERAL ARRANGEMENT & RELATED DRAWINGS FOR APPROVAL:**

- 11.1.1. 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.
- 11.1.2 The Contactor will be required to submit the following drawings in 2 copies to COFMOW and 2 copies to each consignee as per time schedule specified in clause 7 of section-IV
- i) The general arrangement drawings containing all information as described at item 24 of Schedule -II.
  - ii) General lay out drawing of the trolley. **(DG) and Hoist (SG).**
  - iii) Assembly drawings of individual drives like hoists, long travel, cross travel.
  - iv) Sub assembly drawings for wheels. Hook blocks and hoist drum. In case of Ramshorn hook (wherever specified under schedule-I) for Main Hoist, the contractor shall collect the Drawing of lifting tackle to be used with crane from consignee and the Ramshorn hook shall be compatible to the lifting tackle.
  - 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 COFMOW 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.**

11.1.3 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.

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

## **11.2 APPROVAL OF GA DRAWING**

To be governed by Time Schedule in clause 7 of section-IV and following stipulations.

11.2.1 General Arrangement Drawings will be sent by the 'Contractor' to the Consignee as per Time Schedule annexed in LOA/AT. Consignee will download the copy of AT from COFMOW website and take necessary action for approval of GA drawings. 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, under advice to COFMOW, as per the Time Schedule in the LOA/AT.

11.2.2 **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 bid document part-I**. 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, for the purpose of calculations of LD as per clause 1002 of section II of bid document part-I. However if the contractor supply the machine before original delivery period as per AT 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 on account of Contractor, except as detailed below.

11.2.3 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.

11.2.4 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.

11.2.5 Where GA Drawing cannot be prepared due to clear site not being available etc., the Consignee must inform Contractor and COFMOW, explaining the exact delay. In both cases, however, initiative must be taken by Contractor to obtain such a certificate from Consignee. Contractor must bring any difficulty/dispute to the notice of COFMOW immediately.

11.2.6 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.

11.2.7 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.

## **11.3 DISPATCH OF CRANE FROM MANUFACTURER'S WORKS**

11.3.1 The supplier and consignee will ensure that facilities as defined in AT 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. This joint note shall accompany receipt note and the bill for 80% payment.

11.3.2 In case of delay on part of consignee in providing the clear site or any other facility as specified in the contract to the supplier, the supplier will report the matter to COFMOW and consignee. In case of delay in the readiness of site on part of consignee, COFMOW shall take up the matter with concerned Railway /PU.

11.3.3 The packing of crane components shall be as stipulated in Section I, clause 1400 and Section II, clause 1600 of Bid Document Part I. However structural parts viz box girder, platform, crab chassis, and carriages and maintenance cabin being voluminous in sizes may be supplied without packing. While all other mechanical and electrical parts should be supplied suitably packed.

## **12. INSTALLATION, COMMISSIONING AND PROVING TESTS:**

12.1 **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 on receipt of the machine by consignee & bidder's representative to avoid commissioning delays due to shortages/transit damages. After receipt of the machine as above a Joint Receipt Inspection note (JRI) as per Annexure-C of Section-VI shall be prepared by the consignee and the firms representative indicating the tentative time schedule for various activities of installation and commissioning. For Indian manufacturers, JRI note shall accompany the bill for 80% payment.

## **12.2 RESPONSIBILITY OF CONSIGNEE AND BIDDER**

12.2.1 **Consignee's obligation with regard to erection & commissioning will be limited to the following:**

- i) Supplying following free of cost at the site of work.
  - a) Electricity required for the purpose of erection/ lighting.
  - b) Test loads with slings and tackles for performing the load tests.
  - c) The provision of stepladder at gantry end, for going up the gantry rails.
  - d) Supply and erection of cables from mains to DSL (Down shop leads) shall be provided by consignee.
- ii) Safe storing of the material supplied by manufacturer until erection of machine.
- iii) The inspection of foundation, structures etc. and installation of the machine shall be done by authorized representative of the consignee (wherever applicable).

12.2.2 **Following items of work shall be performed by the Contractor**

- i) Unloading and transporting materials free of cost from the manufacturer premises to the work site.
- ii) Checking of alignment of gantry rail at site. Any rectification required, however, will be done by the purchaser.
- iii) Installing of the crane structure and associated machinery in position.
- iv) Complete fitting and wiring of all electrical items.
- v) Fixing of down shop leads wherever required.
- vi) Commissioning of the equipment. The crane performance shall be demonstrated after successful commissioning.
- vii) Design & Construction of foundation, flooring of sufficient thickness, civil works (in line with scope of supply) suiting local soil conditions at the site in compliance with clause 3700 (3701 to 3704) of Bid Document part-I (wherever applicable)

12.3 The contractor shall arrange erection and commissioning of the cranes. Adequate number of teams of technical experts will be made available so that erection and commissioning delays are eliminated. Such personnel will be required to be present immediately as soon as the crane has been received.

- 12.4 The contractor or his agent shall commission and prove out the crane as per time schedule.
- 12.5 In the interest of early commissioning, the supplier shall ensure that minimum amount of assembly is necessary at site. Site welding and riveting shall be avoided as far as possible. The supplier, before proceeding with design details, shall satisfy himself about the site conditions so as avoid any difficulty at the time of erection and also check the span of gantry rails.
- 12.5.1 The bidder shall be responsible for meeting all the criteria set by State Pollution Control Board and Central Pollution Control Board, wherever applicable, with respect to air, water, noise, land etc. The bidder shall be responsible for obtaining clearance/certificate for installation/commissioning/operation of the machine/system supplied. The consignee will provide the administrative help, wherever required, for establishment of communication with the Pollution Control Board.
- 12.5.2 Tenderer shall ensure that weights offered shall be as per information submitted vide schedule II. The bidder shall also ensure in its offer that range of variation in the total actual weight of the crane and quoted value in schedule II will be within  $\pm 5\%$ . Purchaser reserves the right to verify the total weight of the crane offered by the bidder against information submitted under schedule II.
- 12.6 Consignee shall maintain a log book for the individual activities (wherever applicable), for the machine(s) supplied against COFMOW contract, commencing from the date of submission of GA drawing to issue of PTC and further breakdown records of the machine during warranty period. The log book shall contain the information viz :
- (i) Date of submission of GA drawing(s) and date of its approval.
  - (ii) Date of request received from supplier for issue of trial component(s) for prove out at firm's premises (wherever applicable), Date of advice for BG amount (for trial components) by Railways to supplier, Date of submission of BG and date of handing over of trial component(s) by Railways to supplier.
  - (iii) Date of handing over of clear site to the supplier for construction of foundation/ turn key works etc.
  - (iv) Date of availability of utilities Electricity, Air, and Water for foundation/ installation work.
  - (v) Date of readiness of foundation/ turnkey works.
  - (vi) Date of provision of Electricity, water, gas, air etc for machine operation.
  - (vii) Date of supply of Machine.
  - (viii) Date of Joint receipt inspection.
  - (ix) Date of call to supplier for commissioning of machine.
  - (x) Day to day activities of installation & commissioning of machines (including prove out trials), PTC and details of team deputed by supplier.
  - (xi) Date of request by supplier for provisions of component(s) for prove out at consignee's premises and date of issue of prove out component(s) by Railways.
  - (xii) Clear date of Commissioning of machine and issue of PTC.
  - (xiii) Breakdown details during warranty period/ Compliance of PMC Schedules (if PMC applicable during warranty period) and AMC during post warranty period (wherever applicable).
- As far as possible, the log book shall be signed jointly by representatives of consignee & supplier. Where joint signature is not feasible, communication done with supplier shall be linked and recorded in the register.

## **12.7 Test on Purchaser's Premises.**

### **12.7.1 Start up and trial Operations Test (Commissioning Test)**

12.7.1.1 The contractor shall carry out the start up and trial operation tests (commissioning test) on receipt of authorization from the Purchaser. In addition to tests indicated in IS:3177(latest), the following shall also be shown:

- i) The earthing of the crane and control equipment, to be tested as per Indian Electricity Rules.

- ii) The operation of brakes on long travel, cross traverse and hoisting motions.
  - iii) Inching control and creep speed as called for in technical specification.
  - iv) There is no skewness in crane during long travel and cross travel motions, presence of vibrations and unusual noise in operation.
- 12.7.1.2 The trials shall be carried out initially under no load conditions and on satisfactory completion of these, trials shall be repeated for various loads until the full rated load and operating range are covered.
- 12.7.1.3 During the trial operation, all necessary adjustments shall be made so as to ensure compliance with the operating characteristics for the complete equipment as stipulated in the technical specifications.
- 12.8 A Joint Commissioning Note (JCN) to this effect shall be made as per the format at Annexure-D of Section-VI. After issue of JCN the performance shall be watched for a period of one month, after which the PTC shall be issued. The issue of PTC can not be delayed by more than 60 days from the issue of JCN. If some minor breakdowns are noticed after the issue of JCN, these shall be attended as per warranty obligations and suitable extension of the warranty period, under intimation to COFMOW. If no intimation is given to COFMOW and the PTC is not issued till the expiry of 60 days from the issue of JCN, then the issue will be discussed in a meeting between CME/PCM and the consignee. If required, the representative of COFMOW shall visit the site to sort out the issues related to PTC. Based on this, decision to issue PTC will be taken by CME/PCM, the concerned technical officer and CME.
- 12.9 If an assembly/sub-assembly requires to be taken back to the manufacturer's premises for repair/replacement either before commissioning or during warranty, the manufacturer or his agent would be required to submit BG of suitable amount. In case the entire machine has to be taken back, a Bank Guarantee for the cost of the machine would have to be submitted. The bank guarantee should be of adequate value so as to cover the cost of the assembly/sub-assembly/paid up cost of the machine.

### **13. SERVICE FACILITY IN INDIA AND TECHNICAL SUPPORT**

- 13.1 The tenderer will clearly spell out in the offer the facilities available with him or his agent for providing adequate after-sales service in India during warranty period in the appropriate section of Annexure 'A' of Bid Document Part-II. The complete details such as organization for after sales service, availability of technically competent engineers and warehousing facilities for spares should be clearly indicated. Bidders not offering complete servicing/repair facilities in India to ensure quick response to maintenance/ servicing calls are not likely to be considered.
- 13.2 After the warranty period and AMC period, if any, the manufacturer or his agent shall agree to provide service supports for trouble shooting and obtaining spare parts. The manufacturer shall be obliged to provide spare parts required by the Purchasers for a period of 15 years from the date of delivery of the machine at the ultimate destination to safeguard against obsolescence.
- 13.3 Tenderer who are OEM, shall undertake to supply spare parts for a period of expected life of machine. Other tenderers shall submit undertaking from OEM for supply of spare parts for a period of expected life of the machine.
- 13.4 During warranty period, the supplier or his authorized agent shall attend for break down adhering to stipulation of clause 16.4 of section-V.

### **14. INFRASTRUCTURE FACILITIES AND BOUGHT OUT ITEMS**

- 14.1 The bidder should have minimum infrastructure and manufacturing facilities detailed at Annexure-F of Schedule VI and shall provide information on infrastructure available with them.
- 14.2 The bidder shall furnish along with the offer a list of all critical items/ sub-assemblies which are bought out by the bidder and proposed to be used, along with the manufacturer's name, brand model etc.

S. No.	ITEM	MAKE
1	Motors	ABB / CROMPTON / BBL / SIEMENS / KIRLOSKAR / MARATHON

2	Cables	<b>KEI/LAPP /SIEMENS / POLYCAB /FINOLEX / UNIVERSAL / ICC/ KABLE SCHLEPP</b>
3	Contactors	L&T / SCHNEIDER / C&S / SIEMENS / BCH
4	Time relays	SIEMENS / BCH / L&T / SCHNEIDER / C&S
5	Limit Switches	SPEED-O-CONTROL /CCE / ELECTROMAG / C&S / ANAND SYSTEM
6	Master controller	SPEED-O-CONTROL / CCE / ELECTROMAG /C&S / ANAND SYSTEM
7	Overload relays	SIEMENS / BCH / L&T / SCHNEIDER / C&S
8	Moulded case circuit breakers	L&T / SCHNEIDER / C&S/SIEMENS / HAVELLS / BCH / ABB
9	Resistors	SPEED-O-CONTROL / ELECTROMAG /CCE / C&S / ANAND SYSTEM
10	Drag Link Chain system	IGUS / RS COMPONENTS & CONTROL / SILVERLINE / CKS/ <b>KABLE SCHLEPP</b>
11	Safe shrouded DSL conductors wherever applicable	INSUL-8 / SAFE TRACK / SAFE LINES / SILVER LINE / SAFE LINK
12	Thrustor brakes	SPEED-O-CONTROL / CCE / ELECTROMAG / GALVI / KATEEL / ANAND SYSTEM
12	Electrical isolators	SIEMENS / L&T / BCH / C&S
14	VVVF Drive	ABB / L&T / <b>YASKAWA</b> / SCHNEIDER / MITSUBISHI ELECTRIC / DANFOSS / FUJI ELECTRICS / TOSHIBA INDIA / CROMPTON GREAVES/ SIEMENS/ ALLEN BRADLEY
15	Bearings	NBC / SKF / FAG / NORMA / NRB / NTN / KOYO/TIMKEN
16	Wire Rope	USHA MARTIN / BOMBAY WIRE ROPE / MAHADEV

- 14.3 Test certificates of motors, wire ropes, hooks, lifting tackles etc. should be provided by the supplier with proper identification.

#### **15 PAINTING AND COLOUR:**

- 15.1 All parts of the crane shall be thoroughly cleaned of all loose mill scales, rust or foreign matter.

- 15.2 All parts inaccessible after assembly shall be painted before assembly.

- 15.3 All parts except motors, gears, thrustors etc. shall be painted with :

i] Two coats of red oxide zinc chromate primer to IS:2074 and over the second primer coat, two coats of paint finishing Golden yellow with black strips (Ready mixed oil based paints as per the relevant IS code) shall be given before dispatch by the firm.

ii] The contractor shall give touch-up paint wherever required, after erection and testing of crane at site.

- 15.4 The interior of all gear box housing shall be painted with two coats of oil resistant enamel paint.

- 15.5 All machined pads and bearings surfaces on structures or housing shall be painted with white lead.

#### **16.0 COMPREHENSIVE WARRANTY**

- 16.1 The machine shall be designed for a life of 36 years with regular maintenance and all the structural members of the machine and the foundation shall be guaranteed for 7 years against cracks breakages and etc. during the course of normal operations. Tenderer would submit suitable undertaking.

- 16.2 Foreign suppliers who do not have registered office / maintenance facilities in India may authorize an Indian agent, who shall be responsible for maintenance and break down support. In such case, Indian agent should have experience of maintaining any type of five machines after commissioning. The tenderer should submit documentary evidence towards the experience of the Indian agent in maintaining the machines in India, along with the offer. The



Indian agent should submit the details of infrastructure and manpower available with them in the bid.

- 16.3 In addition to warranty obligations/servicing facilities prescribed under Clause 3400 and 3500 of the Bid Document Pt.-I, the warranty period would also cover comprehensive preventive maintenance, which will be inclusive of all spares, material and labour cost. All maintenance consumables like lubricants and grease except hydraulic oil / plant coolants shall form part of the scope of the preventive maintenance during the warranty.
- 16.4 The firm shall ensure that in case a failure is reported by a consignee qualified service engineer of the contractor shall visit the site within the prescribed response time from the date and time of complaint for the machine. This response time shall be **48 hours, for upto 06 cases in entire 02 years (or extended warranty period) & Nil thereafter. 48 hours' response time shall be permitted only if 2 successive failures are staggered 3 months apart.** Complaints shall be lodged by consignee by fax, phone, e-mail, whatsapp or per bearer at address given by the tenderer.
- 16.5 The details of preventive maintenance to be provided during warranty period shall be indicated by the tenderer giving details of type of preventive schedule, periodicity on items to be checked, items to be replaced and expected plant down time. Preventive maintenance schedules shall be conducted on weekends as far as possible or any other day through mutual agreement with consignees. Total breakdown hours shall be calculated after discounting response time and preventive maintenance period.

16.6 The breakdown period (duly signed by shop incharge) in hours should be maintained by the consignee and joint report with the contractor shall be made for each breakdown attention. At the end of second year of warranty, these details of breakdown hours during warranty period should be advised to firm & COFMOW as per performance appraisal report given in Annexure – E of section –VI. The firm will then request COFMOW for release of WBG annexing the performance appraisal report as per Annexure-E of Section-VI and the breakdown details mentioned above.

Penalty will be levied on the contractor for breakdown period on hours' basis (including holidays) after discounting for the response time. Penalty will be calculated with full/partial deduction of amount of WBG, which shall be deducted from the WBG deposited with the COFMOW:

Breakdown period	Applicable penalty
Up to 500 hours in entire duration of warranty of 02 years (plus extended warranty period, if any)	Nil
Exceeding 500 hours to 1200 hours in entire duration of warranty of 02 years (plus extended warranty period, if any)	25% of WBG amount
Exceeding 1200 hours to 2100 hours in entire duration of warranty of 02 years (plus extended warranty period, if any)	50% of WBG amount
Exceeding 2100 hours in entire duration of warranty of 02 years (plus extended warranty period, if any)	Full encashment of Warranty Bank Guarantee besides other action like noting adverse performance of the bidder and/or agent for future tenders and their offer in the subsequent tenders will not be considered for placement of any order for next 02 years.

16.7 In case the contractor fails to carry out the preventive maintenance schedule during warranty period and there is no complaint/ breakdown of the machine during warranty period, COFMOW reserves the right to extend the warranty period for the total duration of the number of PMC schedules not carried out e.g. the preventive maintenance schedule is quarterly and 3 PMCs' have not been carried out then the warranty period will be extended by 9 months.

## 17.0 COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT (CAMC) : OPTIONAL

**The contractor shall be required to take CAMC of the entire machine supplied under the scope of contract.**

- 17.1 Tenderers are required to quote for a comprehensive Annual Maintenance Contract for the various scope of work supplied post warranty on yearly basis giving the rates for each year i.e. first year, second year....so on., which will be inclusive of all spares, material and labour costs. The duties and taxes as applicable should be indicated separately. All consumables spares and materials shall form a part of the scope of CAMC excluding Diesel/Fuel, lubricating oils or coolant.
- 17.2 CAMC shall be operated, managed and paid by the respective consignees. The consignee shall indicate the bill payment authority & custodian of the CAMC BG. No further agreement is required for operating CAMC at consignee end.
- 17.3 CAMC is a part of scope of supply, if included in commercial evaluation criteria vide clause 5 of Section-IV.
- 17.4 The duration of CAMC shall be 5 years from the date of expiry of warranty. Rates for CAMC as quoted by the tenderer on yearly basis, will remain applicable during the duration of CAMC and not subject to any variation except any statutory changes in taxes and duties as compared to quoted rates.
- 17.5 The contractor must provide CAMC services at the consignee location without any precondition. The CAMC should include complete responsibility for the bought out sub-assemblies and components like CNC system, diesel engine, AC unit etc.
- 17.6 The details of preventive maintenance services to be provided under CAMC shall be provided by the tenderer in the following format.

S.No	TYPE OF PREVENTIVE SCHEDULE	PERIODICITY	ITEMS TO BE CHECKED	ITEMS OF REPLACEMENT	EXPECTED PLANT DOWN TIME

- 17.7 Preventive maintenance shall preferably be conducted on weekends through mutual agreement with the consignee. Each preventive maintenance schedule normally shall not exceed one day (24 hours). The preventive maintenance regime offered must be aimed at achieving minimum 95% uptime of the plant excluding the plant down time for preventive maintenance schedules.
- 17.8 The tenderer shall ensure that in case a failure is reported by a consignee, qualified service engineer(s) of the contractor shall visit the site within the prescribed response time from the date and time of complaint for the machine. This response time shall be **48 hours for upto only one case per quarter during the period of CAMC & Nil thereafter. 48 hours response time shall be permitted only if 2 successive failures are staggered 3 months apart.** Complaints shall be lodged by consignee by fax, e-mail, whatsapp or per bearer at communication given by the tenderer. The responsibility to keep the failure reporting address details current will rest with the tenderer.

- 17.9 In case preventive maintenance is carried out along with breakdown maintenance schedule; preventive maintenance time will be deducted from breakdown time of the plant.
- 17.10 **Penalty Clause:** Penalty shall be levied on the contractor for maintaining up time below the limit of 95% calculated on working days basis, after discounting for response time and preventive maintenance period. Penalty shall be calculated as %age of quarterly payment and will be deducted from the respective quarterly payments. Penalty calculation will be done over quarterly payment period.

S.No	Availability Slab	Applicable Penalty
1	95% and above	Nil
2	Below 95%	2.5% for every 1% (or part thereof) reduction in availability of plant below 95%.

- 17.11 For CAMC, a Bank Guarantee (BG) equivalent to 5% of the combined quoted cost of equipment including accessories, shall be deposited by the contractor to the consignee, 90 days before the expiry of warranty. BG will have the validity of 5 years and 6 months. The confirmation for the submission of this BG will be submitted to COFMOW for the release of WBG. The CAMC BG will be returned on completion of CAMC period. In case, the contractor fails to provide CAMC services successfully, the CAMC BG will be forfeited. This will be in addition to penalty as per Clause 17.10 above.
- 17.12 Up time of less than 75% for two consecutive quarters will constitute complete failure of contractor to provide the CAMC services successfully and will result in forfeiture of CAMC BG, besides other action like noting adverse performance of the bidder and/or agent for future tenders and their offer in the subsequent tenders will not be considered for placement of any order for next 02 years. This will be in addition to penalty Clause 17.10 above for the period of actual performance.
- 17.13 Since CAMC is part of evaluation of offer, it is the sole responsibility of contractor to stock all spares and materials as required for smoother execution of CAMC in order to achieve up time in compliance to plant availability as per stipulated requirements.
- 17.14 In case of damage on account of any external factor, viz., floods, earthquake, fire, arson or sabotage, it shall be the responsibility of the Railways for restoration of the plant to the earlier working order prior to the external factor and the entire cost for repair of the plant shall be borne by the railways.
- 17.15 In case of damage to the plant as mentioned in para 17.14, any spare parts and material necessary to restore the plant to proper working order shall be arranged by the contractor and charged on actual basis duly certified by authorized railway official in the next quarterly bills. The rates charged for such spare parts shall be based upon the spare part rate list provided by tenderer and supported by necessary documents.
- 17.16 In all cases of failure except as mentioned in Clause 17.14 any other spare part or material necessary to restore the plant to proper working order will be arranged by the contractor as a part of CAMC.
- 17.17 Normally quarterly payment (@ 1/4<sup>th</sup> of the annual quoted rates) under CAMC will be made to the contractor within 30 days from the end of that quarter subject to submission of the following documents by the contractor to the paying authority assigned by the consignee:
- Consignee's certificate for work done as per Annexure-G of Section-VI with calculation of down time and penalty applicable.
  - A certificate by consignee that no spare part is due with the contractor as per clause 17.13 above.

- c. Bills submitted by the contractor & accepted by consignee.
  - d. Attested photocopy of the CAMC BG.
- 17.18 In case of failure of the contractor to provide CAMC services as defined in Clause 17.12, the CAMC BG shall be forfeited with levy of other penalties as applicable under advice to the contractor regarding termination of CAMC.
- 17.19 Other general conditions shall be governed by Bid Document Part-I (Section-I, II and III) as applicable to respective COFMOW A/T.

**SCHEDULE - II**  
(See clause 1.1.6 of section-V)

(In respect of items 10, 14, 20.3, 20.6, 20.9, 21.2 & 21.6 of Schedule-II, non-submission of information / incomplete information / deviation in the offer is not acceptable. No clarifications / correspondence will be sought / entertained in this regard and the offer shall be summarily rejected.)

**INFORMATION TO BE SUPPLIED BY THE TENDERER**

	_____Tonnes	Capacity	_____operated	EOT_____	Crane
S.No.	Description				Remarks
01.	Specification of the crane offered (class of duty/capacity in tonnes/span in metres)			:	
02.	Is it the tenderer's intention if awarded the contract, to comply fully and in all respects with purchaser's specification covering the work? If not, he shall state exceptions in details			:	
03.	Time in which tenderers will agree to deliver or complete all work covered by these specs.			:	
04.	Break up weights of the crane as mentioned below should be furnished			:	
	4.1 Total weight of crane including electrical equipment.			:	
	4.2 Total weight of trolley, including electrical equipment.			:	
	4.3 Weight of each bridge girder assembled and ready for erection with and without mech. and electrical equipment.			:	
	4.4 Weight of each end carriage assembled and ready for erection.			:	
	4.5 Weight of operator's cabin together with all equipments mounted in it.			:	
05.	Type and class of crane and its mechanism			:	
06.	Safe working load in tonnes			:	
	6.1 Main hoist			:	
	6.2 Aux. hoist			:	
07.	Maximum speed with max. workload (MPM)			:	
	7.1 Main hoist			:	
	7.2 Aux. hoist			:	
	7.3 Creep Speed of main hoist			:	
	7.4 Long travel			:	
	7.5 Cross traverse			:	
08.	Speed steps and speed range in meter/min. at various steps. The remarks offered should be in accordance with single girder or double girder crane.			:	
	8.1 Hoist Motion			:	
	8.2 Cross traverse			:	
	8.3 Long Travel			:	
09.	Rope size and construction details (MH/AH)			:	
10.	Number of rope falls supporting the load (MH/AH)			:	
11.	Diameter of drum (MH/AH)			:	
12.	Material of drum			:	

13.	Material of gear box	:
14.	Material and Hardness of gears (Indicate specifications)	:
15.	Material of sheaves	:
16.	Diameter of sheaves (MH/AH)	:
17.	Brakes, type make and size (MH/AH)	:
18.	Make and type of bearings	:
19	Type of hook and its specification. -	:
20.0	Trolley	
20.1	Wheel span	:
20.2	Wheel base	:
20.3	C.T. Wheel Diameter, material and hardness	:
20.4	Maximum wheel load	:
20.5	Material of gear box	:
20.6	Material and hardness of gears (indicate specifications)	:
20.7	Make, type and size of brake	:
20.8	Make and type of bearings	:
20.9	Size of trolley runway rail (DG)	:
20.10	<b>Bidder shall furnish Current Rating &amp; Material of DSL being offered. (i.e. M S, G.I. or Copper)</b>	:
21.	Bridge	
21.1	Wheel base	:
21.2	L. T. wheel Diameter, material and hardness	:
21.3	No. of wheels on each end of crane	:
21.4	Maximum wheel load	:
21.5	Material of gear box	:
21.6	Material and hardness of gears. (Indicate specifications)	:
21.7	Make, type and size of brakes	:
21.8	Make and type of bearings.	:
21.9	Clear width of each foot walk. (DG)	:
22.	STRUCTURAL Details (Refer sketch NO. COFMOW/IR/EOTC/X/Y/Z/86	
22.1	Centre to centre of gantry/track rail span (S) meters	
22.2	Lift of Hook above floor level (Exclusive of travel required to operate limit switch)	:
22.3	Drop of Hook below floor level	:
22.4	Nearest position of hook to centre line of gantry rail	
	i. Main hoist	
	cabin end (E) meters	:
	other end (F) meters	:
	ii. Auxiliary Hoist	

- |  |                      |   |
|--|----------------------|---|
|  | cabin end (E) meters | : |
|  | other end (F) meters | : |
- 22.5 Type of main girder  
Design drawings showing overall dimensions,  
Size of each section and location and depth of  
diaphragms should be submitted for the girders.
23. Particulars of safety devices :
24. General arrangement drawing showing to scale elevation,  
cross section and plan which shall indicate the following  
information:
- |    |                                  |   |
|----|----------------------------------|---|
| a) | Clearance diagram of crane       | : |
| b) | Construction of bridge structure |   |
| c) | Hook approaches.                 |   |
| d) | Wheel base                       |   |
| e) | Wheel loads                      |   |
| f) | Wheel diameter                   |   |
| g) | Outer buffer dimension           |   |
- Drawing should be offered along with the offer  
Drawing No. should be indicated.
25. Detailed wheel diameter calculation for  
long travel and cross traverse wheels
26. Other information offered along with the tender.
- Note: 1. If above clauses are found inadequate for furnishing all necessary information of the crane  
offer, the tenderer may append further information separately.
2. Bidders should furnish information on Schedule-II & Schedule-III. In case of any discrepancy  
in the information submitted against Schedule-II and III and that furnished in clause wise  
comments, the information submitted against schedule-II & III shall over-ride that against  
the clauses.

## SCHEDULE -III

(Refer to Clause 1.1.6 of Section V)

for.....shop of.....Workshops.....Railway

### ELECTRICAL DETAILS OF CRANES

The under mentioned electrical details should be furnished for each motor separate alongwith the offer. The particulars indicated below should be offered for each motor/control separately.

#### 01 MOTORS :

- |      |   |   |
|------|---|---|
| 1.1  | Manufacturer's Name   | : |
| 1.2  | Type and degree of enclosure  | : |
| 1.3  | Type of duty  | : |
| 1.4  | Rating-continuous/intermittent  | : |
| 1.5  | Output (KW/BHP)   | : |
| 1.6  | AC Voltage across phases & frequency  | : |
| 1.7  | Speed in RPM  | : |
| 1.8  | Class of Insulation of stator   | : |
| 1.9  | Class of Insulation of rotor (Applicable for Non VVVF Drive Crane only):            | : |
| 1.10 | Frame size  | : |
| 1.11 | Normal full load current  | : |
| 1.12 | Starting current  | : |
| 1.13 | Motor type  | : |
| 1.14 | Temperature rise of windings & other parts allowed above ambient temp. of 50 deg.C. | : |
| 1.15 | Cyclic duration factor  | : |
| 1.16 | Max. starts per hour for which motor is suitable                                    | : |
| 1.17 | Class of duty (S1,S2,S3,S4 Etc.)  | : |
| 1.18 | Ambient temp. for which motor is suitable   | : |
| 1.19 | Voltage range for which motor is suitable   | : |
| 1.20 | Motor horse power calculations :  | : |
| 1.21 | Efficiency at   | : |
|      | a] full load  | : |
|      | b] 3/4 load   | : |
|      | c] 1/2 load   | : |
| 1.22 | Power Factor at   | : |
|      | a] Full load  | : |
|      | b] 3/4 load   | : |
|      | c] 1/2 load   | : |
| 1.23 | Type of drive (Direct gear etc.)  | : |

#### 2. CONTROL GEAR

- |       |   |
|-------|---|
| 2.1   | Rating of AC 4 / AC-3 Contactors suitably derated for AC-4 with minimum 2,00,000 cycles of operation. |
| 2.2   | Are the following provided for each motor.  |
| 2.2.1 | Short circuits protection by HRC fuses.   |
| 2.2.2 | No volt trip  |
| 2.2.3 | Overload trip   |
| 2.2.4 | Instantaneous trip current sensitive single phasing preventor.  |
| 3.    | Standard specifications to which the motor control gear and its ancilliary offered conform to         |
| 4.    | Any other special feature   |



**SCHEDULE – IV**

**SPARES FOR CRANE**

<b>S.NO.</b>	<b>DESCRIPTION OF ITEMS</b>	<b>QTY. /NOS</b>
01.	Fixed & moving contact tips for contactors	1 no. of each size
02.	For Contactors coils	1 set consisting of 3 nos. of each size
03.	Overload relays	1 set of each size <b>(applicable for non VVVF drive crane)</b>
04.	Timers	1 no. of each size <b>(applicable for non VVVF drive crane)</b>
05.	Carbon brushes	2 sets of each size <b>(applicable for non VVVF drive crane)</b>
06.	Carbon brush holders	1 set of each size <b>(applicable for non VVVF drive crane)</b>
07.	Limit switches	1 set of M.H 1 set of C.T. 1 set of L.T  1 set of A.H (if applicable)
08.	Current collectors	2 sets
<b>09.</b>	<b>MCB</b>	<b>1 set of each size</b>
10.	Thrusters	1 of each size
11.	Brake Liners with rivets	1 pair of each size
12.	Main spring for thruster brakes Used on crane	1 of each size
13.	Brakes shoes complete with	1 pair of each size lining
14.	Oil seals for gear cases	1 for each size of gear box and geared coupling on the crane
15.	Spare cards for VVVF drive For all drives viz .MH, AH, LT & CT	1 no. each
16.	A set comprising of 2 nos. Each long travel and cross Travel motion wheel in Assembled condition with axle Bearings housing	1 set of 2 nos. each.
17.	Any other items considered Essential (Ref. Cl.1.4)	

**SCHEDULE-V**  
**LIST OF MAINTENANCE TOOLS**

<b>S.NO.</b>	<b>DESCRIPTION</b>	<b>QTY.</b>
<b>01.</b>	<b>Tool box (For storage tools from Sr.no.2 to Sr. no.10)</b>	
02.	D/E Spanners required sizes	1 Set
03.	Grease gun	1 No.
04.	Oil can	1 No.
05.	Screw Driver of required sizes	1 Set
06.	Nose plier	1 No.
07.	Insulated plier	1 No.
08.	Hammer 2 lbs	1 No.
09.	Allen Key required sizes	1 Set
10.	Hydraulic jack	1 No.

**SECTION -VI**  
**ANNEXURE-A**

**FORMAT FOR SUBMISSION OF TECHNICAL BID**

1 (a) We, M/s. \_\_\_\_\_ offer our \_\_\_\_\_ for crane nos. \_\_\_\_\_ as per the description given in Schedule of Requirements.

(b) We state that, except for the following, for which clause wise brief description and justification for deviation has been indicated, our machine fully complies with all the clauses as given in technical specification Section-V.

S.No.	Clause/Item	Brief description of Deviation	Justification for deviation

(c) We also confirm all the schedules given in the Delivery Schedule at para 7 of **Section-IV.** :

**Note1:** The Bidder shall mention all technical deviation only in the format enclosed above and/ or in proforma for statement of deviation from technical specification as per Annexure-9 of Bid Document Part-I.

**Note-2** The deviation mentioned elsewhere in the bid shall not be considered and the bid shall be evaluated based on the information provided against **Annexure-A of Section-VI.**

**Note:-3** In case tenderer offers internationally accepted alternative specifications as per clause **1.7of Instructions to tenderes for filling technical bid.** Complete details of alternative specification apart from filling above deviation statement, may be enclosed.

2. We further certify that we are meeting the reference clause as;

(A) We are the regular manufacturer of this type of machine.

Clause (B)

S. No .	Name of purchaser with address	Purchaser's, telephone, email Address, Name of contact person	Purchase/ Supply order no. and date (along with a copy of PO)	Quantity Supplied (with proof of supply) @	Date of Supply @	Date of installation and / or Commissioning @	Leading Parameters of machine(s) to be establish similarity as per clause 3 of qualifying Requirements (QR) (Capacity)
1.	2.	3.	4.	5.	6	7	8.

@ (along with copies of relevant documents to establish linkage of documents /entities as detailed in clause 5 of qualifying Requirements )

Clause (C)

S. No .	Name of purchaser with address	Purchase / Supply Order number (along with a date copy of PO) (It should be the one(s) which are enlisted at clause 2B above)	Quantity Supplied	Date of Supply	Date of installation and / or Commissioning	Date of issue of Performance Certificate	Performance as per Annexure-A-1
1.	2.	3	4	5	8	7	8

3. We are having following facilities available with us or our agent for providing adequate after-sales service in India during warranty period. Complete details of after sales service, availability of technically competent engineers and warehousing facilities for spares is indicated below:

- After sales service centers:
- Availability of technically competent engineers;
- Warehousing facilities for spares:

4. We have quoted for comprehensive Annual Maintenance Contract as per clause 17 of Section V. Details of preventive maintenance services including cleaning of machine to be provided under AMC is given in the following format. (The information shall be provided whether AMC is in Scope or not)

S.No.	TYPE OF PREVENTIVE SCHEDULE	PERIODICITY	ITEMS TO BE CHECKED	ITEMS OF REPLACEMENT	EXPECTED PLANT DOWN TIME

5. \*We hereby confirm that we are the OEM and undertake to supply spare parts for a period of expected life of machine.

\*We hereby confirm that we are not the OEM, but are submitting undertaking from OEM for supply of spare parts for a period of expected life of the machine to provide maintenance spares (as and when ordered) after the expiry of the Warranty/AMC for X years (life of machine - 7yrs) including the maintenance spares required for the bought out sub-assemblies and parts.

(\*Strike out which ever is not applicable)

6. It is certified that we are having suitable facilities at our works for carrying out various performance tests on the sub-assembly/assembly/machine and these shall be made available to the inspecting authority.

7. **BOUGHT OUT ITEMS:** We hereby furnish a list of all critical items/ sub-assemblies which are bought out by us and proposed to be used, along with the manufacturer's name, brand model etc.

Sr No.	Description	Item no.1	Item no. 2	Item no. 3
1.	Brief description of item			
2.	Model no.			
3.	Make			
4.	Quantity/machine			
5.	Manufacturer's name and complete address			
6.	Whether imported or indigenous			
7.	Country of origin			

8. We further submit the following information about the offered machine as per the technical specification **section V** and Important Features of the tender section IV. We understand that any omission of any of the below mentioned information will render our offer incomplete to that extent.

**Note :-**

Bidder shall photocopy the specification (Section-IV & V) and furnish comments/ details against each clause or link to deviation statement. Any fraudulent change(s) made in COMFOW specifications (while making photocopy) will lead to summarily rejection of offer. Appropriate punitive action may be initiated.

S.N	Information required	As per Clause No./Schedule	Value /Write up/ Brochure
1	Information on schedule-I	Schedule-I (of section-V)	Values
2.	Information as per Schedule-II	Schedule-II (of section-V)	Values / write up

3	Information as per Schedule-III	Schedule-III (of section-V)	Values / write up
4	Information on quantity of each item offered under spares	Schedule-IV (of section-V)	Values
5	Structural calculations for girders, end carriage, crab and other structural members along with breakup of weights of major assemblies/components.	Clause 1.1.7 (of section-V)	Values/Details
6	Details of weather proof protection provide	Clause 1.4.11 of section-V	Write up
7	Safety stop details	Clause 1.9.5 of section-V	Write up
8	Details on heat treatment process of wheels	Clause 1.10.2 of section-V	Write Up
9	Details of method of stress relieving of gear boxes	Clause 1.15.1 of section-V	Write up
10	Calculations of current density in DSL	Clause 2.5 of section-V	Value / Write up
11	Current collector section selection calculations	Clause 2.5.1.3 of section-V	Value / Write up
12	Details of automatically cutting off resistances after a pre selected time	Clause 2.8.1.7 of section-V	Write up
13.	Details of control system	Clause 2.8 of section-V	Write up
14.	Details of alarm system provided	Clause 2.21 of section-V	Write up
15.	Make and Model no. of VVVF drive	-	Write up
16.	Annexure F- Infrastructure requirements	Clause 14.1 of section-V	Write up

**Signature of the  
Authorized representative of the bidder  
with company stamp**

**ANNEXURE-B**

**FORMAT FOR INDEMNITY BOND**

This deed of Indemnity executed by M/s. ----- hereinafter referred to as Indemnifier' which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, representative and assignees in favour of Central Organisation for Modernisation of Workshops, Railway offices Complex, Tilak Bridge, New Delhi – 110 002, India, hereinafter referred to as the 'Indemnified' which expression shall unless repugnant to the context or meaning thereof, include its successors and assignees witnesses as to.

Whereas the Indemnifier herein had participated in a global tender for the supply of --  
----- (machine name) which is opened on ----- (date) on terms and conditions set out interalia in the Tender Document.

And whereas, clause of the above mentioned tender document described that the machine shall be designed for a life of 20 years with regular maintenance and all the structural members of the machine should be guaranteed for 5 years against cracks, breakages etc. during the course of normal operations from the date of commissioning whichever is earlier of the stores supplied by the Indemnifier to the indemnified.

The indemnifier hereby irrevocably agrees to indemnify the indemnified that in the event of the said machine not achieving the life guarantee, the indemnifier shall as may be deemed necessary repair the defective machine at site, free of cost, within a reasonable time specified by the indemnified or reimburse the pro-rata cost of the machine to the extent a life not achieved as per the guarantee, or supply a spare stores for the defective portion only free of cost at site.

Bidder's authorized signatory  
With seal

Station:

Date:

Witness: 1.-----  
(Signature with Name, Designation & Address)

2. -----  
(Signature with Name, Designation & Address)

**JOINT RECEIPT INSPECTION NOTE**

***Note:** With the issue of JRI, payment is released to the contractor, as per the terms of contract. Consignee shall satisfy themselves that the conditions of contract are met before issue of the JRI.*

**Date**.....

**Sub: Receipt of consignment for machine**.....

**Ref: COFMOW Contract No**.....

1.	Name of consignee/Railway	
2.	Machine name	
3.	Quantity	
4.	Name of supplier	
5.	Consignment of the machine received on	
6.	The foundation & associated works essential for "Safe Installation of Machine" are ready (for turnkey contracts only) *	

\* If there are Delays on account of Consignee such as clear site is not given, then the condition 6 will not be a valid ground for holding JRI.

It is certified that the consignment of the machine has been received complete and in good condition as per specification shown in the contract.

**Tentative plan for installation and commissioning of the machine is as under:**

1.	Date of clear site provided	
2.	Contract	Turnkey/Non-turnkey
3.	<b>Status of readiness of foundation:</b>	
3(a)	Already constructed on	
3(b)	Under construction & likely date of its completion	
3(c)	Construction yet to be started from ..... and likely date of its completion	
4.	Status of availability of electrical power, water and compressed air etc.	Available/Not-available
5.	Number of components to be proved out on the machine	
6.	Likely date for start of erection/installation	
7.	Likely date for switch-on the machine	
8.	Likely date of completion of commissioning of the machine	

**Representative of firm  
Designation**

**Representative of consignee  
Designation  
(Minimum Gazetted level)**

JOINT COMMISSIONING NOTE**Date:**.....**Sub:** Commissioning of (name of machine).....**Ref:** COFMOW AT No.....

1.	Name of consignee/Railway	
2.	Machine name	
3.	Quantity	
4.	Name of supplier	
5.	Machine received on	

6. All the parameters of the machine are found okay. The proving test on the machine was conducted from ..... to ..... and machine is working satisfactorily.
7. Machine has finally been commissioned on..... . The machine has been handed over for regular use and kept under one month observation to watch its performance.
8. Following minor deficiencies (if any) found during joint observation trials are to be attended/rectified by the firm during one month observation and before issuing the PTC for the machine:
  - a.
  - b.
  - c.

Representative of firm  
Designation

Representative of consignee  
Designation  
(Minimum Gazetted level)



**ANNEXURE-E**  
**PERFORMANCE APPRAISAL FORM**

**APPRAISAL ON COMPLETION OF \_\_\_\_ YEAR OF WARRANTY PERIOD**

**To, M/s. ....**

**Dated:.....**

1.	COFMOW AT No.	
2.	Consignee/Railway	
3.	Name of supplier	
4.	Machine Name	
5.	Machine received on	
6.	Machine commissioned on	
7.	PTC issued on	
8.	Warranty period expired on	
9.	<b>Performance during warranty period:</b>	
9(a)	Total number of breakdowns	
9(b)	Total downtime in number of days	
10(a)	Any warranty complaint pending on date	Yes/No
10(b)	If yes, then the date and nature of defect(s)	

11. In case, Reliability clause No.16 of the machine during warranty period is also given in Bid Document Pt.II, then following details of breakdown hours for preceding eight quarters may also be furnished.

Quarter	Period From -----To-----	Breakdown hours
1		
To		
8		

**Signature-----**  
**Name-----**

**Designation:**  
**DY.CME/Sr.DME/Dy.CEE/Sr.DEE**

**Office Stamp**

1. COS/COFMOW/Railway Offices Complex, Tilak Bridge, New Delhi-110 002
2. CME(PCM)/COFMOW/Railway Offices Complex, Tilak Bridge, New Delhi-110 002
3. FA&CAO/COFMOW

**Note:**

i.)This appraisal may please be sent immediately on completion of warranty period.  
If any extension of warranty period required, may please also be mentioned with details.

ii) Sr.Scale Officer having independent charge is also authorised to sign.

**MINIMUM MANDATORY INFRASTRUCTURE REQUIREMENTS**

<b>S. No.</b>	<b>Item Description</b>	<b>Information/Details to be furnished by the bidder</b>
<b>1.</b>	<b>Covered Area</b> - The firm should have adequate covered area in workshop for storage & manufacturing activities. 600 Sq.mt for manufacture of cranes upto 30 T capacity. 1200 Sq.mt. for manufacture of cranes above 30 T capacity.	
<b>2.</b>	<b>Design Office</b> : The design deptt shall have dedicated qualified design engineer (minimum diploma holder) and should have dedicated PC/LAPTOP loaded with design analysis software/programmes for crane.	
<b>3.</b>	<b>Staff Strength</b> excluding MD/Owner/Partners/ /Stores staff /office staff/Peons & security staff : <b>10 (min) (list to be furnished)</b>	
<b>4</b>	<b>Stores</b> : Sufficient covered area for safe storage of items	
<b>5</b>	<b>Electrical</b> : Electrical design and assembly facility with demarcated area in workshop and a dedicated electrical engineer (minimum Diploma holder)	
<b>6</b>	<b>Quality Control/Assurance</b> : measuring tapes, scales, vernier calipers, micrometers, DPT testing facility, hardness tester, test load, test stand or pit for load testing of crane, control panel testing arrangement, Megger, Incoming/bought out material inspection, gear box test facility, Insulation resistance testing facilities, leveling test facility, Sound level test meter, stage inspection records, x-ray viewer, Bore gauge, Tachometer, welding gauge etc. <b>(list to be furnished)</b>	
<b>7</b>	<b>ISO 9001 certification</b> , Good record keeping, traceability	
<b>8</b>	<b>After sales service facilites with dedicated staff. (list to be furnished)</b>	
<b>9</b>	<b>Inhouse manufacturing facilities</b> viz : Lathe machine, milling machine, Power saw, drilling machine, MIG/MAG welding sets, welding transformer, Preheating oven for electrodes, Cutting torches, Pug cutting machines, EOT crane for material handling and hand grinders, spray painting arrangement, as applicable. <b>(list to be furnished), CNC cutting machines, semi automated girder manufacturing fixtures.</b>	
<b>10</b>	<b>The firm shall either have in house arrangement or permanent reputed vendors for following activities.</b>	<b>In house /Name of vendor</b>
<b>i.</b>	Heat treatment	
<b>ii.</b>	Gear manufacturing.	
<b>iii.</b>	Radiography test of weld joints (The lab shall be NABL approved)	
<b>iv.</b>	Calibration arrangement of testing equipments	
<b>v.</b>	Raw material test arrangement	
<b>vi.</b>	Tensile test arrangement of hooks	
<b>vii.</b>	Welder approval test arrangement.	
<b>viii</b>	Load testing arrangement	

**Consignee's Certificate for Quarterly Work Done Under AMC**

1. Name of Plant: \_\_\_\_\_
2. Consignee: \_\_\_\_\_
3. COFMOW AT No.: \_\_\_\_\_
4. Name of Contractor: \_\_\_\_\_
5. Quarterly charges for AMC(Standard): Rs. \_\_\_\_\_  
As per COFMOW AT no. \_\_\_\_\_ dt. \_\_\_\_\_
6. Quarter for which bills are preferred: \_\_\_\_\_  
From: \_\_\_\_\_ To: \_\_\_\_\_
7. No. of Breakdowns during the quarter: \_\_\_\_\_
8. **Calculation of Penalty and Net AMC charges payable to Contractor for the quarter:**
  - i. Total Plant Down Time (in days): \_\_\_\_\_
  - ii. Standard down days for preventive maintenance (in days/quarter): \_\_\_\_\_
  - iii. Total grace period for breakdown: \_\_\_\_\_
  - iv. Net down time for the plant [= (i)-{(ii)+(iii)}]: \_\_\_\_\_
  - v. 100% Availability for the quarter (in days): \_\_\_\_\_
  - vi. Actual availability [= (v)-(iv)]: \_\_\_\_\_  
Actual availability in %age [= {(vi) / (v)}x 100]: \_\_\_\_\_
  - vii. Calculation of penalty:
    - a. %age availability below 95%: \_\_\_\_\_
    - b. Penalty = Quarterly charges for AMC x (vii a) x 2.5/100
  - viii. Net amount payable as AMC charges to = Quarterly charges for AMC - (vii b)

It is certified that all spares borrowed by the contractor for the previous quarter have been returned in good condition.

**Signature of authorized representative of consignee**

**CENTRAL ORGANISATION FOR MODERNISATION OF WORKSHOPS  
(C O F M O W)**

**Report on Capability Assessment of New Vendors**

M/s.....(Name of Vendor).....

Machine/Product Class .....

**Contents:**

- Para - 1 : General Information
- Para - 2 : General Information (Technical)
- Para - 3 : Design Capability
- Para - 4 : Manufacturing Process
- Para - 5 : Quality Assurance
- Para - 6 : After-Sales Service
- Para - 7 : Past Performance
- Para - 8 : Commercial Information
- Para - 9 : Conclusions
- Para – 10 : Recommendations

**List of Annexures :**

- A : List of Managerial Staff
- B : Plan of Works to be assessed
- C : List of Machinery & Plant
- D : List of Raw Materials in Stock
- E : Q.A.P. of the Firm.
- F : List of QC equipments, Measuring equipments and Gauges
- G : List of Important Customers & Orders
- H : List of pending orders
- I : Performance of Machines supplied
- J : Proof of Ownership
- K : Factory License, NSIC/ SSI
- L : Copy of Latest Electricity Bill
- M : Certified copies of Balance Sheet and Profit & Loss accounts
- N : Income Tax Clearance Certificate Other Annexure (if any)

## Report on Capability Assessment of New Vendors

- i) **Name of Vendor** .....
- ii) **Purpose:** ..... (Assessing officers should detail the purpose of assessment, manufacturer, name of the machine and the tender number which necessitated assessment or otherwise.)
- iii) **Scope:** .....(The scope should define scope of capability assessment carried out detailing the machine/system or range of machines/systems.)
- iv) **Details of Stores/Items/Parts/components** for which assessment is carried out.  
(Indicate complete description. Vendor should submit a request to include more similar items in the assessment if required)
- v) **Assessment done on** .....

### 1.0 General Information

1.1. Background of vendor in Brief

1.1.2 Location

1.2 Postal Address

i. Head Office :

ii. Works/Factory (as per Factory License) :

1.3. Telephone No.(with STD code and Mobile)

i. Head Office :

ii. Works/Factory :

iii. Authorized Person who can be contacted telephonically:

1.4. E-mail IDs

i. Head Office :

ii. Works/Factory :

iii. Authorized Person :

1.5 Description of Factory/Works.

i. Total land area :  
(in Sq. metres)

ii. Total covered area :

(in sq. metres)

iii. Different sub-units :  
(with details of covered/  
uncovered area, etc.)

iv. Special features, if any :

1.6. No. of personnel employed (category-wise).

i. Managerial :  
(List to be attached as **Annexure-A**)

ii. Supervisory : Permanent \_\_\_\_\_ Temporary

iii. Skilled artisans : Permanent \_\_\_\_\_ Temporary

iv. Unskilled : Permanent \_\_\_\_\_ Temporary

1.7 Hours of working :

1.8 Is this first inspection for assessment?

If it is a re-inspection, details of earlier capability assessment(s) to be recorded and attached.

## 2.0 General Information--Technical

2.1 Description of different departments in the Factory/Works and function of each department.

2.1.1 The break-up of different work areas given below

### Unit - I

Administrative Block :  
Fabrication and assembly :  
Machine Shop :  
Store :  
Laboratory :

### Unit – II, Unit – III .....

Administrative Block :  
Fabrication and assembly. :  
Machine Shop :  
Store :  
Laboratory :

2.1.2 A plan of the works, as described above, to be attached (**Annexure-B**).

- 2.2 Detailed description of Machinery and Plant in each department Unit wise (make and year of procurement/commissioning to be provided. For special type of equipment copy of pamphlets/write ups to be furnished so as to supplement the description).

The list of machinery & plant available to be attached (**Annexure-C**).

- 2.2.1 It was observed that ..... (Comments of Assessing Officer(s), on machines and infrastructure)

- 2.3 Plans for future expansion, if any.....

- 2.4 Details of raw-materials held in stock (state whether imported/indigenous). (list enclosed as **Annexure-D**)

- 2.5 Production Capacity.

i. Per month :

ii. Per year :

- 2.5.1 Whether Production capacity has been certified by external agencies? If yes, then details/certificates to be attached.  
(Comments of Assessing Officer(s))

- 2.6 Enumerate Type of Stores/Items, which the firm is capable of manufacturing.

(Comments of Assessing Officer(s))

### **3.0 Design Capability**

- 3.1 Availability of Qualified Personnel.

(Comments of Assessing Officer(s))

- 3.2 Assessment of Expertise and Facilities.

(Comments of Assessing Officer(s))

### **4.0 Manufacturing Process**

- 4.1 In-house Manufacturing Facilities for the item(s) being assessed.

(Comments of Assessing Officer(s))

- 4.2 Details of manufacturing process relevant to the items for which assessment is carried out.

(Comments of Assessing Officer(s))

4.3 Important Items/processes Outsourced by the Vendors  
(Comments of Assessing Officer(s))

4.4 What is the system of traceability of the components/sub-assemblies manufactured in-house and outsourced.  
(Assessment team to comment on the traceability records maintained by the vendor for the range of machines manufactured, from the stage of drawings to dispatch of material/machine.)

## 5.0 Quality Assurance

5.1 Does the factory have an established Quality Assurance Programme. If yes, please enclose a copy of the write-up? If not, what plans are there if any for setting it up? (QAP attached as **Annexure-E**)

(Comments of Assessing Officer(s))

5.2 Details of Quality Assurance Organization.  
Names of key personnel, their qualifications, designations and position in overall management structure (Data in tabular form, explain with organization chart, if necessary).

5.2.1 The QC organization is headed by Shri ....., who is designated as ....., with responsibility for .....(Comments of Assessing Officer(s))

5.3 Enlist Quality Control Testing Facilities and Laboratory equipment available.

5.3.1 In-house facilities available for inspection and QC include the following:  
i.....  
ii .....  
iii .....  
(list enclosed as **Annexure-F**)

5.4 Availability of gauges

5.4.1 The following important items of gauging and other related equipment are available: (**Annexure F**)

5.5 Calibration of Laboratory / test equipment / gauges, indicated in para 5.3 and 5.4 above:

- i. How is the calibration done? :
- ii. Frequency of calibration. :
- iii. System to ensure that calibration of above equipments :  
does not fall overdue.
- iv. Action taken if such calibration has fallen overdue :

(Comments of Assessing Officer(s))

5.6 Source of procurement of raw-materials, important bought-outs, and steps taken to ensure their quality.  
(Comments of Assessing Officer(s))



5.7 Details of inspection/checks done on material during various stages of the above manufacturing process.

(Comments of Assessing Officer(s))

5.8 Have acceptable values for the parameters inspected during above stage checks been laid down? If yes, the action taken if value of the parameter inspected does not meet the desired laid-down value.

(Comments of Assessing Officer(s))

5.9 System for documentation of the results of the above stage checks.

(Comments of Assessing Officer(s))

## **6.0 After-Sales Service**

6.1 After-Sales Service Facilities Available at Works and Branch Offices.

6.2 What is the system of recording customer complaints and action taken there upon.

(Comments of Assessing Officer(s))

6.3 Assessment of Quality of Service Including Response times.

(Comments of Assessing Officer(s))

## **7.0 Past Performance**

7.1 List of important customers of the firm (as relevant to the works for which assessment being done)

This is attached at **Annexure-G**.

7.2 Details of important orders executed / supplies in the past.

Also included in **Annexure-G**. .....

7.3 Details of Pending orders in hand (**Annexure-H**)

7.4 Whether another unit/factory of the firm is already approved by COFMOW for supply of stores/components.

(Comments of Assessing Officer(s))

7.5 Performance of machines manufactured and supplied in the past to different consignees.

(Comments of Assessing Officer(s))

7.5.1 Machines at M/s. .... (Name of consignee)

- 7.5.2 Conclusions on performance (Attach performance certificates from at least 5 consignees where machines are working for more than one year since commissioning as **Annexure-I**).

(Comments of Assessing Officer(s))

## **8.0 Commercial Information**

- 8.1 Copies of following documents obtained and attached as Annexures.

- i. Proof of Ownership. : **Annexure-J.**
- ii. Factory License, NSIC/ SSI : **Annexure-K.**
- iii. Latest Electricity Bill. : **Annexure-L.**
- iv. CA/CS certified copies of  
Balance sheets and Profit & Loss accounts : **Annexure-M**

- 8.2 Whether the firm is registered under Indian Factories Act.

(Comments of Assessing Officer(s))

- 8.3 Whether the firm comes under the scope of Industries  
(Development & Regulations) Act, 1951.

(Comments of Assessing Officer(s))

- 8.4 Income Tax Clearance Certificate Copy attached at **Annexure-N**.

## **9.0 Conclusions**

(Comments of Assessing Officer(s))

## **10 Recommendations**

(Should detail the findings in line with the scope of the assessment)

(Signatures of the Assessing Officer(s)  
Name & Designation

Place:

Date:

**ANNEXURE -C**  
**LIST OF MACHINERY AND PLANT**

S.N.	Description of Items	Make	Qty.	Year of procurement

**ANNEXURE - F**  
**LIST OF QC EQUIPMENT, MEASURING EQUIPMENT AND GAUGES**

S.No.	Description	Range Least count where applicable	Qty.	Year of procurement

**ANNEXURE - G**  
**LIST OF IMPORATANT CUSTOMER &ORDERS EXECUTED W.E.F.....(DATE)**

S.N.	Purchaser Order No.	Description/ value	Delivery dt.	Date recd.	Date Comm.	REMARKS

**ANNEXURE - H**  
**LIST OF PENDING ORDERS AS ON----- (DATE)**

S.N.	Purchaser	Order No. and date	Value

**Annexure-I**  
**CENTRAL ORGANISATION FOR MODERNISATION OF WORKSHOPS**  
**QUALITY ASSURANCE PLAN FOR EOT CRANE**

SL NO.	COMPONENT & OPERATION	TYPE OF CHECK	QUANTAM OF CHECK	ACCEP TANCE NORM	FORMAT OF RECORD	SOURCE	REMARK	OTHER REMARKS
1	2	3	4	5	6	7	8	9
01.	<b>RAW MATERIAL</b>							
1.1	Structural material for Bridge Girders, End Carriage, Crab, Platform,	Chem. & Mech.	1 Sample per size of plate and Other Structural	IS: 2062-2011, Grade E-250 BR or BO	T.C. & Inv.	SAIL TISCO IISCO, ESSAR Jindal Steel, RIN vendor appd. lab	CHP	Identification and Tests to be carried out in the absence of Mill T.C and proper Co-relation chalk mark
1.2	Rope Drum Plate	Chem. & Mech.	1 Sample per size of plate	IS: 2062-2011, Grade E-250 BR or BO	T.C. & Inv	-do-	CHP	-do-
	Seamless Steel Tubes of Gr. A106/ A53 of Gr. 'A', 'B', 'C' ASTM Standard	Acid Etching of end	100%	ASTM A-106	IR	Vendor	CHP	Check whether welded or seamless
1.3	Brake-Drum	Chem.	1 Sample	IS:1875 Class 3A or above IS:1030 Grade 280-520W	T.C	Manfr.	V	Forging or Cast steel
1.4	Gears	Chem.	1 per size per lot	DIN17210 DIN 10084 IS: 9175 EN-353 SAE-8620 -do-	T.C.	Vendor Appd. Lab	CHP	Case casburising low carbon alloy steel
1.5	Pinions	Chem.	-do-	-do-	-do-	-do-	CHP	-do-
1.6	Sheave/Pulleys	Chem.	1/lot	IS: 2062-2011 Gr.E-250 BR or BO IS: 1030 GR 230-450 (for Cast Steel) IS: 1875 Class 2 or above (for Forged Steel) BM 320 of IS: 14329 (for Malleable Iron Casting)	T.C.	Vendor/	V Lab Approve	-do-
1.7	Wheels	Chem.	1 Sample	IS:1570	-do-	-do-	CHP	C <sub>55</sub> Mn <sub>75</sub>

1	2	3	4	5	6	7	8	9
1.8	Hooks	U.T.	100%	IS: 3664 ASTM A 388	T.C. and Inv.	Vendor/ appd. agency	CHP	U.T. on shank portion only
1.9	Wire rope	Examination of reports for breaking load	100%	IS: 2266	T.C. and Inv.	Manf./ auth. Stockist	V	Wire ropes of Usha Martin Fort Stokst Williams & South India Bombay wire rope to be used
2.0	Rails	Visual	100%	Rail	Inv.	Manf./ auth. stockist	V	
2.1	Bearings	Visual	100%	Mfrs. Standard	Inv.	Manf./ auth. stockist	CHP	For Bearing mfd. in the country
02	<b>IN PROCESS INSPECTION</b>							
2.1	Welding Procedure/ Welder qualification	WPS PQR WQTR	TYPE test	As per IS:7318 IS:817 AWS D14.1 ASME Sec IX		Vendor	V	Proper welding / welders records maintained by as per ASME ix AWS D14.1 Inspecting Engineer to carry out the type test if he is not satisfied
2.2	Welding of Rope drum	MPI/DPT RT of Joint	100%	IS:4853	I.R.	Qualified/auth radiography Agency	V	To be conducted by ISNT/ASNT qualified personnels
a)	Rope drum (for seamless tube)	Flattening test	100%	ASTM-A-106 IS 2328	TC	Vendor	V	
2.3	Welding of Box- girder, crab, End carriage etc.	Visual DPT	100% Random	<b>IS: 822</b> <b>AWSD 14.1</b> <b>IS: 3658</b> <b>ASTM E-165</b>	I.R. I.R.	Vendor Vendor	CHP CHP	Check of blow holes, size and waiviness
2.4	Welding (Soundness)	R.T. of Butt welds in tension	100%	<b>IS: 4853</b> <b>ASME SEC.</b> <b>V &amp; VIII</b> <b>ASTM-A-388</b>	I.R.	auth. Radiographic agency	CHP	(Review of RT films - weld no. to be given by Inspector)
2.5	Gear & Pinions							
a)	U.T.	Ultrasonic testing	100%	IS:3664 when backwall echo set to 100% (a) defect shall not exceed 20% (b) Backwall echo	I.R.	IS:3664	CHP	for thickness >50 mm

b)	Dimensional accuracy	Measurement	Random	shall be minimum 80% in any area. IS: 3681 (Grade- 8 DIN 8)	I.R.	Vendor	CHP	Min. 50% Qty. to be witnessed & other 50% to be verified.
c)	Hardness	Hardness	100%	pinion 50 – 60 HRC gears 2 to 3 HRC lower than pinion	I.R.	I.R.	-do-	CHP Difference in hardness of gears & pinion must not be less than 2-3 HRC
d)	MPI	Crack Detection	Random	<b>ASTM E-709</b> No Linear Indication	I.R.	-do-	V	
e)	Surface finish	Surface	Random	1.6 microns max.	I.R.	-do-	CHP	1.6 microns max.
2.6	Gear Boxes:							
a)	Sound level	Sound	100%	COFMOW Specs. Sound Gear Box Practice	I.R.	-do-	CHP	85 db at a distance of 1 meter from Gear Box.
b)	Temp. rise	-do-	100%	<b>Maximum 20 deg. "C" above ambient temperature after 2Hours continuous Running.</b>	I.R.	Vendor	CHP	Maximum 20 deg. C. above ambient.
c)	Leakage	-do-	100%		I.R.	Vendor	CHP	No Leakage
d)	Backlash	Measurement	Random		I.R.	Vendor	V	
2.7	Hooks	Proof load	100%	<b>IS: 15560 for 'C' Hook</b> <b>IS: 5749 for Ramshorn Hook</b>		T.C.	Vendor/appd. Lab.	CHP
		DPT after Proof load	100%	<b>IS: 3658</b> <b>ASTM E165</b>	I.R.	-do-	CHP	

1	2	3	4	5	6	7	8	9
03	<b>FINAL INSPECTION</b>							
3.1	Motors	Review of routine test certificate	100%	<b>IS:325</b> <b>IEC:60034</b>	T.C. & Inv.	Manfr./auth. stockist	V	In case of purchase from auth.-stockist, manufacturers invoice to auth. stockist should be available for verification by inspector.
3.2	Cables	Review of Type test/ Routine test	100%	IS:694 IS:1554 IS:9968	T.C. & Inv.	Manuf./auth. stockist	V	-do-
3.3	Control Panel & Pendant wiring, marking, continuity Input, Output, sequence operation	Visual check of fitting of components	100%	Electrical Diagram	I.R.	Vendor	CHP	Component type/routine test certificate to be reviewed.
3.4	Components	Visual/rating	100%	-do-	I.R.	Vendor	CHP	
3.5	Complete Assembled EOT	Visual & Checking over-all dimensions alignment & completeness	100%	Appd. drgs./Sch. II	I.R.	Vendor	CHP	
		Load test/ overload test, Deflection test, Hoisting speed measurements, for LT & CT current measurement	100%	IS:3177 IS:800 IS: 807 <b>IS:3938</b>	I.R.	Vendor	CHP	
3.6	Painting	Surface preparation	100%	COFMOW SPEC.	I.R.	Vendor	V	Sand blasting will be preferred.
3.7	Lubrication		100%	-do-	I.R.	Vendor	V	Ease of lubrication without dismantling any component.
V	= Verification				M	= Major		
CHP	= Hold Point-to be got cleared before further processing				Vendor	= Crane Mfr.		
I.R.	= Inspection Report				Appd. lab	= Lab. approved by inspecting Engineer		
T.C.	= Test Certificate				Cdt.7	= If test facility is not available with Vendor		
CR	= Critical					test must be done in an approved lab.		