MAZAGON DOCK SHIPBUILDERS LIMITED
(Formerly known as Mazagon Dock Ltd.)
CIN : U35100MH1934GOI002079
(A Government of India Undertaking)
Dockyard Road, Mazagon,
Mumbai 400 010.
INDIA

Design, Supply, Installation, Testing & Commissioning of Eight (08) nos. Level Luffing (LL) Jib Cranes for MAZAGON DOCK SHIPBUILDERS LIMITED

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PART: A : PARTICULAR SITE CONDITIONS AND REQUIREMENTS

BUYER'S REQUIREMENTS

MDL is intended to procure 08 Nos. single boom Level Luffing Jib Cranes as under,

Sr.No.	Location	Crane No.	Capacity	
			Main Hoist	Aux. Hoist
1	South Yard	LLC 09	15T	5T
2		LLC 10	50T	10T
3		LLC 11	20T	7.5T
4	North Yard	LLC 12	25T	5T
5		LLC 13	25T	5T
6		LLC 14	25T	5T
7		LLC 16	60T	5T
8		LLC 17	25T	5T

1. SITE LOCATION AND LAYOUT

The supplier has to visit the site and to take their own measurements/assessment as stated in succeeding paragraphs

2. <u>CLIMATIC DATA</u>

The details provided below are from our available data bank for reference only. Bidders are requested to verify the same before its use:

a) **Air temperature:** mean min. 16 °C, mean max. 36 °C, extreme max 40 °C

b) **Rainfall:** average annual rainfall 2080 mm, average 71 days with 2.5 mm or more. Highest averages June (520 mm), July (709 mm), August (419 mm), lowest averages December, January, February, March and April all less than 10 mm. Abnormal rain of 934mm in one day in July 2005.

c) **Relative humidity:** range 62 to 86 %

d) **Barometric pressure:** at mean sea level, monthly means range from 1004 to 1013 mb.

e) **Wind:** General direction of wind is from the North to the West quarter, with seasonal variations as shown below: -

<u>Seasonal Wind Variations</u>

Months	Directions	Speeds
Feb-May	Mainly from N.W.	(Max. 8 to 10 Beaufort. Substantial 4-6 Beaufort)
June-Sep.	Mainly from W.N.W.	(Max. 8 to 10 Beaufort. Substantial 6-8 Beaufort
Oct-Jan	Mainly from W.N.W.	(Max. 6 to 8 Beaufort. Substantial 2-6 Beaufort

f) Cyclones: These may occur in the period of May/June or October/November.
Occasionally, sudden, high winds also occur during the fine weather period from N.E.

3. SITE DATUM AND TIDAL DATA

3.1	The datum for all works shall be zero Mumbai chart datum. Bench marks have already been established within the working area by the MDL and shall be verified by the Supplier before commencing the works.
3.2	All the levels shown on the drawings or referred to in the Specifications are related to the Chart Datum, unless mentioned otherwise.
3.3	Tidal data for the site is as follows:-

Highest Recorded Tide	HRT	+5.40m CD
Highest Astronomical Tide	HAT	+5.04m CD
Mean High Water Spring Tides	MHWS	+4.42m CD
Mean High Water Neap Tides	MHWN	+3.30m CD
Mean Sea Level	MSL	+2.51m CD
Mean Low Water Neap Tides	MLWN	+1.86m CD
Mean Low Water Spring Tides	MLWS	+0.76m CD
Lowest Astronomical Tide	LAT	-0.46m CD
Mumbai Chart Datum and Site Datum	CD	+/-0.00m CD

4. CURRENTS AND WAVES

4.1	The currents at the site of the proposed Works are essentially caused by the tides, and are not influenced to any extent by monsoons. The strength of both the ebb and flood currents are similar (1.5 to 2 knots, equivalent to 0.75 to 1.10 m/sec) and the directions are generally North to South / South to North respectively.
4.2	The predominant waves entering the site of the proposed Works are the swell waves generated by deep sea storms. These mainly arise just before and during the South West monsoon. The wave height at the site of Works is not expected to exceed 1.5 m. The statistical analysis also indicates that most wave periods fall between 6 seconds and 10 seconds.
4.3	During the continuance of the North-east monsoon, north-easterly winds known as "Elephantas" blow for short duration during the months of October-November. As the fetch and duration of these winds are limited, the "Significant height" of the resulting waves is not likely to exceed 1 meter with period ranging from 3 to 5 seconds.

5. ACCESS TO THE SITE:

5.1 The Supplier shall at all times make use of the site entrance as instructed by the MDL for access to the site. Movement of Vehicles and persons will be restricted to the Supplier's working area only. Except for making deliveries, Supplier’s vehicles shall be parked outside the yard.

5.2	The Supplier shall make necessary arrangements to obtain required passes for vehicles and persons entering the shipyard site for the purposes of carrying out the Works from the MDL.

5.3	The extent of the site will vary as the work progresses to suit the construction of the Works. In general, the site comprises a number of discrete areas within and outside Mazagon Dock Shipbuilders Ltd. The Supplier shall gain access to the various site areas through shipyard operational areas. The MDL shall in general provide clear access for the Supplier to the various site areas; however, the Supplier shall expect at times to have restrictions in access due to shipyard operations.

6. INSTRUCTIONS FOR SUPPLIERS WORKING IN MAZAGON DOCK SHIPBUILDERS LTD.

6.1	All Suppliers working within Mazagon Dock Shipbuilders Ltd. shall comply with the following rules and instructions:
(i)	While employing workers in Mazagon Dock Shipbuilders Ltd., the Supplier shall bear in mind that it is a vital Defence Installation.
(ii)	The Supplier shall be responsible to produce a Police Verification Report regarding checking of antecedents and verification of character of his employees.
(iii)	The Supplier shall declare in the Security Office all tools, equipment or any other items brought by him for work in Mazagon Dock Shipbuilders Ltd. In case of electric cables, its measurement (size & length) is to be written properly. The paper containing the list of items declared in the Security Office shall be retained by the Supplier properly. For items of stores / material resembling that of Mazagon Dock Shipbuilders Ltd., precaution shall be taken to mark their clear identification of colour code and / or serial number and / or clear marking on each item of stores / material including tools.
(iv)	All the items / material required to be taken out of Mazagon Dock Shipbuilders Ltd. after completion of work is to be removed only during working hours. This shall be supported by the original paper / document at the time bringing the material / items inside Mazagon Dock Shipbuilders Ltd.
(v)	At the time of entry / exit, the Supplier's employees shall display their entry passes issued to them. As far as possible, temporary workers passes shall be collected and kept by the Supervisor of the Supplier at the time of his workers going out after completion of work in the Yard. On the next day, these passes shall be reissued to the workmen who are required for work inside Mazagon Dock Shipbuilders Ltd. In respect of those workmen who are not required to report on the following day or who are discharged, their passes shall be deposited in the Security Department's Pass Issue Cell.
(vi)	If the Supplier's employee is required to work in Mazagon Dock Shipbuilders Ltd. for a period of 89 days or more, he shall produce 3 copies of photographs of each of his employees and other detailed information as may be required, which will be informed to him by the Staff of Pass Issue Cell of the Security Department.
(vii)	If the period of work in Mazagon Dock Shipbuilders Ltd. is less than 89 days, then the Supplier has to furnish the following information in a register as per the labour challan issued by the Personnel Department:

Sl. ……
Address ……
……
No. ……
Name ……
Age ……
Distinguishing mark on the body, if any……
Designation ……
Local Address ……
Permanent Address ……

(viii)	The Supplier shall take adequate care while completing the labour challan (ESIS formalities from Personnel Department). The names of his employees who are required to work in the Yard are to be written in the labour challan. The labour challan must be signed by the Proprietor / Manager / Site executive of his concern. ESIS formalities in respect of his / his sub-Suppliers workers have to be completed every month without fail.
(ix)	Cost of Security Passes / Identity Cards will be recovered from the Supplier at the existing rate per Security Pass / Identity Card. For re-issue of Security Pass / Identity Card, in case of loss of the same, the Supplier will be charged extra as per prevailing rates. The amount shall be deposited to the Cash Department of Mazagon Dock Shipbuilders Ltd.
(x)	The Supplier must ensure that all the Security Rules of Mazagon Dock Shipbuilders Ltd. are observed by his employees.
(xi)	The Supplier shall give strict instructions to his or his Sub-Supplier's employees not to step on board ships under construction / repairs.
(xii)	The Supplier shall ensure that his / Sub-Supplier's employees remain at the place of work assigned to them and do not loiter around any other ship or working area. If any such infringement is observed, the employee is liable to be barred from further entry to Mazagon Dock Shipbuilders Ltd.
(xiii)	In case the Supplier finds any difficulty in compliance of above Security instructions, he may call on the Chief Security Officer for the necessary guidance.

7. SUPPLIER'S PLANT, EQUIPMENT, LABOUR, PERSONNEL, FUEL AND CONSUMABLES

7.1 The Supplier shall provide and mobilize all necessary plant, equipment and labour for the Construction of the Works. He shall provide all necessary maintenance facilities for the plant and equipment, which shall not be de-mobilized and removed from site before the completion of the Works without the written permission of the MDL executive.
7.2 The Supplier shall ensure that all work is undertaken by trained and competent personnel under the supervision of responsible persons, experienced in the particular aspect of the works being undertaken.
7.3 The Supplier shall arrange for required supervisory staff on Site as and when required. He shall submit on award of the Contract for the approval of the MDL executive in the form of a bar chart showing numbers of supervisory staff needed at various stages of construction.

7.4 The Supplier shall provide and pay for all fuel, lubricants, gas and other consumable stores required for his plant, equipment and transport and for the execution of the Works.

8. SANITARY PROVISIONS

8.1 The Supplier shall, at all times, during the continuance of the Contract adopt such precautions as may be necessary to prevent soil or water pollution on the Site (including any area occupied by temporary accommodation) and shall compel his and his Sub-Suppliers' employees and labour to use the facilities provided which shall be carefully maintained by the Supplier throughout the currency of the Contract to the satisfaction of the MDL executive.

9. SAFETY, HEALTH & WELFARE PROTECTION, LIFE-SAVING.

9.1 The Supplier shall comply with the regulations of the Statutory Authorities in respect of safety, health and welfare requirements. All facilities provided shall also be subjected to the approval of the MDL executive in respect of siting, type, quality, maintenance and cleanliness.

9.2 The Supplier shall adhere to safe construction practices and guard against hazardous and unsafe working conditions and shall comply with MDL's Safety Rules.

9.3 The Supplier shall give prompt and due consideration to any matters to which the MDL executive may find it necessary to call attention, for the purpose of ensuring compliance with the foregoing requirements.

9.4 The Supplier shall provide handrails, scaffolding, and take such other safety precautions as are consistent with normal good safety practice.

9.5 Site operatives shall be fully conversant with the use of safety equipment and drills shall be carried out frequently to ensure that all necessary procedures can be correctly observed.

9.6 The Supplier shall provide all necessary personal protective equipment (PPE) to his workforce and that of his sub-Suppliers. This shall include, but shall not be limited to; safety boots, hard hats, gloves, lifejackets, eye protection, ear defenders, high visibility vests, harnesses.

9.7 All safety rules to be observed while working on live electrical system or installation as stipulated in The Indian Electricity Rules and other relevant rules.

9.8 The Supplier shall in all dealings with labour in his employment have due regard to all recognised festivals, days of rest and religious or other customs and observe days of rest as applicable to the outdoor staff of the MDL.

9.9 The Supplier shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his personnel or Sub-Suppliers.

9.10 The Supplier shall recognize the freedom of his work people to be members of trade unions.

9.11 All personnel employed by the Supplier and any of his sub-Suppliers' shall carry an identity card, which shall be clearly visible at all times on the Site.

9.12 The Contractor shall fully comply with the General HSE guidelines promulgated by MDL.
9.13 All precautions and permits not limited to the following shall be complied with in connection with the erection, testing and commissioning of the crane. i. Hot work permit ii. Permit for work at height iii. Permit for Scaffolding iv. Electrical shut down permit
9.14 The Contractor shall provide handrails, scaffolding, and take such other safety precautions as are consistent with normal good safety practice. Warning signs shall be displayed at relevant locations in English and Hindi.
9.15 Crane supplier shall submit the detailed erection procedure before commencing the erection activities at site. The procedure shall include details regarding the sequence of erection, capacity of cranes used for erection activities, etc.

10. FIRE-FIGHTING EQUIPMENT AND STORAGE OF DANGEROUS MATERIALS

10.1 Suitable fire-fighting equipment shall be provided and maintained on the Site to deal with any outbreaks of fire on the site of the Works.

10.2 All possible precautions shall be taken to provide for the safe storage of petroleum, gas bottles, or other dangerous materials. Permits shall be obtained for the storage of such materials wherever this is required by the regulations of the relevant authorities, and the Supplier will be deemed to have included for all costs arising from such regulations within his tender prices and for providing the level of security required for storage and for arranging for the safe delivery to site of such materials.

10.3 The Supplier shall observe and abide by all fire and safety regulations of the MDL before starting and during execution of construction work. The Supplier shall consult with MDL's Safety executives and must make good to the satisfaction of the MDL any loss or damage to any portion of the work done or to be done under this Contract or to any of the MDL's existing property.

11. ADVANCE NOTIFICATION OF ALL OPERATIONS

11.1 In addition to his general obligations under the Contract, full and complete notice shall be given by the Supplier of all operations to be carried out on the site. Such notice shall be provided in sufficient time for the MDL/TPIA to make all necessary arrangements for inspection and checking. Such inspection and checking shall not relieve in any way the obligations of the Crane Supplier under the Contract.

11.2 Where the MDL executive is required by the specification to give approval to the supply of materials, plant or methods to be used in any part of the Works,

this notice shall be sufficient to allow time to carry out inspections, checks or tests prior to giving such approval.

12. REGULATIONS OF STATUTORY AUTHORITIES AND CUSTOMS

12.1 Without limiting his obligations under the general conditions of the Contract, the Supplier shall be responsible for meeting obligations of all statutory authorities, including but not limited to, local representatives, The Indian Electricity Rules and Act, Fire Insurance Regulations, Brihan Mumbai Electricity Supply and Transport Undertaking (B.E.S.T.) and the Central Electricity Authority (CEA) and Mumbai Port Trust (herein referred as MbPT).

12.2 Should any of the statutory authorities request an inspection of the installation, equipment or the final works, the Supplier shall co-ordinate with the MDL executive in carrying out such inspection. Any modification suggested by the authorities shall be carried out by the Supplier, on the advice of the MDL executive at no additional cost.

12.3 The Supplier shall comply with all regulations imposed by the Customs authorities in respect of the passage of all imported Supplier's equipment, plant, materials and vehicles and personnel through Customs barriers inclusive of relevant fees.

13. WORKS NOT TO INTERFERE WITH MDL'S NORMAL BUSINESS

13.1 The Supplier shall not interfere in any respect with the normal business of the MDL and shall co-operate with him/them if and when special measures become necessary as a direct consequence on the progress of the Works.

13.2 The Supplier, shall co-operate, by temporarily removing any of his Equipment, floating craft, obstructions, etc. which may cause hindrance to the launching of a newly built ship till the process of launching has been completed, as per direction of the MDL executive at no additional cost.

14. SITE CLEARANCE, MAKE GOOD ETC. ON COMPLETION

14.1 The MDL will provide phase wise space to the supplier during assembly/erection of crane and subsequent project work.

14.2 The Supplier shall on completion of the Works at his own expense restore, reinstate or make good the surfaces of all ground disturbed by his operations; remove any rubbish, surplus materials etc, and leave the Site clean and tidy to the satisfaction of the MDL executive.

PART B: TECHNICAL REQUIREMENTS

Technical requirements for the Level Luffing Jib cranes required by the Employer are broadly given below. The Contractor is requested to submit detail specifications of the crane offered in line with technical requirements, which should include the type, make, capacity, rating, material specifications etc. of major components. The Cranes and its accessories shall be inspected either by MDL/ authorized representative/ Third Party Inspection Agency (TPIA) during various stages/steps to confirm whether structural strength capacities, load test, dimensions, accuracy, operating requirement, working of safety devices such as limit switches and functioning of control system assigned with positive logics, brakes etc. meet with the approved specifications, drawings and crane design code as applicable. MDL reserve the right to inspect and or to depute any external inspection agency to inspect at supplier's works and also at his sub-contractors works. Necessary facilities shall be provided by the supplier for the above. Moreover, the supplier shall extend all sort of support to explain and demonstrate the functions in a reasonable level. Travelling, boarding and lodging costs of MDL officials would be borne by MDL. It is the responsibility of the contractor to inform one month in advance before shipment in order to carry the witnessing and factory acceptance test by the employer. All required facilities, test equipments/units shall be arranged by crane supplier at their cost. The design, manufacture, **inspection and testing at works at all stages as required**, supply, erection, testing and commissioning shall be covered under inspection by a TPIA, viz. IRS/LRS/BV/ABS/TUV/DNV. MDL reserves the right and power to choose and finalize the TPIA and the supplier have no rights to question or disobey the same. Cost for TPIA for the third party inspection shall be borne by the crane supplier. The supplier has to comply with various requirements of TPIA meeting QAP, inspection, testing of crane sub-assemblies as per Standards

15. SCOPE OF SUPPLY:

Technical requirements of the 08 nos Level Luffing Jib cranes required by the MDL are broadly given below. The bidder is requested to submit detailed specifications of the cranes offered, which should include the type, class, make, capacity, rating, material specifications of major components

15.1 The scope of supply shall include:

a) The design, manufacture, delivery, off load and move to erection site, on-site assembly and erection, installation, testing, commissioning and setting to work of a Luffing jib cranes and all necessary peripherals, inclusive of all necessary temporary works required.

   The equipment shall be complete with all necessary parts, auxiliary items and safety devices whether specified herein or not which should form part of crane for operating the crane for intended purpose.

b) The crane rails for Cranes are as existing **ISCR80** respectively.

c) The Electrical installations shall be carried out as per Indian Electricity Rules and Regulations or IEC.

d) The provision and mounting of the cable reeling drum and associated power supply cable together with the cable turn over device, cable anchor device and crane isolation switch/connection box within a cable turnover pit

e) The provision for the turnover pit shall be in suppliers' scope. The specifications and size of supply cable, cable reeling drum to be given by crane supplier to suit the size of pit. Isolation Switch / Connection box should have locking arrangement

f) Supply of the manufacturer's recommended additional spare parts considered necessary to support the all eight (08) cranes during the initial 6 years of operation.

g) The provision of comprehensive operating, maintenance and spare parts manuals for the crane. All such manuals to be in English (soft and hard copy).

h) The provision of all necessary operating and maintenance training at site for MDL's nominated personnel.

i) A Guarantee/Warranty against damage or failure due to breakdowns/ defects for a period of 36 months from the date of final acceptance of the crane at MDL site.

j) Buffer stops and end stops, storm anchors including sockets, all embedment which are to be casted in concrete etc. and necessary details in this regard shall be intimated by crane supplier in advance.

k) Necessary clearance to be checked at the site between machinery house, counterweight and Slipway cover sheds/ other obstructions during Slewing & LT motion of the cranes. Various obstructions for SL, Luff & LT motion are shown in drawings. These dimensions are only for reference only and bidder shall visit the site for cross verify/check before designing of the crane.

15.2 The cranes shall be handed over to MDL after erection, satisfactory trials, testing and commissioning at MDL site. The entire responsibility regarding handling of material, manpower, compliances of statutory and safety regulations, rules or act for the above actions rest with the supplier of the crane. Supplier of crane may take notice that MDL is no way responsible for any actions, failures, non-compliances of statutory and safety rules/ regulations/ act as applicable in India and especially inside MDL during the transportation of materials inside yard or during erection process of crane or during trails/ tests/ statutory tests or evaluations or any regulations or rules as stipulated by Government of India time to time during the period of contract and supplier of the crane solely be responsible for all such actions and has to be dealt with at their risk and cost .

Safety of items delivered against damages, theft, etc. and its preservation till commissioning are covered under the scope of the supplier.

16. CRANE LOCATION, SITE CONDITIONS AND LIMITATIONS

a. The cranes are to be delivered to, installed and operated within the Mazagon Dock Shipbuilders Ltd. Shipyard, Mumbai, India. Companies/Firms wishing to tender for the supply of the cranes shall visit the shipyard to fully familiarize themselves with the intended location, the prevailing site conditions and any possible constraints in advance of submitting their offer.

b. It should be noted that access to the Site would be subject to limitations and restrictions. In addition, the availability of working areas will be reduced due to other Suppliers working in the vicinity of the dockyard area generally. Companies wishing to tender are to ensure that they are fully conversant with any limitations and restrictions on access and the work being undertaken by other Suppliers.

c. The MDL draws to the attention of the Supplier that there is no space available on site to carry out fabrication works.

d. The Supplier should fabricate the components of the cranes at the Supplier's workshop and transport these components to the MDL site and assemble these components at site.

e. Transportation of the fabricated crane components from the Supplier's workshop to MDL site is a critical activity, and may require transportation to the erection site by barge. Components that are large will be transported to site by barge and the assembly will take place at site.

f. The Erection of shipyard type Level Luffing Jib Cranes is a difficult and complex activity, in view of the physical constraints at the site. It is therefore required that the Supplier indicates in the Technical Bid, probable experienced agencies which may perform this activity. The Supplier should study the requirement by visiting the site, carry out detailed site constraints, finalize the Erection Methodology for erecting the Cranes. **The Supplier should confirm the feasibility of erecting the shipyard type Level Luffing Jib Crane within the present constraints and submit the Erection Methodology along with all necessary inputs and information, to demonstrate the same.** It is required to give a technical presentation of the Erection Methodology at the time of Technical Negotiation. Also all the Temporary works (including the associated civil works) for Erecting Cranes are part of Suppliers Scope of Works and are to be quoted without any exceptions.

g. For the erection of the LL Cranes, approximately 40 to 50 mtr track lengths from either sea side/ land side shall be provided to the crane supplier depending upon the site constraints/ongoing MDL production activities. However, the Crane supplier has to utilize the space in such a manner, so that the access to adjoining workshops should not get blocked and they have to ensure bare minimum inconvenience to the ongoing production activities in the vicinity at that point of time.

h. Compressed air, Electricity and water will be provided at free of cost by the MDL during erection, installation and Commissioning of the Cranes**.**

i. SPECIAL NOTE:

i) If bidder is bringing crane components by sea, then taking permission of MbPT, arranging tugs and boats is in the scope of bidder.

ii) MDL may provide Goliath crane for unloading of crane components in south yard due to space constraints at site for limited period of time in first shift only. Supplier shall intimate requirement of goliath crane 3 days in advance. In this regard MDL's decision will be final.

However, if due to any breakdown of the crane or due to our own production requirements crane is not available, then MDL shall not be held responsible for production held ups and LD waiver will not be considered. Bidder shall use hired mobile cranes of suitable capacity for day to day activities.

iii) If bidder is bringing crane components by sea and unable to unload the same in time due to tidal limitations, then MDL will provide wet basin facility for temporary berthing of the vessel depending upon the space availability in wet basin. For opening of wet basin gates two days' prior intimation is required to make necessary arrangements.

iv) Schedules for shifting of crane components via sea shall be prepared in consultation with MDL executives.

v) For load testing of cranes during commissioning weighing load will be provided by MDL. Slings, shackles will be under Bidder's scope. Arranging competent authority for witnessing and manpower for the same is in the scope of bidder.

17. APPOINTMENT OF THIRD PARTY INSPECTION AGENCY (TPIA)

The crane supplier shall appoint a Third Party Inspection Agency to carry out following activities:

a. To familiarize themselves with the site condition and users need.
b. To review & approve the GA drawings and its suitability for the crane site.
c. To review & approve the design calculation & Crane specifications and to suggest improvement, amendment/alteration, if so required. They should also verify the adequacy of the LL crane design submitted by the supplier.
d. To verify and to approve various drawings submitted by the crane suppliers within a period not exceeding 02 weeks' time during the currency of the project.
e. To carry out stage inspection on site/supplier works either accompanied with MDL executive or solo as per MDL directions as and when felt appropriate.
f. To act as an expert technical guide for the project concerned and to provide required information / solution to the technical issues if so arises during the currency of the project.

g. To devise a checking / inspection mechanism to ensure that cranes are manufactured following sound engineering practices and the cranes are fitted / provided with standard instruments / machines / components etc.
h. To prepare an independent monthly progress report with input from crane supplier and MDL.
i. To safeguard the users, need / purpose of investment in the larger interest of MDL.
j. Inspection / test during erection & final test at MDL site.

i. The crane supplier shall appoint any of these expert agencies such as: ABS / IRS / DNV / BV / TUV/LRS. The crane supplier shall furnish documents pertaining to credentials & past experience of the agency in this field & seek approval from MDL prior to the appointment of a particular TPIA.

ii. The TPIA once appointed shall not be changed till the completion of the project.

18. DRAWING APPROVAL PROCEDURE

18.1 The crane supplier shall submit all design drawings, specifications, literature, erection, testing, commissioning and setting to work programme to the TPIA (third party inspection agency) for approval purposes with a copy to MDL for reference. The TPIA shall respond within two weeks of receipt of such information advising each items approved or those being returned for amendment. The approval procedure for amended items will be the same as for the original submission. However, comments / approval of the drawings by the TPIA will not relieve the supplier of his responsibilities for the correctness, adequacy of design and completeness of his work as per the contract.

18.2 The Supplier shall maintain a complete record of all the changes made to the crane design or construction and supply to MDL in three A0 size sets of “as built” drawings together with two sets of drawings in soft copy, each on a CD-R disc in a PC compatible AutoCAD/PDF/MS Windows format at the time of delivery. Supplier shall grant MDL licence to use and modify documents, drawings and software for the use on the delivered cranes but immaterial property rights shall not transfer to MDL.

18.3 The Supplier shall maintain a complete record of all the changes made to the crane design or construction and supply to MDL in three A3 size sets of “as built” drawings together with two sets of drawings in soft copy, each on a CD-R disc in a PC compatible AutoCAD/PDF/MS Windows format at the time of delivery. Supplier shall grant MDL licence to use and modify documetns, drawings and software for the use on the delivered cranes but immaterial property rights shall not transfer to MDL.

18.4 The Supplier shall be responsible for preparing all necessary electrical drawings as requested by CEA or any other authority through a licensed electrical Supplier and submit the same to the MDL executive for obtaining approval from CEA or any other authority.

19. MINIMUM DRAWINGS AND DOCUMENTS REQUIREMENT

19.1 The drawings and documentation for Level Luffing cranes shall be, as a minimum, including the followings:

a) General arrangement drawings

b) i) Machinery assembly drawings with itemized parts lists and component ratings as appropriate.

ii) The complete technical details of bought out items/components fitted into the cranes along with brochures/manuals etc.

c) Structural arrangement drawings with materials and quantities. **The drawings should also indicate Paintable surface area in Sq. Mtr for the complete structure for record purpose.**

d) Layout drawings of machinery control room(s)

e) Control cabin layout and arrangement showing operators seat, windows, limiting sight lines, location of operating controls and all other significant features.

f) Schematic diagrams of rope reeving systems for all rope motions.

g) Structural erection drawings

h) Machinery/mechanical erection drawings

i) Supplier shall submit in 3 sets of Quality Assurance Plan and Inspection and Test Plan for works at manufacturer's shop and at worksite to TPIA and a copy to MDL.

j) The criteria and supporting calculations used in selecting the individual gearboxes.

k) Supplier shall submit in 3 sets of residual risk details for installation of LL Cranes for following important works (but not limited to) to TPIA for approval and a copy to MDL.

1. Assembly and Erection of 08 no. LL Cranes with associated equipments.

2. Installation of Cabling System with trays and jointing accessories.

3. Installation of LT Cabling System with trays and jointing accessories.

4. Installation of LT Panels with associated switch gears.

5. Installation of Power Factor Improvement System.

6. Earthing System.

l) The crane supplier shall submit in 3 sets of Technical submittals for installation of LL Cranes for following important items (but not limited to) to TPIA for approval with a copy to MDL. Technical submittal shall contain documents as applicable but not limited to Index of documents, compliance

statement, General Arrangement drawings and diagrams, Power and Control wiring diagrams, guaranteed technical parameters of main equipments, Type test certificates for main equipments, Technical Brochures, Bill of Materials specifying technical particulars, rating, quantity, function and make of each component of the equipment.

1. LT Cables, trays and jointing accessories.

2. LT switchgear Panels.

3. Power Factor Improvement System.

4. Earthing system.
5. PLC backup and ladder diagrams in electronic form.

19.2 In addition, the Supplier will supply full documentation for the installed electrical power and control systems for the LL cranes as below:

a) List of all equipment and devices complete with ratings as appropriate.
b) Line diagrams of power distribution system.
c) Simple schematic diagrams depicting each control circuit.
d) PLC logic diagrams.
e) Power supply termination details and termination box.
f) Block diagram showing all conduits, trunking and cable trays with their associated sizes together with all cable sizes identifying insulation and conductor types.
g) Wiring layout diagram indicating the location of each item of equipment, any junction boxes and the routing of each conduit, trunk and cable tray.
h) Connection diagrams for all electrical equipment showing all terminal strips in their correct orientation with each wire and conduit identified.
i) Connection details of the power supply cable within the turn over pit to the yard power supply.
j) General arrangements of lighting and lightning protection and earthing system.

h) Calculation in support of selection of the following items:
(i) Switch gears.
(ii) Size of the power cable.
(iii) Number of cores of control cables and sizes.

All the above details shall be given in both hardcopy and soft copy.

20. HEALTH AND SAFETY

20.1 Permanent safe access must be provided for all operating and routine maintenance functions on the Crane. Safe access means stairways, ladders, platforms, guard rails and all doors, hatches and other openings having safe means of securing in both the open and shut positions all to a standard appropriate to best Indian / European practice.

20.2 Stairways, ladders, platforms shall be made from steel and tread areas are to be provided with a non-slip finish or be constructed from galvanized expanded metal sections of approved design. All guard rails and toe boards shall similarly be of galvanized steel construction. The angle of rake of the stairways shall be such that a man can descend the flight while facing away from the staircase.

20.3 The maximum permitted noise levels that may be generated by crane operation, at ground level, and within the operater's cabin with open windows is 75dB(A). Within the cab with windows closed the maximum noise level shall not exceed 60dB(A). Verification measurement to be done according to the ISO 11202 standard.
Note: These values should be in line with Indian H&S legislation requirement.

20.4 The crane structure and each individual hook shall be prominently marked with their respective safe working load.

20.5 The Supplier must fully comply with all relevant Indian Health & Safety legislation in force at the date of tender submission.

20.6 All required warning signs shall be displayed in English and Hindi as far as possible.

21. DESIGN, CONSTRUCTION AND TESTING STANDARDS

21.1 The International System of measurement units (SI) shall apply throughout. The design, manufacture and testing of all elements of the crane structure and machinery, together with all equipment and components of sub contract and/or external supply shall comply with the appropriate recommendations or requirements of recognized international standards and codes such as:

a) Federation European de la Manutention (FEM)

b) British Standards Institute (BSI)

c) International Electro Technical Commission (IEC)

d) Deutsches Institu fur Normung e.V. (DIN)

e) Indian Standards Institution (IS)

However, following below listed standards is mandatory:

a) FEM 1.001 3edition or BSEN 14985
b) IEC 60204-32- electrical equipment of machines.
c) EN 13586 or ISO 11660-1 crane access.

21.2 The Supplier will be responsible for ensuring compliance with any other relevant standard or code as appropriate and may propose other or alternative equivalent internationally recognized standards provided they are published in English and prove acceptable to the MDL. All Standards shall be the latest version of the relevant Standard.

21.3 A complete schedule of standards and codes that it is intended to employ shall be submitted with the bid (in Part 1 – Techno-commercial Bid) for consideration and approval by the MDL. Changes to approved standards following acceptance of the bid will not be permitted.

21.4 An English language copy of all such approved standards to be employed shall be provided to the MDL after contract signing and before commencement of the design and procurement activities.

22. OPERATOR TRAINING AND MAINTENANCE STAFF TRAINING

22.1 Full training at the site in the safe operation and maintenance of the cranes and all equipment shall be provided to the MDL's nominated personnel by a suitably qualified person, or persons, employed by the Supplier and approved by the MDL. If interpreters are required to assist the exchange of information and instructions from the trainer to the operators, these are to be provided by the Supplier at his own cost.

22.2 The necessary training programs will be developed jointly with the MDL to ensure that the specific operational requirements of the yard and workforce are adequately addressed.

22.3 Training at site will commence during the site assembly stage for the maintenance personnel and continue through testing and commissioning and into the setting to work phase for the crane operators.

22.4 Maintenance training shall include, inter alia:

- routine examination and maintenance
- fault diagnosis
- removal, dismantling and replacement of parts and components.
- basic electrical checks, safety routines and component replacement.
- approach to hydraulic systems overhaul
- maintenance planning records and procedures.
- using bypasses in control system.
- Procedures /instructions for corrections or settings in PLC /VVFD.
- Details regarding the logical integration implemented.
- Swapping of components on emergency.
- Uploading and downloading procedures in relevant concepts.
- Rectification on fibre optic cables-procedures.
- Uploading and downloading of programs to PLC and HMI
- Instruction and familiarization regarding the overall operation and maintenance of the crane including Health and safety provisions incorporated (including the operation of items such as load weighing and limit switches etc.).

22.5 Operational training shall include, inter alia:

a) Safety procedures & SOP
b) Practice at the control and synchronization of the main crane motions, long travel, luff, slew and both hoists.
c) Start up and shut down procedures including use of the storm anchors and any supplementary securing equipment.
d) application of the daily check list.
e) Instruction and familiarization regarding the overall operation and maintenance of the crane including Health & Safety provisions incorporated (including the operation of items such as load weighing and limit switches).

23. OPERATION AND MAINTENANCE MANUALS

23.1 Separate illustrated manuals shall be provided by the Supplier covering the operation, maintenance and parts identification for the cranes and associated equipment and components for LL cranes. Proprietary equipment manufacturer's manuals may be provided where they comply with the requirements of this specification. Where possible the manuals shall be presented in A4 format and be protected from damage by employing durable covers and plastic encapsulated pages.

23.2 The operator's manuals should contain advice and instructions on all aspects of the safe operation and use of the crane including actions to be taken in the event of emergency or breakdown. A start up and hand over check list for the operator shall also be included.

23.3 Manuals of PLC, HMI, VVVFDs, encoders etc. shall be given along with relevant instructions or programs. Detailed interconnection diagrams shall be provided. Manuals of each unit shall be provided. MDL shall receive licence to use system software, application
Drawing "as fitted and commissioned" shall be provided and is a compulsory requirement as per this tender. Fault diagnosis procedures shall be provided.

23.4 The maintenance manual shall include illustrated instructions on what tasks need to be undertaken on a regular basis and how to perform all routine and scheduled tasks. Additionally, a separate document, or set of documents, with exploded isometrics where possible identifying all components and their associated spare part numbers for all items and components of the crane, both for the Suppliers own manufacture and of all sub Suppliers shall be provided.

23.5 Copies of all manuals and illustrations shall also be provided on CD-R discs compatible with a PC system running Microsoft Windows.

23.5 In total 4 (four) sets of paper based and 2 (two) sets CD-R disc based copies of all manuals shall be provided.

23.6 The comparable sets of manuals and CD-R discs for the maintenance instructions shall be marked using the same format.

23.7 All such manuals shall be in English.

24. PACKING MATERIALS

24.1 All the packing material (which shall include hay, straw, wood shavings, wood chips, sawdust, wood waste, wooden pallets, dunnage mats, wooden packages, coir pith, peat or sphagnum moss made of plant origin used for packing shall require treatment including Heat-kiln treatment at 56 degree centigrade for a minimum of 30 hours or Methyl Bromide fumigation at 48 g/cum for 32 hours or chemical impregnation of wood with wood preservatives such as copper arsenic or any other approved treatment as per international standards.

24.2 All the shipments coming into India shall be packed in packaging material confirming to the above standard and shall carry a Phytosanitary certificate issued by an authorised officer at the Country of Origin of the consignment in the format prescribed under International Plant Protection Convention of the Food & Agriculture Organisation.

25. ENVIRONMENTAL AND CLIMATIC CONSIDERATIONS

25.1 All elements and components of supply for the crane shall be suited to performing to reliably and to specification within the environmental and climatic conditions that prevail in the yard as summarized below.

a) Climate – marine / tropical

b) Annual temperature range – typically 15°C to 45°C. Temperatures in direct sunlight may be considerably higher and consideration shall be given to this possibility in the location and specification of any potentially affected elements or components.

c) Relative humidity - Ranging between 50% and 95%.

d) Wind Speeds: The crane shall be designed for a maximum in service wind speed of 20m/sec (72 Km/Hr). The crane and storm anchors shall be able to withstand the maximum out of service wind speed of 53.1 m/sec (191.16 Km/Hr) calculated in accordance with IS 875 (Part 3) 1987.
Earthquake Provision: The crane shall be able to resist the lateral acceleration forces generated by earthquakes of the severity and frequency defined for Mumbai in IS 1893 – 1984 (Fourth Revision).

26. MATERIALS AND WORKMANSHIP

26.1 All major items of equipment and major materials used in the manufacture of the cranes shall have been specified and procured specifically for this contract. No pre used or substandard materials or equipment shall be employed.
26.2 The country of origin and manufacture for all major materials, equipment and systems shall be identified by the Supplier for approval by the MDL.
26.3 In the event, fabrication of the crane structure is being outsourced by the crane supplier, the same should be undertaken under guidance and supervision of the Supplier. However, the Supplier shall be fully responsible for the work done by the fabricator. The Supplier shall provide all required details of the intended fabricator meeting the qualification requirements to the MDL.

26.4 The Supplier shall provide details of the Quality Assurance system operated that must cover all aspects of in house design and manufacture as well as covering the monitoring of quality from external suppliers of sub-assemblies and components. The QA plan shall be approved by the TPIA and a copy to be provided to MDL.

27. POWER SUPPLY

27.1 Power will be provided to the cable anchor pit for connection to the crane trailing cable as below:

Supply: - 3 Phase
Frequency: - 50 Hz
Voltage: 415 V +/- 10%

Total electrical power requirement for each crane is to be given by the Supplier along with bid.

28. CRANE DESIGN CLASSIFICATION

28.1 The crane structure and machinery is to be designed in accordance with the following standard specifications:
FEM/I 3rd Edition 1998
Alternatively, the crane can be designed to BS 2573 – Part 1 1983 and Part 2 1980 and / or BSEN 13001, or any other comparable recognized international crane design standard subject to MDL's acceptance and approval.

Classifications as per FEM standard,

S/N	Particulars	
a)	Structure and complete crane Structure and complete crane	
	Classification of Utilization	U4
	Group Classification	A4
	State of Loading	Q2
	Duty Factor	0.95
	Impact Factor	1.15
b)	Main Machinery	
	Main hoist Group Classification	M5
	Main hoist Classification of Utilization	T5
	State of Loading	L2
	Aux. Group Classification	M5
	Aux. hoist Classification of Utilization	T5
	State of Loading	L2
c)	Slewing Group Classification	M5
	Classification of Utilization	T5
	Loading Spectrum	L2
d)	Luffing Group Classification	M5
	Classification of Utilization	T5
	Loading Spectrum	L2
e)	Travel Group Classification	M5
	Classification of Utilization	T5
	Loading Spectrum	L2

Note: The classification/rating of the crane is not limited to the above, but shall confirm to the latest standards/specifications and the crane has to be designed considering all safety standards. Any safety critical parts of control system shall be minimum Performance Level C as per ISO 13849-1.

29. OPERATING CONDITIONS

29.1 The cranes are to be stable in still air conditions with 160% of the safe working load upon the hook.

29.2 The maximum permissible linear rail loading specified in Clause 25 shall not be exceeded for any possible load, outreach and operating or out of service combinations including, inter alia, dead loads, live load, inertia forces and wind and storm loadings.

The highest loading for any condition shall always remain within the permitted rail load.

30. OUT OF SERVICE SECURING AND STORM ANCHORS

30.1 The crane shall be equipped with clamp, remotely operated from OPERATOR's cabin to secure the crane when not in service. The clamps shall be capable of safely holding the crane against movement by wind with 50% of the wheel brakes inoperative. Electric interlocks shall be provided such that the travelling machinery cannot be energized until the clamps have been released.

30.2 The cranes shall also be equipped with some form of mechanical locking device(s), by **stowage pins** for example, locating into special reinforced anchor location or similar to secure against movement during storm conditions. The device(s) shall be fitted to the crane portal structure on each side of the crane, not to the long travel bogies. Ideally the pins and anchor locations shall provide the resistance to overturning rather than having to resort to separate tie down provisions where the design rules adopted allow for the existence of net overturning moments. Electric interlocks shall be provided such that the travelling machinery cannot be energized until the storm anchors have been released.

31. STRUCTURE

31.1 The main structural elements of the crane are considered to comprise, inter alia, the portal, crane column, slewing frame, machinery house, 'A'-frame, Jib and counterbalance arrangement and the operator's cabin. The crane portal is to have a minimum clear height of 6m to permit vehicle access to the quay.

31. 2 All structural elements shall be made from low carbon weldable steel in accordance with EN 10025, 1993 standards or as dictated otherwise by the crane design code adopted. The minimum allowable thickness for structurally significant elements as per calculations, however, not less than what enables corner rounding as per preworks for surface treatment as per ISO 12944 - C5.

31. 3 The structural members of the crane shall be of rolled steel plates and sections and shall be constructed using electric welding. Counterbalance weights shall be cast iron or cast steel.

31. 4 All enclosed volumes within the structure that are not 100% sealed shall be fitted with weatherproof covers or similar to facilitate inspection. Fully enclosed volumes shall be treated with a wax type corrosion inhibitor immediately prior to final closure.

31.5 Construction joints, such as splice plates in the portal and jib, employing clench bolts or similar high strength friction fastenings shall be assembled with clean metal to metal surfaces. Such joints are then to be fully coated after completion. Other structural bolted joints shall be made by painting the contacting surfaces and assembling whilst the paint is still wet or by having primer paint surfaces and adding flexible sealant (

31.6 Platforms, walkways and stairs shall be designed to accommodate a live load of 3.5 kN/m2 and a concentrated load of 100 kg at any point. All such components

shall be hot dip galvanized to BSEN/ISO 1461 or equivalent internationally recognized standard.

31.7 Where electric cables, hydraulic lines or similar vulnerable items are run through the crane structure access panels shall be provided for inspection and maintenance purposes. All exterior surface runs shall be adequately protected from accidental damage.

31.8 Steel mill cast or batch properties certificates relating to all major structural steel shall be provided to the MDL by the Supplier. The unique steel batch identities shall be traceable throughout all stages of manufacture up to and including site erection. All such certification information shall be retained within the Suppliers QA and internal documentation storage system. This information shall be available for inspection by the MDL on request at any time throughout the operating life of the crane.

32. WELDING

32.1 All welding shall be undertaken using the metal arc process. All welding consumable shall be stored and used in strict accordance with the manufacturer's recommendations and the electrodes selected shall provide weld metal properties as close as possible those of the parent materials. The Supplier shall hold copies of the manufacturer's tests on representative samples of electrodes.

32.2 Structural welding shall only be undertaken at the Suppliers works or within the premises of appointed sub Suppliers.

32.3 All weld spatters shall be removed and welding scars from stray arcs and temporary attachments etc. shall be made good. All free edges of steel work shall be ground or similarly dressed to provide a corner radius in accordance with ISO 8501-3 preparation grade P3 and as required by coating system instructions specification to prevent premature failure of the coating system applied.

32.4 Only adequately qualified welders able to demonstrate their competence through recognized examination or work record shall be employed on the fabrication of the crane.

32.5 All welds will be subject to 100% visual inspection for defects such as undercutting, surface porosity, acceptable weld bead, fillet shape and size. All structural full penetration butt welds shall be subject to 100% NDT inspection by ultrasonic testing or radiography whilst other structural welds shall be subject to 25% NDT inspection on a random selection basis or as per Designer's QAP and approved by the MDL executive. Any significant weld defects identified shall be rectified by the most appropriate means.

32.6 Testing will be witness by an independent TPIA. Copies of test certificates shall be provided to the MDL executive within 7 days of testing.

33. MECHANICAL CONNECTIONS

All high tensile bolts and fastenings shall be supplied with identifying marks and, where employed for structural joints all such fastenings shall be supplied with a recognised corrosion resistant surface finish. All fastenings shall be supplied in

metric sizes. Where high strength threaded fastenings are employed a schedule of fastening torques is to be supplied.
All structural fastenings shall be 12mm diameter or larger and no connection transmitting a design load shall employ less than two fastenings. 5% excess quantities of all types and sizes of site construction fastenings shall be supplied and delivered in total.

34. COATING SYSTEM

34.1 The paint coating system shall be mostly applied within the manufacturer's works in a controlled environment with only damage repair, construction joint painting being permitted on site prior to the application of the top coat. Each paint coat shall be of a different colour to the preceding one to help ensure proper coverage is achieved. All coatings are to be applied in conformance with the paint manufacturer's published requirements. Such requirements are considered to form an integral part of this specification.

34.2 All steel work, both structural and nonstructural, shall be blast cleaned to Swedish standard SIS 05900 grade Sa 2.5 and immediately painted with a zinc based primer. Wherever possible paint shall be applied by airless spray. Where this process is impracticable roller or brush application may be employed although the number of applied coats may need to be adjusted to achieve the desired DFT at each nominal coat stage.

34.3 The paint system of steel structures shall comply with ISO 12944 C5 durability high for external structures exposed to weather. The external finish top coat shall be gloss golden yellow epoxy or polyurethene top coat paints to be used.

34.4 The paint system of steel structures shall comply with ISO 12944 C3 durability medium for internal steel work protected from the weather. The external finish top coat shall be gloss golden yellow epoxy or polyurethene top coat paints. The interior of the machinery house and other areas man accessed shall be gloss white.

34.5 The supplier shall provide suitable colour swatches to enable the precise paint colours to be identified in advance.

34.6 The overall systems shall be designed to provide 05 year coating life with minimum degradation of the top coat colour over this period.

34.7 Coated surfaces will only be inspected when the paint is fully dry. Inspection criteria will include achieved DFT, consistency of application and the physical appearance of the paint coat. The MDL executive may reject unsatisfactory paint work, which shall then be rectified to the MDL executive's satisfaction. The paint coat shall be inspected and certified by TPIA.

34.8 Any repairs necessary to the coating system should be undertaken at the earliest possible opportunity to reinstate the relevant stage and DFT. The coating system in way of the bare steel construction joints shall stepped back, coat by coat, to allow the overall coating system integrity to be achieved on site. The same acceptance criteria as used for the workshops will apply.

34.9 The supplier shall provide approximate paintable crane surface area in square meter after commissioning of the crane.

35. OTHER PROTECTIVE REQUIREMENTS.

35.1 All machined surfaces of machinery or components for assembly and spares shall be protected against corrosion during transit and storage generally in accordance with BS 1133 or similar recognized standard.

35.2 All spare parts forming part of the contract supply shall also be protected from corrosion by packaging or similar means to prevent deterioration during transit and storage. All spare parts shall be adequately identified by name and/or part number as appropriate.

36. MACHINERY

36.1 The machinery design and selection shall be in accordance with those standards identified in Clause 21 and embrace logical equipment layouts that will deliver safe and reliable operation and ready access to all elements for inspection and maintenance including ready removal and replacement.

36.2 All critical items of machinery demanding precise alignment one with another shall be located by means of dowels or fitted bolts.

37. GEARBOXES

37.1 All gearboxes shall, wherever possible, be of reputable proprietary manufacture from standard components. The gearboxes shall be sized to withstand all normal service loads likely to be imposed and to have a predicted life equal to that of the crane.

37.2 The gearbox casings shall all be readily opened for inspection and maintenance of the internals and shall be completely oil tight during operation. Lubrication shall be by oil bath and splash rather than pump circulation. No open gearing allowed.

37.3 The gearboxes shall be of oil-tight welded or cast steel construction and provided with suitable lifting lugs to both halves. Enclosures shall be split horizontally and so arranged that the top half can be easily removed for inspection and repairs without disturbing the bottom half. Small gearboxes can be taken to shop for repair easily and traversing is designed to work with one machinery out.

38. BEARINGS

38.1 All rotating bearings shall be of the anti-friction type of a reputable make and have a service life compatible with that of the equipment on which installed. All exposed bearings (not in gearboxes for example) shall incorporate two seals per side to separately exclude foreign materials and retain the lubricant.

38.2 Pre lubricated sealed for life bearings shall not be used on any of the major crane components.

38.3 The machinery frame with the jib system shall rotate on a slew bearing.

39. ROPE DRUMS

39.1 All drums shall be fabricated from weldable carbon steel and be machined after fabrication and stress relieving. The drum shall carry helical grooves to suit the diameter of wire rope to be used and as specified in the design standard employed.

39.2 There shall be a minimum of 2.5 dead turns remaining on the drums when the hooks are at their lowest point. The laying of the wires during hoisting shall be by means of guide rollers controlled by a scroll mechanism in case of second rope layer. The loss of a wire from either a drum groove or the second rope layer (if applicable) during shall be detected and acted on by control system.

39.3 Only single layer of rope shall be permitted on the drums. At least one spare full wrap of Wire rope on the drums shall be remaining when the hooks are in the fully raised position.

39.4 A full width and depth drip tray shall be provided beneath each rope drum to catch and contain any rope lubricant spill.

39.5 All drums shall be mounted in ball or roller bearings and fitted with fail-safe electro hydraulic or electro mechanical thrusters operating on a full wrap lined band brake. The brakes shall be able to securely hold the design maximum test overload load of the individual winches. Provision shall exist to safely control the progressive release of such brakes to effect the lowering of any load.

39.6 The external brake drums shall form an integral part of the rope drums.

40. WIRE ROPES

40.1 Wire ropes shall be of the pre-formed non-galvanized type of approved construction and from a reputable supplier. The ropes should be conforming to ISO 2408 Standard and be supplied in the pre-lubricated condition. The designed maximum rope load shall be defined using safety factors as per FEM. Rope Safe Working Load (SWL) to be used as given in rope manufacturer datasheet.
40.2 Wire ropes that are operated in pairs (if applicable) from left and right grooved drums shall be constructed to opposite hands. The rope ends shall be secured on each of the drums by means of bolted clamps.

41. ROPE SHEAVES

41.1 The minimum pitch diameter of the sheaves and the groove radius and form shall be in accordance with the requirements of the crane design standard being employed. All sheaves within a particular hoist system shall be standardised with material of cast steel and fully interchangeable one with another. All individual sheaves shall be statically balanced. Bearing diameters for the sheaves shall be equal to or greater than specified within the design standard employed.

41.2 The blocks and trolley sheaves assemblies shall permit easy and ready removal and replacement of individual sheaves, bearings and associated shafts with adequate and safe working space available in all cases. The individual sheaves shall be designed to allow ease of handling.

41.3 The sheaves shall be fitted with suitable covers and collectors to contain, as

far as is reasonable, contamination of the surrounding structure and area beneath the crane from excess rope lubricant. The covers are to be fitted with inspection doors and be designed so as to offer minimum obstruction to the maintenance of the sheaves.

42. BLOCKS AND HOOKS

42.1 The main hoist hooks are to be manufactured from high tensile steel and be of the ram's horn type to DIN15402/BS 3017 or equivalent mounted on roller bearings and fitted with gravity or spring type safety catches generally to DIN15402/BS 2903. The hooks can be manufactured either from steel forgings or by steel fabrication.

42.2 The auxiliary hoist hook shall be of the 'C' type manufactured from a steel forging and equipped with a gravity safety catch generally in accordance with BS 2903 or equivalent. The hook shall be mounted on a ball or roller bearing.

PART C: MAIN CRANE MOTIONS

43. GENERAL

The cranes shall be provided with independent machinery units for hoisting, luffing, slewing and long travelling, each operated by their independent motor(s) with PLC frequency controlled drive. The crane shall be capable of performing all operations (long travel, slewing, luffing and hoisting) at a time with no load. However, for smoother and safe operations the crane with load shall be capable of performing 2 operations at a time.

44. LONG TRAVEL

44.1 When developing their designs for this element of the crane Suppliers shall read this section in conjunction with Clause 65 Crane Rails - giving particularly attention to any limited operational clearances identified.

44.2 The long travel machinery shall consist of a number of identical bogie mounted drive units installed at the corners of the portal leg structures. Typically, the drive units will be powered by intermittently rated totally enclosed AC motor driving at least one a crane wheel through a geared reduction drive. Number and dimensioning of long travel machineries of the crane shall be such that crane can be operated with one machinery out of operation at limited speed. The total installed power shall be capable of moving the crane at 75% of rated speed into the maximum in-service wind with nominal load lifted.

44.3 The drive units shall be provided with step less variable speed with variable voltage and variable frequency control over the full torque / speed range.
Regenerative braking is to be provided for speed control under normal dynamic operation.

44.4 intermittently rated totally enclosed AC motor driving at least one crane wheel through a geared reduction drive. The total installed power shall be capable of moving the crane at 75% of rated speed into the maximum in-service wind.

44.3 The drive units shall be provided with step less variable speed with variable voltage and variable frequency control over the full torque / speed range.
Regenerative braking is to be provided for speed control under normal dynamic operation.

44.4 Each drive unit shall be equipped with an electro-magnetically released brake capable of holding the crane in the stopped condition and providing emergency braking capabilities sufficient to stop the crane with the maximum in service flowing wind and shall be rated 50% higher. With one brake out of service on each side (1 per rail) remaining brakes shall be capable of holding the crane in maximum in service wind.

44.5 All brakes shall be installed within weather proof covers. Drive units shall be provided with a space heater and a humidistat to ensure proper operation after long periods of idleness in a location of very high humidity as defined in Clause 2.

44.6 No open gearing shall be used. Generous ground clearances shall apply. The drive and braking arrangement selected must allow movement of the crane by external means by equipping brakes with release handles or other equivalent solution.

44.7 All crane wheels shall be of the Centre flange type. All wheels and gears shall run in anti-friction bearings. Pinned connections on the crane bogie frames and any load equalizing structures can be mounted in plain, non-ferrous bushes. The loading on each group of wheels shall, as far as can be realised, be made equal.

44.8 Jacking hard points to the concrete surfacing of the cranes track will be in supplier's scope to permit the safe jacking of the crane to allow bogie maintenance to be performed. The Supplier shall provide to the MDL with details of the jacking system being provided within 4 weeks of award of the Contract including;

a) The area of the base plate of the jack.
b) The maximum anticipated vertical load on each jack (including for all potential wind loads).
c) The "in plan" position of the jacking pedestals on the crane bogie and of the jack base plate when jacking is undertaken.

44.9 A weatherproof travel control station is to be provided near ground level at opposite corners of the portal to allow the crane to be moved during maintenance. These control stations to be interlocked to prevent attempted control from both stations at the same time. The stations are both to be automatically isolated from use when the driver's cab is occupied during normal crane operation.

44.10 Audiovisual alarms shall be fitted at eye height on the four ground corners of the crane to be initiated whenever the long travel drive is selected. The crane movement itself shall be delayed by some seconds from the alarms to allow personnel and machinery to move out of danger. The audiovisual alarms shall operate continuously while the crane is in motion.

44.11The following interlocks and limit devices shall be fitted.

a) The limits of track travel in both directions shall be regulated by means of two sets of limit switches. These shall operate in parallel with the cable reel over

travel switches to provide a two stage protection, initially reducing the long travel speed to some 10% of maximum before the drive is switched off and the brakes applied.

b) Crane long travel motion will be inhibited if the storm anchor pins and/or bracing are deployed or if the bogies maintenance jacking points are being used.

c) Trip bars, trip plates or optical sensors are to be provided covering from near rail level to a height of 2 meter, positioned at each corner of the crane to cover the full width of the bogies in the direction of travel. They shall interrupt the long travel drive and apply the brakes if contacted or triggered by personnel or objects.

44.12 Compressible buffers of the Oleo type are to be provided at each corner of the crane compatible with the track end stops. Brushes shall be fitted to the leading edges of each outer bogie to clear the rails of minor debris.

45. LUFFING MOTION

45.1 The luffing motion of the jib may be operated either by hydraulics or a ball nut and screw or a multi sheaved rope system, and shall be powered by an intermittently rated AC motor. The luffing motion control system shall be provided with a frequency controlled variable speed control over the full motor speed / torque range with steps less control.

45.2 The jib must be capable of being lowered to the ground for rope changing and maintenance.

45.3 As a minimum, the luffing system employed shall be duplicated for safety, such that in the event of one element of the system failing the remaining element(s) will be able to securely retain the maximum possible load / outreach combination.

45.4 Two sets of failsafe brake assemblies (one safety brake operating directly on drum flange and one operational brake on the primary (motor) side of the gear) shall be installed on the drive each provided with a positive mechanical link between the applied load and the brake components.

45.5 Normal braking shall be regenerative, regulated by the control system to provide smooth, step less operation. An over-speed sensing system shall be provided that will automatically shut down the motion and apply the brakes if activated shall be minimum performance level c as per ISO 13849-1

45.6 No open gearing shall be used. Generous ground clearances shall apply. The drive and braking arrangement selected must allow movement of the crane by external means by equipping brakes with release handles or other equivalent solution.

45.7 As a safeguard against possible failure of the normal limits extra ultimate travel limits shall be installed bringing the motion safely to a stop and requiring reset to restart motion. If operated at extended lifting height control system shall ensure hook is not lifted into boom during luffing. The luffing control solution shall fulfill minimum performance level c as per ISO 13849-1. Mechanical stoppers to be

provided at both ends in the case of a luffing screw mechanism in addition to limit switches and structural buffers.

45.8 Emergency braking should be sufficient to quickly stop the luff motion with minimum shock in the event of over-travel interlock actuation, reaching the tonne-metre limit of the crane, mains power failure or the application of and Emergency Stop button.

45.9 The luff position of the crane is to be continuously monitored and factored with the hook load information from the main hoist to provide actual tonne-metre loading information. If the design value is reached at any radius the control system shall inhibit any further luff out and only allow the jib to be luffed in.

45.10 The Supplier shall identify the means adopted to comply with all the luffing operating and safety aspects as defined in this section.

46. SLEWING MOTION

46.1 The crane slewing system shall consist of multiple, intermittently rated AC motors operating through reduction gear sets to rotate the superstructure assembly through 360 degrees relative to the portal base.

46.2 The drive motors, or first stage gearboxes input shafts, shall each be fitted with an electromagnetic brake/ electro-hydraulic thruster brake/twin external shoe spring brakes.

46.3 The slewing motion control system shall provide step less variable speed frequency control over the full torque / speed range. The motor speed is to be coordinated with the jib luff position to ensure excessive load travel speeds and centrifugal forces are avoided.

46.4 The crane superstructure shall be equipped with some form of mechanical locking device, by stowage pin for example, locating into an anchor location in crane base structure or similar to secure against rotational movement when the crane is unmanned and out of service. Electric interlocks shall be provided such that the slewing machinery cannot be energized until the locking device has been released.

47. HOISTS (MAIN AND AUXILIARY)

47.1 The hoist machinery shall consist of a winch driven by a rated AC motor through an enclosed reduction gearbox driving the rope drum. Normal braking shall be regenerative and regulated by the electrical control system to produce smooth step less electrical braking.

47.2 A rope tension or drum torque measuring devices shall be provided on all winches to provide continuous load indication readout to the driver's cab. The hoists shall automatically apply load matching counter torque to the drums immediately prior to brake release, whether for further hoisting or lowering, to prevent load snatch. Lowering shall be automatically stopped if a slack rope condition is encountered.

47.3 Normal lowering operations shall be by means of regenerative braking so as to provide continuously variable speed control. In addition, the hoists shall be equipped with electro mechanical or electro hydraulic brakes able to bring a lowering load, up to and including the test load, to a complete and smooth halt in the event of mains supply power failure or the application of an Emergency Stop button and safely hold the load at any position of the lift during normal operations.

47.4 The winches shall each be fitted with an over-speed monitoring and prevention system able to apply the brakes to control the load if necessary that shall be minimum performance level C as per ISO 13849-1. Additionally, the driver's cab shall be provided with readouts depicting either the rope or the hook speed for each winch.

47.5 Two sets of failsafe brake assemblies shall be fitted on the drive. Each of the brakes shall be designed for at least 150% the hoist nominal load. There shall be a positive mechanical link between the winch component that generates the braking effect and the supported load.

47.6 The winch barrel shall be fabricated in steel and flanged at the ends.

47.7 An over-speed switch shall be fitted to the drum that, in an over-speed condition, will shut down the motion drive and apply the brakes. Operation of the hoist motion shall be regulated by the following limits and interlocks:
i) The upper and lower limits of the hoist motion shall have normal slow down and stop limits. Separate ultimate stop limit a short distance beyond normal stop limit shall stop operation and generate a fault.
ii) There shall be fitted a limit switch to stop the machinery if the rope has come out of the rope grooves on the rope drum
iii) There shall be fitted a limit to stop the machinery if there is less than 2 turns of rope remaining on the drum.

47.8 The drive unit is to be equipped with a speed control system providing frequency controlled variable speed control over the full torque / speed range (step less control). The crane shall be capable of lifting the hook above nominal lifting height at smaller outreach; maximum hook height essentially following the arc of constant vertical distance from the boom tip except close to boom up position.

A drum speed indicator calibrated in m/min shall be fitted in the view of the crane operator. The control system safety related functions shall fulfill minimum performance level c as per ISO 13849-1.

47.9 Operation of the hoist motion shall be regulated by the following limits and interlocks:

i) The upper and lower limits of the hoist motion shall have normal slow down and stop limit switches. The switches shall be wired into the control circuit. To safeguard against failure of the normal limits an over hoist limit shall be provided at a short distance beyond the normal stop limit and be wired into the main hoist contactor;

ii) There shall be fitted a limit switch to stop the machinery if the rope has come out of the rope grooves on the rope drum;

iii) There shall be fitted a limit switch to stop the machinery if, with the hook on the ground, there is less than 2 turns of rope remaining on the drum.

PART D: ELECTRICAL EQUIPMENT

48. GENERAL

48.1 All electrical installation work shall comply with the current edition of the IEE (Institution of Electrical Engineers Regulations for Electrical Installations and / or other comparable Indian or international standard.

48.2 The electrical equipment (motors, PLC, VVVF drives, HMIs, Encoders, controls, switches, safety devices, panels, etc.) shall be designed for safe and satisfactory operation under conditions of temperature and moisture as indicated in the main particulars.

48.3 All electrical equipment shall be located for ready accessibility for maintenance, repair and removal. All electrical equipment shall be protected, by means of installing them in closed casings when needed, so as to exclude accidental contact.

49. ELECTRIC SUPPLY

49.1 Power supply to the cranes shall be as stated in Clause No. 27.

49.2 All electrical installations shall be adequately earthed to protect from the consequences of lightning strikes. **Lightning arresters** shall be provided at the upper extremities of the crane and the crane structure shall be electrically bonded to the rail as defined in Clause 29. Use of the long travel bogies and wheels, as the conduction path is not permitted. The Supplier shall provide full details of the system.

49.3 All power distribution cables employed on the crane shall be of adequate size and grade with approved insulation and sheathing. All external cable runs shall be enclosed in conduit, all other runs can be on cable trays, within trunking or in conduit. All cable terminations shall be made through suitable watertight glands. Design provisions shall be made to minimise the probability of condensation occurring at any point in the electrical installation whether in conduits, junction boxes, control cabinets etc.

49.4 Small wiring in control cabinets and consoles shall be made up into replaceable harnesses.

49.5 All electrical cables shall be protected from the possibility of mechanical damage and shall be clearly marked to coincide with the wiring diagrams to be supplied for all systems by the Supplier.

49.6 The crane electrical systems shall be provided with an agreed level of radio frequency immunity and all installed electrical equipment and machinery shall be suppressed against radio frequency generation.

49.7 Every cable shall be properly marked on both sides. They shall be done permanently by hot stamping the identifications on to PVC sleeves. The marking of the cables as per manufacturer's standard proven design is also acceptable. The numbering of the cables shall be systematic such that maintenance staff can easily identify the location, function or electrical system of a cable through the number.

49.8 10% of spare controls cables shall be provided, properly marked and terminated at spare connector or terminal blocks throughout the crane.

49.9 Every cable shall be secured and supported in such a manner that the cable and its termination shall not be exposed to undue mechanical strain.

49.10 Every cable shall be secured and supported in such a manner that the cable and its termination shall not be exposed to undue mechanical strain.

49.11 All power cables used shall be of ISI/BIS or equivalent international standard.All power & control cables shall have copper conductor and of 1100V grade.
49.12 The crane shall be equipped with rail earthing brushes sized to accommodate both welding return currents and lightning strikes. The brushes are to be mounted on the crane structure. The Supplier shall provide full details of the system

49.13 The flexible copper supply cable shall be provided with an earth conductor. Adequate protection to be provided on the entire crane structure against any accidental electric shock to the personnel and materials.

49.14 All electronic and electrical equipment shall be adequately protected from the effects of multiple transient voltages. The crane electrical systems shall be provided with an agreed level of radio frequency immunity and all installed electrical equipment and machinery shall be suppressed against radio frequency generation.

49.15 The crane drive system shall also be equipped to handle the reverse energy generated in the crane to feedback on to the electrical network and also ensure that the harmonics are less than 5% (total harmonic distortion is less than 5%).

50. CABLE REEL SYSTEM

50.1 The cable reel shall be of the bi-directional, mono-spiral type operating at a constant cable tension throughout the full extent of travel in either direction. The cable is to be terminated at a central turn over anchor. The reel shall be driven by a suitable electric motor. The crane long travel drive shall be interlocked with cable reel drive such that it is able to temporarily slow the crane on approach to the turn over position if required. The Supplier shall provide the reeling drum system to suit the existing facility.

50.2 The reel and associated gearbox shall be fitted with over temperature and over tension protection interlocked to shut down the long travel drive in the event of problems.

50.3 The reel shall be constructed from galvanised steel and be sited on the crane such that it fits within the overall envelope of the crane. Reeling in and out shall be synchronised to suit the crane long travel movement and the cable shall be guided onto the reel from the cable trench by means of paired rollers.

50.4 A minimum of 2.5 dead turns shall remain on the cable reel at the extremities of travel. The cable shall be sized to compensate for voltage drop along its length.

50.5 Termination boxes and associated cable glands on the cable reeling system shall be watertight, complying with protection code IP 65 as a minimum. Power take off from the cable to the crane shall be through a totally enclosed slipring collector. The enclosure shall be provided with an anti-condensation heater and

weatherproofed to protection code IP 65. A dedicated separate earthing slipring shall be provided for the cable reel itself. Appropriate sliprings for the communications together with, as number of spare rings for future needs shall also be provided. Each ring shall have minimum two copper graphite spring loaded brush and all the rocker arms shall be mounted on the common assembly to avoid misalignment. Adequate precaution is to be taken for insulation and high moisture content in the atmosphere.

50.6 The cable reel drive system shall be capable of paying out cable whilst in the un-powered condition, in response to wind movement of the crane, without over tensioning the cable.

50.7 Adequate access by staircase and platforms shall be provided to the whole of the Cable Reel system for maintenance purposes.

51. ELECTRIC MOTORS

51.1 The electric motors fitted to all the crane motion drives shall comply with applicable relevant parts of BS 4999 and / or BSEN 60034 or comparable recognised international standards. / Indian standards. Individual hours run meters shall be provided for each motor, or group of motors, associated with each crane motion.

51.2 The hoist motors shall be capable of withstanding an over speed of 10%.

51.3 Motors operating under cover from the weather shall have a protection code of minimum IP 54 whilst any motors exposed to the weather shall be protected to IP 55 standard. All motors shall be of the totally enclosed type. Cooling can be provided by separate external fan or by integral fan depending on rating and duty.
51.4 All motors shall have their windings suitably impregnated to withstand tropical duties and to insulation Class F. suitable for variable frequency drives.

51.5 All motors shall be equipped with anti-condensation heaters and be provided with over temperature protection by means of embedded thermistors.

51.6 Type of motors – AC squirrel cage induction motor suitable for speed control of variable frequency drive.

51.7 The thermal loading of the electric motors should not exceed that of rated current under specified operating condition. (ED % on motor nameplate)

52. LIMIT SWITCHES AND EXTERNAL INTERLOCKS

52.1 All main motions of the crane shall be protected from over travel by means of limits. These as a safety critical parts of the control system shall fulfill minimum performance level c as per ISO 13849-1.
52. 2 Non critical applications may employ non-contacting or proximity devices if preferred.

53. CONTROL EQUIPMENT

53.1 The Electrical room in which the electronic controls and systems are installed shall be suitably air-conditioned. Machinery room shall be suitably ventilated

54. PROGRAMMABLE LOGIC CONTROLLERS

54.1 Modern Programmable Logic Controllers (PLC's) shall be employed for all drive sequencing and system interlock functions interconnected and networked with each other. Details of the communication structure proposed in support of these requirements shall be included within the Tender.

54.2 All components of the PLC's shall be suitable for extended industrial use within the particular operating and climatic environment applicable to the crane. The memory capacity shall be sufficient to contain control algorithms for more than one function and space shall be available to extend the memory to support future developments. The PLC I/O ports shall be capable of being individually programmed to be either input or output and provision shall be provided to provide additional I/O ports if required in the future.

54.3 Access to the series links of the PLC's shall be provided within the driver's cab and the machinery house(s).
54.4 The PLC's shall be provided with programming and monitoring facilities for maintenance and fault logging. Off line revision and development of programmes and documentation production shall also be possible.

54.5 PLC expansion shall be by plug in modules to a common rack. Self-diagnostic capability shall be incorporated in all PLC's both on line during operation and when powered up. All faults shall be visually displayed and signaled by the sounding of an audible alarm, with mute facility, within the driver's cab.

54.6 The PLC programming language employed shall be of PLC make latest generation language. Only authorized users shall be permitted access for program amendments. The system shall be capable of providing real time display of programs and equipment status information to remote sites.
54.7 Back up of PLC programming along with password shall be provided to MDL**.**

55. MAIN SWITCHBOARDS, MOTOR CONTROLS AND DISTRIBUTION BOARDS

55.1 All cabinets shall be designed with heaters, air circulating fans and/or air conditioning as required to ensure that the possibility of condensation occurring within them when in or out of service is avoided and that the maximum operating temperature of installed components and equipment is not exceeded. However, the control panels accommodating VFDs should have air conditioning or be located in air conditioned e-room.

55.2 Control gear for the main crane motions shall include "hours run" meters, circuit testing capabilities and fault indication equipment. Any such faults arising shall be relayed to a conveniently located central fault indication panel able to identify the motion in which the fault has occurred. Fault SIGNAL/messages shall also be provided in the OPERATORs cab.

55.3 The electrical panels and inverters shall be mounted in cabinets.
55.4. The electrical cubicles in air conditioned space shall be of minimum IP 20 Protection. Electrical cubicles elsewhere shall be minimum IP55. All the components of the panel shall be of reputed make and fully confirming to the relevant IS standard

/ equivalent international standard.

55.5 The indicating lamps shall be of LED type.

55.6 All the internal wiring shall be done with proper ferrule numbers at both ends. The wire used for control wiring shall be multi stranded copper wire of size 1.5 sq. mm. In special locations like to PLC I/O cards finer wire can be used. All the internal power cables shall be of multi-stranded copper conductor flexible cables and of required rating.

55.7 All the components and the panel shall have identification name plate. The name plate shall be durable plastic stickers or anodized Aluminum with engraving durably fixed. Paper stickers for identification of the components are not acceptable.

55.8 All the power and control terminations for external connections shall be terminated on the bottom portion of the control panel with suitable rated elmex terminals. There shall be 20 % spare terminals for future use.

55.9 All the cable entry shall be from the bottom of the panel. The gland plate shall be of 3.15 mm thick M.S, powder coated plate. All the cables required for the connection of the motor, resistance box, master controller and the brake with the control panel including earthing cables shall be in vendor's scope. All brass cable glands and copper cable lugs required for the termination of the external cables and termination of all the cables shall be in vendor's scope.

55.10 A wiring diagram of the specific cabinet components shall be provided on the inside of the cabinet doors.

56. WIRING

56.1 Where the control system wiring or similar vulnerable means of transmitting electrical or electronic signals are run through the crane structure, access panels shall be provided for the inspection and maintenance purposes. All surface runs, whether exterior or interior, shall be adequately protected from accidental damage.

57. CRANE MANAGEMENT SYSTEM

57.1 A Crane Management system shall be proposed by the Supplier. This system shall at a minimum comprise the following elements:

a) Crane Operations Monitoring and Management.
b) Crane Fault Monitoring, Diagnosis
c) Crane Condition Monitoring

57.2 The systems provided shall be capable of informing a remote interrogation facility of the full results of the diagnostic and condition monitoring i.e. the information displayed on the Electrical Equipment House VDU – and enable remote diagnostic where the problem is not hardware related – or can be ameliorated by adjustments to settings embedded in the software.

a) Crane Operations Monitoring and Management.

This system shall monitor and record all movement and lifting operations undertaken by the crane for collecting, visualizing, managing and analyzing the crane data. Like bar diagrams for the frequency of alarms and events. Ready-made reports. Machinery run hours and number of starts. Load spectrum diagrams.

b) Crane Fault Monitoring and Diagnosis

System needed to provide clear reports for analyzing the use and help preventive maintenance and troubleshooting. The diagnostics module provides real-time information and assistance for troubleshooting. Real time alarms, events and faults data shall be available. Status of field bus connected devices shall be visually presented. Crane manuals and drawings shall be available in the system. Further crane shall be equipped with remote connection for supplier to provide trouble shooting service if requested. MDL shall be able to turn on and off the connection.

c) Crane Condition Monitoring Facility

In conjunction with the Diagnostic Facility referred above, a condition monitoring facility shall be provided. Signal presentation with the trend tool as a function of time. Diagrams for the frequency of alarms and faults.

58. INSTRUMENTATION

58.1 As a minimum the following information/instruments shall be provided in a readily visible
location(s) within the main control panel(s) or in crane management system:
a) A non-re-settable "hours run" meter for each of the main crane drive systems
b) Voltage and ampere meters monitoring the incoming supply as well as the individual power demands of the individual crane drive systems.
c) KVAR and Kilowatt hour meters for the complete crane.

59. COMMUNICATIONS

59.1 Telephone shall be provided within the OPERATORs cabin, within the machinery house and at the portal base adjacent to the access stairs.

59.2 The OPERATOR's cabin shall be provided with a microphone/loudspeaker and microphone/transceiver system so that he can communicate readily with people on the ground and on board ships alongside slipway. In addition to the fixed transceiver one portable personal sets shall also be supplied.

60. CONTROL TRANSFORMER

60.1 Independent transformers shall be provided for the control circuits.

61. VVVF DRIVE SYSTEM & E -House:

61.1 Reputed make of Common DC bus Regenerative crane duty type VVVF drives listed in preferred make shall be used.

61.2 VVVF drives shall withstand 500VAC. Converters & Inverters shall be separate unit.
61.3 VVVF drives shall be located in air-conditioned electrical room.
61.4 All VFD drives shall be housed in E-House.
61.5 E- House shall have air conditioning system.

62. LIGHTING

62.1 The crane shall be equipped with exterior LED floodlights able to illuminate the crane working area to an average illumination level of 50 lux.

62.2 Access lighting for stairs, walkways and platforms shall be enclosed in weatherproof bulkhead or overhead fittings and shall be able to provide adequate illumination without dazzling users. Interior lighting shall be designed to provide for maintenance and operational activities and provide an intensity of not less than 300 lux overall. Lighting to compartments containing moving machinery must not produce any stroboscopic effect. The lighting fixtures shall be LED lighting fixtures.

62.3 Red neon aircraft warning lights shall be fitted at the highest point of the jib in the fully luffed in condition in accordance with the FAA Regulations applicable to the site. The lighting enclosure shall conform to IP67. The mountings shall be of the anti-vibration type to give an overall lamp life expectancy of more than 20,000 hours. These warning lights shall be fitted with continuously charged standby batteries, or other approved power source whereby the lights shall remain fully illuminated for a minimum period of 36 hours in the event of failure in the mains power supply to the crane.

62.4 All lights and lamps shall be readily and safely accessible for repairs/replacement. The floodlights shall be positioned to allow such replacement be undertaken during normal crane operations safely, without the use of temporary platforms or scaffolding.

62.5 Walkway lights and floodlights shall be controlled from the OPERATOR's cab, from the machinery house and from selected access locations on the crane.

62.6 All main lighting circuits shall operate on 240 V, single phase, 50 Hz supply.

62.7 Continuously trickle charged battery or powered emergency lighting shall be provided to enable personnel to safely exit from the crane in the event of a total mains power failure. This emergency lighting shall give a minimum level of illumination 50 lux in all working or accessible areas of the crane. Portable automatic recharging hand lamps are to be provided in the OPERATOR's cab and machinery house and any other locations where maintenance personnel are likely to be active. Ampere-hour of battery / battery capacity is to be stated.

63. SOCKET OUTLETS

63.1 A range of socket outlets are to be provided within the machinery house and OPERATOR's cab and at suitable locations inside and outside the crane structure as follows:

a) 240 V, single phase, 50 Hz supply.
   2 – inside OPERATOR's cab
   4 - inside machinery house
   1- near cable reeling drum

b) 110 V (55 V to earth), single phase. 50 Hz supply
4 – on outside of crane structure

c) 24 V DC.
1 – inside OPERATOR's cab
1 – inside machinery house

2 415 V, 3 phase, 50 Hz, 10 kVA – Welding Set Supply
1 – inside machinery house

63.2 All supplies are to be protected with overload and residual current device (RCD) circuit breakers or suitable switch/fuse arrangements.

64. CRANE BUFFERS

64.1 Spring loaded end stopper shall be provided at both side of Crane bogie ends (Seaside and Shop side)

PART E: TECHNICAL SPECIFICATIONS

65. CRANE RAILS

The cranes will be duplex rail mounted, of the portal level luffing slewing type with a single boom jib and equipped with main and auxiliary hoists. The specified minimum required performances are as below:

a) The rails are duplex ISCR 80 type to suit Centre-flanged wheels.
b) There is no height difference between the rails. Rail tolerance as ISO 12488-1
c) Radius of sharpest curve = 250 M approx. for LLC no. 12 & 17.

d) **Maximum permissible wheel load is,**

i) For LLC crane Nos. 12,13,14,16,17 = 35T

ii) For LLC crane no. 10 = 40T

iii) For LLC crane no. 9 & 11 = 16.3T & 28.3T respectively

66. CRANE DETAILS (Technical specifications)

66.1 The cranes will be rail mounted, of the portal level luffing slewing type with a single boom jib and equipped with main and auxiliary hoists.

66.2 **The crane shall be Class duty 2 i.e. Medium duty for general use.**

66.3 Each crane shall be capable of lowering down the jib to the ground level to facilitate easy maintenance of crane.

66.4 Separate motors to be provided for each mechanism of crane.

66.5 Centralized lubrication system to be provided in each crane & access for all the lubrication points to be provided to facilitate maintenance of crane.

66.6 Capacity of cranes: - Following is the requirement of capacity cranes,

Details of L. L. Cranes					
Sr. no.	**Description of crane**	**Type of hoist**	**SWL. Capacity of hoist**	**Maximum radius**	**Minimum radius**
1	L. L. Crane no.9	Main Hoist	15T	33.5M	11M
		Aux. Hoist	5T	35.5 M	13M
2	L. L. Crane no.10	Main Hoist	50T	33.5M	12M
		Aux. Hoist	10T	35.5 M	14M
3	L. L. Crane no.11	Main Hoist	20T	33.5 M	11M
		Aux. Hoist	7.5T	35.5 M	13M
4	L. L. Crane no. 12	Main Hoist	25 T	33.5M	11M
		Aux. Hoist	5 T	35.5 M	13M
5	L. L. Crane no. 13	Main Hoist	25 T	33.5M	11M
		Aux. Hoist	5 T	35.5 M	13M
6	L. L. Crane no. 14	Main Hoist	25 T	33.5M	11M
		Aux. Hoist	5 T	35.5 M	13M
7	L. L. Crane no. 16	Main Hoist	60 T	40 M	13M
		Aux. Hoist	5 T	44 M	18.5 M
8	L. L. Crane no. 17	Main Hoist	25 T	33.5M	11M
		Aux. Hoist	5 T	35.5 M	13 M

66.7 OBSTRUCTIONS: Distances from nearest fouling point,

Sr. no.	**Crane No.**	**Track length**	**CRS. Of double rails**	**Nearest distances up to nearest rail centerline**			
				From existing building / workshop	**From incomer panels**	**From fire hydrants**	**From bollard**
1	LLC no.9	220M	7.6 M	Refer attached drawings at annexure-A			
2	LLC no.10	220M	7.6 M	Refer attached drawings at annexure-A			

3	LLC no.11	220M	7.6 M	Refer attached drawings at annexure-A			
4	LLC no. 12*	360.65 M	6.096 M	0.8 M	0.57 M	0.39 M	0.98 M
5	LLC no. 13	240 M	6.096 M	1.47 M	0.68 M	0.69 M	1 M
6	LLC no. 14	215.15 M	6.096 M	2.2 M	0.55 M	0.55 M	1.1 M
7	LLC no. 16	142.23 M	10 M	3.17 M from workshop wall / 1.5 M from gas station	-	-	-
8	LLC no. 17*	360.65 M	6.096 M	1.03 M	1.2 M	-	1.39 M

*** - L. L. Crane no. 12 & 17 travels on same track.**

66.8 Range of lift: -

Sr. no.	Crane No.	Lift above rail	Lift below rail
1	L. L. Crane no. 09	33 M	7 M
2	L. L. Crane no. 10	35M	7 M
3	L. L. Crane no. 11	35M	7 M
4	L. L. Crane no. 12	29 M	9.1 M
5	L. L. Crane no. 13	29 M	9.1 M
6	L. L. Crane no. 14	29 M	9.1 M
7	L. L. Crane no. 16	36.5 M	4.5 M
8	L. L. Crane no. 17	29 M	9.1 M

66.9 Clearances of cranes :

Sr. no.	Description of crane	Minimum clear height to underside of jib or revolving structure	Tail radius from Centre of crane	Portal Clearance (Min)	Crane Mast height
1	L.L. Crane no.9	19.8M	6.786M	6 M	35M
2	L.L. Crane no.10	19.8M	8.534M	6 M	35M
3	L.L. Crane no.11	19.8M	6.786M	6 M	35M
4	LL Crane no. 12	13.2 M	6 M	6 M	32.8M

5	LL Crane no. 13	13.2 M	6 M	6 M	32.8M
6	LL Crane no. 14	13.2 M	6 M	6 M	32.8M
7	LL Crane no. 16	27.55 M	9.75 M	7.5 M	40.8M
8	LL Crane no. 17	16.85 M	6.096 M	6 M	31.377M

66.10 Speed (maximum): Following are the requirements of speed range for crane motion. However, supplier can propose different speeds depending upon their design calculation and in consultation with MDL.

Crane No.	Aux. Hoist	MH	LUFF	SLEW	LT
LLC 9	0-40 m/min	0-20 m/min	0-18 m/min	0-0.5 rev/min.	0-40 m/min
LLC 10	0-40 m/min	0-15 m/min	0-10 m/min	0-0.5 rev/min.	0-40 m/min
LLC 11	0-40 m/min	0-20 m/min	0-18 m/min	0-0.5 rev/min.	0-40 m/min
LLC 12	0-40 m/min.	0-20 m/min.	0- 18 m/min.	0-0.5 rev/min.	0-40 m/min
LLC 13	0-40 m/min.	0-20m/min.	0-18 m/min.	0-0.5 rev/min.	0-40 m/min
LLC 14	0-40 m/min.	0-20 m/min.	0- 18 m/min.	0-0.5 rev/min.	0-40 m/min
LLC 16	0-40 m/min.	0-12 m/min.	0-15 m/min.	0-0.5 rev/min.	0-40 m/min
LLC 17	0-40 m/min	0-20m/min	0-18 m/min	0-0.5 rev/min	0-40 m/min

66.11 General Requirements for each crane:

a	All motions shall offer variable speed with steeples control from zero through to the load-limited maximum.	
b	other requirement	1. Air conditioner for VFD drive system & operator. 2. Anemometer for wind speed interconnected with cranes operation for safety purpose and display. 3. Load indicator and load cell Make: 5. HMI Display in the cabin. 6. Crane management system for trouble shooting. 7. LT machinery shall be with brake operation indication and without open gearing 8. Electro Hydraulic service brake & emergency disc brake for Luffing machinery and two electro hydraulic service breaks for main &aux hoist each. 11. Limit switch & E- Stop for all the motions. 12 Audio visual Hooter/siren for LT motion. 13. PA system for communication between operator & helper standing below crane. 14. Strom anchor system. 15. Centralized manual lubrication system. 16. Peripheral lighting system (LED). 17. Electric hoist for maintenance purpose. 18. Boom rest stand of suitable capacity shall be

		provided to carry out replacement of the wire rope. 19. Gantry anti-collision system 20. Common DC bus regenerative drive system. 21. Aviation light & Lighting arrester for each crane. 22. **Tandem operation System shall be provided for crane no.12 & 17. L. L. Crane no. 12 & 17 travels on same track.**
c	If the contractor's standard operating speeds are different from but are generally comparable to the above-specified values, the standard speeds should be offered for consideration by the MDL with such deviations highlighted within the tender documents.	

67. HYDRAULIC EQUIPMENT AND LUBRICATION REQUIREMENTS

67.1 Where fitted, hydraulic systems shall be designed and installed in accordance with DIN 19705 to provide smooth, controlled operation. Pipe diameters shall be generous and pressure relief valves are to be fitted at all necessary locations to avoid over pressure situations. Pressure gauges shall be installed on all systems as required. All piping shall be amply supported to prevent vibration and all radiuses and bends proportioned to minimise the likelihood of cavitation. Bleeding points shall be provided at high points in each system and the necessary bleeding sequence instructions provided in the maintenance manual.

67.2 Oil reservoirs shall be of generous capacity, baffled internally to minimize surge and fitted with magnetic drain plugs. They shall be vented to atmosphere through filtered breathers with desiccants and water drains shall also be provided.

67.3 The maximum permitted oil hot spot temperature within any reservoir is 60°C.
67.4 Pump flow and return lines are to be fitted with full flow filters of 10 microns filter capability or better to suit the components employed. Filters shall be fitted with pressure drop blockage indicators and integral bypass as elements of the control/alarm system.
67.5 The Supplier shall provide catch trays or similar such that wherever hydraulic fluids are to be bled or drained from the system, the resultant releases of hydraulic fluid can be captured and removed from the crane without spillage occurring such that they can be disposed of in a controlled manner.

67.6 Where possible hydraulic cylinders shall be parked in the retracted position and fitted with both pressure and wiper seals for the exclusion of dirt. If possible short stroke cylinders shall be fitted with gaiters.

67.7 All design use of hydraulic components must comply with manufacturer's recommendations.

68. LUBRICATION

68.1 Wherever possible all regular, routine lubrication requirements shall be mechanised, employing small bore piping to pressure distribute lubrication from

central filling locations to all necessary locations. All individual grease lines shall be labelled indicating the item being lubricated.

68.2 Manual lubrication sequence should be initiated.
68.3 Where manual lubrication is retained all grease nipples etc. shall be brought to convenient and accessible central locations. All nipples shall be approved by MDL.

68.4 Lubrication and oil fill points shall be clearly and permanently labelled with the type of lubricant to be used. A list of all recommended lubricants and oils required for the crane shall be submitted to the MDL's approval that these lubricants and oils are all readily available from stock within India. The Supplier shall be responsible for the first fill of all lubricants and for ensuring that the crane is correctly lubricated in all areas before commencement of testing and commissioning activities.

68.5 All pressure lubricated machinery shall be provided with renewable oil filters equipped with pressure drop blockage indicators.

68.6 To the extent practicable, the Supplier shall provide catch trays or similar such that wherever Lubricants including greases and oils are ejected or otherwise removed from the system concerned, the resultant releases of the greases and oils can be captured and removed from the crane without spillage occurring such that they can be disposed of in a controlled manner.

69. PIPING OF HYDRAULIC AND LUBRICATION SYSTEMS

69.1 Where pipe systems carrying hydraulic fluid or lubricants are run through the crane structure, access panels shall be provided for the inspection and maintenance purposes. All surface runs, whether exterior or interior, shall be adequately protected from accidental damage.

PART F: MISCELLANEOUS REQUIREMENTS

70. MACHINERY HOUSE

70.1 The main hoist, auxiliary hoist, and luffing machinery shall all be housed in a single weatherproof steel framed and steel clad machinery house mounted on the slewing superstructure. Converter/inverter cabinets together with the main electrical control panels shall be in air conditioned electrical room.
70.2 The machinery house shall have two personnel entrances. Each shall provide a completely separate exit route from the machinery house to the quay. Both doors shall be half glazed with wired glass and fitted with locks. Two 10 kg CO2 portable fire extinguishers shall be provided on permanent brackets close to floor level, one at each entrance.

70.3 The machinery house shall be force ventilated through a filtered intake if such a measure is necessary to maintain ambient temperature within permissible limits. The ventilation system shall be designed to ensure low noise level and for comfort of the technician during maintenance works while the crane is in operation. Air filters shall be easily accessible and readily replaceable.

70.4 A rope reeving winch or similar consideration shall be provided to assist with rope changing. The design and layout shall be such as to facilitate rope changes for

each of the rope drives.

70.5 A fenced double trap door shall be provided in the floor for maintenance purposes. An alternative to this could be suitable arrangements for the removing and replacing of machinery items through the roof of the machinery house. The aperture shall be large enough to pass the largest individual item of machinery to quay level.
70.6 Sufficient space shall be provided for a work bench, with MDL executives vice, storage space for lubricants and a cabinet with lock for tools and small electrical spare parts.
70.7 The machinery house shall be provided with electrically operated hoisting arrangement of adequate capacity to handle the material from the ground to the machinery house. The opening size in the machinery house to allow access of biggest size of crane component (gear box, electric motor etc) and the capacity of hoist shall be adequate to hoist and lower these components (except rope drum) to and fro from the ground level.

70.8 Adequate space shall be arranged for the maintenance of the equipment installed and exhaust fans shall be provided in the machinery house. Air duct for sufficient air circulation shall be provided if necessary.

71. OPERATORS CABIN

71.1 The OPERATORs Cabin shall be fully weatherproof and located at the front of the slewing frame at a level that provides the optimum visibility for the OPERATOR. Access shall be from weather and waterproof naturally and artificially lit platform or staircase, not a near vertical ladder. The rake of the staircase shall be such that a man can descend the flight while facing away from the staircase.

71.2 The cab shall comprise a fully enclosed rigid steel framed and clad structure. It shall also be suitably insulated and trimmed inside and fitted with a lockable weatherproof access door positioned to the rear. The minimum clear unobstructed height within the cabin shall be 2.2m above floor level. The minimum clear unobstructed height of the door shall be 2.0m over any cell provided. The floor shall be covered with a suitable non-slip finish capable of easy cleaning out.

71.3 The cabin windows shall all comprise flexibly mounted safety glass and should be positioned so as to provide excellent vision and unobstructed lines of sight ahead, below and to both sides. Any roof or floor glazing installed shall be fitted with a hinged protective grid. All glazing shall preferably be capable of being opened adequately or fully turned for ease of cleaning from the inside of the cabin and should be tinted as necessary to minimise solar gain and provide ultra violet filtering. Any glazing not accessible for cleaning from the inside of the cabin shall be provided with secure external access platforms, walkways and ladders as appropriate. Electrically operated variable speed wipers shall be provided together with screen washers to all main windows.

71.4 The inside of the cabin shall be shaded from direct sun as far as is operationally reasonable and a separate, false, overhanging canopy roof shall be provided. The cabin shall be air conditioned. The cabin shall also be provided with Wall mounted oscillating fan.

71.5 The OPERATOR's seat shall be comfortable, ergonomically designed and upholstered in a material suited to the climate. It shall be fully adjustable, fore and aft and for height. The main crane functions shall be operated by means of joystick controllers, switches, buttons etc. as appropriate situated on or in close proximity of the chair arms. A lift up seat, for a driving instructor or second person, shall be provided and fixed to the rear or side walls of the cabin.

71.6 All electrical contractors, relays etc. within the cabin shall be collectively mounted within a single sheet steel enclosure fitted with a locking door. A small document cabinet and work top shall also be provided. A 3kg portable CO2 fire extinguisher shall be mounted in the cabin within easy reach of the OPERATOR.

71.7 The cabin shall be provided with an emergency door unless an immediately convenient emergency escape exists adjacent to the existing exit at cabin level.

72. SAFE LOAD INDICATOR AND RADIUS INDICATER

72.1 Safe load indicators (HMI) for the main hoist and auxiliary hoist shall be fitted in the
OPERATOR's cabin providing dial scale information on the loads on each hoist. A visual indicator and audible alarm shall be provided to advise once 95% of the designed working load for any hoist has been reached. An audible alarm shall be sounded if 105% of the designed working load is reached.

72.2 Control system shall stop movements in case of overload and only allow driving in direction of reducing load. Overload protection shall fulfill minimum performance level c as per ISO 13849-1.

72.3 Luff radius indicator (HMI) shall be provided and shall be of digital display type with fitted in suitable place for easy maintenance. This shall be interconnected with loading of the crane for main hoist and auxiliary hook. Suitable warning and shutdown facility shall be provided to prevent overloading and exceeding limit of radius of the crane. Luff indicating system shall be reliable and rugged construction.
72.3 Accurate device shall be provided to read the exact load (+/- 5%).
72.4 Load indicator shall work in synchronization with radius indicator.

73. EMERGENCY STOPS

73.1 Emergency stops shall be provided at the following locations on the crane.

a) at ground level adjacent to the crane access points on the portal

b) at ground level at the extremities of the long travel bogies

c) in the OPERATOR cabin

d) in the machinery house

e) at the ground travel control station

f) at the crane power supply isolator.

73.2 Any one of the emergency stops shall be capable of tripping all control circuits.

73.3 The Emergency Stops shall be of robust construction and have yellow bodies and red mushroom heads. When depressed the red mushroom head will not be released automatically except for the OPERATORs Operating Panel. Depression of the red mushroom head will immediately activate an Emergency Stop in all motions. A red light indicating which Emergency Stop was depressed on the OPERATORs Operating Panel to be provided. When the cause of the Emergency Stop being depressed has been investigated and corrected, the OPERATOR may restart his crane using the appropriate security system and start up procedure and release the depressed Red Mushroom Head Emergency Stop. Emergency stop implementations shall fulfill minimum performance level c as per ISO 13849-1.

74. ACCESS PREFERENCES

74.1 Wherever possible foot access to the crane shall be by stairs rather than ladders. Landings shall be provided to all stairways at not more than 9 meter intervals. Staircases shall not exceed 50 degrees from the horizontal.

74.2 All staircases and platforms shall have continuous toe boards, intermediate and upper handrails provided. The intermediate and upper handrail tubes and supporting stanchions shall be purchased from a specialist-approved manufacturer of such systems and designed and installed in conformance with his recommendations.

74.3 The provision of access holes in platforms, walkways and staircases is not permitted for any purpose.

74.4 Ladders shall not be used unless there is no realistic alternative and the Purchaser's prior agreement is obtained. This requirement applies to both access and emergency escape routes. Where ladders are approved, safety hoops commencing at 2.2m meter above the foot of the ladder and continuing to a height of 2.2 m above the top landing shall be provided. Ladders shall be of the single rung type with rungs spaced not more than 230mm apart. Additionally, a swing up safety bar shall be provided at the height of the upper handrail on the adjacent platform. The angle through which a swing up safety bar shall travel shall not exceed 85 degrees.

74.5 Alternative exit routes of walkways, platforms, stairways and ladders, shall be available to enable the OPERATOR and any maintenance personnel escape from the crane cabin and machinery house areas in an emergency.

75. WIND SPEED MONITORING

75.1 The crane shall be fitted with an anemometer to continually monitor and display to the OPERATOR the 3–second average wind speed. An audible alarm shall be sounded in the OPERATOR’s cabin in the event of the wind speed exceeding the maximum allowed for crane operation.

75. 2 The alarm shall be repeated by claxon or similar, external to the cabin, such that all personnel on the ground beneath the crane are made aware of the situation.

76. NOTICES AND LABELS

76.1 Safe working load notices shall be prominently displayed on the structure of the cranes in both English and Hindi.

76.2 All notices and labels within the OPERATOR's cabin shall be in both English and Hindi.

76.3 Filling points for water, lubricating oils and greases, tank capacities and other similar maintenance instructions shall be in both English and Hindi.

76.4 All crane manufacturers rating and identification plates shall be in English.

76.5 The crane Manufacturer must submit the locations, styles and sizes proposed for all significant notices for approval by the MDL. Notices and labels shall be manufactured from steel, brass or durable plastic. External notices shall be painted and manufacturer's rating plates stamped. General labels shall be engraved from white/black/white sandwich plastic or similar to provide black lettering on a white background. Emergency labels etc. shall be engraved to provide red lettering on a white background. All labels shall be mechanically secured by screws, rivets or similar. Adhesive labels are not permitted.

76.6 Both side walls of the crane machinery house shall be painted with the MDL logo and the following legend in large blue lettering. The precise colour blue to be applied will be selected from a selection of colour swatches provided by the supplier.

76.7 Before dispatch to site for assembly and erection all connecting items, whether mechanical, electrical or structural shall be suitably identified and, where appropriate, also carry orientation marks to prevent miss-assembly. Identification marks shall be positioned such that they will remain visible throughout the assembly or erection process. Small loose items shall either be securely wired to associated parts or bagged. All such items shall be clearly identified. Nuts, bolts and washers shall be bagged and identified by size and material specification.

PART G: TESTING

77. TESTS AT WORKS

77.1 Crane components / sub-assembly shall be tested and inspected at various stages during fabrication / manufacturing (prior to erection) by TPIA either accompanied with MDL executive or solo as per MDL directions as and when felt appropriate. Inspection / test during erection and final test shall be done by TPIA & MDL executive jointly.

77.2 The following minimum tests/inspections shall be undertaken at the Supplier's works or have been undertaken by main materials and equipment suppliers to the Supplier. Suitable certification shall be provided in all cases.

77.2.1 Examination of material, its identification and issue of test certificates for compliance with the MDL's requirement,

77.2.2 Checking the dimensions of the component / sub-assemblies / assemblies as per the manufacturers drawings and testing thereof

77.2.3 Physical properties tests in accordance with standards for:

a) Main structural and high tensile steel plates and sections.

b) Shafts.

c) Wire ropes – sample test to destruction.

81.2.4 Magnetic particle inspection on:

a) All major castings.

b) All major forgings.

77.2.5 Weld Tests and Inspections:

a) for requirements refer Clause 36 Welding above

b) during fabrication

c) all records with respect to welding inspections, tests, defects and the rectification thereof shall be retained by the Supplier until the crane is Ultimately removed from service and demolished.

77.2.6 Functional tests to demonstrate the correct operation of all control and alarm equipment shall be conducted.

77.2.7 The major crane structural components shall, where size permits, be trial assembled within the Supplier's works or, where this is not possible the erection interfaces shall be demonstrated to be compatible, one with another, by use of photogrammetric or similar techniques.

77.2.8 All machinery elements shall be assembled sufficiently to be capable of being tested under no load for proper operation and control of all speeds and directions and that feedback information and interlock functions are also correct.

77.2.9 Any other test as required by the TPIA.

77.3 Following successful testing all components requiring dismantling for transport and shipment shall have all their mating faces etc. marked to assist reassembly and where necessary, realignments ensured by use of doweled locations.

77.4 The MDL and / or TPIA to witness certain of the works / equipment tests. The Supplier shall provide a schedule of all the proposed inspection stages during the manufacture of the crane. The Supplier shall provide ample advance notification of all impending tests to the MDL.

78. COMMISSIONING

78.1 The commissioning tests shall be conducted by the Supplier's personnel and demonstrate the overall suitability of the cranes for the shipbuilding function intended together with proof of specified performance as required in Clause 80 above and amply demonstrating operational reliability.

78.2 The test weight, lifting beams and load frames such that a variety of test loads up to the overload test weight can be securely assembled and safely used in all Tests undertaken at the Shipyard and during the Setting to Work period, shall be provided by MDL. However, the fibre slings and shackles of requisite capacity will have to be provided by the Supplier.

78.3 Any breakages or component or equipment failures that arise during commissioning shall be rectified or replaced at the Suppliers cost and without penalty to the overall crane guarantee. All tests associated with the breakage or failure shall be repeated.

79. PERFORMANCE TESTS

79.1 The Supplier shall perform fitness tests of the cranes to include functional, load tests, endurance and trial operations type work. After the cranes have successfully completed all such tests to MDL's satisfaction a certificate of crane competence will be issued to the MDL including a certificate from a Competent Authority under the Factory Act.

79.2 Upon receipt of the certificate the MDLs representatives and their operators will conduct the performance tests under supervision of TPIA. The performance tests to include, inter alia:

a) Operation of all emergency stops, interlocks and safety equipment.

b) Long travel, luff, slew and hoist speed and function tests.

c) Rated load tests.

d) Over load test in accordance with design standard requirements.

e) Noise level checks.

f) emulate satisfactory working of the wind speed monitoring and alarm system

g) Any other requirement of a Competent Authority under the Factory Act

79.3 The Supplier shall provide details of all proposed procedures and methods for each discrete test at the tender stage for discussion. Testing will be undertaken in accordance with the agreed finalised procedures and methods and to the satisfaction of the MDL/TPIA that the results are in accord with the Contract Specification.

80. DURABILITY

80.1 The crane will be subjected to a durability test after successfully completing all performance tests. Durability shall be proven by subjecting the crane to a period of continuous simulated operation at its maximum designed load. The test shall include representative deployment of the luff and slew motions and the portal long travel drive.

81. SETTING TO WORK

81.1 Once the crane has successfully completed all formal testing it will be handed over to the MDL so that shipbuilding and operations can begin.

82. CERTIFICATION

82.1 The Supplier shall supply test certificates in accordance with the relevant statutory requirements following completion of all necessary tests to the MDL.

PART H: MAINTENANCE

83. GUARANTEE/WARANTEE

83.1 The Supplier should have established service network to rapidly attend to crane breakdowns and repairs during and after the guarantee period. Details are to be included in the Tender Document. A **Guarantee** against damage or failure due to **breakdowns/ defects** for a period of 36 months from the date of final acceptance of the crane at MDL site.

83.2 During the Guarantee period of 36 months, after satisfactory acceptance of the crane. the crane supplier should respond to any notice of defect / malfunction / under performance of any of the crane components within first 48 working hours of such notification from MDL. Also, such defect should be resolved / set right within reasonable period of time. The supplier shall replace or repair the defective/**damaged** parts at his cost. **If any of the spares from initial spares provided with the cranes is used by the contractor during the guarantee period, the same shall be replenished within reasonable period free of cost to MDL.**

The necessary spares, tools, technicians etc required to attend the breakdown and to set the defect right during guarantee period shall be under Supplier's scope of work.

A set of frequently required recommended spare parts and consumables during guarantee period shall be kept ready/handy to minimize down time.

83.3 At the Tender submission stage an itemized price listing of the manufacturer's recommended additional spare parts considered necessary to support the crane during the initial 6 years of operation to be provided. This listing shall not include consumables except where the Supplier has been unable to identify a source in India. Where this is the case he shall provide full details of such items giving the justification for the Specification used which necessitates the import of the consumable involved.

83.4 To simplify the spares holding and procurement aspects, materials, equipment and components shall be standardized as far as is reasonable within the design of the crane. All spare parts are to be fully interchangeable with the original parts and be manufactured to the same quality and standards.

83.5 All spare parts and any associated special tools shall be suitably boxed and/or preserved to prevent deterioration whilst in storage. All such packaged items shall be clearly labelled in English and Hindi for ease of identification.

84. SPECIALIST TOOLING

84.1 The Supplier shall supply to the MDL one complete set of special tools and

fixtures necessary for the erection, removal, maintenance and subsequent replacement of all assemblies, components, spare parts and consumables including all lifting tackle, lifting beams and handling equipment required to ensure that no item exceeding 25 kg need be manually handled.

84.2 All special tools and fixtures shall be permanently marked as to their function and specific use. Size permitting, they shall all be stowed in secure portable metal tool chests or, if large, wall mounted on shadow boards within a suitably located compartment within the crane structure.

84.3 All necessary lifting equipment comprising slings, shackles, eyebolts etc. necessary for the safe and effective handling of crane components on arrival to site and during erection or to facilitate maintenance shall be provided by the Supplier.

85. SUBMISSION OF MILESTONE/ACTIVITY-TIME CHART:

85.1 The supplier shall submit a milestone/Activity-time chart to indicate the various project activities and their time line.

85.2 The milestone chart shall establish the indicated delivery/commissioning date for the crane.

86. DOCUMENTS TO BE SUBMITTED IN TECHNICAL BID

86.1 The supplier shall submit documents as required to establish the eligibility in accordance with Pre-Qualification criteria.

86.2 A table indicating each clause no. of technical specification and the remarks, such as “noted/ Accepted/ confirmed/ submitted” as may be the case in response to the para be submitted.

86.3 Wherever, the supplier remarks as “submitted”, they should indicate the document No, page no., para no. etc to be referred to.

86.4 **The supplier shall submit tentative plan for crane erection methodology of individual crane along with the bid documents.**

87. PREFFERED MAKE FOR MAJOR COMPONENTS:

S No	ITEM	PREFERRED MAKE
1	MOTORS	SIEMENS/ABB/FUJI ELECTRIC/SUMITOMO/ YASKAWA/ALLEN BRADLY/ BHARAT BIJLEE/ALSTOM/CG/KONE or OEM of crane.
2	ACB,MCB,MCCB,EARTH LEAKAGE DEVICES,SWITCHES	SIEMENS/SCHNEIDER/ABB/L&T/ALLEN BRADLY /FUJI/Legrand /G.E. / Merlin Gerin / Crompton / Schnider
3	VVVF DRIVES & PLC	ALLEN BRADLEY/ SIEMENS/ FUJI / YASKAWA /ABB/KONE CRANES
4	ENCODER	SIEMENS/ HUBNER/LEINE & LINDE/ OMRAN/KUBLER/ BAUMER / Kone cranes/ P&F/ TR ELECTRONIC
5	HMI	SIEMENS/HONEYWELL/ABB/FUJI/TOSHIBA /ALLENBRADLEY/Pro-face/ chneider/Omron / Delta / GeFanuc/EATON / Mitsubishi/ Hitachi
6	LOAD CELLS	SHINHAN / MAGTROL / STRAIGHTPOINT USA /ROBWAY/ FUTEK / HONEYWELL / FLINTEC/SENSY/DINACELL/LAHTIPRECISION/ACME
7	GEAR BOX	SIEMENS/ SEW/HYOSUNG/SEISHA/ KONECRANES / Brevini / Bonfiglioli / Zollern or OEM of crane.
8	BRAKES & BRAKE DRUM	SIBRE/BCH/ ELECTROMAG/ PINTSH /KONECRANES/ Speed-O-Control / Stromag / Intorq / Kateel / Pintsch Bubenzer
9	WIRE ROPE	USHAMARTIN/BHARAT WIREROPES/TEUFELBRGER/KISWIRE/ DIEPA / PFEIFER
10	INDUSTRIAL AIR CONDITIONER	TOSHIBA/ CARRIER/ DAIKIN/ MITSUBISHI/ GENERAL/BLUESTAR/LLYOD /SAMSUNG/LG
11	BUFFER	OLEO/ GANTREX/KOBA/ ENIDINE / KATEEL / EMCO
12	PA system	Philips/Bosch / Ahuja
13	FIRE DETECTION SYSTEM	HONEYWELL/ BOSCH/ KIDDE/ NIPPON HAKUYO/CONSELIUM MARINE/SCHNEIDER/DAHUA
14	ANEMOMETER	JYOTI/YOUNG MARINE/ LILI &GILLY/THIES/KANA/LAWRENCE & MAYO/PROTO CONTROL/ACO MECHANIC
15	BEARINGS (OF MECHANICAL COMPONENTS)	SKF/FAG/NTN/ KOYO / TIMKEN/ INA/NSK/NTN/SNR/NACHI/ROLLWAY
16	SLEW BEARING	ROTHE-ERDE/ ROBELLO/INA/ROLLIX / LIEBHHERR / IMO/ GALPERTI/ SKF
17	OIL PUMP	NOP/ REPUTED MAKE (SUBJECT TO MDL APPROVAL)
18	ROPE DRUM	As per design standard (Also Pl refer Sr No.43)
19	WHEELS	As per design standard (Also Pl refer Sr No.48.7)

20	HOOKS AND PULLEYS	As per design standard (Also Pl refer Sr No.46)
21	APFC Relay	Siemens (EPCOS) / L&T /Merlin Gerin / Areva / ABB / Schneider / Selec / BELUK/EPCOS/C&S
22	Capacitor bank (gas filled)	Siemens / Merlin Gerin / MEHER (L&T)/ Crompton / Universal / Prabodhan / ABB / SCHNEIDER/EPCOS
23	Microprocessor based releases for ACB	Siemens / L&T / Merlin Gerin/ GEC / ABB /AREVA / C&S / Crompton Greaves/ Eaton/Schneider
24	UPS	Merlin Gerin / HI-REL / APC / Vertiv /FUJI / Delta / Schneider/ Emerson / MG/ Toshiba / G.E./ Mitsubishi / Siemens / Socomec / Vertiv/ Luminous / Microtek/ Amaron / Aplab
25	Computer i7, W10 for CMS	HP /ACER / DELL / Siemens (Industrial PC for CMS)
26	APFC Relay	Siemens (EPCOS) / L&T /Merlin Gerin / Areva / ABB / Schneider / Selec / BELUK
27	CONTACTOR	SIEMENS/ABB/ SCHNEIDER/ BCH/L&T
28	PAINT	JOTUN/HEMPEL/ SIGMA/AKZO NOBLE/KCC

88. CRITICAL SPARES TO BE SUPPLIED ALONG WITH THE CRANES:

Following spares shall be supplied along with the crane by the supplier and the cost of these spares shall be included in bid. If any of the spare from initial spares provided with the cranes is used by the contractor during the guarantee period, the same shall be replenished within reasonable period free of cost.

Sr. No.	Description	**Quantity (SET)**				
		25/5T for 04 cranes	**15/5T**	**60/5T**	**40/5T**	**20/7.5T**
	Electrical spares					
1.	Encoder for Main Hoist	2	1	1	1	1
2.	Encoder for Aux Hoist	2	1	1	1	
3.	Profibus connector	4	1	1	1	1
4.	Profibus cable	2	1	1	1	
5.	Profibus Slipring	2	1	1	1	1
6.	Rectifier for magnetic disc brake	4	1	1	1	1
7.	LT Motor with brake unit	1	1	1	1	1
8.	Limit switch for MH, AH, Luffing and LT	4	2	2	2	2
9.	Aviation light	4	1	1	1	1
10.	Long Travell Warning Siren	2	1	1	1	1
11.	PLC Power supply Module	2	1	1	1	1

12.	PLC D/I Module	2	1	1	1	1
13.	PLC D/O Module	2	1	1	1	1
14.	PLC Analog Input Module	2	1	1	1	1
15.	PLC Analog Output Module	2	1	1	1	1
16.	PLC Communication Module	2	1	1	1	1
17.	Sensor: Optical / Proximity	4	2	2	2	2
18.	Emergency Stop Push Button	4	2	2	2	2
19	Inverters	1	1	1	1	1
20	Converters	1	1	1	1	1
21	Inverter/Converter cards	2	1	1	1	1
22	Inverter/ Converter comm. cards	2	1	1	1	1
23	Anemometer	2	0	0	0	0
Mechanical Spares						
01	Long Travel (LT) Gearboxes	2	1	1	1	1
02	LT Drive Wheel assembly with bearings	2	1	1	1	1
03	Wire ropes of Main Hoist					
04	Wire ropes of Aux Hoist					
05	Sheave Pulleys with bearings	2	1	1	1	1
06	Brake unit /set for Main/Aux/Luffing	2 set	1set	1set	1set	1 set
07	Cabin window wipers	8	4	4	4	4

Note: The spares are not limited to above; supplier may suggest additional critical spares.

89. RELATIONSHIPS WITH OTHER CONTRACTORS

89.1 The Crane Supplier shall afford all reasonable co-operation to other Contractors carrying out other works for MDL in the shipyard. This will include allowing other Contractors all reasonable access required to perform their work and conferring with them regarding connections and interfaces (if any)

89.2 Work being undertaken by other contractors identified above includes but not limited to: (a) Construction of Crane Track and associated works

90. PROGRESS MEETNGS:

90.1 During site work, the Crane Supplier shall appraise the work duly to Engineer/MDL and have to attend progress meetings on site, weekly unless otherwise approved by the Engineer/MDL, to report on progress and to discuss any issues with the Engineer/MDL. Meetings will be held at a location to be decided by the Engineer/MDL. The Contractor shall arrange for the attendance of any of his staff members as required by the Engineer/MDL. A designated officer who is in charge of the project and authorized to take decision shall attend the meeting. Suggestion of improvements/instructions of the Engineer within the scope of project shall be implemented by the crane supplier duly

90.2 The Crane Supplier may be required by the Engineer/MDL to attend other meetings, as necessary.

91 . SCHEDULE OF DELIVERY

Crane Supplier may take notice that the cranes are required for MDL slipways/dry-dock. It is the responsibility and risk of crane supplier to imbibe and coordinate with MDL and main civil construction contractor executing associated civil works of MDL. The crane supplier shall understand the requirement of completion and shall duly intimate MDL regarding the progress of proceedings on a reasonable timeframe. The supplier shall choose reliable sub-suppliers meticulously to match the schedule of 28 months. Supplier shall ensure compliances of all applicable procedures, rules, regulations for ensuring the safety and protection of men and materials in all respect and ensure seamless safe working procedures at MDL site. The split up of the schedule & grouping cranes is stipulated below:

STAGE 1: Commissioning of crane No. 9,10,11 & 16 (04 cranes)
STAGE 2: Commissioning of crane No. 14 & 17 (02 cranes)
STAGE 3: Commissioning of crane No. 12 & 13 (02 cranes)

S No	Activity	Time lines
1	Submission of drawings related to Civil works (trench requirements, end buffers, anchors, embedment..etc) to MDL for progression of civil work by the MDL civil construction contractor.	Within 2 months after issue of PO
2	Submission of the design and quality assurance Documentation (QAP) to MDL duly approved by TPIA	Within 2 months after issue of PO
3	Submission of quality assurance Documentation (QAP) to MDL duly approved by TPIA.	
4	Shipment of materials/items as per mutually agreed material delivery schedule of stage 1 cranes.	Within 18 months after issue of PO
5	Completion of Erection/Testing, commissioning, Approvals and handing over to MDL for stage- 1 cranes.	22 months after issue of PO
6	Shipment of materials/items as per mutually agreed material delivery schedule of stage 2	Within 20-22 months after issue of PO
7	Completion of Erection/Testing, commissioning, Approvals and handing over to MDL for stage -2 cranes	25 months after issue of PO
8	Shipment of materials/items as per mutually agreed material delivery schedule for stage 3 cranes	Within 23-25 months after issue of PO
9	Completion of Erection/Testing, commissioning, Approvals and handing over to MDL for stage-3 cranes	28 months after issue of PO

Note: Contractor has to submit a detailed program for individual cranes keeping the broad schedule indicated as reference.

92. SITE VISIT AND DECLARATION FORM

Ref: Tender No.: _____ Dated _____ /2023

Item Description: - Procurement of 8 Nos. level luffing cranes.

We have visited MDL site and fully understood the scope of work and noted the space constraints, obstacles & limitation at site and design new cranes accordingly. We will take actual measurements while designing of the crane. We also noted down the limitation for vehicular movement for transportation, erection of crane components at site. All above mentioned conditions are acceptable to us.

NAME OF COMPANY _____

SIGNATURE_____

NAME: _____

DISIGNATION: _____

DATE: _____

ANNEXURE-A

FOLLOWING ARE THE APPROXIMATE MEASUREMENT OF OBSTRUCTIONS AT SITE FOR LT & SLEW MOTION FOR EACH CRANE. (attachments)