

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

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

## 1.6. MOTORS

### 1.6.1. FOR DOUBLE GIRDER CRANES:-

- 1.6.1.1. All crane motors should be of ABB, Crompton, BBL, Marathon, Siemens, Kirloskar make and totally enclosed fan cooled (TEFC) squirrel cage type and designed for 150 starts / hour. The motor shall be suitable for heavy duty crane hoisting service having cyclic duty factor not less than 40 % for class III and 60 % for class IV cranes. The motors shall be suitable for 50° C ambient temperature and 415 +/- 10% 50 Hz +/- 3%, 3 phase, 3 wire AC supply. The motor shall be generally conform to IS 325 (latest) and shall be 6 or 4 pole type. However, where IS specification is at variance with this specification, the provision made in this specification shall prevail.
- 1.6.1.2. The winding shall be of copper wire specially insulated and impregnated to withstand moist tropical climate and class of insulation shall not be less than 'B' class.
- 1.6.1.3. The motor shall be of adequate power, motor power requirement being computed as per Annexure 'C' of IS 3177-2020 (latest). Detailed motor power calculations shall be given in the offer. The motor should be rated for class S-4 duty. Derating factor for temperature and voltage variation if any shall be taken into consideration as per recommendations of the motor manufacturers. Technical details of motors along with control gear and electrical accessories shall be given as per schedule-III.
- 1.6.1.4. Type and routine test chart of motor selected shall be submitted to the inspecting authority during inspection.
- 1.6.1.5. Forced cooling shall be arranged by mounting suitably continuously run fan on all the motors for all motions.
- 1.6.1.6. **Horse Power**  
  
The torque factor of longitudinal travel and cross traverse motors should be of the range of 1.3 to 1.5. The frame size of motor should be indicated in the offer. For selection of LT & CT motor sizes, longitudinal and cross traverse acceleration will be taken as 15 cm/sec.<sup>2</sup> and 8cm/sec<sup>2</sup> respectively.
- 1.6.1.7. All motors should be provided with insulation of class 'B' for stator and class 'F' for rotor. The maximum permissible winding temperatures measured by thermometer and resistance method

shall not exceed 120 deg. C and 130 deg. C respectively.

- 1.6.1.8. The pull out torque of the motors at rated voltage and frequency range shall be as per IS: 3177-2020 (latest).

## 1.7. TERMINAL BOX

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

## 1.8. CRANE CONTROL

### 1.8.1. FOR PENDANT CONTROL CRANES ONLY:-

- 1.8.1.1. Pendant push button control station will be used for long travel, cross travel and hoist motions, for switching ON and OFF the motor of a particular motion. The supply voltage to the pendant control shall be 110V AC which shall be obtained through a suitable transformer. Necessary flexible multicore cable with sufficient length shall be supplied to enable the crane to be operated from floor level. Pendant shall be moving type and the movement of pendant will be independent of trolley.
- 1.8.1.2. On all the motions the circuit shall be so designed that brakes come into operation immediately in the event of tripping of motor main circuit breaker.
- 1.8.1.3. The pendant control station shall be capable of withstanding rough handling without being damaged. The cover shall be firmly secured.
- 1.8.1.4. The mass of the pendant shall be supported independently of the electric cable by means of wire rope/chain. If the pendant is of metal, it should be effectively earthed.
- 1.8.1.5. On all pendant cranes safety means shall be provided to prevent inadvertent operation from floor while maintenance work is being carried out on the crane.
- 1.8.1.6. Adequate guards shall be provided to prevent accidental contact of pendant ropes or holding wire rope/chain with cross traverse.
- 1.8.1.7. Suitable arrangements shall be provided for automatically cutting off the resistances after a pre-selected time. The bidders shall explain the details in the offer.

### 1.8.2. FOR CABIN OPERATED CRANES:-

- 1.8.2.1. For all the motions spring return jockey switches or push button shall be used. (**Applicable for VVVF Drive Cranes**)
- 1.8.2.2. Two step two direction jockey switches in case of cabin control shall be used for all the motion.
- The rest position of jockey shall conform to zero position or off position.
  - During running the rest position, means de-acceleration to stop.
  - Step one at preset minimum speed of upto 10% of the maximum speed.
  - Second step speed gradually accelerates to maximum speed.

Should a speed between minimum and maximum is desired; the operator shall return to step one and the same speed shall be maintained.

With the above system step-less speed shall be obtained.

Alternatively above features can be achieved by use of two push button control for each direction for all the motions. Tenderers shall indicate the details of the proposed arrangement.

- 1.8.2.3. On all motions the circuit shall be so designed that brakes come into operation immediately in the event of tripping of motor main circuit breaks.
- 1.8.2.4. All controllers shall be so designed that the contacts and terminal arrangements are readily accessible for inspection and maintenance purpose.
- 1.8.2.5. Each controller shall be fitted with
  - i) Necessary steps for the forward and reverse motion to give smooth and stepless-acceleration between each position.
  - ii) Auxiliary contacts to provide an interlock between the controller and circuit breaker, so that the circuit breaker cannot be closed unless the controller is in off position.
  - iii) Auxiliary contacts to provide an interlock with the limit switches, so that when the travel exceeds the safety limits, the motor circuit will be broken and the motor can only be allowed to reverse.
- 1.8.2.6. Controller in off position shall open all supply lines of the respective motors.
- 1.8.2.7. AC variable frequency control (VVVF) of adequate capacity for all the motions shall be used. Independent AC variable frequency control for main hoist, Aux. Hoist, CT & LT shall be used by using independent variable voltage variable frequency drives. However common controller for both the motors of LT may be used. Tenderer shall submit necessary details of the offered model as well as make confirmation for compliance as per clause 2.22 shall be submitted along with the bid.
- 1.8.2.8. Bidders shall submit the layout scheme of the operator's cabin showing the positions of various controls with respect to operator's seat.

## 1.9. CONTACTORS

- 1.9.1. All contactors shall be of AC-4 Class of duty or **AC-3 Class duty suitably de-rated for AC-4 class duty** with rating sufficiently higher than the full load current of the respective motors at the specified duty cycle. The directional contactors of all motions shall be suitably interlocked for correct sequence of operation. Electrical & mechanical life of the contactors shall be indicated. For AC 4 Class of duty or AC 3 Class duty suitably de-rated for AC-4 class duty, Electrical life shall be minimum 2, 00,000 cycles of operations.
- 1.9.2. The contactors shall have high contact reliability with preferably double break parallel bridge contact and facility of time saving termination.
- 1.9.3. All contactors shall be of L&T, Schneider, C&S, Siemens and Cutler Hammer make. Test certificate of the manufacturers shall be submitted in support of life and rating of the

contactors.

#### 1.10. **RESISTORS (for slipping motors)**

- 1.10.1. Resistors shall be adequately protected to prevent accidental contact.
- 1.10.2. The resistors shall be air-cooled, robust, heavy duty, Corrosion resistant stainless steel punched grid type. The resistance boxes shall be placed in racks or on the platform and shall be capable of independent removal of any selected box. Spacing recommended by the resistor manufacturer shall be maintained. The racks shall be robust in construction to withstand vibration due to crane operation. Wire wound resistors shall not be used on any motion of the crane.
- 1.10.3. All resistors shall be rated for 10 minutes continuous loading.
- 1.10.4. Resistors housing on cranes working in open yards shall be weather proof and on all cranes they shall be adequately protected. The electrical clearance between resistors and earthed metal shall not be less than 100 mm. Cable terminal arrangement shall be such that cablecores do not get loose due to vibration.
- 1.10.5. The temperature of resistors shall not exceed 275 °C at specified duty.

#### 1.11. **CIRCUIT PROTECTIVE SWITCH GEAR**

- 1.11.1. One triple pole manually operated moulded case circuit breaker (MCCB) make L&T, Schneider, C&S, Siemens, Havells, Cutler Hammer and ABB serving as main incoming protective device, fitted with no volt, short circuit and overload releases and rated to carry at least combined full load currents of the two motions of the crane having largest power should be provided. The circuit breaker shall have adequate rupturing capacity to withstand and clear fault current of the order of 30 KA. The circuit breaker shall have adequate rupturing capacity to withstand and clear fault near the protective panel, in such a way that adequate clearance is provided as per Indian Electricity Rules. In case of floor operated cranes instead of MCCB, push button operated contactor shall be provided, other provisions remaining unchanged.
- 1.11.2. The trip circuit of the circuit breaker shall be so designed such that it will prevent the circuit breaker from being enclosed when main contactor of any of the motions has failed to open, although the corresponding controller has been brought to OFF position. Suitable protective features to trip the circuit breaker with the operation of limit switches and emergency push buttons shall also be provided.
- 1.11.3. To indicate whether power and control sources are ON and whether any emergency switch has been operated, indicating lamps shall be provided in operator's cabin, in case of cabin operated cranes.
- 1.11.4. For protection of each drive motor against over loads adjustable inverse time lag manually reset electro-magnetic type relays shall be provided for each motor. Alternatively, electronic type relays shall be acceptable. These relays shall be mounted in respective contactor panels and shall be set to trip the circuit of motion being controlled when current exceeds 200% of normal value for more than 10 seconds. The control circuit of individual motions shall have off position interlock with respective master controllers.

1.11.5. Each motor feeder shall be protected with no volt trip device, HRC fuses against short circuit, and with instantaneous trip current sensitive type single phasing cum phase reversal preventer.

1.11.6. Isolating switches fitted with HRC fuses shall be provided for the following branch circuits:

- a) Lighting and hand lamp socket outlets
- b) Control circuit.

Both of the above mentioned isolators shall be installed in driver's cabin in case of cabin operated cranes.

1.11.7. Each control circuit branch to every contactor panel shall be provided with facility for isolation and protection against short circuits and sustained high overloads by means of appropriately rated miniature circuit breaker.

1.11.8. A triple pole isolating switch without fuse shall be provided on the long travel bridge walkway, as close as possible to the main current collectors. This shall isolate all the circuits except the crane lighting circuit.

#### 1.12. **LIMIT SWITCHES**

1.12.1. All hoist motions shall be provided with limit switches to prevent crane from over hoisting and over lowering. Two limit switches shall be provided for proper back up protection. The first limit switch shall act in the event of over hoisting and over lowering shall be of snap action/pin type self resetting feature and incorporated in the control circuit of respective drive motor. It can also be of Proximity non-contact type. The second one shall be of gravity operated hand resetting type switch connected in the trip circuit of main incoming breaker. The second limit switch connected in the main incoming circuit breaker's control circuit shall operate and trip the breaker.

1.12.2. Any other limit switch viz. for slewing, skewing of crane etc. shall be provided if required.

1.12.3. Limit switch for hoist cross and long travel motion shall be supplied installed and wired by the manufacturer.

#### 1.13. **EMERGENCY STOP PUSH BUTTONS**

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

1.13.2. Pendant controls shall be provided with mushroom head type push button having in built key so that main incoming circuit breaker can be tripped under any emergency condition by pressing the push button (Applicable for Pendant Control cranes).

#### 1.14. **CONTROL PANEL**



- 1.14.1. All power and auxiliary contactors, individual overload relay shall be mounted in a sheet steel cubical with lockable hinged doors. The door hinges shall be of such type that during the repair works inside the panel the entire door can be lifted out and placed away enabling better access inside the panel. Each motion shall have its individual panel and the provision shall be confirmed in the bid. However, common panel with separate compartment for each motion shall be acceptable. Interiors of panel shall be dust and vermin proof. For cranes working in open yards, all control panels shall be fully weather-proof type.
- 1.14.2. Panels shall be front wired with readily accessible terminal blocks for making connections in the external equipment. Panels shall be pre wired into terminal strip. Single core, copper conductor shall be used for control circuit wiring in the panel.
- 1.14.3. All contactors etc. shall be mounted securely in a vertical arrangement with the consideration of the vibrations encountered in the operation of cranes. The bottom most row of the equipment mounted inside the panel except terminals strips shall be at least 150 mm above the panel bottom cover to facilitate inspection and repairs.
- 1.14.4. All the equipments shall be so mounted in panel as to enable its easy removal/replacement from the front.
- 1.14.5. The terminal strips shall be fixed inside the panel preferably in a horizontal manner leaving enough space underneath the strip for termination of cables in a convenient manner. Power and control terminals shall be segregated. Power terminals blocks shall be separated from each other by means of replaceable insulated spacers. Terminal block shall have adequate clearance to avoid tracking. A minimum of 20% spare terminals block shall be provided in terminals strips.
- 1.14.6. All equipments inside the panel shall have permanent identification labels in accordance with circuit diagram as also the power and control terminals. Terminal blocks shall be of robust and of such construction as to preclude possibility of cable connections getting loose during vibration on crane.
- 1.14.7. Sheet steel used for fabrication of panels shall have a minimum thickness of 2.0 mm. Panels shall be mounted such that bottom of panel is at least 150mm above the floor.
- 1.14.8. The electrical clearance in air between all live parts of different polarity and voltage and between live parts and earth shall be not less than 75mm.
- 1.14.9. Contactor panels shall be well braced to the crane structure and each panel shall be provided with adequate number of lifting lugs.
- 1.14.10. The control system should include operating hour meter for crane, Mechanical load sensing device (for cranes up to 15T capacity), Electronic overload protection device (for cranes above 30 T capacity) and motor over current protection system (in case of VVVF drives cranes. Torque based protection is also acceptable).

#### 1.15. LIGHTING

- 1.15.1. 10 Watt LED Lighting shall be provided in the driver's cabin and staircase. Bulk head fittings with dust proof covers shall be used for the above areas. 06 nos. underslung LED lights of minimum 80 watts with steel cage with shock absorbing and anti-swing suspension

arrangement shall be provided for uniform floor illumination for the cranes having span upto 15mtrs and 02 nos. underslung LED lights of minimum 80 watts with steel cage with shock absorbing and anti-swing suspension arrangement for every 5mtrs span thereafter. e.g if span is 20 metres, LED bulbs =  $6 + 2 = 8$  nos., however if span is 22 meters, then still LEDbulbs = 8 nos. but if span is 23 metres, then no. of LED bulbs =  $8 + 2 = 10$  nos. and so on. Lighting transformers shall have 50% reserve capacity. However, if required, the same arrangement shall be able to take load of LED bulbs of upto 120 Watts also.

1.15.2. Toggle Switches: Industrial toggle switches shall be used for lighting distribution

#### 1.16. SOCKET OUTLETS.

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

#### 1.17. CABLING

1.17.1. All wiring for power control & lighting circuit shall be carried out with 1.1KV grade Flame Retardant Low Smoke (FRLS) PVC insulated copper cables as per IS:694 and IS:1554 Pt-I with smoke index and typical index corresponding to ASTM-2843 & IEC332-I.

1.17.2. Minimum size of power & control cables shall be 4mm<sup>2</sup> & 2.5mm<sup>2</sup> respectively.

1.17.3. All cables shall be systematically laid on G.I. trays & fixed with adequate number of G.I. clamps.

1.17.4. All cables shall be weather proof and shall be either of LAPP/SIEMENS/POLYCAB/FINOLEX/UNIVERSAL/ICC make.

#### 1.18. IDENTIFICATION OF CIRCUIT CABLES ETC.

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

#### 1.19. EARTHING

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

#### 1.20. DEAD MAN'S HANDLE

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

operator releases the thumb pressure on the button.

#### 1.21. ALARMS

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

#### 1.22. FEATURES OF AC DRIVE

- 1.22.1. Inverter offered should be suitable for crane application for all motion.
- 1.22.2. Inverter rated O/P current should be at 45 °C ambient and maximum over temperature shall be 55 °C.
- 1.22.3. Drive sizing should be done accurately after considering the ambient temperature, type of panel, environment condition, etc. and deration on any account viz temperature/carrier frequency, or other factors should be considered and should not exceed 15% of rated O/P current of inverter offered.
- 1.22.4. The drive should be capable of taking 125% overload for one minute at the creep speed of 20% and at full speed as per crane IS standard for crane.
- 1.22.5. Inverter offered should have slip compensation feature in both up/down motions (even during regeneration).
- 1.22.6. Inverter offered should be with built in modes of control strategies viz standard V/F, OPEN LOOP VECTOR (REAL SENSORLESS VECTOR) AND MAGNETIC FLUX VECTOR so that the same inverter is used for all motions selecting the control mode. This should minimize spares inventory and training costs. However for hoisting the drive should be operated in Magnetic flux vector control and open loop brake sequence system. Brake release should be through torque base sensing.
- 1.22.7. Inverter offered should be provided with accurate brake coordination signals.

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

- 1.22.7.1. Overload current capacity : 150% of rated output current for one minute.
- 1.22.7.2. Maximum output voltage: 3 phase, 380/400/440/460V  
(Proportional to input voltage)
- 1.22.7.3. Maximum O/P frequency : 400 Hz (programmable)
- 1.22.7.4. Rated input voltage and frequency: 3Phase, 380 - 460V, 50/60 Hz.
- 1.22.7.5. Allowable voltage fluctuation : +10% to -15%
- 1.22.7.6. Allowable frequency fluctuation: +5% to -5%



- 1.22.7.7. Control Method : High carried freq. (low noise) sine wave PWM technique.
- 1.22.7.8. Starting torque : 150% below 1 Hz. (150% at 0 RPM with PG)
- 1.22.7.9. Speed control range : 100:1 (1000:1 with PG)
- 1.22.7.10. Speed control accuracy : +/-0.2% (+/-0.02% with PG)
- 1.22.7.11. Speed response : 20 to 30 rad. per sec.
- 1.22.7.12. Torque limit : Settable through programme (parameter)
- 1.22.7.13. Output freq. Resolution : 0.01 Hz.
- 1.22.7.14. Freq. Setting signal : +10 to -10 V, 0 to 10 , 4-20 mA, INC/DCR through PB (Programmable).
- 1.22.7.15. Acceleration/deceleration time : 1.1 to 6000 sec (Can be set independently)  
Four rates should be possible.
- 1.22.7.16. Braking torque : Approx. 20% (approx. 125% when using braking resistor)
- 1.22.7.17. Main control functions : Auto tuning  
Drop control  
DC injection braking  
Slip compensation  
S-curves  
Speed search  
Excess torque detection  
Torque limit  
Full range auto torque boost  
Multi step speed operation  
Accl/Decl time changeover operational  
3 wire sequence Speed/torque control  
switch operation Fault log.
- 1.22.7.18. Protective functions : Motor overload  
Instantaneous over current  
Fuse protection  
Over voltage  
Under voltage  
Power loss ride through FIN overheat  
O/P short circuit protection  
I/P & O/P open circuit protection  
Stall prevention  
Ground fault

1.22.7.19. Type of Enclosure : **IP:21** or better

### 1.23. RADIO REMOTE CONTROL

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

- 1.23.1.1. The wireless control facility shall incorporate control of movements in all directions, with speeds identical to those provided for the cabin/pendant control. The facilities shall be provided in the set for Radio Frequency adjustments within 335-336 M Hz or 865-866 M Hz range which are to be advised to the supplier by consignee on allotment of such frequency by the Department of Communications.
- 1.23.1.2. The facilities to be provided shall incorporate but need not be limited to the operations features listed below:
  - i. Emergency stop.
  - ii. Emergency Alarm.
  - iii. Normal ON / OFF control.
  - iv. Micro / Normal speed switches.
  - v. Directional movement control switches.
  - vi. Radio / Normal control selection switch.
  - vii. Overall weight of equipment to be carried by operator not to exceed 2.5 kgs.

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

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

### 1.23.2. SCOPE OF RADIO REMOTE CONTROL

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

- iii. AUXILIARY HOIST ONE SET
- iv. LONG TRAVEL ONE SET
- v. CROSS TRAVEL ONE SET
- vi. EMERGENCY STOP ON / OFF CONTROL

- 1.23.2.5. Each transmitter shall not weigh more than 2.5 kg and shall be provided with a shoulder belt and shall be in IP65 enclosure.
- 1.23.2.6. The system shall be microprocessor based.
- 1.23.2.7. The system shall have self-diagnostic feature with LED display.
- 1.23.2.8. For ease of maintenance the cards should be easily replaceable type.
- 1.23.2.9. The transmitter shall have indication for low battery. The battery should not be get discharged, have longer life and before reaching discharge level it should give visual indication.
- 1.23.2.10. The system shall be suitable for operation of 335-336 M Hz or 865-866 M Hz frequency range with a provision of fine adjustment.
- 1.23.2.11. The range of operation should be adjustable from 0 to 100 meters.
- 1.23.2.12. Frequency of operation of the Remote Control Units shall be indicated in the offer.
- 1.23.2.13. Tenderer shall ensure adequate supply of spares and availability of maintenance support within country.
- 1.23.2.14. The tenderer shall be responsible for commissioning the above system.
- 1.23.2.15. Equipment supplied should be certified by internationally recognised international inspection agency.

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

**3. TECHNICAL LITERATURE:**

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

**Note:** All manual and literature should be in English.