

with suitable single brick protection on three sides. The provision of transformer and enhancement of the load (if required), is in the scope of consignee. The cable shall be armored cable of three and half core of minimum 240 sq. mm diameter to IS: 694 latest or equivalent international standard to withstand the total load of the shed and machine. **Firm should give details of the cable, IS and make in the offer.(Applicable for BSB consignee Only)**

- 1.2.17.2 The cost of laying of cable (including material cost) shall be quoted on per meter basis. The total length will depend on actual site conditions.
- 1.2.17.3 All the necessary electrical equipments like distribution board and control panel etc. to be provided by the bidder.
- 1.2.18 CNC CONTROL SYSTEM**
- 1.2.18.1 The machine shall be provided with a micro processor based CNC control over the number of axes adequate for the capability of the machine mentioned at para 2.3 of Section-I above. Simultaneous control over these axes shall be available. **(No. of axes provided shall be indicated in the bid).**
- 1.2.18.2 There shall be provision of a LCD/TFT screen of app. 200mm screen size.
- 1.2.18.3 Status output shall be available on the LCD/TFT screen indicating automatic operation mode selected, manual operation mode selected, automatic operation status, program edit status, axis movement/dwell status, auxiliary function, spindle speed, feed rate, tool offset, emergency stop. Current position display giving position in local co-ordinate system, work co-ordinate system, machine co-ordinate system and residual amount of movement shall be provided.
- 1.2.18.4 It shall be possible to operate the machine automatically through memory and/or MDI.
- 1.2.18.5 Facility of machine lock, machine lock on each axis, auxiliary function lock and dry run shall be available for checking the program.
- 1.2.18.6 The CNC control shall perform various diagnostic checks and display error status in English text.
- 1.2.18.7 Data protection key shall be provided. It shall prevent the program offset parameters, data etc. from being registered, modified or deleted erroneously.
- 1.2.18.8 Part program editing and background editing shall be available.
- 1.2.18.9 The possible number of registered programs shall be 50 minimum. CNC user memory for program and data should be 2GB or more.
- 1.2.18.10 Facility for program search using program name or program number shall be available. It shall be possible to select the sequence number required to be searched.
- 1.2.18.11 It shall be possible to store program number and program name for identifying the program. The number of characters in program name shall be indicated.
- 1.2.18.12 For symmetrical work pieces, facility of programmable mirror image shall be available.
- 1.2.18.13 To facilitate programming, it shall be possible to program angles, chamfers, corner rounding values from machining drawings by direct input of these values.
- 1.2.18.14 For repetitive machining particular to the type of machine built in boring, turning, facing, grooving and drilling cycles shall be provided.
- 1.2.18.15 To facilitate programming of family of similar work pieces, custom macro/parametric functions shall be available.
- 1.2.18.16 Stored stroke limit shall be provided thus enabling creation of forbidden zones where the cutting tool may not travel.
- 1.2.18.17 It shall be possible to return the machine tool to the reference point through program commands as well as manually.
- 1.2.18.18 Facility of optional block skip shall be available. It shall be possible for the operator to skip a block at his discretion.
- 1.2.18.19 Provision of 100 tool offsets to compensate for the difference of tool actually used to the imaginary tool used in programming shall be available. It shall also



- be possible to enter tool offsets through programmable command.
- 1.2.18.20 Compensations for cutter radius, tool length and tool nose radius shall be available (Nos. shall be indicated in the offer).
- 1.2.18.21 It shall be possible to control the movement of tool with respect to machine zero through the machine co-ordinate system.
- 1.2.18.22 It shall be possible to set up work co-ordinate system using tape command. It should also be possible to set up adequate number of work co-ordinate systems (app.6) through the MDI and select any of these in the program.
- 1.2.18.23 It shall be possible to set up local co-ordinate systems with respect to work co-ordinate systems which have been set up through MDI.
- 1.2.18.24 Absolute/incremental programming shall be available. It shall be possible to use both of them in the same block.
- 1.2.18.26 The input resolution (least input increment) should be 0.01mm or 0.001mm (selectable) for linear axes. The position control resolution (least command increment) shall be 0.01mm or 0.001mm (selectable) for linear axes.
- 1.2.18.27 It shall be possible to move the machine tool along any axis in incremental mode. The increment shall be selectable (0.001mm, 0.01mm, 0.1mm and 1mm).
- 1.2.18.28 For precise adjustment of the feed rate, provision of manual pulse generator shall be available.
- 1.2.18.29 For spindle speed, feed rate and rapid traverse, manual over-ride shall be available from 0-120%.
- 1.2.18.30 Input shall be in metric system.
- 1.2.18.31 Linear/circular interpolation shall be available.
- 1.2.18.32 Feed rate command shall be available in mm/min.
- 1.2.18.33 **The manufacturer's infrastructure for repair and maintenance of controls in India, in particular for repair of PCBs/Modules shall be commented upon in detail in the offer.**
- 1.2.18.34 CNC control cabinets shall be suitably air-conditioned.
- 1.2.18.35 Facility of buffer storage shall be available in the control so that machine waiting time is avoided while the next programmed instruction is being read into the control system.
- 1.2.18.36 Provision of pitch error compensation and backlash compensation shall be available.
- 1.2.18.37 The part program shall be protected in the event of power failure. Automatic tool withdrawal facility in the event of power failure shall also be available.
- 1.2.18.38 RS 232 C port / USB 2.0 or better port to directly download programs from PC shall be provided.
- 1.2.18.39 CNC control should indicate run hours
- 1.2.18.40 Constant surface speed programming shall be available.
- 1.2.18.41 Emergency stop button provided on the panel should stop all the machine movements if operated.
- 1.2.18.42 Parametric program should be available.
- 1.2.19 Industry 4.0 Features:**
- 1.2.19.1 REMOTE PERFORMANCE MONITORING:**
- CNC system should be able to monitor parameters of CNC and other machine components. CNC parameters and data like axis and drive data etc. and data of machine from the sensors/probes additionally installed for monitoring health of machine as enumerated in clause 1.2.19.3.1.1 to 1.2.19.3.1.14 etc..

After loading the wheel set on the machine, pre inspection shall be carried out. Wear data and diameter of individual wheel of the wheel set as measured should be recorded in Excel format with respect to the wheel set identification number and real time clock of CNC system of the Machine. Similarly, after completing the wheel profiling operation, diameter of individual wheel of the wheel set shall be measured and recorded. Similarly, machined wheel profile type shall also be

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recorded. Both these records shall be stored in Excel format with respect to the wheel set identification number and real time clock of CNC system of Machine. Via high speed internet connection through Ethernet (LAN) cabled connection or 3G / 4G/ 5G wireless internet connection, this wheel set pre and post inspection data shall be remotely accessible to authorized representatives of CME/Plg./NR and consignee and emailed to designate email ids at the pre-determined time frequency. Necessary hardware and software shall be supplied by machine manufacturer. However, high speed internet connection as detailed above has to be arranged by consignee.

#### 1.2.19.2 REMOTE DIAGNOSTICS:

Using remote diagnosis feature CNC controls of the machine shall be connected to remote computer located at manufacturer's service centre using the high-speed internet connection. This high-speed internet connection can be established using Ethernet (LAN) cabled connection or 3G / 4G/ 5G wireless plug and play telephony (dongle) or router connected to CNC controls. Necessary hardware and software required for this remote diagnosis shall be provided by machine manufacturer, however, high-speed internet connection as detailed above needs shall be arranged by consignee. Remote computer of manufacturer shall also be connected to high speed internet connection using above methods. Remote computer and its internet connectivity shall be managed by the machine manufacturer. Suitable software like 'Team Viewer / eWON' shall be used for the communication between CNC controls and the remote computer. On activation of this software secured connection shall be established with remote computer. Remote computer shall be able to access all the CNC and PLC data including the PLC ladder. CNC parameters and data like axis and drive data shall be accessed and modified from the remote computer. Status of inputs and outputs for PLC shall be accessed and faults if any shall be identified. Software related issues shall be corrected and hardware related issues like faulty limit switches, faulty proximity switches etc. shall be advised to site engineer or technician for correction over phone. Complete CNC screens shall be visible on the remote Computer. Software shall be corrected in situ or corrected software shall be uploaded from the remote computer. This shall enable quick and specialized services employing experts from the manufacturers headquarter for the quick resolution of software and hardware related issues of the machines

#### 1.2.19.3 PREDICTIVE MAINTENANCE:

1. CNC controls of machine shall be equipped with predictive maintenance software to generate and log the alarms on machine controls as well as on manufacturer's server / cloud. These alarms shall be directly Communicated to two email ids assigned by consignee and one or two email ids of supplier. CNC controls shall be equipped with necessary software and hardware for connecting to internet. Consignee shall provide continuous High-speed internet connection using Ethernet (LAN) cabled connection or 3G / 4G / 5G wireless plug and play telephony (dongle). Caution alarm will be generated sufficiently in advance before final failure alarm. Machine shall continue to work during caution alarm, which shall be repeated every eight hours till the time corrective action is taken or till the time failure alarm is generated. Caution and failure alarms must be provided for the following minimum conditions:

- 1.1 Hydraulic oil low level.
- 1.2 Hydraulic oil high temperature.
- 1.3 Hydraulic oil filter clogging.
- 1.4 Condition of hydraulic pump by monitoring its leakage rate.
- 1.5 Rollers drive motor current.
- 1.6 CNC Axes motor current.



- 1.7 Calibration of the machine.
- 1.8 Vibrations on tool slides.
- 1.9 Monitoring the working of electrostatic filtration unit.
- 1.10 Monitoring the working of hydraulic oil chiller unit.
- 1.11 Drive roller pressure will be continuously monitored.
- 1.12 Battery of CNC system.
- 1.13 Battery of UPS for CNC system.
- 1.14 Temperature inside the control panel will be continuously monitored.
2. In addition to above, an instantaneous email shall be provided in case of an emergency alarms, like hitting of CNC axes hard limit switches, headstock over travel limit switches etc.
3. Separate CNC screen/window to measure individual and cumulative energy consumption of each servo and spindle motor should be available to know regeneration energy and power saving.
4. CNC must give information about the failure of FANs, Servo Motors & Drives with dedicated screens to check online health of FANs, Servo Motors & Drives.
5. CNC should have facility to measure the life of the consumables in the separate screen like filters, batteries etc. and alarm should be displayed once the life is over.

#### 1.2.20 Operation of Under Floor Wheel Lathe

- 1.2.20.1 The tenderer/manufacturer shall quote for comprehensive operation of the Underfloor Wheel Lathe on single shift per day basis at the rated capacity for a period five years from the date of commissioning of machine. Railway reserve the right to enter into operation contract for a period of one year or two year or three years or may not to enter into the operation contract for a particular machine.
- 1.2.20.2 The price breakup element wise as attachment of the price schedule, are to be quoted the format is given below.

Format for Operation Charges in single shift at rated output including manpower, supervision and with all consumables and Tools (fig in Rs)		
The charges shall be quoted year-wise for 5 years of Operation commencing from date of commissioning of individual machine.		
	Please quote Operation charges for 5 years (in figures & words)	
Year of commencement of Operation agreement	Cost of Operation (In figures)	Cost of Operation (In words)
Upto 1st year		
From 1 <sup>st</sup> year upto 2 <sup>nd</sup> year		
From 2 <sup>nd</sup> year upto 3 <sup>rd</sup> year		
From 3 <sup>rd</sup> year upto 4 <sup>th</sup> year		
From 4 <sup>th</sup> year upto 5 <sup>th</sup> year		
<b>NOTE:</b> The year wise cost of Operation quoted is all inclusive price excluding applicable taxes. Taxes will be paid extra at actual.		

- 1.2.20.3 The Agreement for operation contract of Under-floor Wheel Lathe will be done separately for that machine by the consignee as per the clauses mentioned below:
  - a) The operation period will commence from the date of issue of LOA by NR and the contractor is bound to enter into the M&P operation agreement at the quoted rates as per below table. However, Railways reserve the right not to enter into the operation contract for a particular machine..
  - b) The detailed terms and conditions of operation contract shall be given by the

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bidder in the technical bid.

- c) Rates for operation agreement shall not be subject to any variation except for any statutory changes in taxes and duties.
- d) Performance bank guarantee is to be submitted in the prescribed format and document of the railways equal to the 1/4th value of operation cost for each machine separately.

- 1.2.20.4 The Contractor shall ensure operation of the machine, employing sufficient number of suitably trained skilled and unskilled manpower, ensuring quality and productivity parameters, during the period of operation.
- 1.2.20.5 The Contractor shall make available all the consumables except those being provided by Railways at free of cost for operation of the M&Ps. Railway will provide utilities like compressed air, natural water and electricity free of cost for operation.
- 1.2.20.6 Criteria of acceptance: For satisfactory performance and for payment of operation charges, the contractor should produce the finished products as per rated output every quarter, of acceptable quality certified as per Para 1.2.20.15 below:
- 1.2.20.7 **Rated output:** As per the productivity of the machine to the committed cycle time, as called for in the technical specification.
- 75 locomotives per quarter considering 25 working days in a month.
- 1.2.20.8 Each finished product from machine will be accounted for rated output only upon certification for compliance to the quality parameters as per the respective drawings.
- 1.2.20.9 Periodical quality checks as per existing norms (for determining the quality of the components produced on these machines) will be carried by the Railways.
- 1.2.20.10 In case of defective components produced on these machines, the same have to be rectified free of cost by the contractor duly ensuring no loss to the rated output of the machines.
- 1.2.20.11 Contractor may require operating the machines on holidays/ Sundays also; for meeting the quarterly production target if machine remains under breakdown or non-availability of manpower on working days.
- 1.2.20.12 Contractor shall not be eligible any extra payment if the quarterly output is increased by 10% of the rated output (rounded off to nearest whole number). Beyond 10 % increase in output in a quarter, additional payments shall be made as given below:

$$\text{Additional Payment} = \frac{\text{Additional Output}}{\text{Rated output for that quarter}} \times \text{Quarterly payment}$$

- 1.2.20.13 If Railway fails to provide minimum guaranteed quarterly load (Raw material input in good condition for the rated output, compressed air, natural water and electricity) then also the contractor would be paid as per the terms and condition of the operation contract agreement, i.e., the contractor would be paid fully for rated output for the quarter.
- 1.2.20.14 **Payment:** Normally quarterly payment will be made to the contractor within 30 days from the end of that quarter subject to submission of the Certificate for the satisfactory performance, on submission of bills.
- 1.2.20.15 Certificate for the satisfactory production as per rated capacity of the machine, will be certified by concerned Dy. Chief Mechanical Engineers/Sr.DME/Sr.DEE in-charge of production, based on the report of the concerned SSEs in-charge of Production.



1.2.20.16

**Penalty Clause:** Failure to ensure the rated output will result in the following penalty. Penalty shall be calculated as percentage of quarterly payment and will be deducted from the respective quarterly payment. Penalty calculation will be done as per details given below:

SN	Description
1	<p>Reduction in rated quantity of output on proportionate basis, calculated as follows: Quarterly Outturn required :- 75 locomotives</p> <p>The penalty will be calculated for each machine separately as below:</p> $\text{Penalty} = \left\{ \frac{\text{Rated Output} - \text{Actual outturn}}{\text{Rated output for that quarter}} \right\} \times \text{Quarterly payment as per the contract}$

1.2.20.17

The operation contract agreement for each machine will be done separately on mutually agreed terms and conditions as offered by bidder and accepted by Railway.

1.2.20.18

The operation charges attached in financial bid will not be considered for evaluation of offer being optional.

1.2.20.19

The contractor should engage only those persons who have been medically examined by the Medical Practitioner having minimum MBBS degree and their character should also have been duly verified by the Police/ Gazetted Officer/ Notary/ Sarpanch/ Village Pradhan. However, in case of Govt./ Public Sector agency engaging staff, such certificate/ character verification will be exempted. The contractor shall submit the medical fitness and character certificates of his employees to the concerned CDO, before taking up the job inside the complex at the beginning of the work as well as between as and when any of his employee is replaced with new employee.

1.2.20.19.1

The contractor shall submit the BIO-DATA (name, Father's name, Address, Age, size photo & employee no. etc.) of his employees duly attested by the contractor to the CDO, before taking up the job inside the complex at the beginning of the work as well as in between as and when any of his employee is replaced with new employee.

1.2.20.20

**Issue of Entry Permit:** Contractor should issue Identity badges (as per approved format by concerned CDO) to all his labour being engaged to carry out the Work, including the Supervisor. These identity badges should be so carried that Railway Security can identify them.

1.2.20.21

**Legal obligations of the successful bidder:**

The contractor shall be responsible for carrying out all legal obligations under this contract. The contractor shall adhere to the provisions of various acts as under:

- Minimum Wages Act, 1948 (para 54 of Indian Railways Standard General Conditions of Contract)
- Payment of Wages Act 1936 (para 55 of IRGCC)
- Contractor Labour (Regulation and Abolition Act) (para 55 A of IRGCC)
- The workmen's Compensation Act. (para 57 A of IRGCC)
- Factories Act, 1948.
- The contractor shall also fulfil any other required legal obligations as part of this contract.

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## 2. GENERAL ELECTRIC SPECIFICATION:

2.1 The provision of this General Specification shall apply, where ever relevant.

2.2 All equipments and material shall comply with appropriate Indian Standards (latest), International Standards or National Standards of the country of origin provided the latter are equivalent to or better than the former. The tenderer shall indicate the Standards applicable. The following standards are applicable in particular.  
(Corresponding International Standards like ASA, NEMA, BIS, DIN etc. may also be quoted).

- |                         |  |
|-------------------------|--|
| IS : 325-1979 (latest)  | - Three phase induction motors (corresponding to IEC pub-34-1) (Latest).   |
| IS : 1248 (Latest)      | - Direct acting indicating analogue electrical measure instruments and their accessories (corresponding to IEC Pub-51) (Latest).                                       |
| IS : 1231-1974 (Latest) | - Dimensions of three phase induction motors (corresponding to IEC Pub-72-1) (Latest).   |
| IS : 1271-1985 (Latest) | - Classification of insulation material for electrical machinery & apparatus in relation to their thermal stability in service (corresponding to IEC-Pub-85) (Latest). |
| IS : 6875 (Latest)      | - Push Buttons and related control switches corresponding to IEC Pub/73) (Latest).   |
| IS : 375-1963 (Latest)  | - Marking and arrangement of switch gear, bus bars, main connection & auxiliary wiring.  |
| IS : 996-1979 (Latest)  | - Single phase small AC and universal electrical motors.   |
| IS : 1356 (Latest)      | - Electrical equipment of machine tools.   |
| IS : 2516 (Latest)      | - Circuit breakers (corresponding to IEC Pub-56) (Latest)  |

2.3 Unless specified in the main specification, the AC motors and starters shall be of the following type. Tenderer is, however, free to give alternative proposal along with justification, if in his view alternative proposal is warranted by site conditions. Type of motor type of starter.

### TYPE OF MOTOR

### TYPE OF STARTER

- |       |  |                                     |
|-------|--|-------------------------------------|
| 2.3.1 | Any type of AC motor starting current of which does not exceed 75 amps.  | Direct on line.                     |
| 2.3.2 | AC squirrel cage, introduction motors, starting current of which is above 75 amps. if started direct on line   | Star delta or Auto transformertype. |
| 2.3.3 | AC slipring type motor   | Resistance type air/fan Cooled      |
| 2.3.4 | AC synchronous or synchronous induction motor.   | Suitable makers standard.           |
| 2.3.5 | DC motor   | Resistance type/Thyristor type.     |
| 2.4   | The control gear for AC/DC motors shall incorporate the following protection devices as concomitant accessories.   |                                     |
| 2.4.1 | <b>No Voltage Protection</b> - No voltage protection shall be provided so that machine will not start up again by itself when, following an interruption the supply is restored. |                                     |
| 2.4.2 | <b>Short Circuit Protection</b> - To protect against short circuits due to insulation failure  |                                     |

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of faulty connections HRC fuses/MPCB's shall be provided for each motor. The rating of the fuse/MPCB's shall be such as to take care of the over current due to motor starting.

- 2.4.3 **Over Load Protection** - To prevent motors from overloading, overload protection shall be provided separately for each motor. Three phase motors shall be protected by overload tripping devices on each phase.
- 2.4.4 **Single Phasing Protection** - On load single phasing protection shall be provided using MPCB as detailed above.
- 2.5 Control equipment shall be mounted in separate drip proof enclosures. Control enclosures and compartments are to be so designed as to give adequate protection against ingress of dust, oil, coolant or chips. All control devices like contractors etc. shall be front mounted on a rigidly fabricated metal panel for ease of operation. All other electrics shall be installed that they are readily accessible when the doors and covers are opened. Hinged covers shall be interlocked with the machine tool control to prevent operation of the machine when cover is open.
- 2.6 The motor shall be totally enclosed with or without fan cooled frame. Screen protected drip proof type motor may be provided if it is mounted inside protective enclosures.
- 2.7 The electrical equipments shall comply with the requirement of Indian Electricity Act and Rules (latest).
- 2.8 All instruments shall be of the Industrial Grade "A" (IS-1248) switch board type the range of the instrument shall be such that the maximum load expected in the circuit shall produce a deflection of 60% to 80% of the full scale.
- 2.9 The supplier shall furnish 3 sets of complete electrical and electronic wiring diagrams in full details to enable the maintenance staff to locate faults in the circuits, 3 sets of part catalogues, maintenance manuals operating instructions with details of coils and windings, used in the equipment to facilitate repairs and maintenance should also be supplied.
- 2.10 For main motor class minimum "B" Class insulation shall be provided. If any other class of insulation is proposed, detailed justification for providing different class of insulation shall be given.
- 2.11 Motors shall be designed to withstand frequent starts, stops and reversals as demanded in the operation of the machine.
- 2.12 Two earthing terminals shall be provided on all electric motors including the control gear.
- 2.13 **POWER SUPPLY:**
- 2.13.1 The machine shall be suitable for operation on 415 volts 3 phase 50 cycles AC 3 wire or 4 wire system with neutral solidly earthed. The supply voltage may vary up to +10% -20%. The frequency may vary up to  $\pm 3\%$ . However, full rated power of the motor shall be available at the lower voltage. Firm should confirm satisfactory performance of the machine at incoming power supply in the range 415V+10%-20% and 50HZ $\pm 3\%$  frequency or should provide voltage stabilizer as specified against clause 2.13.2 below of required capacity.
- 2.13.2 The voltage stabilizer, if required, shall conform to :
- |          |                    |   |
|----------|--------------------|---|
| 2.13.2.1 | Input Voltage      | - 320 to 460 volts 3 phase 4 wire supply. |
| 2.13.2.2 | Out put Voltage    | - 415 volts                               |
| 2.13.2.3 | Regulation         | - $\pm 1\%$ from No load to Full load.    |
| 2.13.2.4 | Rate of correction | - 20 volts per second per phase.          |

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