

**Computer controlled, Simultaneous, Bench Top, Atomic Emission Rotating Disc Electrode (AES-RDE) type  
Spectrometer to Specification No.CR / IR /Spectrometer/RDE/Oil/2025**

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## ABBREVIATIONS

A-1,A-2, A-3, A-4	Standard paper sizes
AC	Alternating Current
AMC	Annual Maintenance Contract
AT	Acceptance of Tender
BG	Bank Guarantee
PCME	Principal Chief Mechanical Engineer
CNC	Computer Numeric Control
CR	Central Railway
PCMM	Principal Chief Material Manager
PFA	Principal Finance Advisor
Db	Decibel
DC	Direct Current
FA&CAO	Financial Advisor & Chief Accounts Officer
Sr.DFM	Senior Divisional Finance Manager
Dy.FA& CAO	Deputy Financial Advisor & Chief Accounts Officer
WAO	Workshop Accounts Officer
GA (Drawing)	General Arrangement (Drawing)
HRC	Hardness Rockwell 'C' Scale (value)
Hz	Hertz
IEC-Pub	International Electro technical Commission – Publication
JCN	Joint Commissioning Note
JRI	Joint Receipt Inspection
kW	Kilo Watt
LC	Letter of Credit
LD	Liquidated Damages
LOA	Letter of Acceptance
NC	Numeric Control
NIT	Notice Inviting Tenders
PBG	Performance Bank Guarantee
PDF	Portable Document Format
PLC	Programmable Logic Controller
PTC	Proving Test Certificate
PU	Production Unit (Any of the six Railway Production Units e.g. RCF, ICF etc.)
RDSO	Research Design & Standards Organisation
SS	Stainless Steel
WBG	Warranty Bank Guarantee

## **BASIC DESIGNFEATURES**

### **Safety Features**

1.1.1 The machine shall incorporate all safety devices so as to provide complete protection to the operator and machine. Some of the important safety features, which should be available on the machine, are mentioned below which are applicable to the quoted machine-

- (a) If the samples are not properly clamped or rested, machine should be stopped and error is to be displayed on the control screen.
- (b) The sample should not get unclamped in the event of power failure or an emergency stock.

**Note-Offer should give details of all safety features present in machine.**

- 1.1.2 The safety feature shall include safety device against over loading.
- 1.1.3 Emergency stop (a master switch) shall be provided on the machine, which shall be easily accessible and capable of disabling the machine in case of any emergency.
- 1.1.4 A detailed list of alarms / indications provided on machine should be submitted by the supplier, if being provided on the offered machine.
- 1.1.5 Environmental conditions:- The machine shall be capable of working at an ambient temperature upto 50 deg. C and relative humidity of 98% in a normal, non air –conditioned environment.
- 1.1.6 The spectrometer shall be contained, compact and unibody construction. All system components should be mounted within a spacious well-ventilated cabinet and easily accessible for maintenance and service. Modular construction with suitable colour coded printed circuit boards for easy identification shall be preferred for minimizing down time during system failure.
- 1.1.7 The system shall suitably integrate an optical system, power input and distribution including voltage regulators and computer with data printer for controlled data handling and print out.
- 1.1.8 The equipment should be suitably tropicalized to meet with the Indian climatic conditions during transportation, assembly and operation.
- 1.1.9 The Spectrometer should be of such design that it ensure the safety of the operator and the machine at all the times. Details of the safety features including various interlocking between subsystems of the spectrometer provided shall be furnished in the bid with adequate write-up and diagrams, clearly bringing out advantage of each features provided.

## **1.2 SPECIFIC CHARACTERISTIC**

The supply of RDE Spectrometer shall be on turnkey basis and should include all equipment and concomitant accessories as detailed in the specification and any other equipment, which the manufacturer considers essential to make the machine fully operational when installed and connected to power source.

### **1.2.1 GENERAL**

#### **1.2.2 Capability**

**The bidder must confirm and indicate actual capability of the offered equipment against each of the following capability clauses. The bidder should clearly mention the model number of equipment offered.**

- 1.2.2.1 The spectrometer shall be capable of the following purposes. The exact requirement and technical parameters are indicated in Leading parameters vide clause 2.2 of Section-IV.
- 1.2.2.2 Rapid, Accurate and Repetitive Quantitative & Qualitative Metallurgical analysis of wear metals in used oils of Diesel locomotives up to 1-ppm concentration.
- 1.2.2.3 Capable of analyzing up to thirty-two elements in a semi-quantitative manner and Simultaneous detection capability in ppm range for all elements as given in Annexure 'E' to Section-VI.
- 1.2.2.4 Capable of analyzing various elements in oil as per RDSO recommendation in three minutes or less. The measurement should be quick, reliable, and repeatable with sample testing time to test minimum 120 samples in 8 hours shift. The cycle time should cover all the activities given below:
  - i) fill up oil sample in the sample testing cup
  - ii) put up sample cup in the sample chamber
  - iii) after putting the sample in the chamber close the door
  - iv) press the analysis button of the machine for analysis
  - v) start the burning of the sample and analysis processes
  - vi) print out the analysis reports
- 1.2.2.5 The analytical program, being followed at Diesel Locomotive Repair Sheds, for various elements in oil as per RDSO recommendation (Ref: Ann.-I of MP guide no.6, May 2007, Rev-02 of RDSO/LKO) may be referred vide sub-clause 2.2.2.5 of Leading parameters under clause 2.2 of Section-IV.

- 1.2.2.5 Achieving analytical stability in fifteen minutes or less from a cold shutdown state.
- 1.2.2.6 Achieving thermal stability without the use of heating or cooling elements for any optical components.
- 1.2.2.7 The machine should be able to work continuously for 2 shifts per day and for 365 days in a year (the only shutdown allowable would be for preventive maintenance. The preventive maintenance schedules along with approximate time carrying out each schedule should be submitted as part of the bid.)

### **1.2.3 OPTICAL SYSTEM**

- 1.2.3.1 The optical design/arrangement shall cover Wavelengths indicated in Leading parameter under clause 2.2 of Section-IV of technical specifications to cover the specified analytical requirement indicated therein. The appropriate spectral order shall be selected for optimum resolution and sensitivity with minimum Inter-elemental interference. It shall cover maximum analytical emission wavelength lines.
- 1.2.3.2 The optical system shall comprise of Entrance and Exit slits suitably designed and matched to provide maximum light throughput.
- 1.2.3.3 The polychromator optics shall be capable of meeting the parameters furnished in Leading parameter under clause 2.2 of Section-IV. The optical profile shall verify alignment of each channel. Full details about the optics should be furnished in the bid along with suitable diagram(s).
- 1.2.3.4 The optical system of spectrometer shall have dynamic background correction applied for all application. The optical components shall be so designed to minimize the stray light emanating from them, aiming to completely eliminating it and shall be shock and vibration protected.
- 1.2.3.5 The grating used shall be of adequate groove density in order to meet the parameters furnished in Leading parameter under clause 2.2 of Section-IV. The grating used shall be capable of adequately dispersing the wavelengths, so as to cut down any overlapping of wavelengths for the elements given in Schedule-I of section-IV & Annexure - E of section-VI, and minimize interference.
- 1.2.3.6 The gas purging system for optics, if required, should have effective method of removing contamination and impurities and it should have minimal consumption of purging gas. Details of gas purging system along with the requirement of purging gas shall be furnished in the bid.
- 1.2.3.7 For thermal stability, the optical system shall be isolated from all heat generating components. The system of isolation shall be explained in detail in the bid alongwith corresponding diagram(s) and adequate write-up.

### **1.2.4 SAMPLE EXCITATION SYSTEM**

- 1.2.4.1 The excitation system of spectrometer shall have following technical features: --
  - Oscillatory arc discharge
  - Solid-state ignition to fix source frequency with high temperature resistant components.
  - Voltage stabilized, internally regulated
  - Automatic voltage/ frequency selection
- 1.2.4.2 The spectrometer shall have automatic sample stand set-up monitors and warning indicators for following: -
  - Monitor presence of disc electrode
  - Monitor presence of rod electrode
  - Monitor presence of analytical gap
  - Monitor presence of oil in sample holder
  - Monitor presence of oil sample holder on sample stand
  - Monitor sample stand door closure
- 1.2.4.3 **Details of the offered sample excitation system should be furnished along with adequate technical write-up highlighting advantages of offered system in the bid.**

### **1.2.5 SAMPLE INTRODUCTION SYSTEM/Sample Stand:**

- 1.2.5.1 The sample introduction system shall be incorporated with following technical features:-

- Automatic sensing to determine that electrodes and sample are properly loaded -
  - Suitable Sample vessel holder
  - Rod electrode holder with automatic gap setting mechanism -
  - Exhaust mechanism
  - Door safety interlock
  - Oil drip tray
- 1.2.5.2 Details of the offered sample introduction system should be furnished along with adequate technical write-up highlighting advantages of offered system in the bid.
- 1.2.5.3 SAMPLE STANDARD**
- 1.2.5.3.1 The spectrometer shall be provided with the facility of using standard consumable electrodes and shall be capable of accommodating readily available disposable and reusable sample vessels.
- 1.2.5.3.2 It shall contain carbon electrode, sample table, rod electrode gaping mechanism and sample stand monitoring sensor. Details for the same and its working shall be explained in the offer by the bidder.
- 1.2.6 DETECTION SYSTEM:**
- 1.2.6.1 The detection system shall be having high signal multiplication capability.
- 1.2.6.2 The detection system shall be so designed to produce best result & good sensitivity for the wavelength of the chosen element as per Leading parameter under clause 2.2 of Section-IV & Annexure- E of Section-VI. The system should be properly cooled for stability and continuous working.
- 1.2.6.3 The bidder shall offer a detection system capable to achieve required accuracy for detection.
- 1.2.6.4 Details of the offered detection system should be furnished along with adequate technical write-up highlighting advantages of offered system in the bid.
- 1.2.6.5 The spectrometer shall be provided with suitable Sulphur optics to count Sulphur counts in the oil as stipulated in clause 4.3.10 as optional accessory and relevant details for the same shall be provided in the offer by the bidder.
- 1.2.7 ANALYTICAL SYSTEM**
- 1.2.7.1 Computer System–HARDWARE**
- 1.2.7.1.1 The Spectrometer shall have suitable computer system to control and monitor primary spectrometer functions, integration, A/D Conversions and diagnostics. It should be supported by Key Board, Printer, Monitor etc and shall confirm to the following minimum features (or the latest available at the time of supply):
- Processor – Intel Core i7 (latest Generation)
  - Completely environmentally sealed, shock & vibration protected -
  - 16 GB RAM minimum.
  - Hard Disk 2TB Min
  - DVD Rewriter 16X or better.
  - 23 inch Colour LED Monitor display
  - Four USB Port, one parallel printer port minimum.
  - Key Board (multimedia) wireless
  - Colour Laserjet printer with, Xerox and Automatic 2 side printing
  - Network capability.
  - Clock/calendar board with battery backup
  - Only internationally reputed makes e.g. HP/COMPAQ/IBM/DELL/ASUS of computers and peripherals shall be accepted.
- 1.2.7.1.2 A compatible UPS capable of providing 60 minutes backup for the spectrometer and the computer system should be offered to take care of power supply failures. Make Model number and full technical literature should be furnished in the bid, along with calculation to prove full back up capability for 60 minutes of operation.
- 1.2.7.2 Computer System-SOFTWARE**
- 1.2.7.2.1 The operating system shall be Windows 10 (Pro) or latest, which should be preloaded and supplied along with the genuine media. A suitable Antivirus (with license for 03 years) like Norton/Quick Heal etc latest preloaded and on media should be supplied with the computer system to prevent any virus attack. The system shall be preloaded with Microsoft office (Pro).

- 1.2.7.2.2 All functions as well as output sequence should be determined and controlled by suitable software of international repute. It should offer the following minimum features:
- a) Storage of one time standardization and calibration curves to avoid periodic calibration.
  - b) Menu driven interactive programming methods shall be used for communications by operator for routine operation, calibration, standardization etc.
  - c) The system should not require the operator to have special knowledge of computer programming in order to operate the system. With minimum training the operator should be able to perform all routine operating functions, diagnosis and routine maintenance. The software should be easy to use and user friendly
  - d) Automatic programme selection through computer

- 1.2.7.2.3 The software shall be capable of simultaneous integration of wavelengths. The software shall be based on Windows 10 (pro) or latest. The capabilities of the software shall necessarily include, but not be limited to, the following functions:

- i. Pull down menu selection of all spectrometer functions
- ii. Complaint screen structure
- iii. Database software interfaces for relevant protocols
- iv. Output of intensities, intensity ratios, standardized and corrected intensity ratios, and PPM or % concentration
- v. Automatic switching of spectral lines based on concentration
- vi. Sample stand set-up sensing software
- vii. Sample ID with date and time
- viii. Automatic optical profile procedure
- ix. Additive and multiplicative inter-element corrections
- x. Automatic repeatability calculation
- xi. Real Time Clock
- xii. Automatic calculation of average, standard deviation, and relative standard deviation
- xiii. Automatic hardware diagnostics
- xiv. Standards Library
- xv. Storage of complete spectral information for future evaluation
- xvi. Direct screen reading of samples under test.
- xvii. Remote access and network capability
- xviii. Minimum 20 report formats to be provided and finalized with consignee approval in the event of the tender getting accepted

The bidder should furnish full technical literature/write-up which confirms each of the capabilities as listed above in the bid.

## 1.2.8 **Infrastructural requirements**

- 1.2.8.1 The bidder shall indicate the space, air-conditioning and other requirements for optimal performance of the machine in the bid.
- 1.2.8.2 Consumables (e.g. Argon/Nitrogen gas, if required, requirement of graphite rod & disc electrodes etc.) for initial commissioning shall also be indicated in the bid giving full technical specification and quantity.
- 1.2.8.3 The bidder shall clearly furnish the cooling water requirement, if required, flow rate, inlet temperature and inlet pressure along with water quality required for the machine.
- 1.2.8.4 The bidder shall furnish the electrical power requirements for the machine along with its subsystems.
- 1.2.8.5 The bidder shall quote and furnish details of the exhaust system, if needed, with all its components and accessories with diagrams detailed write-ups. This exhaust system should accompany the machine as a concomitant accessory.

2.

## **GENERAL ELECTRIC SPECIFICATION**

2.1

2.2

The provision of this General Specification shall apply, wherever relevant.

All equipments and material shall comply with appropriate Indian Standards (latest) or National Standards of the country of origin provided the latter are equivalent to or better than the former. Items for which Indian Standards are not published, National Standards shall be acceptable. The tenderer shall indicate the Standards applicable. The following standards are applicable in particular.

(Corresponding International Standards like ASA, NEMA, BSS, 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 measuring 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 transformer type.
2.3.3	AC slipring type motor	Resistance type air/fan Cooled
2.3.4	AC synchronous or synchronous induction motor.	Suitable maker's 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 of faulty connections HRC fuses shall be provided for each motor. The rating of the fuse shall be such as to take care of the over current due to motor starting.	
2.4.3	<b>OverLoad Protection-</b> 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	<b>Single Phasing Protection-</b> A separate current sensitive delayed action single phasing preventer shall be provided for each motor separately. Overload protection shall not be treated as single phasing preventer.	
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.	
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 04 sets of complete electrical and electronic wiring diagrams in full details to enable the maintenance staff to locate faults in the circuits, 04 sets of part catalogues, maintenance manuals operating instructions with details of coils and windings, used in the equipment as per clause 4 of Section-V to facilitate repairs and maintenance should also be supplied.
- 2.10 For main motor class minimum "B/F" 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 220 volts single phase 50 cycles AC with neutral solidly earthed. The supply voltage may vary up to  $\pm 10\%$ . The frequency may vary up to  $+3\%$ . 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  $220V \pm 10\%$  and  $50\text{HZ} + 3\%$  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
- |      |                                 |   |   |
|------|---------------------------------|---|---|
| i)   | Input Voltage                   | - | $220 \pm 10\%$ volts single phase                         |
| ii)  | Out put Voltage                 | - | 220 volts   |
| iii) | Regulation                      | - | $+1\%$ from No load to Full load.                         |
| iv)  | Rate of correction              | - | 20 volts per second per phase.                            |
| v)   | Wave from distortion            | - | NIL   |
| vi)  | Efficiency                      | - | Not less than 97%.  |
| vii) | Winding and class of insulation | - | Copper wire wound with "B" class of insulation or better. |
- 2.13.3 In case of machines equipped with NC, SS, CNC, Thyristor controlled devices and other sophisticated electronic gadgets including microprocessors etc. which are susceptible to power line spikes and surges, a suitable voltage stabilizer and ultra isolation transformer of adequate capacity to cover for the entire electrical load of the machine shall be offered as a concomitant accessory conforming to Specification for voltage stabilizer as mentioned in clause 2.13.2 above and isolation transformer to the parameters mentioned below. Indigenous make voltage stabilizer and isolation transformer from the reputed manufacturers are acceptable.
- |      |                             |   |  |
|------|-----------------------------|---|--|
| i)   | Transformer ratio           | - | 1:1  |
| ii)  | Winding                     | - | Copper wire wound with "B" class insulation or better.                               |
| iii) | Protection                  | - | To arrest spikes and surges to the order of 3 KV for 200-400 micro seconds duration. |
| iv)  | Common mode noise rejection | - | 120 dB   |
| v)   | Isolation                   | - | Capacitance 005 Pf: resistance greater than 1000 Mega Ohms.                          |
- 2.13.4 Voltage stabilizer shall be equipped with a protective relay to trip to trip the AC power supply to the machine instantaneously with audio and visual indication to the operator. Settings of the protective relay for low and high voltage shall be 320 volts and 460 volts respectively.
- ### **2.14 ATMOSPHERIC CONDITIONS/ TROPICALISATION**
- 2.14.1 The ambient temperature at the site at which the machine will be installed may vary from  $+0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  over the year. The relative humidity may be as high as 98%. The atmosphere is expected to be dusty. The machines offered shall be suitably tropicalized to work under these atmospheric conditions without any adverse effect on their performance.



- 2.14.2 The bidder should clearly indicate the features / sub assemblies provided in electrical, mechanical and electronic systems to achieve the above objectives.
- 2.15 The temperature rise shall not reach such a value that there is a risk of injury to any insulating material or adjacent parts.
- 2.16 The drive shall be capable of operating at any one of the speed required independent of the load in accordance with the requirements of the machine.
- 2.17 Information/data shall be furnished as per the format of submission of technical bid in Annexure–A of Section-VI.

### **3. GENERAL CHARACTERISTIC**

#### **3.1 RIGIDITY AND STABILITY**

- 3.1.1 The machine shall be robust, rigid and of sturdy construction. It shall be designed to meet heavy duty demands of various operations on the machine under normal Workshop environment for such machines. It shall be free for vibrations even when working at full capacity.
- 3.1.2 All machine castings shall be made of close grained high grade cast iron like Mechanite or equivalent materials meeting IS-210 Standards to ensure durability and rigidity. The casting shall be thermal stress relieved to ensure stability and continued accuracy.
- 3.1.3 All machine fabrications of critical load bearing assemblies like beds, columns etc. shall be adequately strengthened and stress relieved.
- 3.1.4 Change in ambient temperature shall not affect the performance of the machine.
- 3.1.5 There shall be no change in the performance of the machine either on switching on the machine or after continuous running.
- 3.1.6 There shall be no resonant vibrations throughout the working range of the machine at all load levels.

#### **3.2 SAFETY CONTROLS**

- 3.2.1 The machine shall incorporate safety devices to provide protection to the operator and machine against all possible operational and machinery failures.
- 3.2.2 Suitable interlock shall be provided to prevent machine operations in the event of:
  - 3.2.2.1 Faulty sequence of operation.
  - 3.2.2.2 Fluctuation in supply voltage.
  - 3.2.2.3 Resumption of power supply after power failure.
  - 3.2.2.4 Non-positioning of safety guards.
  - 3.2.2.5 Failure of hydraulic system (where applicable)
  - 3.2.2.6 Failure of lubricating system (In case of automatic including drop in pressure lubrication)
- 3.2.3 A fault or damage in the control circuit or interruption re-establishment after an interruption of fluctuation in whatever manner in the power supply to the machinery must not lead to dangerous situations in particular.
  - 3.2.3.1 The machinery must not start unexpectedly.
  - 3.2.3.2 The machinery must not be prevented from stopping if command has already been given.
  - 3.2.3.3 No moving part of the machinery or piece held by the machinery shall fall or be ejected. The protection devices must remain effective.
  - 3.2.3.4
- 3.2.4 The machine shall be fitted with an emergency stop device to enable actual or impending danger to be averted. This device must be:-
  - 3.2.4.1 Conveniently located.
  - 3.2.4.2 Clearly identifiable.
  - 3.2.4.3 Stop the machine as quickly as possible without causing additional hazards.
  - 3.2.4.4 The emergency stop must remain engaged. It should be possible to disengage it only by appropriate operation. Disengaging the control must not restart the machinery but only permit restarting.

- 3.2.5 Safety features shall also include.
- 3.2.5.1 Safety device against overload for all mechanical and electric items to the extent possible.
- 3.2.5.2 Safety stops against over-running of slides.
- 3.2.6 Guard and protection devices shall protect exposed persons against risks related to moving transmission parts (such as pulleys, belts, gears, rack and pinion, shafts etc.) and moving parts directly involved in the process to the extent possible. This shall meet the following requirements: -
  - 3.2.6.1 Be of robust construction
  - 3.2.6.2 Not give rise to any additional risk
  - 3.2.6.3 Not be easy to by pass or render non-operational
  - 3.2.6.4 Be located at an adequate distance from danger zone
  - 3.2.6.5 Cause minimum obstruction to the view of the production process. Rigidly connected and not prone to rattling
  - 3.2.6.6 Enable essential work to be carried out without the guard or protection device having to be dismantled
- 3.2.7 A load meter shall be provided to indicate the load on the machine. The meter shall have a suitable mark to indicate the maximum load the machine can take. Full details of the above and other safety features indicating how each one functions must be explained in the offer.
- 3.3 OPERATIONAL CONTROLS**
  - 3.3.1 The operation of the machine shall be by push buttons or levers. The basic rules for the direction of operation of controls and the corresponding direction of movements of the machine tools shall be as per IS: 2987-1985.
  - 3.3.2 The control devices shall be
    - 3.3.2.1 Clearly visible and identifiable.
    - 3.3.2.2 Ergonomically positioned for safe operation without hesitating or loss of time, and without ambiguity.
  - 3.3.3 CNC Controls (where applicable) -The general requirements of CNC controls are given at Section-V.
- 3.4 LIGHTING**
  - 3.4.1 Integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity shall be provided.
  - 3.4.2 The manufacturer must ensure that there is no area of shadow likely to cause nuisance, that there is no irritating dazzle and that there are no dangerous stroboscopic effects due to lighting provided by the manufacturer.
  - 3.4.3 Integral parts requiring frequent inspection and adjustment and maintenance areas must be provided with appropriate lighting.
  - 3.4.4 The machine lighting should be of low voltage so as to prevent any hazard to the operator.
- 3.5 MACHINE MAINTAINABILITY**
  - 3.5.1 The machine shall be so designed as to require minimum possible maintenance and to give trouble free service.
  - 3.5.2 All assemblies/parts of the machine shall be easily accessible for maintenance.
  - 3.5.3 The machine shall not require major dis-assembly for checking and replacement of a particular part, especially for parts requiring periodical check up and replacement.
  - 3.5.4 The manufacturer must provide means of access e.g. stairs, ladders, cat walks etc. to allow access safety to all areas used for production, adjustments and maintenance operations.
- 3.6 WEAR COMPENSATION ADJUSTMENT**
  - 3.6.1 The original built in accuracy of the machine shall be capable of being maintained conveniently and economically by suitable adjustments for taking up wear on slides, bearings and load screws. The system of adjustments incorporated shall be explained in the offer.
- 3.7 COOLANT SYSTEM (WHERE APPLICABLE)**
  - 3.7.1 The coolant system will be required, if wet cutting is offered. A Recirculation type flood coolant system through adjustable trajectory multiple nozzle around the spindle. The self-contained coolant system should

be completed with coolant pump, piping, coolant reservoir, filter etc. should be provided. The supply of coolant should be in ample volume of at least 40 lpm with provision of internal coolant through spindle of more than 5 bar pressure. System should have preferably flood coolant arrangement as built in feature. The details of the system & Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.

- 3.7.2 The coolant system should consist of pumps, coolant tank, filter drum (made of high quality steel net filter) and re-circulation arrangement. There should be provision of two stage filtration i.e. pre filtration and fine filtration (20 micron size) checking device should be provided for verifying coolant level and pressure. The coolant system should be programmable through the CNC control. A chip and coolant tray shall be provided. The volume of coolant flow shall be indicated. It shall be adjustable. The Technical details including make, model should be furnished with the offer.
- 3.7.3 All attachments, tool holders, adapters etc. shall have the provision for internal & through coolant. In case it is not possible to provide tool holder/adapter with provision for internal/through coolant, the length of the External coolant nozzle / External coolant pressure / External coolant flow rate should be such that it should be sufficient to flood the tool cutting tip while cutting.
- 3.7.4 An enclosure shall be provided to prevent the coolant from splashing outside the machining zone. Details of enclosure shall be provided. Specific requirements of coolant system in milling head shall be clearly indicated.
- 3.7.5 It should be ensured that the coolant should not affect table bearings & spindle bearings. Details of the arrangement provided should be explained in the offer.
- 3.7.6 Coolant collection and recirculation system should be leak proof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc.

### **3.8 LUBRICATION SYSTEM(WHERE APPALICABLE)**

- 3.8.1 The machine shall be provided with an CNC controlled automatic centralized lubricating system for ensuring delivery of adequate quantity of lubricant in regular interval to areas requiring continuous lubrication i.e. headstock gearing, spindle assembly, all sliding surfaces and ball screws shall be provided through continuous cycle, independent motor driven pump complete with filter and safety pressure switch. The centralized lubrication system should be from reputed make i.e. Rexroth, Vogel or Cenlub. Suitable arrangements must be provided for indication of failure of the lubricating system. The make, number of cooling points, other relevant data etc. should be indicated in the offer.
- 3.8.2 The system shall be provided with interlock to prevent machine operating/starting in the event of the failure lubrication system.
- 3.8.3 Suitable filters capable of filtering chips, dust particles etc. shall be provided. Indicators for showing clogged condition of filters shall be available. The filters shall be indigenously available. If reusable filter cannot be offered, the filter cartridge shall be readily available in India. Source of supply shall be indicated. Adequate no. of filters for 2 years working on double shift basis shall be offered as spare.
- 3.8.4 Lubrication and filter cleaning chart shall be displayed on a metal plate at a conspicuous location on the machine indicating :-
  - (a) Specific location of points on the machine to be oiled lubricated/greased.
  - (b) Periodicity of lubrication of these points.
  - (c) Filter to be cleaned.
  - (d) Periodicity of cleaning filters.
  - (e) Periodicity of replenishing lubricating oil for the centralized system.
  - (f) Any other similar relevant information.
- 3.8.5 Points where manual lubrication is needed shall be separately indicated. Frequency of lubrication shall be also clearly mentioned.
- 3.8.6 Lubricating oils used in the machine shall be available in India. Successful tenderer will be required to indicate brand names of approved oils manufactured by various Indian Oil Companies.
- 3.8.7 First fill of lubricating oils used in the machine shall be provided with the machine.

### **3.9 PNEUMATIC SYSTEM(WHERE APPLICABLE)**

- 3.9.1 Pneumatic system shall be provided with air filter, oil filter & air dryer. The system should incorporate safety device for disabling the machine in case of drop in pressure below 5 kg/cm<sup>2</sup>.

- 3.9.2 The compressed air supply will be provided by the customer at the machine within pressure range of 5 kg/cm<sup>2</sup> and a moisture content or 1000 ppm. The pneumatic system of the machine should be designed accordingly. An alarm shall be provided for low air pressure.
- 3.9.2 Suitable filter/moisture trap shall be provided by the bidder in the system of pneumatic air intake. The filter shall be reusable type and indigenously available. If reusable filter cannot be offered, the filter cartridge shall be easily available in India. Source of supply shall be indicated. Adequate no. of filters for 2 years working on double shift basis shall be offered as spare.
- 3.9.3 Air pressure regulator, if necessary, shall also be provided by the tenderer.
- 3.9.4 The make of pneumatic control equipment shall be of reputed make & shall be indicated.
- 3.10. **HYDRAULIC SYSTEM(WHERE APPLICABLE)**
- 3.10.1 The Machine shall be provided with a suitable Re-circulating Type hydraulic system to cater to the needs of the hydraulic systems / Sub-systems required for guide ways and other components. The hydraulic Tank should be preferably placed at shop floor. No Tandem pumps should be used. Maximum desired permissible pressure should be less than 90 Kg/sq.cm. Hydraulic pumps capacity (flow / pressure) to be intimated & should be kept low which is sufficient for functional requirement but does not add unnecessary heat to the system).
- 3.10.2 Hydraulic circuit must be equipped with the following safety and inspection equipments:
- (a) Pressure gauges at all place, where pressure has to be set up or inspected.
  - (b) Safety valves for hydraulic circuit if relief valve does not fulfill this function.
  - (c) Equipment for checking of temperature in the circuit or in the pump wherever necessary.
  - (d) Arrangement to show if the filters (including those in the pump set) (with electric clogging indicator and alarm on PLC) should be used to avoid frequent clogging of the filters and other maintenance related problems. Filter elements should, preferably be of EPE / Hydac make. The filters shall be of reusable type and indigenously available. If reusable filter cannot be offered, the filter cartridge shall be readily available in India. Source of supply shall be indicated. Adequate no. of filters for 2 years working on double shift basis shall be offered as spare.
  - (e) Alarm for low oil level.
- 3.10.3 The sump aggregate shall have the following:
- (a) Oil level sight gauges or any other equipment showing the minimum and maximum oil levels in sump.
  - (b) A drain plug at the lowest portion of the tank.
  - (c) It shall be possible to drain the oil from the tank without disconnecting any pipes or other fittings.
- 3.10.4 The temperature of oil in hydraulic circuits shall not exceed 60°C in any case. Suitable arrangement shall be incorporated to ensure that the oil is not overheated under local weather conditions at continuous normal working of the machine. Details of the arrangement provided should be furnished in the offer.
- 3.10.5 Facilities for bleeding of air in case of air lock shall be provided.
- 3.10.6 The hydraulic reservoir, pump and allied equipment shall be suitably segregated from the machine in order to remove major source of heat.
- 3.10.7 Hydraulic oils used on the machine shall be available in India. Successful tenderer will be required to indicate brand names of approved oils supplied by various Indian Oil Companies.
- 3.10.8 First fill of hydraulic oils used on the machine shall be provided with the machine. The firm shall also submit estimated annual consumption of oil on 7000 hours per year working basis.
- 3.10.9 The hydraulic system elements shall be from reputed Indian manufacturers like M/s. REXROTH, Vickers-Sperry, Yuken, L&T etc. The make of different elements shall be clearly indicated. Details of Hydraulic system shall be indicated.
- 4.0 TECHNICAL LITERATURE:**
- 4.1 One copy of the printed illustrative catalogue showing features of the machine and its elements must be enclosed with each copy of the bid.

- 4.2 The successful tenderer will have to furnish, for each machine 04 sets of the technical literatures of complete machine including imported and indigenously purchased components/sub-assemblies to the consignee directly within 3 months of placement of AT. 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 training cum inspection of the machine. Bidders should provide a list of literature, which they will supply along with the machine. One set of technical literature should cover the following details:
- i. Operational & Maintenance manual of the machine.
  - ii. Operational & Maintenance manual of the servo controlled voltage stabilizer.
  - iii. Operational & Maintenance manual of the ultra isolation transformer.
  - iv. Instruction & Maintenance manual for Hydraulic Oil Cooling Unit.
  - v. User manual for Tool changer system (if provided).
  - vi. Technical & Maintenance manual for Hydraulic System vii.
  - Technical & Maintenance manual for Lubrication System.viii.
  - Operator Guide for CNC Control System (if provided).
  - ix. Programming Guide for CNC Control System (if provided).
  - x. Diagnostic & Trouble shooting Guide for CNC Control System (if provided).
  - xi. Start-up Guide for CNC Control System (if provided).
  - xii. Machine Software Listing (if provided).
  - xiii. Soft and hard copies of PLC Program in ladder form with cross reference listing and PLC project file.
  - xiv. Drawings of tooling & fixtures, hard copies in A-2 size as well as soft copy in PDF format.
  - xv. Wiring diagram, in which length of wires must be mentioned, hard copies in A-3 size as well as soft copy in PDF format.
  - xvi. Mechanical drawings (spindle assembly, table assembly, column assembly), hard copies in A-1 size as well as soft copy in PDF format.
  - xvii. Spare part manual including part lists no., hard copies in A-4 size as well as in PDF format.
  - xviii. Lay out drawings in A-1 size, which clearly shows the position of all type of electrical components in machine.
- Note:All manual and literature should be inEnglish/Hindi language.**
- 5.0 SPARES:**
- 5.1 Since the machine will be under comprehensive preventive maintenance during warranty period of two (02) years and under CAMC for five (5) years after the warranty period. It is the sole responsibility of bidder to stock such spares as required for smoother execution of PMC during warranty and CAMC in order to achieve response time in compliance to machine availability as per stipulated requirements.
- 6.0 CONSUMABLES:**
- 6.1 Since the machine will be under comprehensive preventive maintenance during warranty period of two (02) years and may be under CAMC for five (5) years after the warranty period. However, the bidder should quote & furnished the detailed list of such consumables in the format as given at Para 7 of Annexure –A in Section VI.
- 6.2 These consumables shall be supplied along with the machine or as per agreed time table, if ordered.
- 7.0 SPECIAL FEATURES:**
- 7.1 Special features incorporated in the machine, if any, shall be indicated separately in the bid clearly indicating the advantages.
- 8.0 DEVIATIONS:**
- 8.1 The tenderer shall certify that the offered machine fully meets the specification. Various design features incorporated in the machine to fulfill different technical performance requirements shall be fully explained in the offer. However, minor deviations from these specifications which do not affect or in any way interfere with the stipulated performance standards or would result in improved safety/ reliability or would reduce recurring maintenance/operating cost of the machine, can be considered for acceptance. The tenderer in such eventuality shall clearly indicate the details of these deviations and their implications as per format given at Para-1 in Annexure-A
- 8.2 All Deviations (Both Major & Minor) shall be clearly indicated in the deviation statement as per format of submission of technical bid at Para-1 in Annexure–A.

## 9.0 INSPECTION AND TESTING AT MANUFACTURER'S WORKS:

- 9.1 The machine shall be inspected and tested during different stages of its manufacture starting from raw material till the completion of machine, by the purchaser or his authorized representative at the supplier's or his sub-supplier's works. The Quality Assurance Programme as per Annexure-H shall be submitted along with the bid. The bidder must submit the exhaustive QAP incorporating the tests as given in Annexure-H along with other tests /stage inspection as followed by them.
- 9.2 A load and functional test like no load test and maximum Horse Power test must be carried out at the manufacturer's works. Rigidity of the machine shall be demonstrated to the satisfaction of appointed inspector or inspecting agency.
- 9.3 Manufacturers must have suitable facilities at their works for carrying out various performance tests on the sub-assembly/assembly/machine. The tenderer shall clearly confirm that all facilities exist and shall be made available to the inspecting authority.
- 9.4 A Sample Inspection Chart for inspecting the equipment shall be supplied along with the bid. The inspection chart should indicate all the tests that are carried out during the machine manufacture and also the tests to be offered to inspecting agency. The standard to which this inspection chart conforms should be clearly indicated. Against each test, acceptable limit/ range of values shall be indicated.
- 9.5 The complete machine shall be inspected at manufacturer's premises as per approved GA drawing. Inspecting authority shall not carry out the final inspection in case GA Drawing is not approved by the consignee.
- 9.6 Four stage inspection excluding final lot inspection

S.N	Stage	Sample size
1	Bought Out Raw Material	As per Quality Assurance plan (QAP) of Section VI Annexure- H
2	Bought Out Components	
3	Bought out sub assemblies	
4	In process Inspection stage	

## 10. TRAINING:

- 10.1 Free training by the firm shall be imparted in operation and maintenance of the machine. The training to be imparted shall cover operation, troubleshooting and repair of all mechanical, hydraulic, electrical & electronics equipments (CNC Control & AC Drives) and CNC/PLC part programming. This training shall be provided to 05 persons nominated by the consignee, for a period of 02 weeks free of cost at the manufacturer's premises. Two weeks training will also be provided to one person free of cost in design and construction of the machine at manufacturer premises. All charges pertaining to travel, boarding and lodging shall be borne by Indian Railways.
- 10.2 Subsequently, technical experts from the manufacturer will fully and adequately provide training to operators and maintenance staff nominated by the consignee at the time of commissioning of the machine.
- 10.3.1 The supplier will be responsible for co-coordinating with the consignee the travel plans of trainees to ensure that the training is imparted on the machine at its assembly and testing stage. The bidder shall also submit training schedule along with the offer.

**Note:** All training should be imparted in English/Hindi only.

## 11. FOUNDATION & RELATED DRAWINGS

### 11.1 SUBMISSION OF GA, FOUNDATION & RELATED DRAWINGS FOR APPROVAL:

- 11.1.1 For each machine, the supplier shall first submit 01 copy of foundation drawings with details of construction of foundations, complete layout of machine elements like bed, hydraulic tank, coolant tank, electrical panel, Servo Controlled Voltage Stabilizer etc. and other related diagrams (Mechanical, Hydraulic, Electrical & Electronics) along with machine weight, overall dimensions, electrical load with length of 3 phase, 415 V AC electric power cable for approval as per time schedule specified in Section-IV to each consignee for approval and to enable the consignee for making necessary arrangements for Installation & Commissioning of Machine on receipt. After getting approval from consignee, the supplier shall supply directly to each

consignee 6 copies of approved GA foundation drawings and related diagrams for each machine as per time schedule specified in Section-IV from the date of approval of GA drawing for information only. This information should be furnished on the pattern indicated in detail in the following IS Specifications (Latest) or relevant international standards

- i) IS: 2974 (Pt.I Para 4.1) for reciprocating type machine.
- ii) IS: 2974 (Pt.III Para 3.1) for rotary type machine (medium & high frequency.
- iii) IS:2974 (Pt.IVpara 4.1) for rotary type machines of low frequency.
- iv) IS: 2974 (Pt.Vpara 3.1) for impact type machines other than hammers

## **11.2 APPROVAL OF GA DRAWING**

**(Applicable for machines wherever delivery period is linked with approval of GAdrawing)**

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

- 11.2.1 General Arrangement Drawings will be sent by the 'Contractor' to the Consignee as per Time Schedule annexed in LOA/Contract. The 'Contractor' should ensure that drawings sent to consignee are complete in all respects as specified in technical specification. The GA drawings shall be approved by the consignee and given back to the contractor, under advice to PCME , CENTRAL RAILWAY as per the Time Schedule in the LOA/Contract.
- 11.2.2 **Delays in submission of drawings by Contractor will be added to the delay in supply of machine** in case submission of GA drawing is delayed beyond stipulated time as per time schedule and LD will be levied. Thus the number of days delay in submission of GA drawing plus the number of days delay in supply of machine together will be taken as the delay in supply of machine for the purpose of calculations of LD .However if the contractor supply the machine before original delivery period as per Contract the number of days by which machine has been supplied earlier than original delivery period that many days will be subtracted from the delay in submission of GA drawings and LD will be levied accordingly. Delays in approval of the drawings by consignee will not be on account of Contractor, except as detailed below.
- 11.2.3 In case Consignee finds some deficiencies in the Drawings and returns the same for rectification to the 'Contractor', the contractor must return the rectified drawings within 30 days from the date of issue of letter by Consignee. This period will not be counted towards LD calculation. The consignee shall ensure that all deficiencies in the Drawings shall be pointed for clarification to the firm together at one time only instead of piecemeal multiple reference.
- 11.2.4 A repeat back reference(s) by Consignee to Contractor pointing out further defects/deficiencies in the Drawings, will be considered a delay on account of the contractor, except for special circumstances like change in location, review of arrangement etc. Thus, Contractors must take utmost care in ensuring completeness as per requirements of the Consignee.
- 11.2.5 Where GA Drawing cannot be approved by consignee due to clear site not being available etc., the Consignee must inform Contractor and PCME , CENTRAL RAILWAY explaining the exact delay. However, initiative must be taken by Contractor to obtain such a certificate from Consignee. Contractor must bring any difficulty/dispute to the notice of PCME , CENTRAL RAILWAY immediately.
- 11.2.6 In their own interest, contractor must maintain a log of events in this respect with clear dates and regularly inform consignee and PCME , CENTRAL RAILWAY to avoid wrong levy of LD. Consignees must cooperate with Contractors by providing all assistance, including clear information about any expected delays in site availability, promptly and in writing.
- 11.2.7 If an order has been placed on the firm, the firm will have to advise the consignee well in advance regarding requirement of road permit and assistance required from the consignee, if any, so that delay on this account is avoided. Firm should also visit the site before dispatch of machine to assess the condition of path to be used for movement of trailer.

## **11.3 DISPATCH OF THE MACHINE FROM MANUFACTURER WORKS:**

- 11.3.1 The supplier should normally dispatch the machine only after the foundation is ready for installation and commissioning of the machine on arrival.
- 11.3.2 In case of delay on part of consignee in providing the clear site for construction of foundation or any other facility as specified in the contract to the supplier, the supplier will report the matter to PCME , CENTRAL RAILWAY.
- 11.3.3 In case proving of component at manufacturer works, the supplier should request for the same as soon as possible after receiving contract keeping allowance of transit time etc. and approximately 60 days for consignee to handover the parts after receipt of the request accompanied by appropriate and valid bid guarantee. In the event of consignee certifying the non-availability of proves out components, such components will be deemed to be proved out at manufacturer works. However the firm will prove out these components at consignee subject to the availability.

## **12.0 INSTALLATION, COMMISSIONING AND PROVING TESTS:(ON TURNKEY BASIS)**

- 12.1 **Joint Check**– The contractor or his agent would be required to carry out a joint check at consignee's end,

along with the consignee, before unpacking is done, to avoid subsequent complaints regarding short shipment/transit damages. It is necessary that this joint receipt inspection be done immediately on receipt of the machine by consignee & bidder's representative to avoid commissioning delays due to shortages/transit damages. After receipt of the machine as above a Joint Receipt Inspection note (JRI) as per Annexure-B of Section-VI shall be prepared by the consignee and the firms representative indicating the tentative time schedule for various activities of installation and commissioning.

## **12.2 RESPONSIBILITIES OF CONSIGNEE AND BIDDER**

### **12.2.1 The consignee shall be responsible for-**

- i. Provision of a clear covered (except where shed is in the scope of contract) site for construction of foundation as per the schedule to ensure its readiness before arrival of machine at site.
- ii. In case where construction of shed is also in the scope of contractor the consignee shall ensure site is encroachment and encumbrance free.
- iii. Electricity, water and compressed air for installation and commissioning of machine shall be provided free of cost within one week of arrival of machine at site.
- iv. Wherever a road mobile crane has to be arranged by the supplier for material handling, a clear approach for it up to the site has to be provided. Clear covered space for storage of material/equipment required for working/ construction of foundation and installation of the machine etc. The inspection of foundation, structures etc and installation of the machine shall be done by authorized representative of the consignee.
- v. The consignee shall arrange the raw material for prove out at their end within 15 days of the dry run of the machine (installation, power connection, auxiliary connection like air, water connection) failing which such components will be deemed to have been proved out. The components supplied by the consignee in time will be required to be proved out within 30 days thereafter.

### **12.2.1 The bidder shall be responsible for-**

- i. Design & Construction of foundation, flooring of sufficient thickness, civil works (in line with scope of supply) suiting local soil conditions at the site in compliance.
- ii. Advise consignee in time regarding schedule for requirement of clear site for construction of foundation and other infrastructure, resources & facilities required.
- iii. Construction of foundation as well as flooring (if required) of sufficient thickness suiting local soil conditions, for machine shall be completed by the bidder at the site provided by the consignee before receipt of the machine at their premises.
- iv. Provision of all tools and equipment, technical and unskilled manpower, material handling accessories/ equipment and material for installation and commissioning.
- v. Unloading of the machine on receipt (both imported and indigenous machine) and its movement to the site of installation including provision of road mobile crane.
- vi. The bidder should ensure the proper earthing for the machine and its peripherals/accessories.
- vii. The bidder shall be responsible for meeting all the criteria set by the state pollution control board and central pollution control board, wherever applicable, with respect to air, water, noise, land etc. the bidder shall be responsible for obtaining clearance /certificate for installation/commissioning/operation of the machine/system supplied. The consignee will provide the administrative help for establishment of communication with the pollution control board.

12.3 Consignee will provide only 220 V $\pm$ 10%, single phase 50 Hz $\pm$ 3% AC supply at a single point (mains). All types of cables, connections, circuit breakers etc. required for connecting power supply point to different parts of the machine/control cabinets, shall be the responsibility of the bidder. Requirement of grounding/earthing with required material shall also be incorporated by the bidder during construction of foundation.

Electrical work like laying of power/electrical cables & earthing wires from mains to machine control panel (upto 20 meters) as well as within the machine, with supply of all materials shall also be carried out by the supplier.

12.4 The supplier shall demonstrate machine performance and prove out the claimed capability for successful commissioning at the consignee's works as per clause 2.4 of Section-IV. The M&P shall be deemed to be "commissioned" at consignee premises on the date when it is tested and meets with the specified capabilities/functions according to the technical specifications. In addition to above, in case of tool-up M&P, the M&P shall be deemed to be "Commissioned" at consignee premises on the date when "prove out" components specified as per the relevant clause of technical specification have been successfully proved out meeting the productivity requirements of Technical specification. The consignee shall arrange the raw material for prove out at their end within 30 days of dry run of the machine (installation, power connection, auxiliary connections like air, water etc.) failing which such components will be deemed proved out. The components supplied by consignee in time will be required to be proved out within 30 days thereafter. Any delay in providing the "raw material or any other input" for proving out shall not be logged on supplier's account.



A Joint Commissioning Note (JCN) to this effect shall be made as per the format at Annexure C of Section-VI. After issue of JCN the performance shall be watched for a period of one month, after which the PTC shall be issued. The issue of PTC cannot be delayed by more than 60 days from the issue of JCN. If some minor breakdowns are noticed after the issue of JCN, these shall be attended as per warranty obligations and suitable extension of the warranty period, under intimation to PCMM and PCME, CENTRAL RAILWAY.

- 12.5 If an assembly/sub-assembly requires to be taken back to the manufacturer's premises for repair/replacement either before commissioning or during warranty, the manufacturer or his agent would be required to submit BG of suitable amount. In case the entire machine has to be taken back, a Bank Guarantee for the cost of the machine would have to be submitted. The bank guarantee should be of adequate value so as to cover the cost of the assembly/sub-assembly/paid up cost of the machine.

### **13.0 SERVICE FACILITY IN INDIA AND TECHNICAL SUPPORT**

- 13.1 The tenderer will clearly spell out in the offer the facilities available with him or his agent for providing adequate after-sales service in India during warranty period in the appropriate section of Annexure 'A' of Bid Document Part-II. The complete details such as organization for after sales service, availability of technically competent engineers and warehousing facilities for spares should be clearly indicated. Bidders not offering complete servicing/repair facilities in India to ensure quick response to maintenance/ servicing calls are not likely to be considered.
- 13.2 After the warranty period and CAMC period, if any, the manufacturer or his agent shall agree to provide service supports for trouble shooting and obtaining spare parts. The manufacturer shall be obliged to provide spare parts required by the Purchasers for a period of 15 years from the date of delivery of the machine at the ultimate destination to safeguard against obsolescence.
- 13.3 Tenderer who are OEM, shall undertake to supply spare parts for a period of expected life of machine. Other tenderers shall submit undertaking from OEM for supply of spare parts for a period of expected life of the machine.
- 13.4 During warranty period, the supplier or his authorized agent shall attend for break down as soon as possible, but in no case later than 72 hours of receipt of intimation of the breakdown.

### **14.0 BOUGHT OUT ITEMS**

- 14.1 The bidder shall furnish along with the offer a list of all critical items/ sub-assemblies which are bought out by the bidder and proposed to be used, along with the manufacturer's name, brand model etc. The successful bidder may be required to produce invoices to ensure genuineness of such products / verification by the Inspecting agency.
- 14.2 The bidder should clearly indicate that in case of components/sub assemblies taken from reputed companies such as Vickers, Rexroth, RITTAL, THK, and Shenburger etc., the parent company has already entered into contract with their Indian units/affiliates for undertakings repairs/after sales service during warranty and post warranty.

<b>S.No.</b>	<b>Sub-assembly</b>	<b>Make</b>
1.	Electromagnetic clutch	Vortex /GhatgePatil
2.	A.C. Motors	NGEF/BBL/ABB/KEC/Crompton/ Siemens/ Allen Bradley
3.	Proximity Switch	Elap/Schneider/Omron/Scanner
4.	Contactors	Siemens/BCH/ABB/Schneider/L&T
5.	Limit switches	BCH/Siemens/L&T/Teknic/Euchener/Honeywell,USA

6.	Push button		Teknic/Siemens/ Schneider/BCH
7.	'O' Rings & rubber seals		Merlin/Parker/Busak/Hunger/Merkel/Soloseal/ Walkersolo/Halite
8.	Pneumatic Equipment	Control	Festo/Shavo Norgen/Shradder Scovil/Electro Pneumatics/ Parker/SMC Pneumatics
9.	Control gears		L&T/Siemens/BCH/ABB/Schneider
10.	Filters		Hydac/Hydroline/Parker/Rexroth/EPE,Germany/ Vickers/Purolator
11.	Cable/wire		Siemens/Indramat/ Hubershner/ Finolex/Havells/RR
12.	Sprocket		Rollon/T.I Diamond
13.	AC Drive		Fanuc/Siemens/ABB/Allen Bradley /Schneider
14.	AC servo motor		Fanuc/Siemens/ABB/Allen Bradley /Schneider
15.	PLC		Siemens/Fanuc/Mitsubishi/Messung/Hitachi/ABB/Allenbradley/Schneider
16.	Hour Meter		L&T/Havells
17.	Ammeter & Voltmeter		AE/Meco
18.	Air circuit breaker		Siemens/L&T
19.	Connectors		Harting/Kontakt/L&T/Omron
20.	Feed back devices		Heidenhain/Ballerf/fagor/sony/Siemens/Fanuc
21.	MCCB		Schneider/ABB/Siemens/L&T
22.	Electrical Cabinet	Control	RITTAL/ Siemens or of other reputed make with IP55 Protection level
23.	CNC & Drive Controller		SIEMENS/FANUC/Heidenhain/ Mitsubishi/HMT NUM
24.	Air conditioner for Control cabinet		RITTAL/Warner Finley/Kelvin
25.	Servo Controlled Voltage Stabilizer		Servomax/Consul/ Aplab
26.	Ultra Isolation Transformer		Servomax/Consul/Aplab

**Note:** In case any other reputed make is offered, satisfactory justification for the same will have to be given in the offer.

**15.0 COLOUR:** The machine and its accessories shall be painted in Apple Green Colour No.281 to IS:5-1978,(if any specific colour code standardized by BIS is available, the same be given). The machine can also be painted in equivalent RAL/DIN/other International Standards. If there is a standard color scheme of the manufacturer, the same can also be considered and may be specified.

**16.0 WARRANTY OBLIGATION**—The following conditions regarding Maintenance and reliability shall also apply:-

16.1 The machine shall be designed for a life of 15 years with regular maintenance and all the structural members of the machine and the foundation shall be guaranteed for 15 years against cracks breakages and etc. during the course of normal operations. Tenderer would submit suitable undertaking.

16.2 In addition to warranty obligations the warranty period would also cover comprehensive preventive maintenance, which will be inclusive of all spares, material and labour cost. All maintenance consumables like lubricants and grease except hydraulic oil / machine coolants shall form part of the scope of the preventive maintenance during the warranty. The cost of preventive maintenance to be carried out during warranty period should be quoted separately

- 16.3 The payment of preventive maintenance schedule carried out during warranty period shall be made by Consignee annually at the end of each year after completion of the work and issue of certificate by the consignee as per annexure-D of section-VI.
- 16.4 The machine shall at all times give contractual out-put and accuracy. Any deficiency or break down for a total of 02 hr. or more for a day would be treated as failure for the day, for the purpose of extending warranty period.
- 16.5 The tenderer shall ensure that in case a failure is reported by a consignee qualified service engineers shall visit the site within two days from the date of complaint on calendar day's basis. The period of three days (excluding date of complaint) after the failure reported shall be treated as grace period, which will not count towards breakdown time for up to one failure per month and a maximum of 3 failures per quarter. In case the number of failure exceeds one failure per month or three during any quarter of warranty, grace period of only 1 day will be permissible for such additional failure. Complaints shall be lodged by consignee by fax phone, e-mail or per bearer at address given by the tenderer.
- 16.6 The details of preventive maintenance to be provided during warranty period shall be indicated by the tenderer giving details of type of preventive schedule, periodicity on items to be checked, items to be replaced and expected plant down time. Preventive maintenance schedules shall be conducted on weekends as far as possible or any other day through mutual agreement with consignees. Total break down hours shall be calculated after discounting grace period and preventive maintenance period.
- 16.7 Maximum permissible down time till it is restored back to the contractual output and accuracy levels, in any quarter of the year during the warranty period, shall be 150 hrs. in case the total break down period in any one of year during warranty period, exceeds 500 hrs., the consignee shall inform the same to PCMM and PCME, CENTRAL RAILWAY To ensure this a record of breakdown (duly signed by shop incharge) in hours on quarterly basis should be maintained by the consignee and joint report with the contractor shall be made for each breakdown attention. At the end of first and second year of warranty, these details of breakdown hours during warranty period should be advised to PCMM and PCME CENTRAL RAILWAY as per performance appraisal report given in Annexure –D of section –VI. The firm will then request Consignee for release of WBG annexing the performance appraisal report as per Annexure-D of Section-VI and the breakdown details mentioned above.
- Penalty will be levied on the bidder for breakdown period on working days basis (excluding holidays) after discounting for the grace period. Penalty will be calculated as percentage of annual preventive maintenance charges and will be deducted from the respective annual payments as under

#### **Break down period**

Breakdown period	Applicable penalty
Up to 150 hours in each quarter and not exceeding 500 hours annually	Nil
Exceeding 150 hours - up to 200 hours in any quarter and not exceeding 500 hours annually	5% of annual preventive maintenance charges
Exceeding 500 hours - up to 750 hours annually	10% of annual preventive maintenance charges
Exceeding 750 hours - up to 1000 hours annually	25% of annual preventive maintenance charges
Exceeding 1000 hours annually	50% of annual preventive maintenance charges and Encashment of Warranty Bank Guarantee besides other action like noting adverse performance of the bidder and/or agent for future tenders and their offer in the subsequent tenders will not be considered for placement of any order.

- 16.8 The Consignee, without prejudice, shall be entitled to forfeit the amount of WBG furnished in respect of Warranty in the event of any default, failure or neglect on the part of the Contractor in the fulfillment or performance in all respects of the warranty provisions under reference or failure to extend the validity of WBG for the period of break down occurred during warranty period. Breakdown period exceeding 1000 hours annually, apart from encashing WBG other actions like noting down the adverse performance of the bidder and / or agent for future tenders and their offer in the subsequent tenders will not be considered for placement of any order. The firm will then request to Consignee for release of WBG annexing the performance appraisal report as per Annexure-D of Section-VI.

## 17.0 COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT

- 17.1 Tenderers are required to quote for a comprehensive Annual Maintenance Contract for the machine supplied against this specification for a period of five years on yearly basis giving the rates for each year i.e. first year, second year, so on., which will be inclusive of all spares, material and labor costs. The duties and taxes as applicable should be indicated separately. All consumables spare and materials shall form a part of the scope of comprehensive AMC except as follows.
- Diesel/Fuel, lubricating oils or coolant
  - Major machines elements/structural members which are under guarantee for a period specified in clause 16.1 as stipulated in 'warranty obligations' requirement.
- 17.2 CAMC shall be operated, managed and paid by the consignees indicated under clause 3 of Section IV. The consignee shall indicate the bill payment authority & custodian of the CAMC BG.
- 17.3 CAMC is a part of scope of supply, in case of concomitant requirement and included in commercial evaluation criteria vide clause 5 of Section-IV. The detailed terms and conditions of CAMC shall be as given in following clauses.
- The detailed terms and conditions of CAMC shall be as given in following clauses.
- 17.3.1 The duration of CAMC shall be 5 years from the date of expiry of warranty. Rates for CAMC shall be quoted by the tenderer on yearly basis, which will remain applicable during the duration of CAMC and not subject to any variation except any statutory changes in taxes and duties as compared to quoted rates.
- 17.3.2 The tenderer must provide CAMC services at the consignee location without any precondition. The AMC should include complete responsibility for the bought out sub-assemblies and components like CNC system, diesel engine, AC unit etc.
- 17.3.3 The details of preventive maintenance services including cleaning of machine to be provided under AMC shall be provided by the tenderer in the following format.

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

- 17.3.4 Preventive maintenance shall preferably be conducted on weekends through mutual agreement with the consignee. Each preventive maintenance schedule normally shall not exceed one day. The total shutdown time for preventive maintenance should be kept as low as possible but not more than 60 hours/month (averaged over the quarter) including time for cleaning, weekly, fortnightly, monthly, quarterly schedules etc. The preventive maintenance regime offered must be aimed at achieving minimum 90% uptime of the plant excluding the plant down time for preventive maintenance schedules.
- 17.3.5 The tenderer shall ensure that in case a failure is reported by a consignee, qualified service engineers visit the site within 3 days from the date of complaint on calendar days' basis. This period of 3 days (excluding date of complaint) after the failure report shall be treated as grace period, which will not count towards plant down time for up to one failure per quarter and a maximum of 4 failures per annum. In case, the number of failures exceed one during any quarter or four during any year of CAMC, grace period of only 2 days will be permissible for such additional failures. Complaints shall be lodged by consignee by fax, e-mail or per bearer at address given by the tenderer. The responsibility to keep the failure reporting address details current will rest with the tenderer.
- 17.3.6 In case preventive maintenance is carried out along with breakdown maintenance schedule; preventive maintenance time will be deducted from breakdown time of the plant.
- 17.3.7 **Penalty Clause:** Penalty shall be levied on the tenderer for maintaining plant up time below the limit of 90% calculated on working days' basis, after discounting for grace period and preventive maintenance period. Penalty shall be calculated as %age of quarterly payment and will be deducted from the respective quarterly payments. Penalty calculation will be done over quarterly payment period.

S.No	Availability Slab	Applicable Penalty
1.	90% to 80%	0.5% for every 1% (or part thereof) reduction in availability of plant below 90%.
2.	Below 80%	1% for every 1% (or part thereof) reduction in availability of plant below 80%.

- 17.3.8 A Bank Guarantee equal to 10% of the total value of CAMC for 05 years subject to a minimum value of 2% of total value of Contract (excluding CAMC charges) will be submitted by the tenderer to the consignee 90 days before the expiry of warranty. The CAMC BG will have the validity of 05 years 6 months. The bidder can submit multiple BG for lesser duration to cover the period of 05 years 6 months if permitted by consignee, ensuring the uninterrupted validity of the CAMC BG for 5 years 6 months. If CAMC is extended due to any reasons subsequently BG for CAMC extended. The confirmation for the submission of this BGs will be submitted to consignee for the release of WBG. The CAMC BG will be returned on completion of CAMC period. In Case, the tenderer fails to provide CAMC service successfully the CAMC BG will be forfeited. This will be in addition to penalty as per clause 17.3.7 above.
- 17.3.9 Plant up time of less than 60% for two consecutive quarters will constitute complete failure of tenderer to provide the CAMC services successfully and will result in forfeiture of CAMC BG, besides other action like noting adverse performance of the bidder and/or agent for future tenders and their offer in the subsequent tenders will not be considered for placement of any order. This will be in addition to penalty clause 17.3.7 above for the period of actual performance.
- 17.3.10 As per clause 5.1 of section V, where CAMC is part of evaluation of offer, it is the sole responsibility of bidders to stock all spares and materials as required for smoother execution of CAMC in order to achieve response time in compliance to machine availability as per stipulated requirements.
- 17.3.10.1 In all cases of plant failure except as mentioned in clause 17.3.10.2, any other spare part or material necessary to restore the plant to proper working order will be arranged by the tenderer as a part of CAMC.
- 17.3.10.2. In case of damage to the machine on account of any external factor, viz., floods, earthquake, fire, arson or sabotage, entire cost of spare parts and material necessary for repair of the plant shall be borne by the railways. However, the tenderer shall provide services of their engineers free of cost as a part of CAMC to restore the plant to working order.
- 17.3.10.3. In case of damage to the plant as mentioned in para 17.3.10.2, any spare parts and material necessary to restore the plant to proper working order shall be arranged by the tenderer and charged on actual basis duly certified by authorized railway official in the next quarterly bills. The rates charged for such spare parts shall be based upon the spare part rate list provided by tenderer in compliance of clause 5.2 or any other valid document. The tenderer shall furnish documents to support the rates charged for spares used for repair under para 17.3.11(a).
- 17.3.11. Normally quarterly payment (@ 1/4<sup>th</sup> of the annual quoted rates) under CAMC will be made to the tenderer within 30 days from the end of that quarter subject to submission of the following documents by the tenderer to the paying authority assigned by the consignee:
- a. Consignee's certificate for work done as per Annexure-F of Section-VI with calculation of down time and penalty applicable.
  - b. A certificate by consignee that no spare part is due with the tenderer as per clause 17.3.10 above.
  - c. Bills submitted by the tenderer & accepted by consignee.
  - d. Attested photocopy of the CAMC BG.