

**SPECIFICATION FOR 5-AXIS CNC MACHINING CENTRE WITH AUTOMATIC TOOL CHANGER**  
**Specification No. BMF/03/10/5-AXIS, dated 13.10.25**

**IMPORTANT NOTES:**

- i) Bidders are required to give clause wise and sub clause wise comments confirming compliance on the following technical specifications including Annexure – I, II, V, VI, & VII attached.  
Comments should be specific. It should also give specific information wherever asked for. Deviations, if any, should be clearly indicated with details and proper justification to avoid back reference.
- ii) The bidder will quote as per clause no. 15.2 for the make of sub-assemblies and equipment wherever specified. Other makes of sub-assembly will normally not be acceptable. The actual make quoted should also be indicated in the offer. In case of deviation in make of sub-assemblies and equipment quoted other than that specified, its features, advantages and reasons for the same may please be indicated separately.
- iii) Unless stated otherwise, latest alterations / revisions of specifications / standards / drawings shall be applicable. In respect of safety standards and environmental standards relevant to the machine, it is mandatory for the bidder to ensure compliance with international (CE/ISO/ DIN/ JIS) / national standards (IS) (where applicable) in their offer.
- iv) Offers are likely to be ignored in case of non-compliance of these instructions for furnishing the information. The condition / features indicated in main specifications shall override those mentioned in Annexure V, VI & VII wherever applicable.
- v) Bidders must offer and quote for all the specified concomitant accessories, as these are considered essential for commissioning and utilization of the machine.
- vi) **Please specify relevant clause of tender documents against every comments / statement of your offer. In case, any item is required in sets, please specify nos. / pieces per set. This is essential for proper evaluation of the offer.**

**1. PURPOSE FOR WHICH REQUIRED****1.1 PURPOSE:**

- 1.1.1 The machine shall be required for machining high speed bogie frames to M/s. FIAT/ Italy design to be fitted on Railway passenger coaches (car) operating upto the speed of 180KMPH. (later upgradable to 200 KMPH or higher).

**1.2 CAPABILITY:**

- 1.2.1 The machine must be capable of undertaking different rough and finish machining operations such as Pre-milling, Milling, Chamfering, Pre-drilling, Drilling, Boring, Counter boring, Reaming, Threading, Tapping, Spot face milling etc. using automatic tooling selection transfer/exchange.
- 1.2.2 A gantry type CNC Milling machine with universal milling head, automatic head changer and automatic tool changer is required.
- 1.2.3 The machine shall be supplied fitted with all tools and accessories capable of machining the FIAT bogie frames as per Annexure II.

**1.3 PRODUCTIVITY:**

- 1.3.1 The machine shall be capable of machining 01 (One) FIAT bogie frame for the operations detailed in Annexure II within 6 hours. This shall include the loading & clamping time, set up time, probing time, machining time, head/ cutter and tool change overtime, intermediate inspection and gauging time, unclamping & unloading time.



1.3.2 Bidders are required to give cycle time calculation of machining all bogie frames/ components referred in Clause 1.2 above and as per machining operations indicated in Annexure II clearly showing the followings.

- a) Loading time of bogie on machine along with fixtures and clamping it to floor plates.
- b) Setting of the job in reference to the machine
- c) Probing time
- d) Machining time as per tolerance given in the drawings
- e) Setup change time
- f) Head change time/ Cutter change time
- g) Tool inserts change time
- h) Inspection & gauging time and
- i) Unclamping and unloading time.

The offer should be accompanied with process chart for each operation indicating complete machining details, tools and fixture details and cutting parameters used.

The bogie frame is machined on one setting at present.

Maximum depth of cut may be assumed to be 15mm for all fabricated bogie frames on the surfaces to be machined for the purpose of calculation of cycle timing.

**Note: The above information is necessarily required for proper technical evaluation of offers.**

**BIDDERS ARE REQUESTED TO VISIT BOGIE MANUFACTURING FACTORY, BUDGE BUDGE FOR BETTER UNDERSTANDING OF THE OPERATIONS AND ESTIMATION OF CYCLE TIME, TOOL LAYOUT AND REQUIREMENT OF ADDITIONAL MILLING HEADS AND CUTTERS FOR EACH OPERATION.**

#### 1.4 GEOMETRIC AND PERFORMANCE STANDARDS:

1.4.1 The machine shall conform to ISO 10791-2 or DIN or equivalent International Standards for Geometric and performance test.

#### 1.5 OPERATING ENVIRONMENT:

1.5.1 The machine is required to work in tropical conditions. The ambient temperature at Bogie-frame Manufacturing Factory / Budge Budge ranges from 5°C to 50°C and the relative humidity in the monsoon season reaches 99.8%. The machine should be suitably designed to function efficiently under these conditions. The bidder should clearly indicate the features/ sub-assemblies provided in electrical, mechanical and electronic systems to achieve the above operating conditions.

#### 2. DESCRIPTION AND SCOPE OF SUPPLY:

2.1 The specification covers supply, foundation making, installation and commissioning of CNC Machining Centre with Automatic Tool changes (ATC) required for machining of bogie frames Indicated in Clause 1.2 above. For Basic Design Features of the machine, please refer to clauses and sub- clauses of Annexure V, for General Characteristics (Safety, operation, maintenance, pneumatic, lubrication, coolant and hydraulic systems), Annexure VI for General Electrical Equipment Design, and Annexure VII for CNC System. **If the core machine is Foreign made, bidders shall follow equivalent CE / ISO / DIN / other International Standards wherever only IS standards are mentioned.**

2.1.1 The supply shall include all concomitant accessories/equipment as detailed in this specification and other concomitant accessories/ equipment which the bidder considers essential to make the machine fully operational when installed and connected to power source and other utilities for performing machining operations on bogie frames/ items referred in Clause 1.2 above.

Amended  
10.09.2026  
10.09.2026

Amended  
10.09.2026  
10.09.2026

2

10.09.2026  
10.09.2026  
Page | 2



## 2.2 CONCOMITANT ACCESSORIES:

Following concomitant accessories that are required to make the machine fully operational on installation shall be quoted. The concomitant accessories shall include but will not be limited to the followings.

### 2.2.1 Cutting tools:

(a)	Indexable Carbide type milling cutters required for machining operations on FIAT bogie frames along with holders and adapters with collets for milling cutters (Nomenclature and separate cost for each type of milling cutter should be furnished)	04 nos. of each type
(b)	HSS drills of sizes suitable for drilling operations on bogie frames (Nomenclature and separate cost for each type of milling cutter should be furnished)	04 nos. of each type
(c)	Boring bars (both roughing & finishing) for OD and ID boring (Nomenclature and separate cost for each type of milling cutter should be furnished)	04 nos. of each type
(d)	New generation Carbide inserts of each type used on the offered milling/boring cutters (Nomenclature and separate cost for each type of milling cutter should be furnished)	300 nos. of each type
(e)	Any other cutting tools required for machining bogie frames / components referred in Clause 1.2 above (Nomenclature and separate cost for each type of milling cutter should be furnished)	03 nos. each for milling cutters. 03 nos each of drills / boring bars with 300 nos of each type of inserts

#### Note:

i. Tool Layout with full description and specifications shall be given in the offer in the following format:

Operation (as listed at Annexure II)	Holder ID No. (ISO No.)	Adapter ID No (ISO Nos.)	Cutting Tool Drilling/milling cutters/boring bars/ inserts	Quantity	Unit cost	Remarks

ii. Inserts selected shall have maximum number of cutting edges. Wiper inserts would be preferred. The offered tooling shall provide maximum tool life at optimum cost.

iii. Tooling shall conform to ISO / DIN specifications.

iv. Tool holders and Cutting may be preferably offered from the Indigenous sources of WALTER / SANDVIK / WIDIA Kennametal / Iscar / Addison / Taegutec / Ceratizit / Tungaloy make. Reputed machine tool bidders can also offer their own makes of tool holders and boring bars. Tool bidder's address in India, catalogue no. and part no. must be indicated for each tools.

v. Efforts shall be made to rationalize milling cutter, drills, holders and inserts to the extent feasible. Objective should be to reduce the variety and also inventory of the tooling.

**MOST IMPORTANT NOTE: It may please be noted that unit cost of each tool holder, milling cutter, HSS drill, inserts or any other offered tool is essentially required.**

### 2.2.2 Fixture/clamping system for locating and clamping of all FIAT bogie frames – 2 (two) sets.



- 2.2.3 Set of operating and maintenance services tools (list should be submitted along with description, quantity and make) – 1 (one) set.
- 2.2.4 First fill of lubricants, hydraulic oil, greases\*, cutting coolant etc. (Bidder to indicate the equivalent indigenous brand and quantities for the first fill). – First fill.
- 2.2.5 Foundation and levelling bolts required for installation of machine – 1 (one) set.
- 2.2.6 Voltage Stabilizer of Neel / Delta / Servomax / Aplab / Clean power make suitable to cater to the entire electrical load of the machine as per clause 13.2 of Annexure –VI Reputed international makes can also be offered. – 1 (one) no.
- 2.2.7 Ultra-Isolation Transformer of Neel / Delta / Servomax / Aplab / Clean power make with suitable capacity to cater to the entire electrical load of the machine as per clause 13.3 of Annexure- VI. Reputed international makes can also be offered. -1 (one) no.
- 2.2.8 Suitable touch probe system for quick job set up and measurement as per clause 3.7 – 1 (one) no.
- 2.2.9 Tool pre-setting unit as per clause 3.11 - 1 (one) no.
- 2.2.10 Refrigerant run AC unit for the electrical control cabinet and CNC System- 1 (one) set.
- 2.2.11 Refrigerant compatible cooler for the hydraulic oil. – 1 (one) set.
- 2.2.12 Tool Magazine with tool carrier (Sk-50 / ISO-50) configured for minimum 60 tools – 1 (one) no.
- 2.2.13 The CNC control system complete with (Hardware and software) ancillary items which should be detailed in the offer. - 1 (one) set.
- 2.2.14 Battery backup facility for memory retention during power failure for minimum 30 minutes -1 (one) no.
- 2.2.15 It is to be provided with set of multiple head like Universal milling and boring head (fully automatic), vertical head (Fully automatic) and horizontal head (fully automatic) having high precision and stability (to be detailed in the offer), actual position of all axes should be measured physically and controlled by the CNC control separately. Separate head holding table is to be provided for each head like Universal, vertical and horizontal head.
- 2.2.16 Chip / Swarf conveyor system. – 1 (one) no.
- 2.2.17 Any other concomitant accessories like angular heads, long heads etc. which the bidder feels are necessary for easy and quick machining of FIAT bogie to achieve the productivity of machining of one FIAT bogie frame within 6 hours (This shall include the loading & clamping time, set up time, probing time, machining time, head/ cutter and tool change overtime, intermediate inspection and gauging time, unclamping & unloading time). **Bidders to submit details of make and nomenclature.** – 1 (one) no. of each type offered.
- In case additional heads are offered, Automatic Head Changer shaft must also be offered. **Bidder to furnish cost and technical details.**
- 2.2.18 Coolant system for precision machining operation. Coolant system should be provided in floor but not in pit due to seepage problem in future.
- 2.2.19 Dedicated Air Compressor, air receiver, filters, refrigerated drier & 10 metres of pipeline. – 1 (one) set.
- Note:** \*Oils/ grease should be preferably from Indigenous sources such as IOCL / HPCL / BPCL / Esso / Castrol.

## 2.3 OPTIONAL ACCESSORIES:

- 2.3.1 Remote diagnostic facility for a period of 2 years beyond warranty period must be provided. Infrastructural facilities at consignee's end for availing of the facility shall be clearly laid down in the offer. Cost of providing this facility in the CNC system shall also be clearly given in the offer. Rate shall be quoted on a yearly basis.



2.3.2 Portable Programming Unit as per clause 3.7 – 1 (one) no.

2.3.3 Any other accessory which in the opinion of the bidder can contribute to higher production rate or better precision levels shall be clearly indicated. The price of the optional accessories shall be quoted separately and the price shall not be included in the basic price of the machine.

### 3. **BASIC DESIGN FEATURES:**

#### 3.1. **GENERAL CHARACTERISTICS**

3.1.1. The general characteristics of the machine shall be as per Annexure V, Electrical characteristics of the machine shall be as per Annexure VI (foreign bidders shall follow equivalent CE/ISO/DIN standard where ever IS Specifications are mentioned) and CNC system characteristics shall be as per Annexure VII.

#### 3.2. **MAIN CHARACTERISTICS**

##### 3.2.1. **Safety Features**

3.2.1.1. The machine shall incorporate all safety devices so as to provide complete protection to the operator and the machine. Some of the important safety features that shall be available on the machine are mentioned below.

- a. Emergency stop shall be provided for all modes of operation.
- b. Interlock shall be provided between the spindle brake and the power draw bar to prevent spindle rotation when cutters are being loaded/unloaded on/ from the spindle.
- c. Load meter shall be provided to indicate the load on the cutter motor so that the load on the motor can be maintained within safe limits.
- d. Main motors shall be protected against overload. The method of protection must be explained in the offer.
- e. Number of manual lubrication points shall be as few as possible.

**Note: The offer shall give details of all the safety features installed on the machine.**

3.2.1.2. Suitable Interlocks shall be provided to protect the machine in the event of hydraulic oil failure, lubrication failure, fluctuation in voltage and frequency. **List of all the safety interlocks available in the machine along with their purpose shall be detailed in the offer.**

3.2.1.3. The safety feature shall include safety device against overloading of any drive, over travel of any slide and interlock against conflicting motions. **The details of various safety device provided shall also be furnished in the offer.**

3.2.1.4. Mushroom type emergency stop(s) shall be providing on the machine that shall be easily accessible and capable of disabling the machine drives in case of any emergency.

3.2.1.5. The noise level shall not exceed 85dB at full load when measured at a height of 1.5 meters and 1 meter from the periphery of the machine. Noise measurement shall be carried out as per NMTBA noise measurement technique/ ISO 3746/IS- 1.0988/other equivalent International Standards. **Bidder shall indicate the specific standard to which noise measurement will be carried out along with its test scheme.**

3.2.1.6. Machine shall be provided with fluorescent light to illuminate the work area. The minimum illumination level shall be 300 lux.

##### 3.2.2. **General**

3.2.2.1. All the machine elements shall be properly designed by using finite element method analysis (FEM techniques) to get optimum cross-section and ribbing. The machine should be rigid and of sturdy



construction designed to meet cutting forces at full load encountered in heavy duty application under severe workshop conditions. The machine shall be free from vibrations at full load machining operations. In case, design is based on that are put by machine tool bidder, it shall also be mentioned in the offer along with details thereof.

- 3.2.2.2. All the major machine elements such as bed, column/gantry, cross slide, and table should be of thermo symmetric design. (The elements should be made from highest quality, heavily ribbed, rigid grey cast iron and produced to FG260/230 of IS: 210 or Grade GG-25/30 conforming to DIN 1691 or equivalent ISO/JIS grade. The casting should be suitably stress relieved and aged to ensure dimensional stability and freedom from distortion over the entire life of the machine). **Details of stress relieving cycle/ ageing process shall be given in the offer.**

- 3.2.2.3. The firm can also offer fabricated design with equivalent rigidity, vibration damping and other mechanical characteristics. In case of fabricated structure, the Steel used for fabrication should be Fe360A or better grade conforming to ISO 630-95 or equivalent conforming to IS/DIN/JIS standards. The fabricated Structure shall be subjected to suitable stress relieving cycle.

**The details of the various elements (bed, column/travelling gantry, cross- rail, table, ram assembly etc.) i.e. material, heat treatment cycle, special design and constructional features shall be clearly indicated in the offer.**

- 3.2.2.4. The firm can offer hardened and ground guide ways or linear motion guide ways. In case of hardened and precision ground guide ways, the hardness shall be  $55 \pm 3$  HRC. LM guide-ways shall be fitted with precision roller packs of appropriate size and accuracy class. The linear roller guides shall preferably be of size 65mm.

**The firm shall indicate the type of guide ways, make, accuracy class, no. of blocks and load carrying capacity per runner block.**

- 3.2.2.5. In case of hardened and ground guide-ways, the various axes guide-ways should be lined with anti-friction strips for stick slip free guide motion. The grinding of guide ways should be carried out on precision slide ways grinding machine such as Waldrich-Coburg / Forrest Line or equivalent precision slide-ways grinding machines. **The firm should also indicate the value of grinding accuracy in microns/meter.**

- 3.2.2.6. All the guide ways for axes shall be suitably protected with heavy duty corrosion resistant metallic telescopic covers/ bellow covers and wipers to prevent ingress of coolant swarf, dust and dirt. Heavy duty telescopic covers preferably should be of reputed make specified in clause 15.2. Chip chutes shall also be provided for easy chip disposal.

### 3.2.3. Travelling Gantry

- 3.2.3.1. The travelling gantry type machine shall have individual traverse beds supported on two sets of hardened and precision ground guide-ways hardened to  $55 \pm 3$  HRC and lined with anti-friction synthetic material like turcite for stick slip free motion or on LM guide ways to which travelling gantry is coupled. LM guide ways shall be fitted with precision roller packs of appropriate size, accuracy class and of size preferably 65 mm. The upper surfaces of the transverse beds shall have heavy duty drive racks for independent X-axis feed drive movement and shall also be suitably synchronized. Each side of the gantry shall have dual drive system consisting of a rack and a double pinion with automatic backlash recovery. Two independent X-axis linear measuring systems of makes specified in clause 15.2 shall be provided on the guide-ways of each set of traverse beds.

- 3.2.3.2. The travelling gantry shall support widely spaced, hardened and precision ground guide-ways hardened to  $55 \pm 3$  HRC and lined with anti-friction synthetic material like turcite for stick slip free motion to which spindle head shall be coupled. Alternatively, LM guide-ways fitted with precision roller packs of appropriate size, accuracy class and of size preferably 65 mm can also be provided. Y axis drive shall be through pre-tensioned precision re-circulating ball screw with double nut of reputed make as specified in clause 15.2. Alternatively, drive system consisting of a rack and double pinion with automatic backlash recovery can also be considered. Linear measuring system



for Y-axis of makes specified in clause 15.2 shall be provided on the cross-rail guide-ways of the traveling gantry.

### 3.2.4. Work Table.

- 3.2.4.1. The table casting shall be of high grade cast iron for strength and durability. Alternatively, fabricated construction as per clause 3.2.2.3 can also be offered. The length, width and height of the work table should be indicated in the offer. It should have enough space for operations like gauging, tool changing, clamping and unclamping of jobs. The worktable height should be kept low so as to facilitate easy clamping of jobs and for carrying out the various operations.
- 3.2.4.2. The table shall be well proportioned and capable of withstanding the component load and cutting forces.
- 3.2.4.3. The straightness of table shall be preferably 10 microns/metre for X-axis and 6 microns/metre for Y and Z axes. Actual table straightness in microns/metre for total length of the table and per meter length of individual axis drive shall be clarified on the offer.
- 3.2.4.4. The work table shall essentially be of fixed configuration to carry out machining operations without moving the heavy jobs/ component along with fixtures.
- 3.2.4.5. The top surface of the table shall constitute the work area and shall be provided with adequate number of T-Slots for clamping of job holding fixtures. The weight carrying capacity of the table and details of T-slots such as number, width etc. shall be indicated in the offer. T-slots shall be as per DIN650/IS 2031 or equivalent International Standards.

### 3.2.5 Cross Rail / Saddle.

- 3.2.5.1. The cross rail of gantry should be of box type single piece casting of high grade cast iron with suitable ribbing for strength and rigidity. Alternatively, fabricated construction as per clause 3.2.2.3 can also be considered.
- 3.2.5.2. The cross rail shall be provided with hardened and precision ground guide-ways for movement of the saddle. The guide-ways shall be hardened to 55+/-3 HRC. The hardened and ground guide-ways shall be lined with antifriction synthetic material like turcite to ensure stick slip free movement. Heavy duty corrosion resistant telescopic covers /bellow covers of reputed makes specified in clause 15.2 shall be provided to protect the guide-ways from ingress of swarf, dust and dirt. Alternatively, firm can also offer LM guide-ways. In case of LM guide ways, heavy duty linear motion roller packs of appropriate accuracy class and preferably of size 65mm shall be provided. Suitable arrangement to take up wear in the Cross rail guide ways/saddle for maintaining alignment should be provided.
- 3.2.5.3. The saddle shall be a rigid casting. Alternatively, fabricated construction as per clause 3.2.2.3 can also be offered. The saddle shall be provided with suitable guide-ways for Y-axis movement of the saddle on the cross rail and for Z-axis movement of the ram on the saddle. The Y-axis movement of saddle can be either through precision re-circulating ball screw with double nut of suitable accuracy class or rack and double pinion with automatic backlash recovery of make as specified in clause 15.2. The saddle guide-ways on cross rail and for ram movement shall be hardened to HRC 55 +/-3 and precision ground. These should be lined with synthetic material like turcite for stick slip free movement. Alternatively, LM guide-ways with heavy-duty linear motion roller packs of appropriate accuracy class and preferably of size 65mm can also be considered. The Z-axis movement of ram can be either through precision re- circulating ball screw with double nut of suitable accuracy class or through rack and double pinion with automatic backlash recovery.

### 3.2.6 Ram Assembly.

- 3.2.6.1. The ram assembly shall consist of a rigid casting attached with automatic indexing head housing the spindle and spindle drive. Alternatively, ram assembly can also be a fabricated construction as per clause 3.2.2.3.



- 3.2.6.2. The machine spindle shall be of suitable alloy steel like EN-354 or equivalent, surface hardened to approximately  $60 \pm 2$  HRC with a depth of about 0.5 mm and precision ground to  $0.3 - 0.4$  Ra. Spindle assembly shall be dynamically balanced as per G2.5 of ISO: 1940-1. The spindle shall be supported on heavy duty bearings of suitable design. The bearings shall be of reputed make specified in clause 15.2, preferably P5 class or better. The actual makes, type, no. of rows and accuracy class of bearings shall be mentioned on the offer.
- 3.2.6.3. The spindle shall be provided with power tool lock and release arrangement. Instant tool clamping and release should be possible by means of the push button operation. **Details of the clamping and declamping arrangements shall be fully explained in the offer.**
- 3.2.6.4. The spindle shall have ISO/50 taper and must be capable of clamping various tool holders offered. **Arrangement installed on the machine for mounting milling cutters and details of milling spindle, taper of spindle and drive should be explained in the offer.**
- 3.2.6.5. The spindle shall be driven through AC motor of reputed make as specified in clause 15.2 with minimum IP-55 degree of protection as per details given in Annexure VI of this specification. The spindle speed shall be infinitely variable to cover the entire application range.
- 3.2.6.6. All high speed gears in the drive unit shall be of alloy steel hardened and ground. The surface hardness value of gear teeth should approximately be  $60 \pm 2$  HRC. The material used for gears should be EN353 or equivalent grade of steel and should conform to DIN-6 quality or equivalent AGMA standard or better. **The specification of gear material, quality and surface hardness should be given in the offer.**
- 3.2.6.7. Clamping of heads shall be automatic. Indexing of universal milling head shall be through the CNC system. Indexing accuracy shall be  $0.001^\circ$  minimum. **The method by which automatic indexing and clamping of head is achieved shall be explained in the offer.**
- 3.2.6.8. Ram carriage and ram assembly shall be counterbalanced by means of adequate capacity accumulator powered closed circuit hydraulic system. Capacity of accumulator shall be indicated in the offer. Equivalent alternative system to achieve counter balancing can also be offered. **Details of this system shall be furnished in the offer.**
- 3.2.6.9. Locking of the ram either through mechanical or hydraulic locking arrangement shall be provided.

### 3.2.7. Feeds

- 3.2.7.1. All the feeds shall be derived from independent drive unit through variable speed AC servo motors of reputed make as specified in clause 15.2 with minimum IP55 degree of protection. The feature of rapid feed for reducing idle time shall be available on all the axes. The feed mechanism shall be suitably protected against overload. Mechanism of overload protection shall be specified in the offer.
- 3.2.7.2. Feedback devices shall be of reputed makes as specified in clause 15.2. The minimum resolution for linear axes shall be 0.001mm or better and resolution of rotary axes shall be  $0.0005^\circ$  or better. The actual makes and resolution of individual axes shall be specified in the offer.

### 3.2.8. Operator's Controls

- 3.2.8.1. Operator control panel(s) shall be provided for the operator at convenient location(s). The clamping/unclamping switch for power clamping of tool shall however be provided close to the machine spindle to enable easy Loading/unloading of tools. A provision for mushroom type emergency switches at convenient location to stop the machine in case of emergency shall be incorporated.
- 3.2.8.2. The control cabinet shall be of IP55 or better degree of protection and of reputed make as specified in clause 15.2. Own make of control cabinet of reputed machine tool bidder can also be considered. Refrigerant compatible type cooler with eco-friendly refrigerant and adequate capacity of makes



specified in clause 15.2 shall be provided for the control cabinet. **Make, capacity and refrigerant used shall be specified in the offer.**

### 3.3. LUBRICATION SYSTEM:

- 3.3.1. Suitable oil and grease lubrication system of reputed make as specified in clause 15.2 shall be available for all linear roller bearings, recirculating ball screws and nuts, main spindle drive bearings, axes feed bearings, spindle head, rack and pinion arrangement, gears and bearings. Any failure of the system shall stop the machine. Grease lubricated bearings shall be packed for life. **A schematic diagram of the lubrication system shall be enclosed in the offer.**

### 3.4. HYDRAULIC SYSTEM:

- 3.4.1. The hydraulic oil tank, pump, electric drive motor etc. shall be free standing to eliminate effects of hydraulic oil temperature on the machine.
- 3.4.2. The piping and fittings of hydraulic system shall conform to DIN/ C.
- 3.4.3. Pump shall be used to supply oil for the various hydraulic functions like de-clamping of tool, heads etc. The hydraulic system shall conform to specifications given in Annexure V. Refrigerant compatible oil cooler of reputed make as specified in clause 15.2 for hydraulic oil cooling shall be provided with eco-friendly refrigerant. **The capacity in Kcal/hr., make and eco-friendly refrigerant used shall also be specified in the offer.**

### 3.5. FIXTURING / CLAMPING SYSTEM:

- 3.5.1. Machine shall be offered with two sets of fixture with clamping system for machining of FIAT bogie frame.
- 3.5.2. The fixture/ clamping system shall be suitable to accommodate the job and its clamping, holding and locating system shall be precise, simple, accurate and fast. The clamping mechanism preferably should be hydraulic to reduce the time for clamping/unclamping. The fixture should be rigid, rugged and should withstand the cutting forces and the load without any deflection to maintain accuracy of machining operations.
- 3.5.3. The locating/ mating parts of the fixture should be made from case hardened or nitride material such as 20MnCr4 / 16MnCr5 / 90 MnCrV8 or similar (conforming to DIN standard or equivalent ISO standard) depending upon the requirement. The fixture body shall be of suitable material such as C45 or equivalent. The value of hardness of locating/mating parts shall be in the range of 60 +/-2 HRC to suit the flexibility and strength requirement of each element of the jobholding arrangement. The design features and material of the fixture shall be such that it maintains the rigidity and accuracy for the working life of the machine. **Design features to achieve this objective should be clearly highlighted in the offer.**
- 3.5.4. The schematic fixture design shall be provided in the offer. The finally out with detailed drawings shall be submitted to the consignee for approval within 12 to 14 weeks of receipt of Contract. The firm shall take manufacturing of fixtures only after their approval by the consignee.

### 3.6. CHIP/ SWarf REMOVAL SYSTEM:

- 3.6.1 The machine shall be provided with a suitable motor driven swarf conveyor system on both sides of the table for collection and removal of swarf from the machine without stopping it. The chip conveyor capacity shall be adequate to cater to maximum metal removal rate. There shall be provision to start and stop the chip removal system by CNC PERT Programme through "M-Code" functions. It should be possible to run the chip removal system in manual mode also. The chip conveyor shall conform to relevant DIN/ ISO specifications, which may be indicated in the offer. The firm shall also furnish the following details of the chip conveyor.

- i) Type and make of chip conveyor
- ii) Type of motor and its KW



- iii) Drive speed in mm/ min
- iv) Height of discharge of chip conveyor from the floor level
- v) Width of chip conveyor
- vi) Schematic layout of the system and sub-assemblies.

### 3.7. OFFLINE PART PROGRAMMING SOFTWARE PACKAGE (PORTABLE PROGRAMMING UNIT) – OPTIONAL ACCESSORY.

Supplier shall quote for package to include offline preparation of CNC Part Program suitable for the quoted machine. The package will include: -

- 3.7.1. Supply of Portable programmable unit like SIMATIC IPC MD-57A of Siemens or other equivalent make, with clock speed of 2.4 GHz (minimum) with 24 MB intel smart cache, 16 GB RAM (minimum), 512 GB SSD, CD-ROM/DVD, 15.6" (Minimum) full HD colour screen display. The system should be preloaded with Window 10 or latest user- friendly menu driven software package. The details such as **make, model no., specifications offered should be indicated in the offer.**
- 3.7.2. A suitable colour LASER jet printer of latest model of HP / EPSON / reputed **make** shall also be supplied. **The details such as make, model no. of printer offered should be indicated in the offer.**
- 3.7.3. The machine and programmable unit shall be configured to exchange data (loading & downloading of sub programmes and system parameters through serial port on either standard software like "Programme" or any other simple communication software). It should be possible to make sub programmes on the laptop in plain ASCII and down load this to the machine. A detailed manual explaining the procedure for carrying out communication **tasks** shall also be supplied with the machine.
- 3.7.4. High level interactive user friendly program suitable to prepare part programs of various machining operations based on user specifications shall be provided.
- 3.7.5. Programme shall have features like graphic display of cutter path, calculation of machining time and provide graphical display of the machining process.

### 3.8. ON-LINE WORK PIECE PROBING SYSTEM:

- 3.8.1. A Renishaw / M&H / Blum made probe shall be provided for work-piece along with compatible software. **Make of probe, software and its catalogue** along with its catalogue shall be enclosed with the offer.
- 3.8.2. The probe shall be capable of measurement of fabricated/ cast surface and referencing of machine axes based on the results of the probing cycle. The probe shall be able to give message to the machine controller in case adequate machining allowance is not available in the work piece.
- 3.8.3. It shall also be possible to carry out the final inspection of job with the help of the probe, if desired. The successful bidder shall also provide the probing cycle program for the purpose of gauging and inspection.
- 3.8.4. The scope of supply shall include following: -
  - a. Omni-directional probe with 1-micron unidirectional repeatability.
  - b. Standard shank stylus of 300 mm length with crash protection for protection of probe due to Bogie frame offset generated with a help of centering disk in BMF/BGB.
  - c. Radio receiver and relevant electric interface.
  - d. The system shall have interface with offered CNC system for the use of probe and measurement sub routines.

### 3.9. AUTOMATIC TOOL CHANGER (ATC):

- 3.9.1. The machine shall be provided with an automatic tool changer and tool magazine having provision



of at minimum 60 tools. Random selection of tools shall be possible. The tool magazine shall have bidirectional rotation and tool shall be presented to the ATC arm through the shortest route.

The ATC pocket shall be made of polymeric materials such as ACETAL or equivalent material or SG Cast Iron. The ATC shall be driven through brushless AC electric motor/servo controlled motor.

- 3.9.2. **Endurance Test:** The firm shall carry out 24 hours continuous running of the ATC at its premises and in case of any defect developing during 24 hours continuous running the test shall be repeated for another 24 hours till trouble free operation is achieved. Firm should indicate details of continuous running that shall be carried out at its premises during testing of the machine ATC.

### 3.10. **AUTOMATIC HEAD CLAMPING SYSTEM:**

- 3.10.1. An automatic head clamping system shall be provided which shall automatically clamp the universal head (other heads if provided) hydraulically/ mechanically to the spindle head. Centering and referencing pin as well as clamping check system shall also be provided. This shall be controlled through the CNC system. **Actual system of working/functioning should be explained with the help of schematic diagrams/ photographs in the offer.**
- 3.10.2. Ram assembly shall be provided with hydraulic and electrical automatic connectors and relevant cables for facilitating quick and easy changeover of heads if more than one head is provided on the machine.
- 3.10.3. Provision for manual positioning and pick up of powered head through electronic hand wheel shall also be available to the operator if machine is provided with more than one head.
- 3.10.4. Arrangement provided for keeping and positioning the heads for picking up as and when required may be explained.

### 3.11 **TOOL PRE-SETTER:**

- 3.11.1. Tool pre-setter shall be capable of accommodating all boring bars and other qualified tools required for machining operations. It should be supplied from reputed make as specified in clause 15.2. For getting better accuracy & to protect from dust and foreign particles, a separate AC cabin is required for checking of tools etc.

Size of AC cabin: 10ft X 8ft X 8ft

Capacity of AC : 1 Ton (Split)

- 3.11.2. Resolution of glass scale shall be 0.0005 mm and repeatability should be of the order of 0.002 mm.
- It should be capable of holding tools with taper ISO/ SK/ BT/ HSK 50.
  - It should have connectivity with PC through RS 232 port or latest / USB Port.

- 3.11.3. Built in optical angle measurement system shall be provided on the projector having minimum 10-times magnification.

## 4. **TECHNICAL LITERATURE:**

- 4.1. One copy of the printed illustrative catalogue showing features of the machine and its elements must be enclosed with the bid.
- 4.2. The successful bidders should furnish 3 copies each of spare parts catalogue giving the part list number of each component and also the catalogue number of the sub-vendor for the bought-out parts, assembly drawings, operational manual, troubleshooting guide, maintenance manual and all electrical circuit diagrams to the consignee directly along with equipment. One copy of the same shall be submitted directly to ER. Technical literature/information shall be provided for the complete machine including imported and indigenous components/sub- assemblies. **The bidders should provide the list of literature that will be supplied along with the machine.**
- 4.3. All manuals and literature should be in English language only.
- 4.4. All the drawings and diagrams on a CD / Pen-drive, formatted in Auto CAD should be provided.



**5. SPARES:**

- 5.1. The firm should quote for spares required for normal maintenance of machine working on three shift basis for 02 (two) years, to cover the complete range of mechanical, hydraulic and electrical equipment including controls, in two lists, one list for perishable items and the other list for non-perishable items. The quantities should relate to, in case of non-perishable spares, to two years normal maintenance, and in case of perishable spares to the duration of its shelf life or two years whichever is less. Shelf life should be indicated with the quotation for spares. A complete catalogue giving the part list number of each component and assembly and detailed dimensional drawings shall be provided with each machine in duplicate.
- 5.2. The details of spares should be given in the following format-

Sl. No.	Part No.	Unit rate	Self-life	Quantity	Cost	Likely sources of supply in India, complete address, phone and fax nos. etc.

- 5.3. Bidder shall also quote for maintenance/repair kit for CNC control PLC & AC drives.

**6. SPECIAL FEATURES:**

- 6.1 Special features incorporated into the machine, if any, shall be indicated separately by the bidders clearly indicating advantages of the features.

**7. DEVIATIONS:**

- 7.1 The bidder should certify that the machine offered fully meets the specifications. Various design features incorporated in the machine to fulfil 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 bidder in such eventuality shall clearly indicate the details of these deviations and their implications in the para 1 of Annexure-A od section V, along with its justification.

**8. TESTING AT BIDDER'S WORKS AND CONSIGNEE'S WORKS:**

- 8.1 Bidder must have suitable facilities at their works for carrying out various performance tests on the machine/sub system. The bidder should clearly confirm that all the facilities exist and these shall be made available to the inspecting authority.
- 8.2 A Sample Inspection Chart for inspecting the equipment should be supplied along with the bid. The inspection chart should indicate all the tests that are carried out during the machine manufacture including geometric, performance and functional tests. The tests that shall be conducted by the inspection agency shall be clearly indicated. For each test, acceptable values/ range of values shall also be specified. The standard to which this inspection chart conforms should be clearly indicated.
- 8.3 The bidder will submit quality assurance plan being followed at the bidder's works for ensuring quality of the products offered. In case, firm is ISO certified, a copy of valid ISO certificate shall be enclosed with the offer.

**8.4 PROVE OUT AT FIRM'S PREMISES:**

The firm is required to demonstrate the following at the time of inspection in addition to their normal checks carried out during assembly and testing as part of quality control measures: -



- 8.4.1 **Prove out of floor-to-floor timings** to be done as furnished against clause 1.3 for machining of four nos FIAT Bogie Frames. The firm shall be required to collect four FIAT Bogie Frames for this purpose from BMF/BGB against Bank Guarantee and shall also arrange by their own for their packing, transportation necessary documentation etc. The machined bogie frames shall have to be returned to the consignee along with the machine. Alternatively, the firm can purchase these bogie frames on outright sale basis at a value to be informed by the consignee after award of contract in which case these shall not be required to be returned. However, arrangements for their packing, transportation necessary documentation etc. shall still have to be made by the firm.
- 8.4.2 Geometric and performance tests as per clause 1.4.
- 8.4.3 **No load or reliability test** for a minimum period of 48 hrs. Initially 24 hours with adjustment and subsequently 24 hours without adjustment. However, in case any adjustment is required during this period, then the test shall be repeated for another 24 hours without adjustment.
- 8.4.4 **Max Horse Power or full load cutting test** – minimum test duration will be for 5 minutes. Hardness and UTS of the material to be used for cutting, cutter details and cutting parameters like depth of cut, speed and feed shall be clearly indicated.
- 8.4.5 **Work piece accuracy test as per NAS 979 test scheme.** Details shall be furnished in the offer.
- 8.4.6 **Noise measurement tests** as per clause 3.2.1.5 – Test scheme and relevant standards shall be indicated in the offer.
- 8.4.7 **Vibration test-** Test scheme shall be indicated in the offer.
- 8.4.8 **Renishaw Ball bar contouring test for the spindle** – Test scheme shall be furnished in the offer.

## 8.5 **PROVE OUT AT CONSIGNEE'S WORKS AT BUDGE BUDGE:**

- 8.5.1 The supplier or his authorized Indian agent shall be required to prove out claimed machining timings at Clause 1.3 on 12 FIAT bogie frames at consignee's works. The bogies required for the purpose of prove out at consignee's end shall be provided by Consignee.
- 8.5.2 Stage wise joint inspections (Level I by Supervisors of BMF/BGB & Level II by Officers of BMF/BGB) will be carried out prior to issue of Proving out test / final commissioning certificate.

## 9. **TRAINING:**

- 9.1 The contractor shall arrange to provide free training for a period of 4 (four) weeks works for 6 (six) persons (2 persons each in Operation, Electrical Maintenance & Mechanical Maintenance) at bidder's premises. The boarding, lodging and travel expenses will be borne by the purchaser. Likely places of training should be indicated in the offer. Bidder shall quote for training of one operator per week also.

The supplier will be responsible for co-coordinating the travel plans of trainees to ensure that the training is imparted on the machine at its assembly and testing stage.

- 9.2 The training will be in maintenance and operation of the equipment ordered and will include troubleshooting and repair of the machine and its accessories. The training to be imparted will cover all mechanical, hydraulic, electrical electronic equipment and CNC programming.
- 9.3 In addition to the above, technical experts from the bidder will fully and adequately train operators and maintenance personnel nominated by the consignee during commissioning of the machine.

**NOTE:** All training shall be imparted in ENGLISH / HINDI only. Bidder shall confirm the availability of adequate number of trainers who are proficient in ENGLISH / HINDI language.

## 10. **FOUNDATION & RELATED DRAWINGS:**

- 10.1 The supplier shall furnish to consignee 4 (four) copies of foundation drawings, GA drawings indicating all leading parameter and related diagrams (Mechanical and Electrical) giving machine weight, overall



dimensions, foundations details, electrical load and circuitry within 45 days of the receipt of Purchase Order from Railway to enable them earmark the site. This information should be furnished on the pattern indicated in detail in the following IS specifications (Latest):

- i. IS: 2974 (Pt.I Para 4.1) for reciprocating type machine/ equivalent International Standards.
- ii. IS: 2974 (Pt.III Para 3.1) for rotary type machines medium high frequency) / equivalent International Standards.
- iii. IS: 2974 (Pt.IV para 4.1) for rotary type machines of low frequency/ equivalent International Standards.
- iv. IS: 2974 (Pt.V para 3.1) for impact type machine other than hammers/equivalent International Standards.

- 10.2 The Consignee/ER shall either approve the GA drawings or necessarily return them to the Supplier / contractor for correction(s) within 2 (two) weeks of their receipt from the Supplier / Contractor with clear dated signatures. The supplier should submit corrected drawing within next 14 days for approval. The complete process for the approval of the correct GA drawings shall not exceed 45 days from the date of first submission as specified in the Time Schedule of the contract.

## 11 TIME SCHEDULE:

- 11.1 The bidder shall furnish the time Schedule as per attached Annexure III for supply, delivery at site & commissioning of the machine along with the bid.

## 12 JOINT CHECK:

- 12.1 The supplier or his agent would be required to carry out a joint check at the 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 inspection be done immediately on receipt of the machine by consignee to avoid commissioning delays due to shortages/ transit damages.
- 12.2 The machine is ordered on turnkey basis. The Supplier/Consignee will ensure that facilities necessary at site for commissioning the machine e.g. electrical power, water, compressed air connections etc. are ready before the despatch of the machine. The Supplier shall despatch the machine only after all the on-site requirements from Supplier's side as well as ER/Consignee side for commissioning the machine on arrival have been made ready.

## 13 TURNKEY CONTRACT FOR INSTALLATION & COMMISSIONING:

Bidder shall offer complete installation and commissioning of the machine on a turnkey basis and quote for the prices of turnkey work in their offer. In the absence of this, the offer will be rejected. Quoting for the turnkey work for complete foundation, installation and commissioning of machine is mandatory and price of the turnkey work shall be loaded for the commercial evaluation.

### 13.1 TURNKEY OFFER SHALL INCLUDE THE FOLLOWING ACTIVITIES:

- 13.1.1. Design and construction of foundation suiting local soil conditions to match the receipt/arrival date of the machine at the consignee's premises.
- 13.1.2. Electricals including cabling from mains to machine control panel (upto 10 meters) as well as within the machine, with supply of all materials required. Bidder will separately quote a rate per metre for extra cabling if required at site which will not be included in the evaluation but will be paid after certification of consignee.
- 13.1.3. Provision of all tools and equipment, technical and unskilled manpower, material handling equipment and material for installation and commissioning.
- 13.1.4. Installation and commissioning of the machine shall be completed as per Annexure III [Time Schedule of the contract] from the date of receipt of the machine at consignee's end. This will include the dry run of machine before trials are started. Dry run means that machine is switched on with all



the utilities, pre-commissioning tests carried out and is ready to start cutting operations.

13.1.5. Loading/unloading of the equipment on receipt and its movement to the site of installation.

## 13.2 RESPONSIBILITIES:

### 13.2.1. The consignee shall be responsible for:

13.2.1.1. Provision of a clear covered site for construction of foundation as per the schedule given by the supplier to ensure its readiness before arrival of machine at site.

13.2.1.2. Electricity, water and compressed air free of cost.

13.2.1.3. Providing material handling facility to the extent available. In case 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.

13.2.1.4. Space for storage of material/equipment required for working/construction of foundation and installation of machine etc.

### 13.2.2. The supplier shall be responsible for:

13.2.2.1. Design of the foundation keeping in view the soil conditions at site.

13.2.2.2. Advise consignee in time regarding schedule for requirement of clear site for construction of foundation and other infrastructure.

13.2.2.3. Construction of the foundation including arrangement of all technical and unskilled manpower and material for the same. Construction of foundation to be completed before arrival of machine at site. Encumbrance free, open site is available at Budge Budge/ the foundation is to be constructed on loose soil.

13.2.2.4. Installation and commissioning of the machine including arrangement of all manpower, material, material handling equipment and facilities required for the same keeping in view the facilities to be provided by the consignee as per contract.

13.2.2.5. Any other resources/facilities required.

13.2.2.6. The machine performance shall be demonstrated by the bidder or his agent for the claimed machining timings at clause 1.3 on 12 FIAT bogie frames during commissioning of the machine. Thereafter, the consignee shall watch the performance of the machine for 30 days before the Proving out certificate is issued.

13.3. If an assembly/sub-assembly/complete machine requires to be taken back to the bidder's premises for repairs/replacement either before commissioning or during warranty, the bidder or his agent would be required to submit a Bank Guarantee. 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.

## 14 COLOUR:

14.1 The machine and its accessories shall be preferably painted in Apple Green Colour No. 281 to IS: 5-1978 (if any specific colour code/ scheme standardized by BIS is available, the same may be given). Equivalent colours in RAU DIN/ other International Standards can also be given. If firm has any other standard colour scheme, the same can also be considered. The offered colour scheme may be specified in the offer.

## 15 BOUGHT-OUT ITEMS:

15.1 The bidder shall furnish along with the offer a list of all critical items/ sub- assemblies of mechanical, electrical, hydraulic and electronic systems which are bought out by the bidder and proposed to be