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14/8/25

M/MW/LUMPSUM/MILLING MC/01

OFFICE OF THE SSE/SHOP 40
11.08.2025

SSE/SHOP 41

SUB: Verification of specification vertical milling machine - Reg
REF: SSE/Shop 41 Letter No: TR/M/S/25 Dt 04.08.2025

With reference to the letter cited above, the following points may be included in the specification of Vertical Milling machine proposed to be procured through Lumpsum account in shop 41.

Tender may be called for the above machine including two years warranty and five years CAMC due to shortage of manpower and technical expertise.

1. During warranty and CAMC period, the firm should carry out preventive maintenance once in three months. All the spares and consumables required in warranty and CAMC period to be arranged by the firm.
2. Firm has to ensure 90% availability of the machine calculated on working hour basis monthly.
3. The CAMC should be for a minimum period of five years.
4. Firm should keep all necessary spares (Electrical and Mechanical) during warranty and CAMC period and the list of the said spares to be submitted to ICF before commissioning of the machine.
5. The warranty will be extended based on the number of breakdown days during warranty period.
6. During CAMC period, firm has to attend the breakdown calls within 48 hours from the time of complaint. The period of 48 hours from the time of reporting of the breakdown shall be treated as grace period and will not be counted as Plant down time upto one failure per quarter. Beyond this, the grace period will be only 24 hours for next failure and no grace period will be allowed for subsequent failures in that quarter.
7. All the accessories of the machine like panel board, power pack etc. should be kept 450mm above the ground level.
8. Necessary training should be imparted to ICF Mechanical, electrical and production staffs.
9. Concomitant accessories and spares to be supplied by the firm
10. One set of maintenance tools as per the Annexure-A should be supplied by the firm along the supply of machines.
11. Necessary foundations of the machine to be laid by the firm.

Encl:

Annexure-A

Copy to

AWM/Plant/Shell for kind information

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ANNEXURE -A

1. DOUBLE END SPANNER FROM 6mm TO 50mm – 01 SET
2. BOX SPANNER FULL KIT CONSISTING FROM 6mm TO 50mm – 01 SET
3. RING SPANNER FROM 6mm TO 50mm
4. BALL PEEN HAMMER 2LBS – 02 NOS
5. PIPE WRENCH 8" TO 24" – 01 SET
6. TWO LEG BEARING PULLER 0 – 100 mm – 01 NO,
7. TWO LEG BEARING PULLER 0-200mm – 01 NO
8. THREE LEG BEARING PULLER 0-350mm – 01 NO
9. ALLEN KEY SET FROM 1mm TO 22mm – 01 SET
10. SET OF SCREW DRIVERS (+, - AND STAR) – EACH 01 SET
11. SET OF EXTERNAL AND INTERNAL CIRCLIP PLIERS STRAIGHT OF VARIOUS SIZES – 01 SET
12. SET OF EXTERNAL AND INTERNAL CIRCLIP PLIERS BEND OF VARIOUS SIZES – 01 SET
13. CUTTING PLIER - 01 NO
14. NOSE PLIER – 01 NO
15. WIRE CUTTER – 01 NO
16. SOLDERING IRON STICK 15W – 01 NO

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1.0 GENERAL ELECTRICAL CHARACTERISTICS

1.1 ELECTRICAL STANDARDS

1.1.1 Equipment and materials shall comply with appropriate Indian Standards (latest). International Standards or National Standards of the country of origin provided the latter are equivalent to or better than the former. The following standards shall be applicable in particular (Corresponding International Standards like ASA, NEMA, BSS, DIN etc. may also be quoted)

1.1.1.1 IS: 12615 - 2011 (latest)- Three phase AC induction motors (corresponding to IEC Pub-34-1) (Latest)

1.1.1.2 IS: 1248 (latest)- Direct acting indicating analogue electrical measuring instruments and their accessories (corresponding to IEC Pub-51) (Latest)

1.1.1.3 IS: 1231-1974 (latest)- Dimensions for three phase induction motors (corresponding to IEC Pub 72-1) (Latest)

1.1.1.4 IS: 2223 – 1983 (Latest) Dimensions of flange mounted AC induction motors

1.1.1.5 IS: 2254 – 1985 (Latest) Dimensions for vertical shaft motors for pumps

1.1.1.6 IS: 1271-1985 (latest)- Classification of insulation material for electrical machinery and apparatus in relation to their thermal stability in service (corresponding to IEC-Pub-85) (Latest)

1.1.1.7 IS: 6875 (latest)- Push buttons and related control switches (corresponding to IEC Pub/73) (Latest)

1.1.1.8 IS: 375-1963 (latest)- Marking and arrangement of switch gear, bus-bars, main connections and auxiliary wiring

1.1.1.9 IS: 996-1979 (latest)- Single phase small AC and universal electrical motors

1.1.1.10 IS: 1356 (latest)- Electrical equipment of machine tools

1.1.1.11 IS:2516 (latest)- Circuit breakers (corresponding to IEC Pub-56) (Latest)

1.1.1.12 IS:7752-1975 (Pt-I)- Guide for the improvement of power factor in consumer's installation

1.1.1.13 IS: 694 (latest)- PVC insulated copper cables

1.1.1.14 IS:8130 (latest)- Copper conductors

1.1.2 The Bidder shall furnish the total connected load of the machine with break up for each motor / sub-system in KW / KVA indicating maximum starting as well as running current. Where induction motors are used, those should be sturdy, energy efficient and provided with VVVF drive.

1.1.3 For each motor details like (a) Manufacturer's name (b) Type of Duty (d) Type of enclosure (e) class of insulation (f) Starting Current (g) Normal full load current (h) Maximum temperature rise in the windings above ambient temperature (i) Rating –Continuous/ intermittent (j) Speed in rpm (k) End use of the motor **shall be given in the Offer.**

1.1.4 **Electrical Control Gear:** Control gear for AC / DC motors should incorporate following protection devices:

1.1.5 **No Voltage Protection:** "No voltage protection" shall be provided so that machine shall not start up again by itself when, supply is restored following an interruption. This is achieved by incorporating contactor in control circuit, which goes off when supply interruption occurs. This contactor can be made "ON" only by pressing push button.

1.1.6 **Short Circuit Protection:** To protect against short circuits due to insulation failure or faulty connection, HRC type fuses shall be provided for each motor. Rating of fuse shall be such as to take care of over current due to motor starting.

1.1.7 **Over Load Protection:** To prevent motors from overloading, overload protection shall be provided separately for each motor. Three phase motors shall be protected by overload tripping devices on each phase. For achieving above function, integrated motor protection relay with suitable contactor can be used.

1.1.8 **Single Phasing Protection:** 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.

1.2 CONTROL EQUIPMENT

1.2.1 Control equipment shall be mounted in separate drip proof enclosures. Control enclosures and compartments shall be designed to give adequate protection against ingress of dust, oil, rain water coolant or chips and rodent bite. Control devices like contactors etc., shall be front mounted on a rigidly fabricated metal panel for ease of operation.

1.2.2 All other electrics shall be so installed that they are readily accessible when doors and covers are opened. Hinged covers shall be interlocked with machine tool control to prevent operation of machine when cover is open.

1.2.3 Motor shall be energy efficient TEFC type (totally enclosed with or without fan-cooled frame). Screen protected drip proof type motor, if used, shall be mounted inside protective enclosures. All the AC 3-phase induction motors shall comply with energy efficient standards of latest IS-12615. **These motors shall be provided with star delta starters.**

1.2.4 The motors, control gears and peripherals used in the machine shall be of reputed make.

1.2.5 Electrical equipment shall comply with requirements of Indian Electricity Act and Rules. All instruments shall be of "Industrial Grade A" (IS: 1248) switch board type. Range of instrument shall be such that maximum load expected in circuit shall produce a deflection 60% to 80% of full scale.

1.2.6 For main motor, F-class insulation shall be provided. Motors shall be designed to withstand frequent starts, stops, and reversals as demanded in operation of machine.

1.3 EARTHING

1.3.1 Two earth pits shall be provided with 6-meter distance between each.

1.3.2 The earth pits shall be as per drawing no **ICF/EL/1109** for load capacity of 50 kW and above and as per drawing no. **ICF/EL/1289** for load capacity of less than 50 kW.

1.3.3 The control panel shall be provided with an earth terminating strip and the same shall be connected from the two earth pits separately with copper bus to size 50x50x6 mm.

1.3.4 All induction motors and control gears shall be earthed by using two copper bus to size 25x25x5 mm and terminating to control panel earth strip.

1.3.5 The entire machine shall be earthed at two different locations with copper earth bosses of size 40x40x100mm thick, which has a tapped hole of 12 mm diameter with its tinned surface. Connecting the earth continuity conductors to MS hardware, on painted surface, to foundation bolts etc. shall not be acceptable

1.3.6 All the copper used shall be of electrolytic grade with 99.9% purity and the test report shall be provided for the same.

1.4 CONTROL PANEL

1.4.1 The control panel shall be erected at a height of **600 mm** above from the shop floor level and all the cable entry holes shall be properly sealed to prevent entry of rodents. All inter connection cables shall pass through suitable cable guards from the bottom of the panel with sealing arrangement to avoid ingress of water, oil, dust etc. **All the cable entering the panel shall be properly secured and fixed firmly without hanging loose.**

1.4.2 In case, electrical items / components / Junction boxes are located in the pit (in unavoidable situations), they shall be flood proof / oil tight so that they are not affected even when the pit is filled with water during monsoons, for which IP-68 grade enclosures shall be provided.

1.4.3 The control panel shall be neatly wired with proper cable bunching and securing of cables with adequate spacing for easy maintenance.

1.4.4 A separate power plug for 230V AC points, with spike protection shall be provided for connecting the programming unit and other maintenance tools.

1.4.5 The control circuit shall be provided with HRC fuse protection of appropriate rating. The contactors, fuses, MPCBs, limit switches; valves etc. shall be identified by providing anodized deep etched aluminum name plates. The contactors shall be of DIN rail mounting type.

1.4.6 Modular LED indications of ESBEE / VINAY makes, of panel mounting design and suitable for 22.5 mm diameter shall be used. The solenoid valves connector plugs shall be provided with LED indication.

1.4.7 The CNC control cabinet should be of IP-66 or better degree of protection. The CNC cabinet shall be air conditioned to ensure dust and moisture free temperature-controlled environment. The refrigerant used shall be eco friendly type.

1.4.8 Batteries used in the UPS system of the machine shall be enclosed / covered appropriately, so as to safeguard the battery terminals from any foreign objects.

1.4.9 All power & Control cables and wires shall be provided with lugs at both ends. Proper laying / dressing of cables must be ensured. The cables that are to be laid externally shall be provided with protective hose. The cable entry into panel / machine shall be provided with suitable grommet / glands. All cables shall have numbered ferrules. Numbering to be done on all the switch gears as well as in location they are provided in the panel. The numbering must match and referable to the numberings provided in the electrical schematic drawings / circuit diagrams submitted.

1.4.10 Control panel shall be provided with a Multifunction meter with suitable current transformer for full machine load capacity to record power consumption on daily basis with inbuilt recording.

1.5 CABLING

1.5.1 Power cables and control cables shall be of copper conductor (Aluminum cables shall not be used). The minimum area of cross section of power cables and control cables shall not be less than 10.0 mm² and 1.5 mm² respectively. The current density of copper cables shall not exceed 4 Amps / sq.mm. PVC Insulated copper cables to IS694 (latest) shall be used and the conductors shall conform to IS :8130

1.5.2 Grommets / End fittings shall be provided at the cable entry holes to protect the cables against sharp edges. Wherever interconnecting cables cross over area susceptible to oil spillage / water spillage, water resistant / oil resistant cables shall be provided.

1.5.3 All power and control cables shall be laid through metallic conduit / trays / cable drag chains. Flexible hose / PVC hose shall be avoided. The cable trenches and trays shall be closed and have provision to open whenever required for attending faults or carrying out maintenance work. All power and control cables shall be terminated with suitable crimped terminals or cable lugs. All cables shall be pro-

vided with numbering ferrules at both ends and they should tally with the schematic diagram.

1.5.4 Power cables and Control cables to be laid separately and same shall not to be combined with pneumatic or coolant pipelines.

1.5.5 **The schematic diagrams of both power and control cables shall have prior approval of ICF before manufacturing.**

1.6 POWER SUPPLY

1.6.1 Machine shall be suitable for operation on 415V, 3 phase, 50 cycles AC, 3 wire or 4 wire system with neutral solidly earthed and shall function at supply voltage variation up to $\pm 10\%$ and frequency variation up to $\pm 3\%$. However, full rated power of the motor shall be available at nominal voltage

1.6.2 **CONTROL VOLTAGE:** The control voltage of 24V DC shall be obtained from a SMPS of suitable current rating.

1.6.3 The SFU (Switch Fuse Unit) of suitable capacity shall be provided for connecting incoming supply and for a maximum distance of power point / SFU (Switch Fuse Unit) to the machine control panel / cabinet would be **20 meters**. Flexible electrical cables with copper conductor shall be laid in reinforced flexible conduit with end fittings on either side for connecting the incoming electrical supply from SFU.

1.6.4 Bidder shall provide necessary cable from power point to the machine control panel / cabinet. Trenches / cable trays to run the cable will be in bidder's scope. The location of trenches shall be shown in GA drawing and got approved from ICF.

1.6.5 Bidder shall provide voltage stabilizer and isolation transformer of adequate capacity to cater for entire electrical load of machine for **as per the details given under.**

1.6.5.1 For machines not equipped with NC, CNC and Thyristor controlled devices, but electrical motor load exceeding 30kW (Except EOT Cranes, Traversers), a suitable Static / Servo voltage stabilizer of adequate capacity to cater for entire electrical load of machine shall be provided

1.6.5.2 For machines equipped with NC, CNC, Thyristor controlled devices and other sophisticated electronic gadgets including microprocessors etc., which are susceptible to power line spikes and surges, a suitable Static voltage stabilizer and ultra-isolation transformer of adequate capacity to cover for entire electrical load of machine shall be offered.

1.6.5.3 Voltage stabilizer shall be equipped with a protective relay to trip AC power supply to machine instantaneously with audio and visual indication to operator. Settings of protective relay for low and high voltage shall be 320 V and 460 V respectively. Protective relay shall be provided on machine having electrical load below 30 kW.

1.6.5.4 Indigenous make voltage stabilizer and isolation transformer from reputed manufacturer are acceptable. Specifications for Static voltage stabilizer and Ultra-isolation transformer are given below.

1.6.6 SPECIFICATION OF VOLTAGE STABILIZERS:

1.6.6.1 STATIC VOLTAGE STABILIZER–SPECIFICATION (WHERE APPLICABLE)

The Static Voltage stabilizer shall conform to	
Input Voltage	320 to 460 volts 3 phase 4-wire unbalanced supply (Selectable)
Input Frequency	47 - 53 Hz
Output Voltage	400 / 415 / 420 V AC (Selectable)
Output Voltage regulation	± 1 %
Response Time	20 msec. or better
Rate of correction	Greater than 5000V/sec within 20 milli sec
Waveform distortion	Nil
Effect on Power Factor	Nil
Duty Cycle	100% continuous
Overload	<110% for 30 sec or better / up to 110-125% for 5 mins or better / >150% for 1 min or better
Efficiency	>96% or better at full load.
Switchgears and facilities	Contactors, fuses, manual bypass switch & auto bypass
Protection	
Input over voltage and under voltage	20 V above the selected voltage range and 20 V below the selected voltage range or better
Output over and under voltage	Between 394 & 436 or better
Overload protection: There shall be protection against	Electronic overload trip with time delay / Short Circuit, Thermal Protection / MCB/MCCB for overload & short circuit protection
	(a) Output High Voltage / Low voltage cut-offs & Single-Phase prevention. (b) Over temperature sensing and indications, equipment shall trip if the voltage is beyond the range in event of over temperature. (c) Over-current sensing and indications, equipment shall trip if the voltage is beyond the range in event of over-current. (d) Frequency out of range sensing and indications, equipment shall trip if the voltage is beyond the range in event of low/high frequency.

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Display	LCD display for (1) Input, (2) Output voltages, (3) Output Current, (4) Frequency, (5) Visual annunciation for (a) Input & Output Over & Under voltage, (b) over load, (c) Phase reversal, (d) Error log & (e) Temperature cut-off.
Indication & Key Function For	(1) Input Normal, (2) Output Normal, (3) Phase Fault, (4) Over Load, (5) Menu Key for viewing parameter, (6) Start Key to switch ON Output load, (7) Stop Key to switch OFF Output load, (8) Log Key to view Error Log.
Operable Environmental Condition	
Ambient temperature	> 45° C or better
Ingress Protection	IP - 20
Cooling method	Forced Air Cooled
Class of Insulation	Class-H
Cabinet	(1) Castor Wheels with brakes as mounting wheels (2) Must be of high-quality steel with anti-corrosion painting

1.6.6.2 SERVO VOLTAGE STABILIZER– SPECIFICATION (WHERE APPLICABLE)

The Static Voltage stabilizer shall conform to	
Input Voltage	320 to 460 volts 3 phase 4-wire supply (Selectable)
Output Voltage	415
Output Voltage regulation	± 1 % form No load to Full Load
Rate of correction	20 Volts per second per phase
Waveform distortion	Nil
Efficiency	Not Less than 97%
Winding and class of insulation	Copper wire wound with "B" class of insulation or better

1.6.7 ULTRA-ISOLATION TRANSFORMER-SPECIFICATION (WHERE APPLICABLE)

Ultra Isolation Transformer shall confirm to:	
Transformer ratio	1:1
Winding	Copper wire wound with "B" class insulation or better.
Protection	To arrest spikes and surges to the order of 3 KV for 200-400 micro seconds duration.
Common mode noise rejection	120 dB
Isolation	Capacitance 005 Pf: resistance greater than 1000 Mega Ohms.

1.6.8 POWER FACTOR IMPROVEMENT DEVICE (WHERE APPLICABLE)

1.6.8.1 The power factor improvement device shall be provided with adequate rating of capacitor bank to affect savings in bills. The capacitor bank shall conform to IS: 7752 (Part-1975) or latest.

1.6.8.2 The capacitors shall take care of variation in the voltage / frequency specified in earlier Para. The control gear / scheme employed for switching ON / OFF of the capacitors shall take care of the poor power factor in the input supply etc.

1.6.8.3 The following details for power factor improvement device should be furnished in the offer.

- (a) Manufacturer's name
- (b) Rated capacity in KVAR
- (c) AC voltage across phases, No of phases and frequency
- (d) Frame size

1.7 GENERAL CNC CHARACTERISTICS (WHERE APPLICABLE) : AC servomotors, AC drives, PLC's and drive circuits should preferably be of the same make as that of CNC control. The AC Servo Drives and AC Servomotors shall be of reputed make. The PLC, AC Servo Drives and other control circuitry in the electrical panel shall be firmly fixed to withstand the vibration generated in the machine.

1.7.1 The measurement system provided in various axes should be of reputed make. The firm should furnish the actual detail ie., resolution and accuracy of measuring system provided for various axes. If linear encoder is used for position feedback, it shall be of metallic linear measuring system. (preferably Magnetic type without glass scale).

1.7.2 The system should be provided with high resolution / high brightness colour TFT/LCD screen of 17" (minimum) size. Status output shall be available on the TFT/LCD screen indicating automatic / manual mode operation selected, program edit status, axis movement / dwell status.

1.7.3 The CNC control shall perform various kinds of online diagnostic checks for real time analysis to monitor the status of various electronic components / AC drives / PLC & CNC control system and display error status, if any, in English text. Self-diagnostics like fault message, internal status of PLC, and display of operator's message should be available.

1.7.4 The PLC system shall be of reputed make. **(Refer Clause 6.11 for acceptable brands)**

1.7.5 It shall be possible to operate the machine automatically through memory or MDI. The system must have facility for connecting a regular keyboard and a mouse to input program parameters. Also, provision to connect an external monitor system shall be available. Facility of machine lock, auxiliary function lock, program rest, skip function and dry run shall be available for checking the program.

1.7.6 All CNC system hard disk with fully loaded software as maintenance spare shall be quoted for maintenance purpose. The hard disk shall have a capacity of at least 40 GB.

1.7.7 In case of system monitor failure, it shall be possible to run the machine with conventional PC monitor with VGA input. When the machine is idle for 10 minutes, the main motor shall be switched OFF through CNC or PLC system. Data protection (password protection) shall be provided. All passwords shall be given to ICF during commissioning.

1.7.8 CNC control should indicate "Run hours" of machine and also have facility to "indicate no of Jobs processed in the Machine".

1.8 PROGRAMMING (WHERE APPLICABLE)

1.8.1 Part program editing and background editing shall be available. 2D graphical programming with 2D drawing of the profiles with dimensioning facility shall be available. Facility for program search using program name or program number shall be available. It shall be possible to store program number and program name for identifying the program. The number of characters in program name shall be indicated. Simulation of part programming path on the monitor shall also be available.

1.8.2 Absolute / incremental programming shall be available. It shall be possible to use both of them in the same block. Facility of optional block skip shall be available. It shall be possible for operator to skip a block at his discretion.

1.8.3 Input in both inch / metric systems shall be possible. Change from one mode to the other shall not require re-entry of offset values. Feed rate command shall be available in mm/min and inch/min. Input sensitivity should be 0.001mm. Linear interpolation shall be available.

1.8.4 To facilitate programming of family of similar work pieces custom macro/parametric function shall be available. It shall be possible to program angles, chamfers, corner rounding values and other parameters from drawing by direct input of these values.

1.8.5 A programming kit loaded with suitable lifelong licensed software along with suitable interfacing cables to download & upload CNC/PLC programs and parameters shall be supplied.

1.8.6 Loading and unloading of Part program & PLC program through Ethernet/USB Port/PCMCIA/CD should be provided. Loading and editing of part programming should be possible through MDI/Key board, PCMCIA interface, USB interface and RS 232C interface. Facility of buffer storage shall be available in the control so that machine-waiting time is avoided while the next programmed instruction is being read into the control system.

1.8.7 Execution and PLC programs should be in Memory Card, so that power failure should not affect system execution and PLC program. Off line programming software with lock to be provided and which shall have lifelong license. Software and hardware requirement to load this software shall be same as that of the CNC Control system offered.

1.8.8 Ladder diagram/STL with cross-reference listing for PLC program should be accessible on system screen and provided for ease in maintenance purpose where ever needed.

1.8.9 Programmable zero offsets should be available

1.8.10 All necessary back up / machine set up data, manuals, passwords and software be available on CD-ROM / PCMCIA Card / PEN Drive

1.8.11 Any software / hardware update or up gradation in the machine during Warranty / CAMC period shall be the scope of the supplier.

1.9 MACHINE TOOL (WHERE APPLICABLE)

1.9.1 It shall be possible to return the machine tool to the reference point through program commands as well as manually. It shall be possible to control the movement of the tool with respect to machine zero through machine co-ordinate system.

1.9.2 Auxiliary function, speed, feed rate, tool offset, emergency stop current position, display giving position in work co-ordinate system, machine co-ordinate system and residual amount of movement status shall be provided.

1.9.3 Self-diagnostics like fault message, internal status of PLC, counter monitoring, spindle monitoring and display of operator's message should be available.

1.9.4 The basic CNC system shall be full contouring control system and control system shall be of latest generation.

1.9.5 Compensation for pitch error, backlash, cutter radius, tool length and tool nose radius shall be available.

1.9.6 For precise adjustment of feed rate, provision of manual pulse generator shall be available. For spindle speed, feed rate and rapid traverse, manual override shall be available from 0-120%.

1.9.7 For Axis Control, only AC Servo motors and AC servo drives shall be used in the machine.

1.9.8 Unscheduled power shut down during working of the machine shall not affect its performance and it shall be able to continue the process with ease on restoring the power.

1.10 BOUGHT OUT ITEMS: The bidder shall furnish, along with the offer, a list of all critical items and sub-assemblies that are bought out by the bidder for the proposed machine, **along with the manufacturer's name, brand, model, etc.** All bought out items shall be from reputed manufacturers as tabulated below.

S. No.	SUB ASSEMBLY	MAKE
1	CNC Systems	Delem / Cybelec / Siemens / Fanuc / Allen-Bradley / ABB / Omron / Heidenhain/ Elgo /Cadman / LVD/ Panasonic / Yaskawa / Mitusbishi / Delta / Beckhoff / METAMATION / ECKELMANN/ESA
2	PLC System	Siemens / Fanuc / Mitsubishi / ABB / Schneider / Omron / Delta / Beckhoff
3	Measuring & feedback devices	Heidenhain / Siemens / Fagor/ Elgo / IFM / Balluff / Sick / Kubler / Mitutoyo / Fanuc
4	AC servo drives & Motors	Crompton / NGEF / Hindustan / Kirloskar / BBL / GE / Nord / Fanuc / Siemens / Allen-Bradley / Schneider / ABB / Mitsuibishi / Omron / Yaskawa / Panasonic / Beckhoff / Bharat Bijlee /
5	Time relays	ABB/ Siemens / BCH / L&T / Schneider / C&S
6	Limit Switches & safety switches	BCH / Siemens / L&T / Teknic / Euchener / Honeywell / Balluff / Pepperl& Fuchs / Omron / C&S / Speed-O-Control / CCE / Electromag / Anand System / Orion / Danfoss / IFM/ Schneider
7	VVVF Drive	ABB / L&T / Yaskawa / Schneider / Mitsubishi Electric / Danfoss / Fuji Electrics / Toshiba India / Crompton Greaves / Siemens / Allen Bradley
8	Safety light curtains / safety relays	Omron / ABB/ Pilz / Panasonic / Autonics / Photon / Rockwell / Galco / Keyance
9	Air Conditioning for control cabinet	Rittal / Warner Finley / Kelvin / Pfannerberg / Advance Cooling System / Zapp Cool / Sun Beam
10	Electrical control cabinet	RITTAL / Siemens or other reputed makes with IP 55 protection level
11	Servo Controlled Voltage stabilizer or Solid State Stabilizer	Neelkanth / Servomax / TSI / Fuji Electric / Golden / Adroit / Numax
12	Ultra Isolation transformer	Neelkanth / Servomax / TSI/Fuji Electric/Golden/Adroit/Numax
13	Cables	Siemens / Indramat / Hubershauer / Finolex / Havells / Polycab / Lapp / Roliflex / Rkable / Rk Cable / Kei / C&S / Universal / CCI / ICC / National / Igus / Rallison / Paragon / Kabelschlepp
14	Connectors	Harting / Kontakt / L&T/ Omron / Indoelectric / Phonix / Connet well / Siemens / BCH / ABB / Schneider / L&T / GWE / C&S / Telemechanique / GE / Schemersal / Pilz / Balluff / Sick / Turck / Allen Bradley

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15	Overload relays	Siemens / BCH / L&T / Schneider / C&S
16	SMPS	Phoenix contact / Siemens / Omron / MultiSpan / Mean Well / Schneider / ABB / Delta
17	MCCB	Schneider / ABB / Siemens / L&T / C&S
18	Control Panel Switchgear / Enclosure	GE / Siemens / L&T / Havels / North West / BCH / Merlin Gerlin / GEC-Alstom / Indo Kopp / Telemecanique / Paramount / C&S / L&T / Schneider / Rittal
19	Electrical isolators	SIEMENS / L&T / BCH / C&S/ Schneider
20	Push button switch	Siemens / L&T / BCH / Teknic / C&S/ Schneider
21	Fuses	English Electric / Siemens /GE / L&T /BUSSMANN/ Schneider
22	Sockets for hand lamps etc.	Crompton / BCH / Reyroll/ Schneider
23	Indicating Lamps	Siemens / L&T / BCH/ Schneider
24	Gear Motor	Bonfiglioli / Demag / Nord / SEW Eurodrive
25	Electric Hoists	Yale / Quantum (Ingersoll Rand) / Morris / Avon / Lifturk / Indef / Loadmate / Hindustan / K2 Cranes / Sahjanand
26	Hydraulic System and its elements such as valves and other accessories	Rexroth / Vickers / Yuken / Altos / Parker / Bosch
27	Ball Screws	THK / INA / Rexroth / Star / Sheenburger / Korta
28	Roller Bearings	FAG / SKF / NBC / NTN / KOYO / Nachi / NORMA / NRB / KOYO /RHP / SNFA / Timken
29	LM Guides	Rexroth Star / INA / Tsubaki / THK / Hiwin / Bosch /PMI
30	Rack &Pinion(Helical)	THK / YYC (Taiwan) / Atalnta(US) / Trumpf (Germany) / Hiwin (US) / KHK (Japan)
31	Lubrication System	Cenlub / Dropco / Vogel / Rexroth
32	Master controller (applicable only for cranes)	Speed-O-Control / CCE / Electromag / C&S / Anand Systems
33	Resistors (applicable only for cranes)	Speed-O-Control / Electromag / CCE / C&S / Anand System
34	Gear reducer	Elecon / Greaves / Shanthi / ZF / New Allenbury / Bongfilivali / Rossi / Nord / Premium / Girad / Apex / Siemens / Rototech / Kavistu / Cyclo
35	Gear Box	Gudel Make (Switzerland) / Stobber (Germany) /Nord
36	Hydraulic oil/Coolant oil/Lubricating oil/grease	IOCL / BPCL / HPCL / Castrol / ESSO

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37	Piston seals	Simrit / Merkel / Hunger / Walkersolo / Soloseal / Parker / Trelleberg / Hellite
38	'O' Rings & Rubber seals	Merlin / Parker / Busak / Hunger / Merkel / Soloseal / Walker solo / Trelleberg / Hellite
39	Filters	Hydac / Hydroline / Parker / Rexroth / EPE Germany / Vickers / Mahle / Purolator
40	Refrigerated type Air cooler for Hydraulic system	Emmegi / Warner Finley / Kelvin / Advance Cooling system / Zapp Cool / Sun Beam
41	Wire ropes	Usha Martin / Bombay Wire rope / Mahadev
42	Pneumatics	ASCO (USA) / Hoerbiger (Germany) / SMC (Japan)
43	Gas pressure control system	SMC (Japan) / ASCO
Service and operation tools, each for operation, mechanical and electrical maintenance shall be supplied as listed below		
44	Multi meter & Clamp meter	Fluke / HTC / Motwani
45	Insulated ratchet screw driver set of (Minus, Flower, Ball end etc.) and insulated Cutting Pliers	Stanley / Bosch / Taparia
46	Hexagonal key set / Ball end hexagonal key set and Combination wrench set	Stanley / Bosch / Taparia

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Specification**Table**

Overall dimension	1520x310 mm
Clamping area	1350x310mm
Number of T slots	3
Width of T slots	16mm
Center distance between T slots	65mm
Power operated traverse	longitudinal 800mm Cross ward 265mm Vertical 400mm
Maximum distance from left hand table end to center of spindle	250mm
Maximum safe weight on table	350 kg

Milling spindle

Number of speed	18
Range	35.5-1800
Spindle nose	ISO 50
Swiveling of milling head to either side	45 Degree
Vertical quill movement	70mm
Distance from spindle center to column face	350mm

Feeds

No of feeds	18
Feed range	longitudinal & cross 16-800mm/min Vertical 4-200 mm/min
Rapid	longitudinal & cross 3200 mm/min Vertical 800 mm/min

Power

Main motor	5.5/1500 Kw/rpm
Feed motor	1.5/1500 kw/rpm