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A STUDY ON DETAIL SPECIFICATIONS OF VERTICAL MILLING MACHINE REQUIRED IN INDUSTRY

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ABSTRACT : *From many decades Vertical Milling Centre has been used to make industrial parts and part assembly in many applications like: military and defense sectors, Automation, Mechanical Industries, and Automobile Industry etc. Scientific literature presents many different approaches for manufacturing Vertical Milling Centre.*
In recent years, the development of computer technology resulted in the integration of design and manufacturing systems and automated inspection/gauging systems in manufacturing engineering applications.
Essentially, the machining center is a completely automated, computer-controlled milling machine with 3 dimensional cutting capabilities, characterized by very high absolute positional accuracy, relative repeatability, rigidity, and cutting speed. A wide range of rotary cutting tool types (with automatic tool changing), in conjunction with the three-dimensional programmable relative movement between the cutting tools and mounting table, allows the machining of complex structure shapes and patterns in a wide range of metallic materials that cannot be fabricated using manual milling machines.

The high precision Vertical Machining Center (VMC) must meet or exceed the following "Mechanical Performance Specifications" to meet the requirement of industry.
In this paper description of detail specification of VMC is summarized keeping in view the requirements of manufacturing unit.
The specifications are divided in to various sub headings for better understanding of each specification in brief.

LIST OF SPECIFICATION OF VERTICAL MILLING MACHINE REQUIRED IN INDUSTRY

. 1.0) DESCRIPTION :-

Design, Manufacture, Supply, Erection and Commissioning of CNC Vertical Milling Machine.

2.0) QUANTITY :- Nos.

3.0) DUTY CONDITIONS :-

3.1) The Machine should be designed to perform variety of operations such as Milling, Boring, Drilling, Reaming, Tapping, Contouring, etc. on medium sized alloy steels, forgings, castings and non ferrous alloys, etc.

3.2) This will be used for manufacturing of different types of spare parts on different materials (Medium Carbon Steels, EN Series Materials, Forgings, Casting, Non-Ferrous Materials, etc.)

3.3) The basic machine should be controlled by a computer numerical control system.

4.0) MATERIAL / CONSTRUCTION OF MACHINE :-

4.1) The machine should have rigid structure designed for reliability in accuracy and speed. The complete structure should be made out of high graded casting and heat treated for consistent accuracy for long time.

4.2) The machine should be stress relieved, vibration free and have stabilized structure for long lasting accuracy.

4.3) Table of the machine should be made of nodular casting with the addition of special alloys for consistent accuracy over a long period of time.

4.4) Materials & Constructional Details of structures and list of devices and spares should be furnished in the product catalogue manual.

5.0) TECHNICAL DETAILS OF THE MACHINE :-

5.1) TABLE :

5.1.1) Table Size (minimum)	: 800 – 900 MM Length 450 – 550 MM Width
5.1.2) T-Slot Dimensions (Nos. X Size X Pitch)	: 4 to 5 X 18 MM X 80-100 MM
5.1.3) Load On Table (in Kgf)	: 400 kg. (Minimum)

5.2) TABLE TRAVEL :-

5.2.1) X - Axis (Longitudinal)	: 600 MM (Minimum)
5.2.2) Y – Axis (Cross)	: 400 MM (Minimum)
5.2.3) Z – Axis (Vertical)	: 450 MM (Minimum)

5.3) FEEDS :-

5.3.1) Feed Rate (in X, Y, Z – Axes)	: 1 – 10,000 mm/min
5.3.2) Rapid Traverse (in X, Y, Z- Axes)	: 24/24/24 m/min

5.4) SPINDLE :-

5.4.1) Spindle Speed	: 8000 rpm (Maximum)
5.4.2) Spindle Power	: 5.5 to 15 KW (or) Std. Power
5.4.3) Spindle Nose Taper	: 7/24 No. 40 (or) BT-40
5.4.4) Height of Spindle Face from Table top	: minimum range: 100–150 mm maximum range: 600–650 mm

5.5) AUTOMATIC TOOL CHANGER :-

5.5.1) No. of Tools	: 20 - 24 Nos.
5.5.2) Max. Tool Dia.	
i) All Pockets full	: 80 mm
ii) Alternate Pockets Empty	: 125 mm
iii) Max. Tool Length	: 250 mm
iv) Max. Tool Weight	: 8 kg.
v) Tool Change Time	: 8 Sec. (Maximum)

5.6) ACCURACIES :-

5.6.1) Positioning Accuracy : ± 0.005 mm to ± 0.015 mm

5.6.2) Repeatability : ± 0.003 mm to ± 0.005 mm

5.7) CNC SYSTEM & PROGRAMMING FEATURES :-

5.7.1) CNC System : FANUC OIMD (or) SIEMENS (SINUMERIK 828D) with colour LCD display and HRV Control.

5.7.2) Programming by decimal point in / out

5.7.3) Minimum increment : 0.001 mm

5.7.4) Automatic Recognition of EIA/ISO Code

5.7.5) Part programme storage

5.7.6) Part Programme Editing

5.7.7) Programme Number Editing

5.7.8) Parameter Programming

5.7.9) RS-232C Serial Interface (Computer Interface)

5.7.10) All Softwares on CD/Disk and loaded on Hard Disc

5.7.11) Automatic Tool Change over System (20 – 24 Tools)

5.7.12) PCMCIA Memory card for saving and restoring data

5.7.13) Features of maintenance diagnosis.

5.7.14) Tool Management :

a) Tool life monitoring with time

b) Tool Length Offset

c) Tool Radius Offset

d) No. of Tool Offset

5.7.15) Co–ordinate System :

a) Auto Referencing

b) Machine Co-ordinate system setting

c) Work co-ordinate system setting

d) Programme additive zero offset

5.7.16) MACHINE LOCK :

a) Auto Function Lock

b) Soft approach to and exit from contour

c) Data protection key

5.7.17) Pogramming support functions :

a) Machine Cycle : Milling, Drilling, Tapping, Boring, etc.

b) Cycle sub-programming

c) Extra Stop

5.7.18) Graphics and Simulation

5.7.19) Machine Error Compensation :

a) Stored Pitch Error Compensation

b) Backlash Compensation

5.7.20) Maintenance and Safety :

a) Emergency Stop

b) Safety Interlock, etc.

5.7.21) Leaser Calibration certificate should be provided for each axis.

5.8) STANDARD FEATURES :-

5.8.1) Machine should have rigid base and structure.

5.8.2) Complete work area enclosed

5.8.3) Telescopic covers for all AXES.

5.8.4) Spindle mounted probe

5.8.5) Chip Conveyor with trolley

5.8.6) Air Conditioner for electrical cabinet & it should be energy efficient.

5.8.7) 20 – 24 auto tool changer

5.8.8) CNC 4TH Axis Rotary Table set (Turn Table Dia : 200 MM), Make : UCAM/ Nikken only (fitted with suitable three jaw self centering chuck and suitable tail stock) – 1 set for each machine

5.8.9) Suitable Voltage Stabilizer & Isolation Transformer

5.8.10) Electronic Edge Finder

5.8.11) Coolant system (Auto & Manual)

5.8.12) Set of Operator Tools, ie. Spanners, Allen Key Set, etc.

5.8.13) Machine Lighting

5.8.14) Blue Print Programming

5.8.15) Flash Card

5.8.16) 4th Axis readiness with drives, motors, cables and PLC Software for interfacing Rotary Table.

5.8.17) Air Gun

5.8.18) Automatic Lubrication System

5.8.19) USB Ports for inserting Pen Drives

5.8.20) 3 tier process lamp

5.9) ELECTRICAL :-

5.9.1) Electrical equipment with wiring suitable for standard 3 Phase, 415 V, 50 Hz, AC Supply.

5.9.2) All electrical drive motors should be energy efficient with 'EFF1' labeling and 'TEFC'. Energy Saver Equipment where ever necessary may be provided.

5.9.3) All electrical wiring and panel should be such designed so that Rat Entry Should be prevented (Rat Free).

5.9.4) Inside Control panel all drives and cards to be fixed for easy maintenance and removal, and control panel to be fixed at proper position for easy maintenance of electrical service engineers.

5.10) ESSENTIAL ACCESSORIES (STD. / OPTIONAL) :-

5.10.1) Precision Milling Machine , Swivel base, size : 8" with tenants to be suited to T-Slots of machine table – 1 Nos. for each machine

5.10.2) Clamping Kit for job Holding (ie. T-bolts & Nuts, stepped clamps, blocks, etc.) – 1 set for each machine

5.10.3) Collet Set, size : 0 to 16mm – 1 set for each machine

5.10.4) Tool Holding Kit (Adaptors with pull studs for holding collets, T-Max Cutters, Endmills, etc.) – 1 set for each machine

5.11) MRLS FOR 2 YEARS :-

5.11.1) The supplier has to include Manufacturer Recommended List of Spares and Cost thereof for 2 years successful running of machine in their quotation. However the same will not be considered for finalization of order.

5.11.2) The supplier shall give addresses of the firm from whom brought out spares has been arranged.

5.11.3) The supplier shall agree to provide service support during the life of the machine.

5.12) MANUALS : Three sets of manuals in English covering operation, programming, maintenance, spare parts, CNC System, electrical circuit diagrams & PLC ladder diagrams, duly laminated on cardboard so that same can be hanged near the machine. One set of compact disc in PDF format should be provided.

5.13) GENERAL REQUIREMENTS :-

5.13.1) The Machine should be designed for continuous duty.

5.13.2) The design of machine will incorporate all safety features as per applicable codes, practice and regulations.

5.13.3) The machine will confirm to laid down laws, rules, specification in respect of safety / protection of personnel.

5.14) MAKE : Makes of Mechanical, Electrical and Electronic Items are mentioned in the Annexure 'A'.

6.0) SCOPE OF SUPPLY :-

The scope of supply shall include design, manufacturing, assembly, packing and supply of CNC Vertical Milling Machine with accessories as per the above technical details to Ammunition Factory Khadki, Pune – 411 003

7.0) INSPECTION :-

The Inspection criteria to be as follows :

7.1) PRE-DESPATCH INSPECTION (PDI):

7.1.1) The manufacturer shall intimate the readiness of the machine well in advance.

7.1.2) The machine will be inspected by GM, AFK or his authorized representative/s at firm's premises.

7.1.3) The positional accuracies shall be checked during inspection. All facilities for such inspection shall be provided by the manufacturer.

7.1.4) During inspection firm should show the performance of the machine by conducting trials on a test piece as per the drawing provided by the AFK. Job accuracies will be checked as per tolerances given in the drawing. The raw material for the test piece, toolings and measuring instruments required for inspection shall be arranged by the manufacturer.

7.1.5) Duration of PDI will be three days.

7.2) DESPATCH : The manufacturer shall dispatch the machine duly packed. Any damage to the parts of the machine & spare parts shall be replaced by the tenderer at free of cost & replacement shall accompany certificate of the original manufacturer. No replacement other than that of the original manufacturer will be accepted.

7.3) JOINT INSPECTION : After receipt of machine at AFK, Joint Inspection will be carried out by the firm's representative/s and AFK representative/s before erection.

7.4) FINAL INSPECTION (AT AFK) : The final inspection will be carried out at AFK, PUNE, after erection and commissioning and successful trial run of machine.

8.0) ERECTION AND COMMISSIONING :-

8.1) The firm shall provide detailed foundation drawing and general arrangement drawing well in advance before commencement of erection.

8.2) The firm shall dismantle the existing machine and shift the same to scrap yard at a distance of approximately 1 km within the factory premises itself.

8.3) The firm shall arrange all necessary tools, tackles consumable, welding m/c, chain pulley blocks, necessary labour force, technical personal for carrying out the erection, alignment and commissioning of new machine adhering all safety and security norms prevailing at Ammunition Factory Khadki, pune.

8.4) Civil Works pertaining to the erection and commissioning of the machine is to be carried out by the supplier.

8.5) Supplier should arrange suitable electric cable / wiring required for the machine from panel board to machine. All cables to be neatly laid in cable trays.

9.0) TRAINING :-

Training should be given by the firm at AFK Site in the following areas.

9.1) Programming & Operation : Min. Four Persons

9.2) Mechanical Maintenance : Min. Two Persons

9.3) CNC System & Electrical Maintenance : Min. two persons

9.4) The duration of such training shall not be less than two weeks. The vendor should indicate the detailed syllabus of such training proposal.

9.5) The training has to be arranged by the vendor at no additional charge.

9.6) In addition during erection and commissioning of the equipment at purchaser's works, vendor's representative/s will have to impart training to the purchaser's personnel in operation and maintenance of the equipment.

10.0) GUARANTEE / WARRANTY :-

Supplier should give guarantee / warranty for the satisfactory performance of the machine for a period of 12 months from the date of commissioning.

11.0) SITE VISIT :-

The firm should visit the site at Ammunition Factory Khadki, Pune, to ascertain the scope of work and functional requirement before submitting quotation.

REFERENCES

[1] Specification for a Precision CNC Vertical Milling Machine Centre, Attachment No1. N00173-05-R-HA02.
[2] Optimization of Surface Topography for Hard Material Machining With CNC End Milling, Anmol Kumar1, M.K. Paswan2, Assistant Professor, Dept. of Mechanical Engg., B. A. College of engg. & technology, Jamshedpur, Jharkhand, India 1Professor, Dept. of Mechanical Engg, N.I.T Jamshedpur, Jharkhand, India.
[3] Design of laboratory 3-axis cnc milling machine by modular Approach labros 100s",1. Milica KOVJANIC, 2. Aleksandar KECMAN, 3. Nemanja BRDAR Mihajlo STOJCIC, 5. Gordana GLOBOCKI.
[4] VMC Specification report-Jyoti Ltd.
[5] VMC Specification-ACE Micromatic Group.