

Machine Tool Selection Guide: Avoiding Common Pitfalls

How to correctly select a CNC machine tool is a comprehensive and highly technical decision.

Faced with a wide variety of expensive equipment on the market, purchasers often encounter a series of core challenges:

How to filter out the product that truly meets your processing needs from numerous brands and models?

How to ensure that the selected equipment not only meets current production requirements but also adapts to the company's future development?

How to properly configure auxiliary accessories, cutting tools, software technology, and after-sales technical support to achieve the optimal return on investment?

These issues are interconnected and directly impact processing efficiency, product quality, and long-term operating costs after the equipment is put into use. Only by conducting a systematic evaluation from technical, economic, and developmental perspectives can a scientific and rational decision be made, enabling CNC machine tools to truly become a powerful tool for enhancing corporate competitiveness.

Step 1: Define Your Typical Workpieces

The foremost prerequisite for correctly selecting a CNC machine tool is to clearly define the typical part types your company needs to process. Workpieces with different structural characteristics correspond to machine tools with different process capabilities:

Plate-type parts— Vertical machining centers are recommended.

Plate-type parts are predominantly processed on flat surfaces and are easy to clamp. Vertical machining centers feature a spindle perpendicular to the worktable, offering good rigidity and an open operational view, making them suitable for face milling, drilling, and contouring with high cost-effectiveness.

Box-type parts— Horizontal machining centers are recommended.

Box-type parts typically require multi-face machining with high positional accuracy between hole systems. Horizontal machining centers feature a horizontally oriented spindle and, when paired with a rotary worktable, can complete milling, boring, drilling, and tapping operations on multiple faces in a single setup, delivering both efficiency and precision.

Large structural components and machine tool castings — Gantry machining centers are recommended.

These workpieces are large in size and heavy in weight, requiring high rigidity over extended travel ranges. Gantry machining centers offer broad worktable surfaces and high load-bearing capacity. Their fixed-beam, moving-table configuration ensures

exceptional stability when machining large parts.

Shaft-type and rotary parts — Turning centers or turn-mill centers are recommended.

Shaft, disc, and sleeve-type parts primarily involve rotary surface processing. Turning centers possess robust turning capabilities and, when equipped with a live tool turret or sub-spindle, can perform combined milling, drilling, and tapping operations, making them ideal for efficient, high-precision one-shot machining of rotary parts.

Step 2: Machine Tool Specifications

1. Worktable Size: The worktable area should be larger than the dimensions of your typical parts to ensure sufficient space for fixture installation, clamping, and operation.
2. Travel Range: The travel of each axis must cover the processing range of typical parts, ensuring that cutting tools can move freely without interference.
3. Load Capacity: The maximum load capacity of the worktable must exceed the total weight of the part and its fixture to prevent overload that could compromise machining accuracy and machine life.
4. Spindle Motor Power: Greater spindle motor power translates to more metal removal per unit of time, indicating stronger cutting capability and higher rigidity. The power rating should be selected based on the material and machining allowance of your typical parts.

Step 3: Machine Accuracy

1. Accuracy Standards: ISO standards should be uniformly adopted to measure positioning accuracy and repeat positioning accuracy, ensuring international comparability and consistency.
2. Positioning Accuracy: Refers to the machine's ability to position its moving components at target coordinates, directly reflecting how closely the machined workpiece dimensions match the drawing requirements.
3. Repeat Positioning Accuracy: Refers to the consistency of positioning at the same location over multiple cycles, reflecting the uniformity and stability of dimensions when machining multiple identical workpieces.
4. Stability Metrics: Repeat positioning accuracy is a critical parameter for evaluating the reliability of any control axis at any point within its travel range, determining whether the machine can maintain stable performance over long-term operation.

Step 4: CNC System Selection

1. System Matching: Select the appropriate CNC system based on the processing type — milling systems for milling, turning systems for turning, and drilling systems for drilling.

2. Leading Brands: Currently, commonly used CNC systems for machining centers include Siemens, Mitsubishi, Fanuc, Syntec, and GSK. Users should comprehensively evaluate based on processing requirements, operational habits, and budget. Customizable systems may also be considered to accommodate specialized process requirements.

Step 5: Cycle Time Estimation

1. Capacity Analysis: A feasibility analysis should be conducted before purchase to estimate the number of typical parts the machine can produce within one year, determining whether it meets production targets.
2. Process and Time Calculation: Based on typical parts, determine the processing steps and, considering the types of cutting tools to be configured and cutting parameters, calculate the cutting time and auxiliary time (such as tool change time, typically measured in seconds) for each step to derive the single-piece production cycle time.

Step 6: Tool Magazine and Tool Holder Configuration

1. Tool Magazine Capacity: Larger tool magazines come with higher costs and increased failure rates (approximately 40% of machining center faults are related to the tool magazine). Therefore, capacity should not be over-specified; it should merely satisfy the tool count required for typical part processing.
2. Recommended Capacity: Vertical machining centers typically use tool magazines with around 24 tools, while large horizontal machining centers may consider approximately 40 tools, which generally covers the processing needs of most complex parts.
3. Tool Holder Selection: Determine the types and quantities of tool holders based on the process content of typical parts. If lacking experience, the machine tool manufacturer or cutting tool supplier can be engaged to assist in process analysis and provide professional tool holder configuration recommendations.

Step 7: Drive and Motor Selection

1. System Compatibility: To ensure optimal performance matching, the control system, drive amplifiers, and drive motors should be sourced from the same brand. For example, when using a Mitsubishi CNC system, it is recommended to select Mitsubishi-recommended drive amplifiers and motors; otherwise, response speed and positioning accuracy may be compromised.
2. Feed Motors: Higher power and torque in feed motors provide stronger dynamic response capabilities—starting, braking, acceleration, deceleration, and reversing—resulting in better positioning accuracy, though at a higher cost.
3. Cutting Capability: Higher spindle motor power means more metal removed per minute and stronger cutting resistance. Specific selection must consider the workpiece material (e.g., harder materials require higher-power motors).

Step 8: Optional Accessories and Features

In addition to the basic functions of the CNC system, machines can be equipped with various optional features such as full closed-loop control, full splash guards, CNC rotary tables, automatic chip conveyors, industrial air conditioners, etc. These accessories enhance machine performance or improve the operating environment but add to the cost. Recommendations:

1. Accessories that are commonly used and offer high cost-effectiveness should be included where possible (e.g., full splash guards, automatic chip removal).
2. Accessories with limited utility or excessively high prices may be deferred to avoid unnecessary expenditure.

Step 9: Technical Support and Service

To fully leverage the capabilities of CNC machine tools, a professional technical team must be established:

1. Process Engineers: Familiar with CNC machining processes, capable of logically arranging process steps.
2. Programmers: Proficient in programming software and system commands to ensure efficient and reliable programs.
3. Operators and Maintenance Personnel: Possess standardized operating practices and fault diagnosis capabilities.
4. Only by prioritizing technical team development can machine tools operate stably over the long term and generate maximum value.

Step 10: Comparative Analysis and Final Selection

1. Leverage Manufacturer Support: Most machine tool manufacturers now have pre-sales technical support departments. Users can provide drawings of typical parts and have the manufacturer assist in developing selection proposals.
2. Comprehensive Comparison: Different manufacturers' recommended machines vary in configuration, performance, and price. Multiple proposals should be analyzed and compared in detail, evaluating accuracy, efficiency, reliability, service, and cost-effectiveness to select the optimal solution.

Why Choose Mengji?

Based on clearly defined typical part types, Mengji provides precisely matched processing solutions:

1. Comprehensive Product Line Covering Mainstream Processing Needs

Mengji offers a full range of machining centers, including drilling-tapping, vertical, horizontal, and gantry models, enabling precise machine recommendations based on your typical part types — avoiding the selection pitfalls of "over-specification" or "under-specification."

2. Same-Brand System and Drive Motors for Optimal Performance Matching

We consistently adhere to same-brand matching across control systems, drive amplifiers, and drive motors (e.g., Mitsubishi CNC system paired with Mitsubishi drives and motors), ensuring signal transmission without delay and highly coordinated dynamic response. This approach fully unlocks the system's potential, delivering exceptional performance in starting, braking, acceleration, deceleration, and precise positioning — achieving superior positioning accuracy and processing stability.

3. Complete Basic Accessories—Ready to Use Upon Arrival

Essential accessories such as full splash guards, automatic chip conveyors, and industrial air conditioners are provided as standard or convenient options, eliminating the need for post-installation modifications and enabling rapid production commissioning upon delivery.

4. Robust Technical Support and Pre-Sales Service

Mengji maintains a dedicated pre-sales technical department that offers free process analysis, machine selection, and tooling configuration recommendations based on your typical parts, helping you mitigate risks from the outset and ensuring precise selection.

5. Comprehensive After-Sales Service System

We have an extensive nationwide after-sales service network providing rapid response, scheduled inspections, spare parts supply, and comprehensive support to keep your production running smoothly.

6. Systematic Training for Rapid Team Development

Mengji not only delivers high-quality machine tools but also provides systematic training covering process planning, programming, operation, and maintenance — helping your technical team quickly master core equipment skills, ensuring you "purchase with confidence and operate with peace of mind."

Choose Mengji—choose professionalism, reliability, and long-term value. Let's work together to enhance your processing competitiveness!