

REVO
ENDÜSTRİ

Maktek Eurasia 2026

01

From Idea
to Part

02

Anatomy
of Making

03

Design.
Chips. Part.

Making is pure joy.



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REVO

ENDÜSTRİ

From Idea to Part Anatomy of Making Design. Chips. Part.

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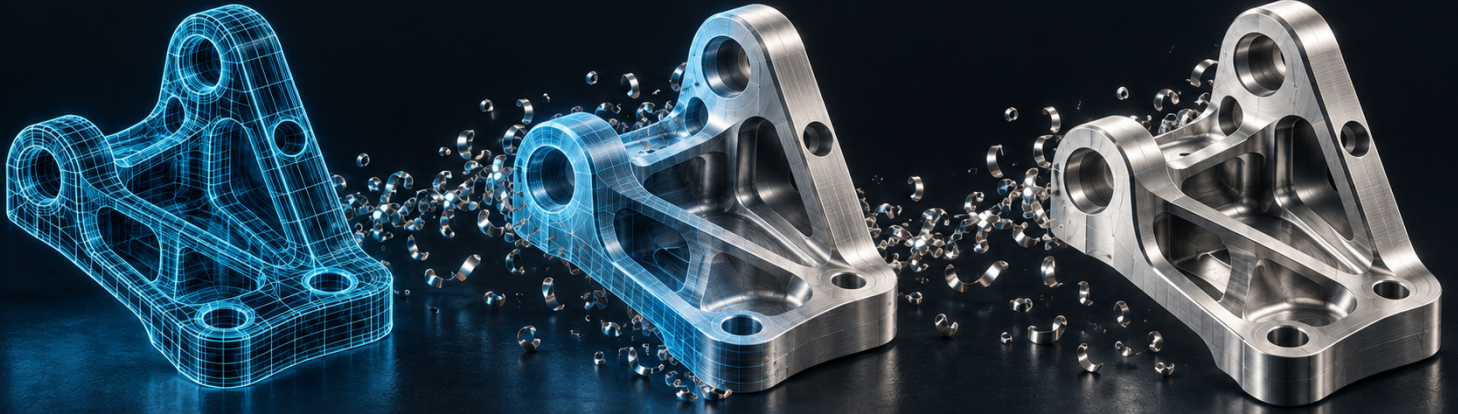
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MIND TO MATTER: MAKING



To us, making is a creative, engineering-driven process that turns ideas into reality.

From its first sketch to a physical part, an idea goes through many decisions, trials and rounds of rethinking. Designing, making, seeing the result, measuring and starting again when needed are natural parts of the process.

However, making is not always within easy reach. The technology, space, infrastructure and know-how it requires, along with the complexity of the process itself, can sometimes make it hard to turn an idea into a part.

REVO's story, too, took shape around this thought. We began by asking how we could do better, and how we could make manufacturing more accessible, more flexible and more enjoyable. Over time, that approach also defined the character of the machines we developed. From the compact design to ease of use, and from engineering details to adapting to different working environments, every decision we have made comes back to one idea: putting manufacturing within easier reach.

That is why, at REVO, "Making is pure joy" is more than a slogan: it sums up how we see our work and making itself.

We love making things, and we believe the desire to make deserves support. That is why we try to share what we know about CNC technology and production processes, along with what experience has taught us, on different channels, especially YouTube. This booklet continues in the same spirit.

In this booklet, which we prepared ahead of MAKTEK Eurasia 2026, you will also find the MATE series and the sample parts we will show at the fair, as part of a bigger picture. Our focus goes beyond the machines themselves: we also look at how a machine is used, which production needs it meets and which decisions go into building a good process.

From design to machining, cutting tools to materials, workholding to measurement: we wanted to explore the layers of making with you.

We hope this booklet inspires new ideas, questions and experiments in making, and becomes a practical resource you can open again whenever you need it.
Welcome to a closer look at making.

Revo Endüstri Makine Teknolojileri A.Ş.

100 years of experience & trust



With a commercial heritage dating back to the 1920s, Topçu Holding is one of Türkiye's long-established family businesses. Over time it has carried more than a century of trading experience into industry, manufacturing and technology, and today it builds for the future through investment in engineering and innovation. With the other group companies, it leads its sector with nearly 2,000 sales outlets across Türkiye and a broad product range.

1920

Ali Reis Topçu began his career in trade.

1957

Topçu Rubber Factory opened, taking the family from trade into industry.

1977

Topçular Hırdavat Pazarlama ve Yatırım A.Ş. was founded in Tahtakale, Istanbul.

1981

Reis Makina began operating in Karaköy, Istanbul.

2000s

With the fourth generation came Topçular Endüstriyel Üretim ve Yatırım A.Ş.

2020

The group companies came together under Topçu Holding A.Ş.

2024

REVO Endüstri Makine Teknolojileri A.Ş. joined Topçu Holding.

2026

Production continues in Istanbul, Düzce and Konya.

100+

years in business

2,000+

sales outlets

100K+

products

30,000

m² plant area

Industrial roots

Before it is a product, a machine takes discipline in production and supply. Topçu Holding's long experience in industry and supply strengthens REVO's engineering know-how.

A strong base for R&D

Developing a CNC machine is a long engineering process. REVO's more than 10 years of experience in research and product development, combined with the Holding's industrial infrastructure and corporate strength, supports long-term, sustainable R&D.

Trusted after-sales

Buying a machine is also an investment in the service and corporate continuity behind it. Deep roots strengthen spare parts supply and after-sales support.

REİS MAKİNA TİCARET VE SANAYİ A.Ş.

Corded and cordless power tools, garden machinery and measuring tools, with a sales and service network.

TOPÇULAR ENDÜSTRİYEL ÜRETİM VE YATIRIM A.Ş.

Generators, band saws and industrial equipment, made for domestic and export markets.

REVO ENDÜSTRİ MAKİNE TEKNOLOJİLERİ A.Ş.

Development and production of compact CNC machining centers, with engineering, application and after-sales support.

CNC

what it is, how it works

There is one technology that is part of the job for everyone in manufacturing and the stuff of dreams for anyone eager to make their own designs: CNC. Yet CNC on its own does not refer to any one machine.

CNC stands for Computer Numerical Control and means that a machine can be controlled by numerical commands sent from a computer. That machine might be a mill, a lathe, a punch press, a wire EDM, a robot arm, a wire bender or a 3D printer. All of these can also be operated manually; once they are put under computer control, their names take the prefix CNC.

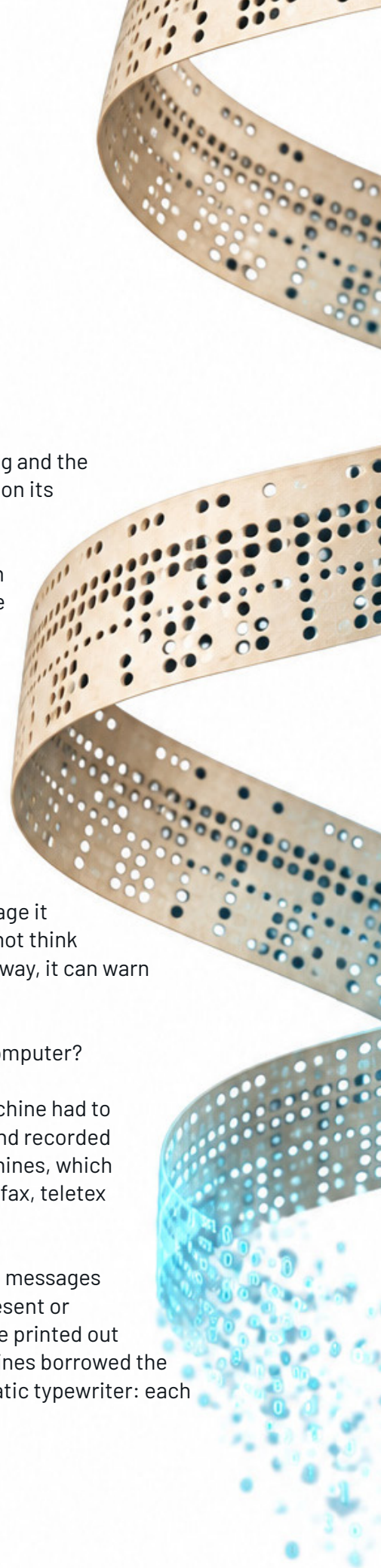
Before Computers: NC Machines and Punched Tape

Go back in time, take the “C” (the computer) out of CNC, and you are left with NC (Numerical Control) machines. If a machine can be moved automatically by commands such as “travel this far along this axis,” “raise this” or “rotate this many degrees,” it is, at its core, an NC machine. Within its capabilities, the machine carries out commands given in a language it understands. But a typical NC machine has no persistent memory: it does not think about what it is doing and does not correct its own errors. Still, in a limited way, it can warn the operator when an incorrect entry is made.

So how did these machines carry out their tasks automatically without a computer?

In the past, to run these machines, one person wrote out each step the machine had to perform, and another translated those steps into the machine’s language and recorded them on tape. The idea behind these tapes came from teletype (telex) machines, which were used to send and receive messages from the 1930s to the 1990s, until fax, teletex and email took over.

With no way to store messages digitally at the time, incoming and outgoing messages were also punched into tape as rows of holes. When a message had to be resent or archived, the punched tape was fed back into the machine and the message printed out again, with no need to retype the whole text. The first NC production machines borrowed the principle of these fairly complex devices, which worked as a kind of automatic typewriter: each machine was run by reading a tape punched with its motion commands.



Telling a machine what to do, in numbers.

Enter the Computer: What CNC Can Do

Today's NC machines, by contrast, accept numerical input directly through digital control panels. Unlike NC machines, CNC machines receive their commands fully digitally, from a computer. "Computer" here can mean a personal computer or any device capable of calculation and evaluation.

Sending commands through a computer gives the machine abilities that NC machines lack, such as memory and error correction. The results include faster operation, higher precision and greater production efficiency. In general, CNC machines can cut, bend, engrave or move a material, or shape it by melting. Their main uses can be summarized as follows:

- * A CNC router can be used to machine wood, MDF, plastic or aluminum parts.
- * A CNC vertical machining center is preferred for fast, precise, high-quality work in metal and plastic.
- * A CNC lathe is used to machine round parts from any material.
- * For fast cutting of sheet metal and plate, laser cutters handle precision work while plasma cutters take on rougher jobs.

Although these machines do different jobs, they all work on essentially the same principle. To move a CNC machine, you need two basic pieces of information: which coordinate axis it should move along, and what position it should reach. For example, if the machine is told to move to 60 on the X axis and 30 on the Y axis, it travels 60 mm in X and 30 mm in Y and arrives at position X60 Y30.

On these machines, every direction of motion is also an axis, and these axes correspond to the standard coordinate axes. Front-to-back motion is the Y axis, side-to-side motion the X axis, and up-and-down motion the Z axis. On a given machine, however, "up" is not always physically up, and the other axes may change depending on which way "up" points.

While X, Y and Z form a true 3D coordinate system, a machine can also have additional axes such as A, B, C, U, X1 and X2, which describe linear or rotary motions beyond the three main axes.

For example, if a 3-axis vertical machining center is fitted with a system to rotate the part, that system becomes its 4th axis.

From numbers to motion

How do numbers become motion?

The CNC program does more than tell the machine which coordinates to go to. It also contains:

- axis movements,
- feed rate,
- spindle speed and direction,
- tool movements,
- coolant on/off commands and more.

The controller reads these commands and sends them to the motion system. Servo motors generate rotation, and mechanical drive elements turn it into controlled axis motion.

This is how coordinates defined on screen become physical motion, and a toolpath becomes a real part.

Not all CNCs are alike

CNC machines share a similar control logic, but their mechanics and uses differ.

CNC routers, for example, mostly machine materials such as wood, plastics, composites and aluminum. In these applications, their large working areas and high-speed spindles are an advantage.

Vertical machining centers, on the other hand, are designed for metalworking, where higher cutting forces are needed. Their structure, spindle characteristics, tool changer and control system are all built around that need.

So calling a machine “CNC” does not, by itself, tell you which materials it can work or which processes it can perform.

CNC describes the control method; the machine’s design decides what it can make, and how.



More in the video

From NC machines and punched tape to the coordinate system, CNC routers and vertical machining centers, our video explains how CNC works in more detail.

Choosing the right CNC mill

Not every production need calls for the same kind of machine. When you choose a CNC, the material, part size, batch size, tool diameters, material removal needs, infrastructure and site conditions matter as much as the working area.

With their high rigidity, powerful spindles and high material removal capacity, conventional vertical machining centers are mainstays of industrial production. For large parts, steel-heavy work, high cutting forces or series production, this design offers significant advantages.

But prototyping, R&D, product development, sample production and low- to mid-volume parts can have different needs. Particularly for users working in aluminum, brass, copper, engineering plastics and similar materials, a more compact CNC can be a better fit in terms of space, energy, installation and use.

Where to start?

Part size

The machine's working volume must accommodate your largest part and its workholding setup.

Material

Aluminum and other non-ferrous metals do not call for the same spindle, body and cutting approach as steel-heavy work.

Batch size

One-off parts, prototypes and short runs differ from high-volume series production in their automation and cycle-time needs.

Tools and operations

How many different tools a single part uses decides between manual and automatic tool changing.

Site conditions

Footprint, power supply, transport, installation and maintenance requirements are all part of the investment decision.

Process demands

High-speed machining with small tools, heavy material removal and multi-operation parts each call for different machine features.

Match capacity to your needs

A bigger or more powerful machine is not always the better choice. Unused capacity can drive up investment, space and infrastructure needs.

The REVO MATE series offers a compact approach to CNC, built for prototyping, product development, sample production and low- to mid-volume precision machining. The aim is not to replace a conventional machining center in every situation, but to offer the right solution wherever a more compact system can meet the need.

The right CNC isn't the highest-capacity one; it's the one that fits your needs.

3D printing and CNC:

Which one, when?

There is no single way to turn an idea into a physical part. In product development, the right method depends on the stage the part has reached, which of its properties you want to verify, the material and the result you expect.

Early in the design process, speed and flexibility matter most. When you need a quick look at a part's form, volume, ergonomics or fit in the assembly, 3D printing has a clear advantage.

Design changes are quick to make, new versions can follow one another in short order, and a geometry that looks right on screen can easily be checked in physical form. At this stage the aim is often not so much to make the final part as to test design decisions as early as possible.

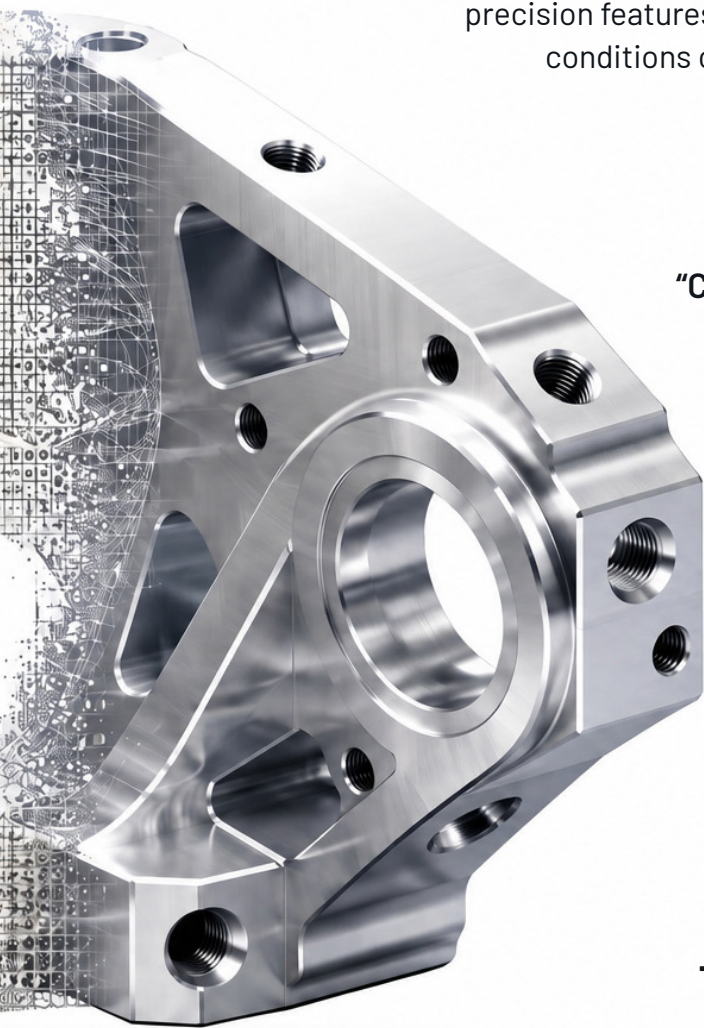
Needs change as the process moves on. When a part calls for the actual material, verified dimensions, machined mating surfaces or real mechanical function, CNC machining, or more precisely subtractive manufacturing, becomes the better choice.

A CNC mill or lathe can produce precise holes, bearing seats, mounting features, grooves and machined datum surfaces in materials such as aluminum, brass, copper and engineering plastics.



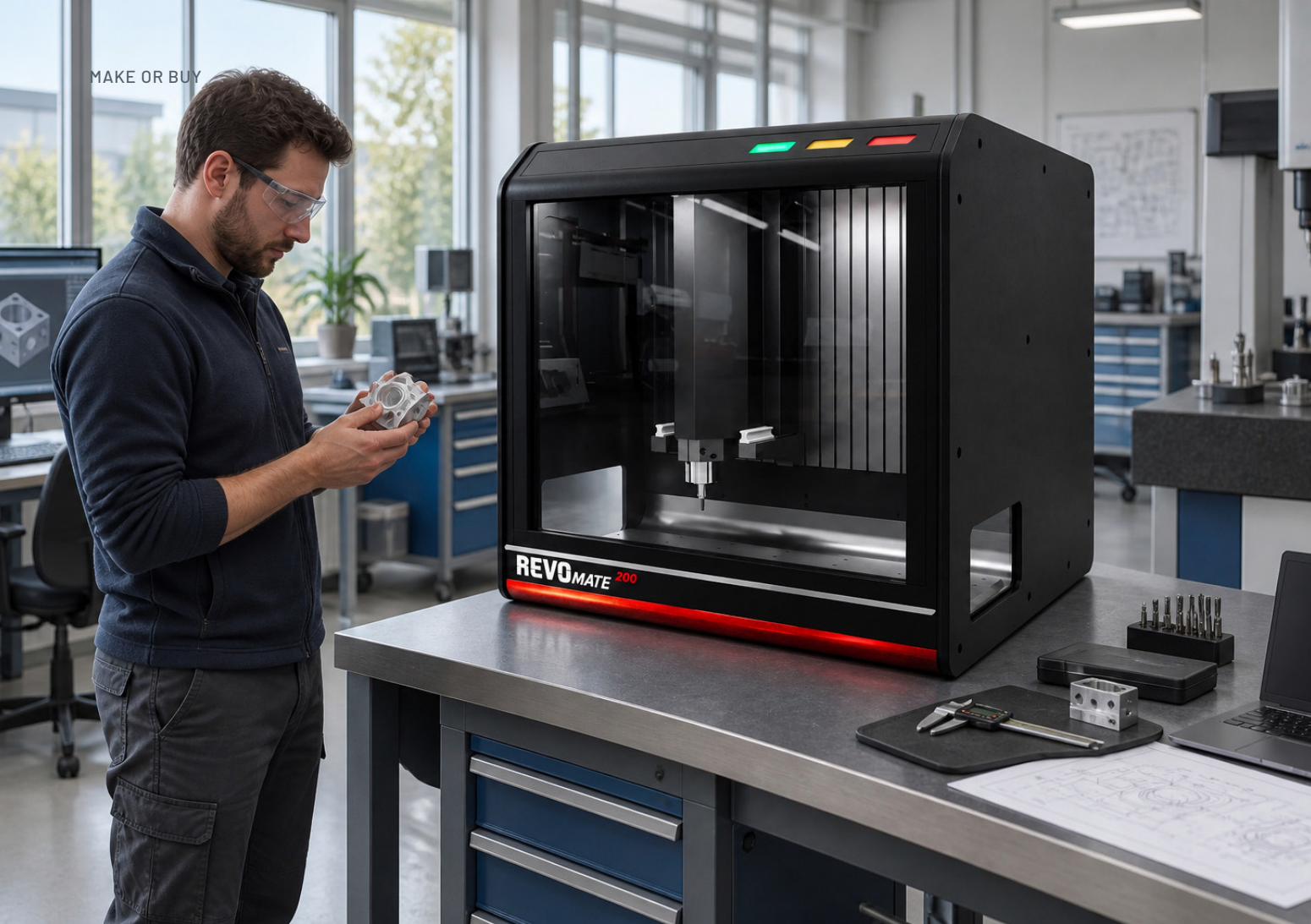
The key difference lies in how the part is made. 3D printing builds the part in layers; CNC machining creates the geometry by removing material in a controlled way. This also shapes the design approach. 3D printing can offer advantages for freer, more complex geometries, while CNC machining means thinking earlier about production decisions such as tool access, workholding, internal radii and machining sequence.

The two methods can be combined in one product development process. The first prototype is 3D printed, form and fit are checked, and the design is revised. Then the functional or precision features are CNC machined so the part can be verified under conditions closer to real use. In some projects, a 3D-printed part serves as a fixture, jig or trial model, while the actual mechanical part is CNC machined.



“Choosing the right method means weighing time, material, quantity, geometry, surface finish and dimensional requirements together. So rather than rivals, 3D printing and CNC are more accurately seen as two distinct production approaches that meet different needs in product development.”

The question isn’t “3D printing or CNC?” but “which method, at which stage?”



When to make, when to buy?

Whether to make a part in-house or source it from outside depends on cost, lead time, quantity, process control, how often the design is revised and the production infrastructure required.

Outsourcing gives a business access to processes and manufacturing capabilities it does not have. For large parts, special processes, work that calls for different machines or periodic capacity peaks, outside suppliers can be the right choice.

In-house CNC capability, by contrast, lets you plan production directly. From design to first part and from revision to series production, the whole process can stay within one organization. This flexibility is a major advantage, especially for frequently changing products, critical parts, fixtures and unexpected production needs.

Why make in-house?

Control over planning

You can plan directly when a part is made, where it sits in the queue and which process is used.

Fast response to changes

When the design changes, production of the new part can restart without waiting on a supplier.

Confidentiality of designs and IP

For R&D, product development or highly confidential production, all work on the design or product stays inside the company.

Flexibility from one-off to long runs

The same equipment can take on prototypes, samples, small batches and repeat production. With the right process and production plan, the machines can also become part of long-running factory operations.

Process know-how grows in-house

Your team builds know-how in tooling, workholding, cutting data, measuring and improving.

Tracking quality at the source

From first part to series production, inspection data can flow straight back into the process.

Production independence

Production independence does not mean bringing every process under one roof. The real value is being able to decide deliberately which part of production to keep in-house and at which stage to use outside suppliers.

When does outsourcing pay off?

Not every part has to be made in-house. Special processes, jobs that call for different machines, very large parts or periodic peaks in volume can make outsourcing the more efficient option.

That is why the strongest approach is often to plan in-house production and specialist outside suppliers together. Parts that are critical, often revised or always needed can be made in-house; work that requires other processes can be sent to the right suppliers.

Production independence is the freedom to decide what you make, when and how.

REVO MATE Series



Wherever Things Are Made

Manufacturing is no longer confined to large factory floors. R&D centers, laboratories, product development units, professional workshops and factories work at different scales, yet share the same need: direct access to manufacturing capability.

230 V single-phase supply

The MATE series runs on 230 V AC, 50 Hz single-phase power, so CNC capability can be set up in many places that have no three-phase industrial supply.

This makes the machines easier to deploy in R&D, laboratory and education settings, and also simplifies infrastructure planning for installations inside factories.

Compact size, easy placement

Thanks to their compact overall dimensions, MATE machines fit easily not only on the shop floor but also in offices, laboratories and R&D spaces. Because they pass through standard doorways, installation calls for no major building work or special rigging. CNC machining can therefore be brought more easily to wherever production is needed.

Adapts to different settings

The MATE series is designed so that one platform can serve different production scenarios. It can make first parts and revisions in product development, handle the daily workflow of a professional workshop, and run repeat, long-running production on the factory floor.

This flexibility lets the same machines meet different needs: prototypes, fixtures, test parts, custom components and regular production. Depending on the purpose, manufacturing capability can be put to use at different scales, from R&D to the workshop and from the workshop to factory production.

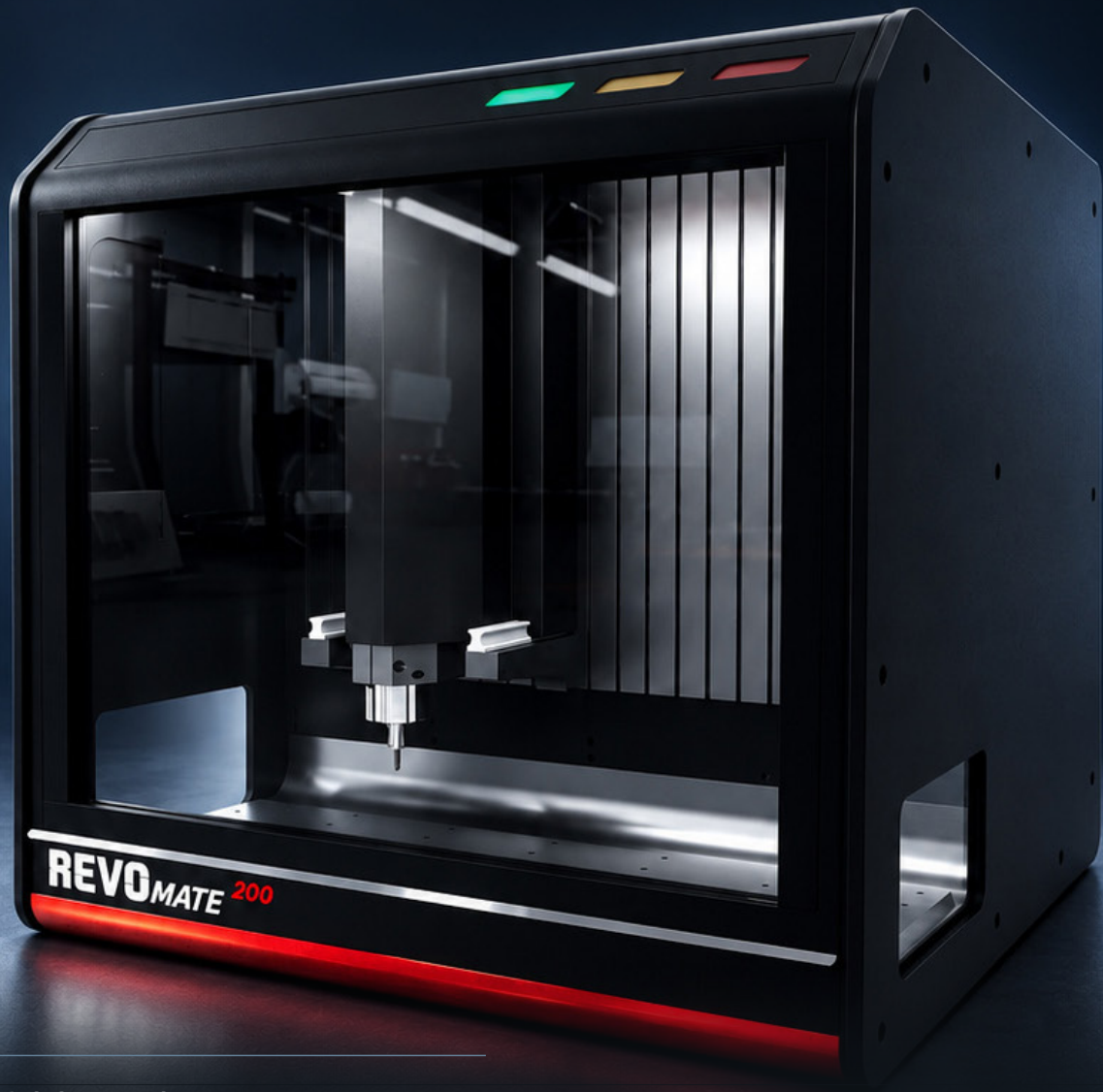
Different materials and processes

The MATE series is suited to machining aluminum, brass, copper, magnesium alloys, engineering plastics and composites. With the tool, cutting data and process approach chosen to suit the material, the machine can handle different part geometries and production needs.

REVO MATE²⁰⁰

Precision in any setting

Bring CNC machining to wherever you need it.



400 × 200 × 170 mm

axis travel

1.5 kW / 40,000 rpm

spindle

230 V

single-phase

Why MATE 200?



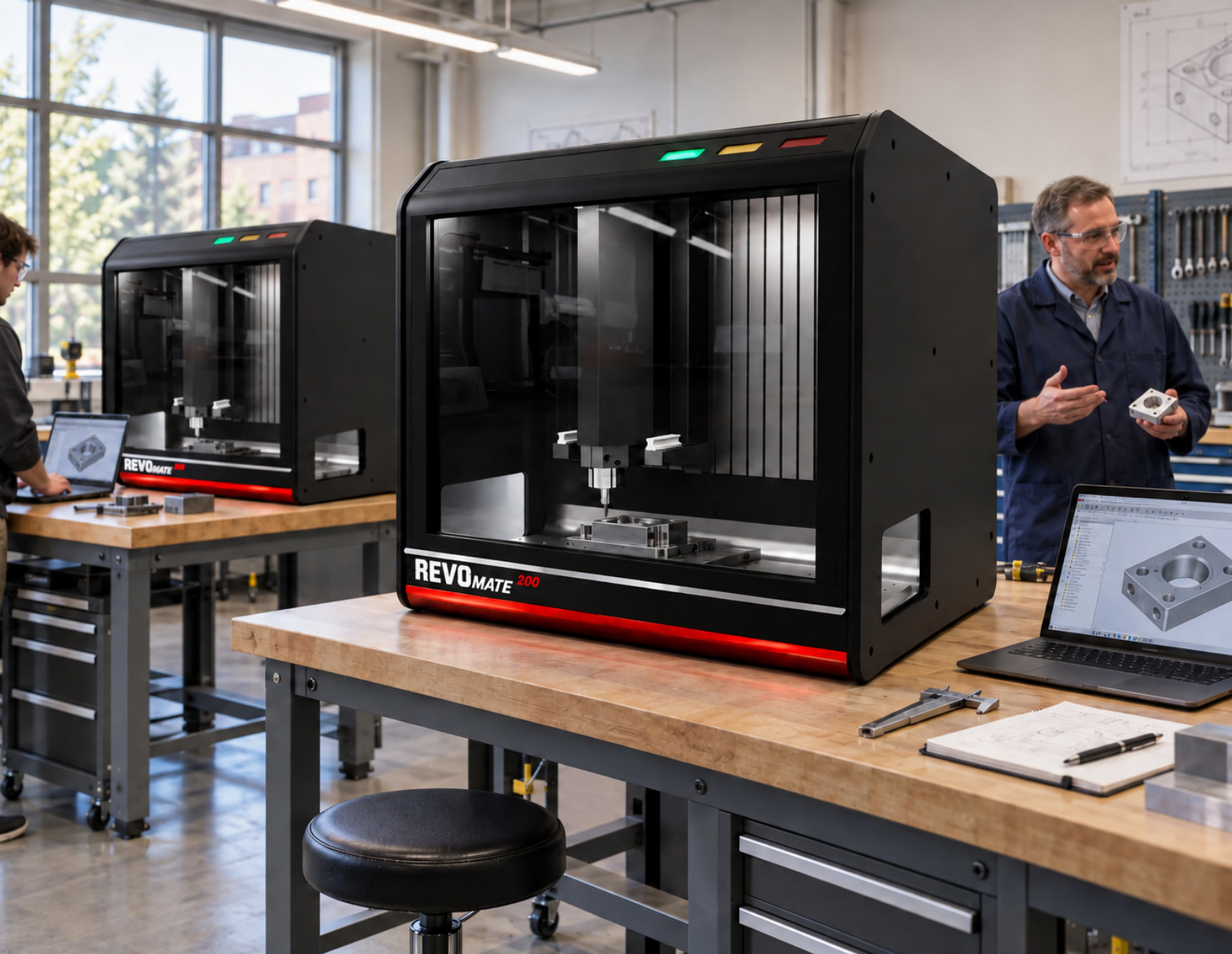
Its compact build makes it ideal for settings as varied as offices, workshops, R&D units and production lines. The 600 × 200 mm table lets you machine long, narrow parts in one setup.

The MATE 200 was developed to bring CNC machining into smaller workspaces.

At 720 × 850 × 850 mm overall, it has a compact footprint, fits through a standard office doorway and runs on a 230 V AC single-phase supply. This makes it easy to place not only in workshops and production areas but also in R&D units, laboratories and office environments.

The 600 × 200 mm table makes it especially easy to clamp long, narrow parts. Its 400 × 200 × 170 mm axis travel offers a suitable working area for small and mid-sized mechanical parts, electronics housings, test jigs, fixtures, samples and custom components.

The 40,000 rpm spindle is well suited to working with small-diameter tools in materials such as aluminum, brass, copper and engineering plastics.



The Best Way to Learn: Making

CNC training takes more than writing programs on a screen.

Turning a design into a real part means learning to make many linked decisions: tool selection, work-holding, zeroing, cutting parameters, chip evacuation and measurement.

Thanks to its compact build and 230 V single-phase supply, the MATE 200 makes it much easier to bring CNC technology into classrooms, laboratories and training workshops.

Students and project teams can work through the whole process in one place, from CAD model to CAM program and from toolpath to actual machining and measurement.

This makes it easier to connect theory with physical production in engineering, mechatronics, machine technology, industrial design and vocational training. Custom parts for competition teams, student projects, robotic systems and academic test rigs can also be made within the institution.

MATE 200

SPECIFICATIONS

SPEC	VALUE
Axis travel X / Y / Z	400 × 200 × 170 mm
Table size / max load	600 × 200 mm / 30 kg
Spindle nose to table	40–210 mm
Positioning	0.02 mm / 300 mm
Feed X / Y / Z	6 / 6 / 2 m/min
Spindle	40,000 rpm · 1.5 kW · 0.35 Nm
Holder / tool change	ER16 / manual
Max tool shank / length	10 mm / 75 mm
Axis motors	Servo
Supply voltage	230 V AC · 50 Hz
Control panel	Masso Touch · 15 in.
Typ. load* (spindle at 60%)	1.8 kW
Full load** (spindle at 100%)	2.5 kW
Body / weight	Cast aluminum / 120 kg
Chip tray	5 L
Size W / D / H	720 × 850 × 850 mm
Warranty	2 years

Accessories

 4th Axis Module

 Vacuum Table

 3D Probe

 Precision Vise

MATE SERIES

REVO MATE⁴⁰⁰

Big working area, small footprint



500 × 400 × 170 mm
axis travel

40,000 rpm / 50,000 rpm
spindle speed options

1.5 kW / 2.2 kW
spindle power options

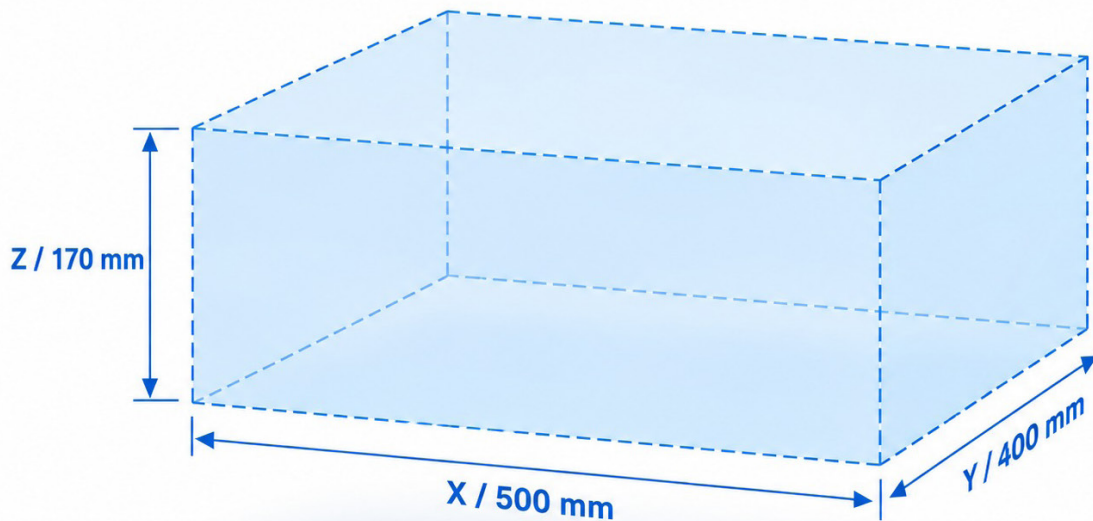
230 V
single-phase

Why MATE 400?

With a cast body and spindle options of 1.5 kW / 40,000 rpm and 2.2 kW / 50,000 rpm, it is built for work ranging from precision prototyping to low- to mid-volume production. Its T-slot table with Helicoil thread inserts lets you clamp workpieces quickly and easily.

The MATE 400 was developed for production that calls for larger parts and varied workholding setups. Its 500 × 400 mm working area leaves room for a range of part geometries, whether you are machining a single part or running fixtured production.

The standard 40,000 rpm / 1.5 kW spindle is well suited to small- and medium-diameter tools, particularly in aluminum, brass, copper and engineering plastics. If needed, the MATE 400 can be fitted with a 2.2 kW / 50,000 rpm ER16 spindle.



Large working area, flexible setup

The 500 × 400 mm table has room for combinations of a vise, custom fixture, vacuum table and 4th axis module. Thin, wide plates can be held on the vacuum table, prismatic parts in a vise or fixture, and cylindrical parts machined with the 4th axis. As a result, many kinds of parts, from electronics enclosures and mounting plates to copper components, test fixtures and mechanical housings, can be made on the same machine.



Compact footprint

At 795 × 960 × 880 mm overall and running on 230 V single-phase, the MATE 400 brings a large working area to the shop floor without the need for major facility upgrades.

Positioning and repeatability

A positioning accuracy of 0.02 mm / 300 mm and a repeatability of 0.002 mm mean that holes, pockets, contours and datum surfaces can be machined in a controlled way.

In repeat production, the same program can be run again and again with consistent positioning, which is a major advantage for process stability.

MATE 400

SPECIFICATIONS

SPEC	VALUE
Axis travel X / Y / Z	500 × 400 × 170 mm
Table size / max load	500 × 400 mm / 25 kg
Spindle nose to table	40–210 mm
Positioning	0.02 mm / 300 mm
Feed X / Y / Z	6 / 6 / 2 m/min
Spindle	40,000 rpm · 1.5 kW · 0.35 Nm
Holder / tool change	ER16 / manual
Max tool shank / length	10 mm / 75 mm
Axis motors	Servo
Supply voltage	230 V AC · 50 Hz
Control panel	Masso Touch · 15 in.
Typ. load* (spindle at 60%)	1.8 kW
Full load** (spindle at 100%)	2.5 kW
Body / weight	Cast aluminum / 160 kg
Chip tray	8 L
Size W / D / H	795 × 960 × 880 mm
Warranty	2 years

Accessories

4th Axis Module

Vacuum Table

3D Probe

Precision Vise

2.2 kW / 50,000 rpm ER16 spindle option

Typ. load* (spindle at 40%) 1.9 kW

Full load** (spindle at 100%) 3.3 kW

REVO^{MATE} 400+

Power, speed and efficiency in one



10 / 16 TOOLS · ATC

50,000 / 60,000 rpm
spindle options

500 × 400 × 170 mm
axis travel

230 V
single-phase

Why MATE 400 Plus?

With an automatic tool changer, spindle options for different processes and a 500 × 400 mm working area, the MATE 400 Plus is a compact CNC mill built for multi-operation parts.

When a part needs several tools, tool changes make up a significant share of the workflow.

The MATE 400 Plus's automatic tool changer lets different operations run one after another within a single program.

On a part that needs pocketing, drilling, finishing, chamfering or tools of several diameters, the program takes care of the tool changes. The operator no longer has to step in between operations, and multi-tool processes run more smoothly.

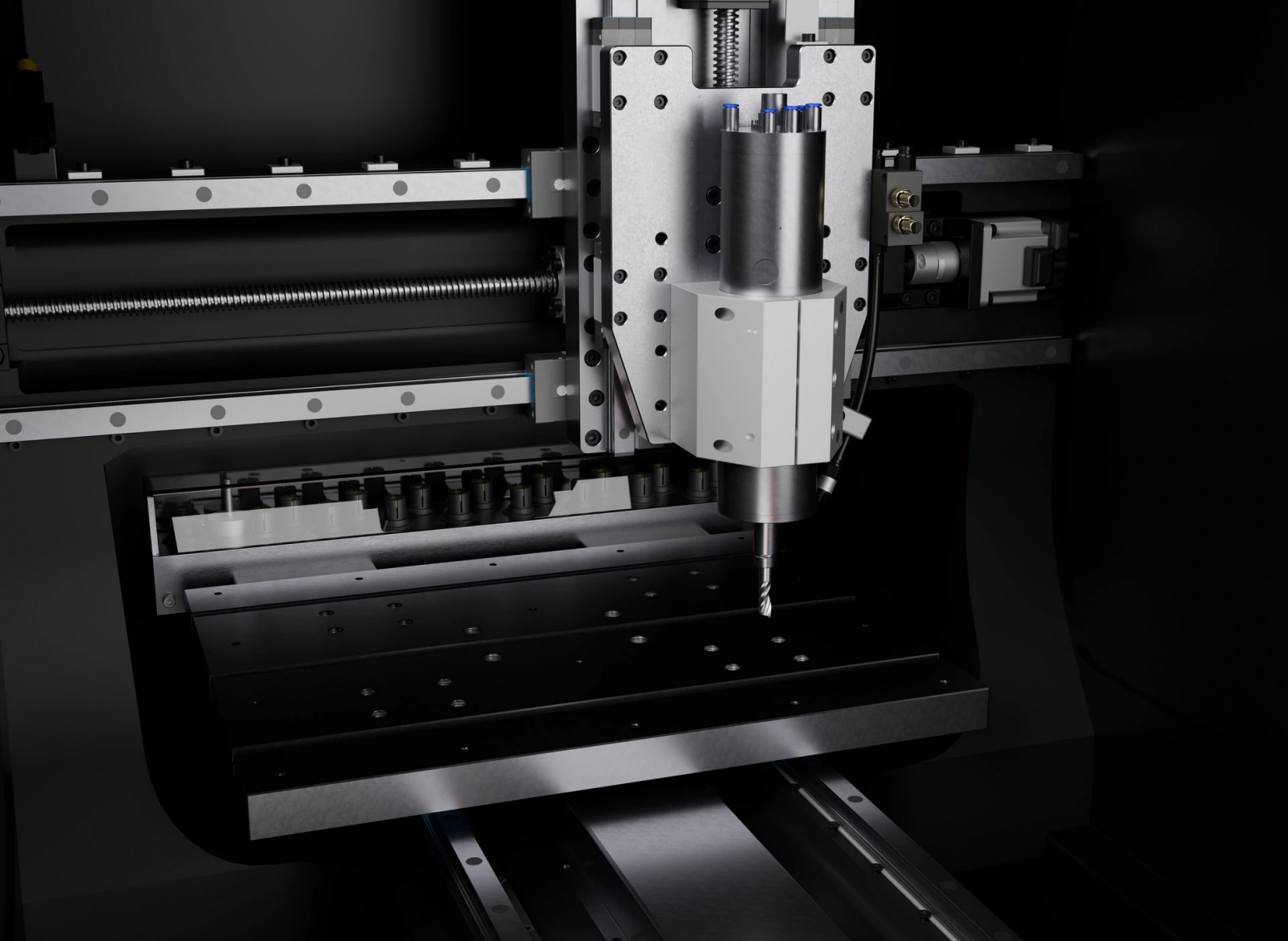
Tools are loaded into the magazine before production starts. The program calls up each tool in the order of operations, and the change is automatic. This helps keep production flowing, especially with parts whose operations are all done in one cycle, in repeat production and on long cycles.

With spindle options of 2.4 kW / 60,000 rpm and 3 kW / 50,000 rpm, the MATE 400 Plus delivers superior performance in high-volume production of finely detailed, multi-operation parts, and its material removal rate per unit of power¹ raises your production efficiency.

Its 0.002 mm repeatability keeps dimensional accuracy stable and the production process reliable over long cycles and repeat jobs.

Like other MATE models, the MATE 400 Plus fits through a standard office doorway and brings professional manufacturing capability wherever you want it.

¹ Full-load performance; see p. 28.



Generous working area

The 500 × 400 mm table and 50 kg maximum table load accommodate the part together with a vise, fixtures and other workholding solutions.

Thanks to 500 × 400 × 170 mm of axis travel, a wide range of part geometries can be machined on the same machine.

Built for intensive production

A cast iron body, a 40-liter chip tray and an automatic tool changer make the MATE 400 Plus well suited to long machining cycles and repeat production. The machine runs on a 230 V AC single-phase supply.

MATE 400 Plus

SPECIFICATIONS

SPEC	HSK-E25	DTC
Axes X / Y / Z	500 × 400 × 170 mm	500 × 400 × 170 mm
Table / max load	500 × 400 mm / 50 kg	500 × 400 mm / 50 kg
Spindle rpm / power	50,000 rpm / 3 kW	60,000 rpm / 2.4 kW
Max torque	1.5 Nm	0.72 Nm
Tool holder	HSK-E25 ER16	Direct · 8 mm shank
Shank Ø / tool length	10 / 75 mm	8 / 60 mm
Feed X / Y / Z	12 / 12 / 4 m/min	6 / 6 / 2 m/min
Control panel	HSC · 15.6 in.	Masso Touch · 15 in.
Typ. load*	1.65 kW (spindle at 30%)	1.95 kW (spindle at 37%)
Full load** (spindle at 100%)	4.1 kW	3.9 kW
Tool change	ATC	ATC

Common features

0.02 mm / 300 mm positioning · 0.002 mm repeatability · 40–210 mm spindle nose to table · 200 W servos · 230 V AC, 50 Hz · cast iron body · 40 L chip tray · 795 × 1140 × 1720 mm · 700 kg · 2-year warranty.

Accessories

4th Axis Module

Vacuum Table

3D Probe

Precision Vise

E25 ER16 holders for the HSK package

MATE SERIES

TECHNICAL COMPARISON

SPEC	MATE 200	MATE 400	MATE 400 Plus
Axes X / Y / Z (mm)	400 × 200 × 170	500 × 400 × 170	500 × 400 × 170
Table (mm)	600 × 200	500 × 400	500 × 400
Max table load	30 kg	25 kg	50 kg
Body	Cast aluminum	Cast aluminum	Cast iron
Spindle	40,000 rpm / 1.5 kW	40,000 rpm / 1.5 kW 50,000 rpm / 2.2 kW	HSK: 50,000 rpm / 3 kW DTC: 60,000 rpm / 2.4 kW
Tool change	Manual / ER16	Manual / ER16	ATC / HSK-E25 or DTC
Feed (m/min)	6 / 6 / 2	6 / 6 / 2	HSK: 12 / 12 / 4 DTC: 6 / 6 / 2
Repeatability	0.002 mm	0.002 mm	0.002 mm
Positioning	0.02 mm / 300 mm	0.02 mm / 300 mm	0.02 mm / 300 mm
Typical* / full load**	1.8 kW / 2.5 kW	1.8 kW / 2.5 kW	HSK: 1.65 kW / 4.1 kW DTC: 1.95 kW / 3.9 kW
Size (mm)	720 × 850 × 850	795 × 960 × 880	795 × 1140 × 1720
Weight	120 kg	160 kg	700 kg
Chip tray	5 L	8 L	40 L

***Typical load:** The total power drawn from the mains by the whole system (spindle, servo motors, controller and other hardware) while the machine is actively cutting 7075 T6 aluminum at 30,000 rpm and a 4,000 mm/min feed rate. This cut removes 48 cm³ of material per minute (MRR = 48 cm³/min).

****Full load:** The condition in which all axis servo motors and the spindle run simultaneously at the limit of their capacity, at peak acceleration and maximum material removal rates. For example, the full-load material removal rate of a MATE 400 Plus with the 3 kW spindle is 225 cm³/min. Such conditions are not expected in normal use, but since they could occur, they are taken as the worst-case reference for a safe working environment.

Which MATE suits your work?

MATE 200

Professional CNC
in less space

The MATE 200 is designed for users who want to bring manufacturing capability into smaller workspaces.

Its 400 × 200 × 170 mm axis travel and 600 × 200 mm table offer a suitable working area for small and medium-sized parts, narrow-profile components and educational use.

Consider it if you:

- machine small and medium-sized parts
- machine profiles and similar parts longer than the working area
- plan to use CNC in R&D, lab or teaching settings
- make development parts, test jigs, fixtures or custom components
- find manual tool changes are enough for your workflow

Key approach:

Compact footprint, controlled machining, accessible production.

MATE 400

Larger table,
more flexibility

With 500 × 400 × 170 mm axis travel and a 500 × 400 mm table, the MATE 400 makes room for larger part geometries and a variety of setups.

It accepts various workholding and process options, such as a vise, custom fixtures, a vacuum table and a 4th axis, so it can handle a wide range of work, from electronics parts to mechanical housings and from test jigs to repeat production parts.

Consider it if you:

- need a larger machining area
- work with varied part geometries and setups
- plan to use a vise, fixtures, a vacuum table or a 4th axis at the same time
- handle jobs from one-offs to regular production
- find manual tool changes fit your schedule

Key approach:

Large working area and a flexible production setup for varied processes.

MATE 400 Plus

Automating
multi-operation work

The MATE 400 Plus combines a 500 × 400 mm working area with an automatic tool changer and a choice of two spindles.

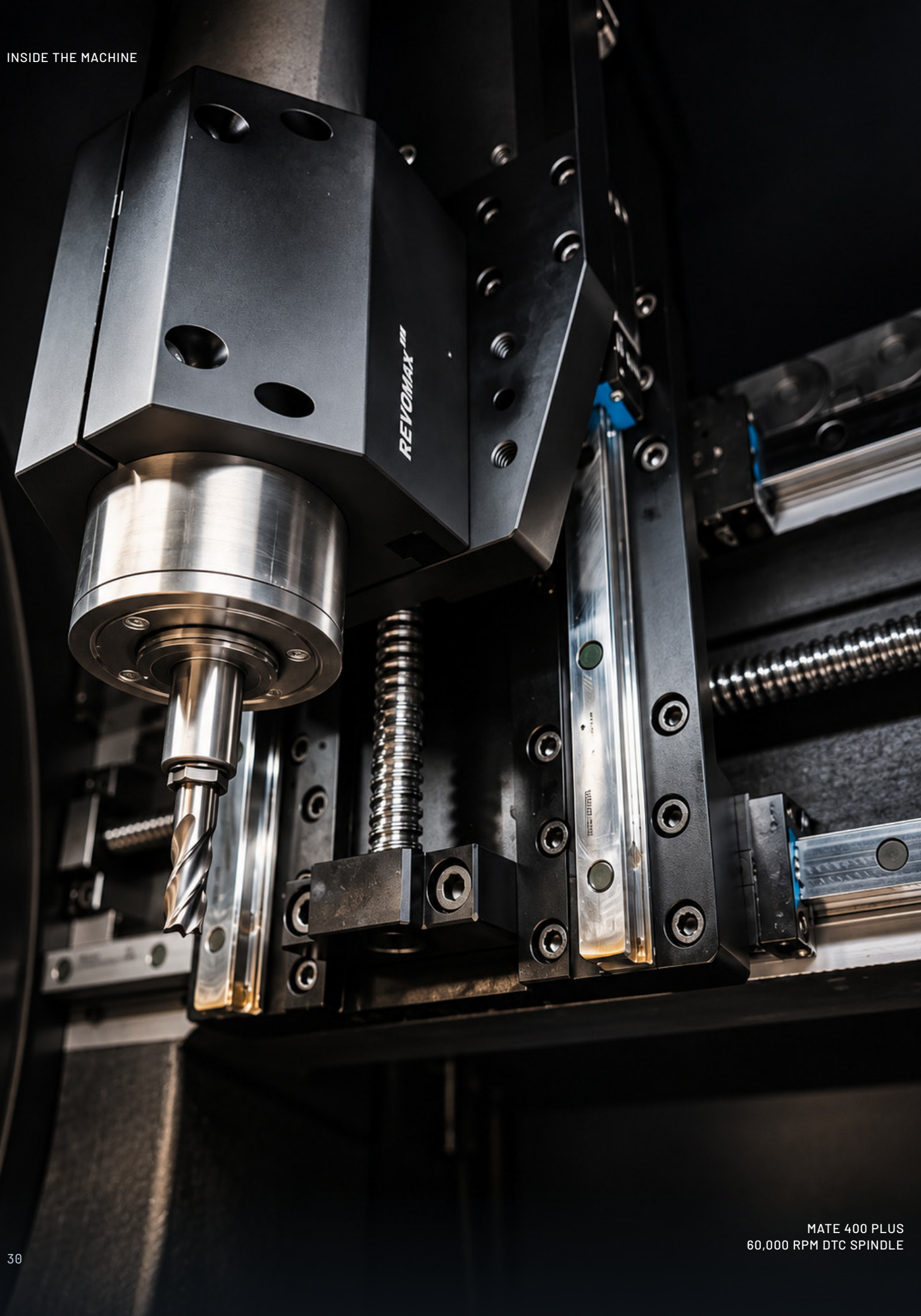
If a part needs more than one tool for operations such as pocketing, drilling, contouring, finishing and chamfering, the program changes the tools automatically. This reduces operator intervention, keeps multi-tool cycles running smoothly and is a significant advantage in repeat or long-running production.

Consider it if you:

- have parts that need more than one cutting tool
- need automatic tool changing
- produce multi-operation parts
- want less operator intervention
- run repeat or long-running production cycles
- need a high-torque or high-speed spindle, depending on the process

Key approach:

Multi-tool operations, automated workflow and a spindle matched to the process.



SPINDLE CHARACTER

The spindle carries the cutting tool and directly generates the cutting motion. Besides speed and torque, its runout, housing design, weight, running noise and tool clamping system also define its machining character. REVO selects its high-speed spindles with three things in mind: precise machining with small-diameter tools, long cycles and a compact machine design.

High speed

Spindle options in the 40,000–60,000 rpm range let small-diameter cutters, in particular, run at suitable cutting speeds.

The smaller the tool, the higher the spindle speed needed for the same cutting speed. That is why high speed matters for fine slots, small pockets, engraving, electrode geometries and detailed surface work.

Sub-micron runout

Spindle runout is the amount by which the cutting tool deviates from its theoretical axis of rotation. Sub-micron runout helps load the cutting edges more evenly and keep the tool running true, especially with small-diameter tools.

Low runout is an important factor for tool life, surface finish and the machining of small features.

Quiet running

High speed does not have to mean high noise. The spindle's balanced rotor, bearing arrangement and running characteristics help limit vibration and mechanical noise.

Quiet running also lets the machine work beyond the factory floor: in R&D departments, laboratories, classrooms and work areas near offices.

Stainless housing

The spindle's stainless steel housing provides high mechanical strength and good surface protection, helping it withstand coolant, chips and the varied conditions of the working environment.

Low mass

In compact CNC machines in particular, a low-mass spindle helps keep the load on the moving axis in check. Less moving mass benefits axis dynamics, acceleration and the overall mechanical design.

Speed and torque go hand in hand

High speed alone is not a measure of performance. Small tools depend on speed, but as tool diameter and chip cross-section grow, so does the need for torque.

When choosing a spindle, weigh speed, torque, tool diameter, holder system and workpiece material together.

What turns the tool?

ER16



HSK-E25



DTC



SPEC	ER16	HSK-E25	DTC
Tool change	Manual	Automatic	Automatic
Max speed	40,000 rpm	50,000 rpm	60,000 rpm
Power	1.5 kW	3 kW	2.4 kW
Torque	0.35 Nm	1.5 Nm	0.72 Nm
Holder	ER16	HSK-E25 ER16	Direct shank
Shank / length	10 / 75 mm	10 / 75 mm	8 / 60 mm
Models	MATE 200 / 400	MATE 400 Plus	MATE 400 Plus

The MATE 400's optional ER16 spindle: 2.2 kW / 50,000 rpm. The ER16 column shows the standard 1.5 kW package.

Which spindle?

Choosing a spindle starts with the part and the process, not the machine. Tool diameter, number of operations, material removal needs, level of detail and how often tools change determine the right system.

In CNC milling, completing a part often takes several cutting tools used one after another. Operations such as roughing, pocketing, drilling, finishing and chamfering may each need a different tool.

Tools can be changed manually by the operator, or automatically within the program by an ATC (automatic tool changer).

Manual or automatic?

MANUAL

Where only a few tools are needed and operator intervention does not disrupt the workflow, manual tool changes may be enough. Examples include prototypes, test parts, fixtures, R&D work and shops that run several different jobs in a day.

ATC

The more operations and tools a part needs, the more automatic tool changing pays off. The ATC calls up the tools defined in the program in sequence, reducing operator intervention and letting multi-operation parts be machined with fewer interruptions.

Choose your spindle by process

MANUAL · ER16



1.5 kW / 40,000 rpm

MATE 200 / 400 · STANDARD

A good fit for work where the operator can change tools, jobs vary during the day and the process does not require automatic tool changing.

Typical uses:

Prototype parts · custom components · test jigs · fixtures · educational projects · small and medium mechanical parts. For general pocketing, slotting, contouring, drilling, facing and similar work in aluminum, brass, copper and engineering plastics.

Choose it if:

You rarely change tools and manual tool changes suit your workflow.

MANUAL · ER16



2.2 kW / 50,000 rpm

MATE 400 · OPTION

Its higher power and rpm make higher cutting speeds possible, especially with small-diameter tools. With the right tools and cutting parameters, it allows shorter cycle times and faster machining.

Typical uses:

Rapid prototyping · finely detailed parts · machining with small-diameter tools · high-speed contouring and pocketing · parts needing short cycle times.

Choose it if:

You want faster machining, shorter cycle times and more performance from small-diameter tools in particular.

DTC · ATC



2.4 kW / 60,000 rpm

High speed, small-diameter tools

The DTC spindle is intended for processes that use small-diameter tools, where fine detail and high speed come first.

The tool mounts directly in the spindle by its 8 mm shank, without a separate holder. Maximum tool length is 60 mm, and the spindle works with the automatic tool changer for multi-tool operations.

Typical uses:

Micro details · engraving · fine slots · small pockets · precise contours · parts that need small-diameter tools.

Choose it if:

You run small-diameter tools at high speed and need automatic tool changing.

HSK-E25 · ATC



3 kW / 50,000 rpm

High torque, multi-tool operations

With its 3 kW of power and 1.5 Nm of torque, the HSK-E25 suits work that calls for higher cutting loads and a wider range of tools. It takes shanks up to Ø10 mm and tools up to 75 mm long. Tools are changed automatically from a 10-tool magazine.

Typical uses:

Fixture parts · mounting plates · deeper pockets · aluminum housings · multi-operation mechanical parts · parts needing tools of several diameters.

Choose it if:

You need more torque, a wider choice of tools and automatic tool changing.



Why cool the spindle?

A spindle turning at tens of thousands of rpm generates heat as well as motion. Bearing friction, motor losses and running time are the main factors behind this thermal load. The higher the speed and the longer the cycle, the more temperature change matters.

Why do a few degrees matter?

Because temperature changes the dimensions of the mechanical structure. As the spindle and the parts around it warm up, they expand.

The ceramic bearings in the spindles of our MATE series CNC mills largely eliminate problems caused by bearing expansion. The spindle shaft, however, is made of precision-machined steel, and it grows longer as its temperature rises.

Likewise, a spindle shaft cooled below its normal operating temperature contracts and shortens.

This is also the main reason why the spindle is run unloaded for a while at start-up: to avoid machining with a cold spindle.

This lengthening and shortening of the shaft shifts the position of the tool tip relative to the table and the part datum. A thermal change that stays small in a short operation can become more pronounced over long machining cycles.

The aim of cooling is not to make the spindle as cold as possible, but to keep changes in its operating temperature under control and so prevent accuracy loss from thermal expansion.

Liquid cooling in the MATE series

A stable thermal environment helps to reduce the temperature-related shifts between tool and part, keep the bearings within their intended operating conditions and make long machining cycles easier to control.

Every MATE series machine features a closed-loop liquid cooling system of our own design to manage spindle temperature.

The system combines high-efficiency, low-noise fans, copper radiators, a powerful water pump and a large reservoir. Together they hold the spindle temperature within a narrow range and provide stable operating conditions.

The Body Comes First

The body is often the least visible part of a machine. All those fancy, eye-catching parts are mounted on it, and it ends up so thoroughly covered that it disappears from view. On a CNC machine tool, you can hardly see the body at all.

Yet however hidden it may be from the outside, a good body is the precondition for a good machine.

The body stays stable under load, damps the vibrations generated during machining and gives every mechanical and moving component a secure base to work on. That makes it the most important element of a machine tool.

This is why, of all the work that goes into a CNC mill, the body gets the most attention and the most time.

At the heart of making a body is the choice of production method. Welded frames and bolted-plate construction are common, especially on small CNC mills and routers, because they are cheap and quick to produce. For vibration damping, dimensional stability and long service life, however, casting is the best way to make a machine body.

For these reasons, we at REVO Endüstri build our machines on cast bodies.

On the MATE 200 and MATE 400, our benchtop CNC mills, low weight matters, so we use cast aluminum bodies. The MATE 400 Plus, with its more powerful spindle and heavier workload, gets a cast iron body.

Design, analysis and casting-pattern making for our bodies all take place in our own facility. For casting, stress relieving and precision machining, we work with qualified suppliers. All of it happens in Türkiye.

One more thing: unlike most manufacturers, we don't cover up our machine bodies. Instead, we leave them on show, adorned with high-quality mechanical components.



MATE 400 CAST ALUMINUM BODY ON THE CMM

In the MATE series, stability starts with the cast body.



The Mechanics of Accuracy

On top of a still, stable, heavy body: a moving, dynamic, eye-catching team.

Linear rails mounted on both sides of the body, carriages riding on the rails, plates tying the carriages together, and the ball screws and nuts that drive those plates.

We call this team “motion components.”

Work on a CNC mill takes place along three basic linear axes. We call them X, Y and Z, and each can be thought of as a line or line segment: motion along it runs dead straight, without deviating in any direction. The axes are also perfectly perpendicular to one another, so the angle between any two of them is exactly 90 degrees.

Of course, such absolute accuracy is impossible to achieve in real life, in structures and in motion alike. So in building a CNC mill, as in all work that demands precision and accuracy, the goal is not perfect straightness and

squareness but a motion system that comes as close to that ideal as possible.

On a CNC mill, the body must of course be made accurately first. After that, the most important step toward accurate motion is to use motion components whose straightness and dimensional accuracy can be trusted. A good machine cannot do without three things: motion components that stay true along their travel, guide correct assembly, transmit motion faithfully and return to the same point every time; accurately machined parts that connect them; and careful assembly work.

On the MATE series, as on every machine we have built to date, we use reliable, high-accuracy, preloaded linear guides and ball screws. We fit these components to the body with carefully machined plates, and we do this assembly work in a climate-controlled room.

All these choices and all this careful work add up to machines that are free of mechanical trouble, hold their accuracy through vibration and over time, and keep running for years.



795_{mm}

795 × 960 × 880 mm

Designed to the Millimeter

Enclosure

After the body, this may be the part of our machines we think about most. The enclosure must be big enough to protect the working area without wasting a single millimeter, yet compact enough to fit through a standard office doorway. It must keep noise, dust and chips inside, making the machine both quiet and safe. And while doing all that, it must look good.

We take as much care over the exterior and ergonomics of our machines as over what is inside. Working with that care, we create machines whose designs are worthy of the best spot in your factory or office, machines that are easy to install and use and safe to work with. We do this because we believe manufacturing is not mere toil but a culture in its own right, and that a culture with no sense of aesthetics, one that gives nothing to its surroundings, cannot exist.

795 mm maximum width

Compact overall dimensions let the machine pass through a standard office doorway and make it easier to place in different work environments. Every millimeter of space is used without giving up working volume.

Safe operation

The fully enclosed design separates the operator from chips, particles and the cutting zone, creating a controlled working area.

Small footprint

The machine's footprint is kept to a minimum, while its usable working volume is made as large as possible. That makes better use of the production floor.

Controlled noise level

The full enclosure helps limit how much machining noise reaches the surroundings, which is important in laboratories, R&D departments and other workspaces.

Aesthetics

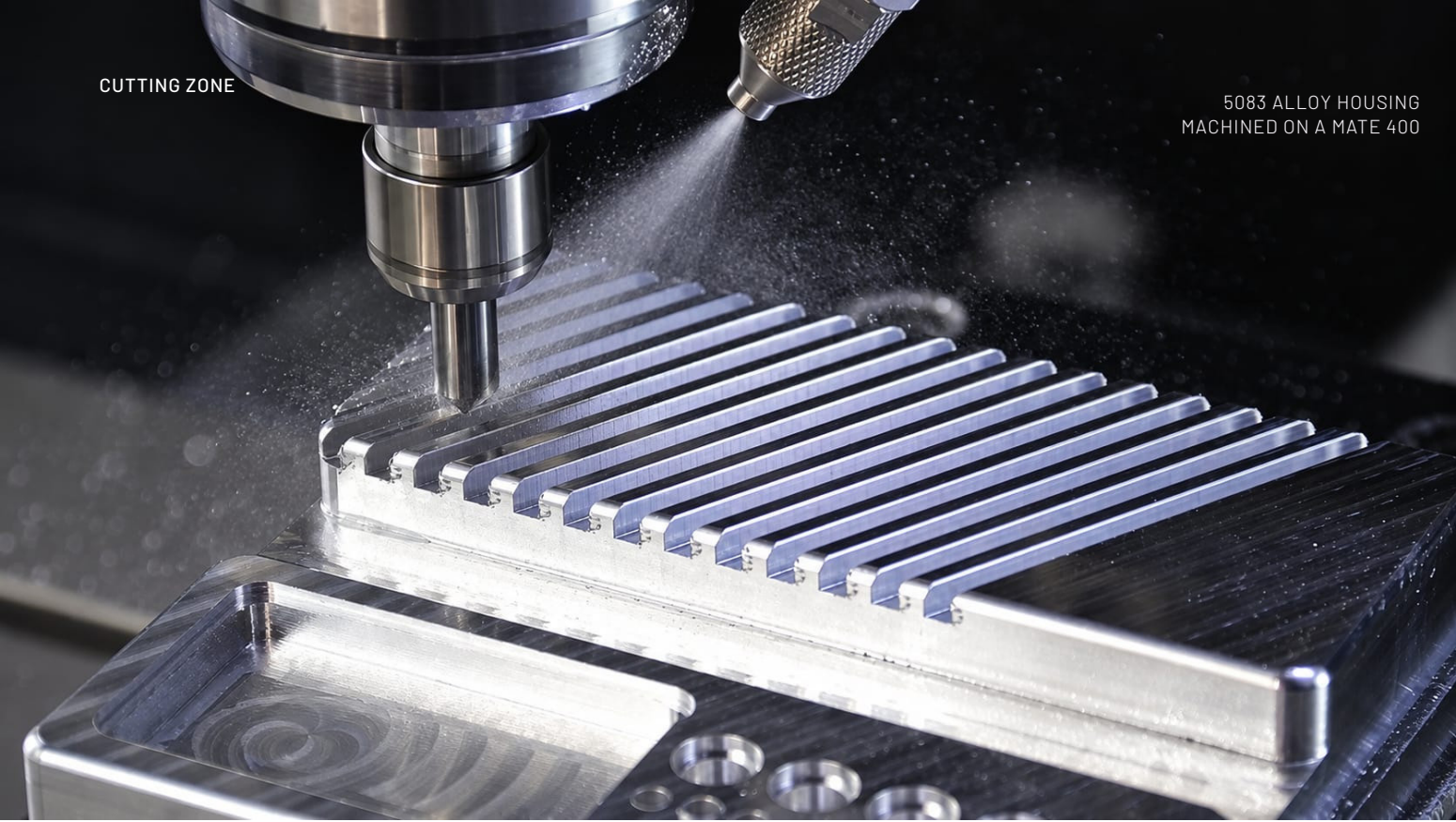
A machine is part of its setting. The enclosure's form, surfaces, colors and details are designed alongside its technical function.

Large working area

Despite the compact exterior, there is still usable room for the part, the workholding and tool movement. The aim is a machine that is compact outside and roomy inside.

Easy installation and use

From placing the machine to using it every day, user experience is part of the design. An accessible working area and straightforward operation make it easier to install and run.



CLEAN, CONTROLLED COOLING

Parts ready to use straight off the machine.

The MATE series was developed with high-speed machining of aluminum alloys especially in mind. Managing the temperature in the cutting zone and evacuating chips efficiently are key parts of that process.

On machines with conventional cooling systems that use cutting oil or fluid, aluminum parts come off with water marks or oil residue. This not only robs the part's surface of its

shine but also means it has to be washed with special cleaning agents after machining.

MATE series machines use an alcohol-based mist cooling system instead. In standard use, it mixes a small amount of alcohol, around 50 ml/h, with compressed air at 6 bar and directs it at the cutting zone, where the cutting tool meets the workpiece.

RESOURCE EFFICIENCY

Efficient production takes more than making the part right: energy, process fluids, floor space and supporting resources must be managed well too.

Carries heat away from the cut

Sprayed onto the tool and the workpiece surface, the alcohol evaporates quickly. Evaporation draws heat away from the cutting zone, while the compressed air helps evacuate chips.

Part and work area stay clean

Especially when machining aluminum, this approach helps keep the tool's cutting conditions under control and produce a clean, bright surface. Because no oil or fluid residue is left on the workpiece, the finished part comes off the machine ready to use, and the chips can be collected dry and clean.

No recirculation

With no sump and no continuous fluid recirculation, the conditions that let bacteria and odors build up in conventional coolant tanks are reduced. There is no tank fluid to maintain or replace; the mist and air system is serviced on its own maintenance schedule.

Simpler utilities

A 230 V single-phase supply, a compact footprint and fewer auxiliary systems make the MATE series easier to fit into different production environments.

Energy use matched to need

Thanks to its compact build, the MATE series keeps energy demand in line with the scale of production. For the typical cutting condition in the comparison table, total power demand is 1.65–1.95 kW, depending on model and spindle. At full load, it is 2.5–4.1 kW. These figures cover the whole machine system.

Power demand changes with the material, the tool-path and the load on the machine. Read the per-model values together with the measurement conditions in the technical comparison table. The aim is not just to use less energy but to match the energy used to the work being done.

Less coolant

The alcohol-based mist system uses compressed air to deliver about 50 ml/h of fluid directly to the cutting zone. This removes the need for large coolant tanks and continuous fluid recirculation. Because the fluid is applied only where it is needed, in controlled amounts, coolant use can also be managed to suit production.

Cleaner chips

Chips can be collected in a cleaner state, free of heavy cutting oil or coolant residue. This not only keeps the machine's working area tidier; it also makes the chips easier to sort and prepare for recycling.



WHERE CONTROL BEGINS

Our first step toward taking production into different work environments was to build compact, ergonomic machines that run on 230 V single-phase power.

The second step was to make the interaction between machine and user as clear as possible. The controller is where the user comes into direct contact with the production process. Machine movements, running the program and the controls needed during production are all handled through this interface. That is why the control system's accessibility and ergonomics matter as much as its technical capability.

The touchscreen control panels on the MATE series are laid out to give quick access to the information and functions needed during production. Grouping functions on screen helps users focus on the operation at hand instead of getting lost in complex menus.

The large touchscreen, the adjustable control arm and the handwheel for precise manual moves are all part of the everyday experience at the machine.

Adjustable control arm

The control panel can be adjusted to the operator's working position, giving comfortable access to both machine and screen. This creates an ergonomic workspace, especially during clamping, zeroing and manual control.

Touchscreen display

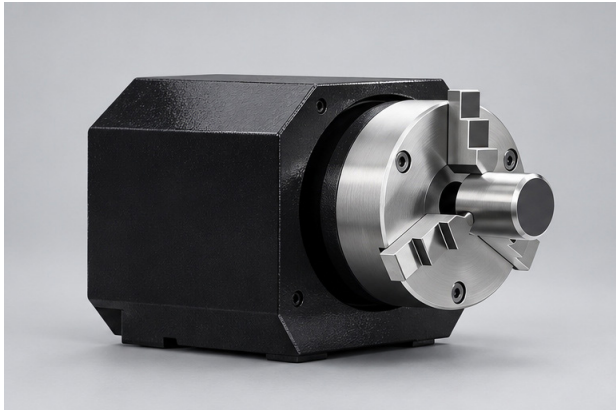
The large touchscreen puts machine data and control functions on a single, easy-to-follow interface. The menu structure helps you reach the function you need quickly.

Handwheel for manual control

Allows controlled, precise manual movement of the axes. When approaching the part, zeroing or making adjustments, the operator has direct, hands-on control of the motion.

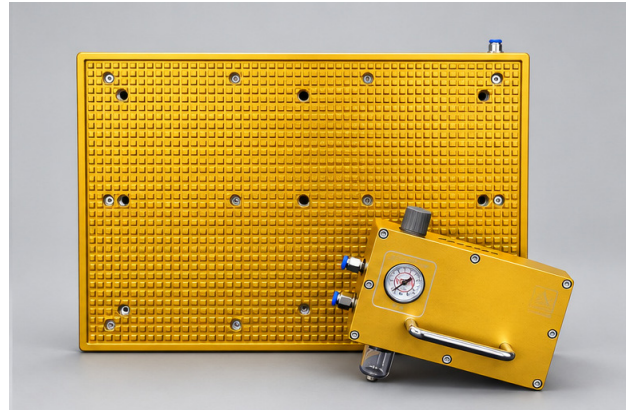
TAILOR THE MACHINE TO YOUR WORK

Not every part has the same workholding, measurement or process needs. The MATE series can be configured with a range of accessories to suit different production scenarios.



4th Axis Module

Gives the workpiece a new axis of motion for cylindrical parts, features around the circumference and multi-angle machining.



Vacuum Table

Holds thin or wide parts, or parts hard to grip in a standard vise, by their underside.



3D Probe

Helps determine part position, datum surfaces and work zero quickly and in a controlled way.



Vises and Fixtures

Clamps prismatic parts rigidly and repeatably.

IF YOU CAN DRAW IT, CAN YOU MAKE IT?

Not every geometry that looks flawless on screen is as easy to make as it is to draw. A part's manufacturability depends not only on its shape but also on its material, tolerances, tool access, internal radii, workholding method and operation sequence. The CAD model tells us what the part should look like. Manufacturing asks other questions: Can the tool reach that area? Where will the part be held? What tool diameter do the inside corners allow? Which surface will be the datum? How many setups will it take? **Good design starts answering these questions at the drawing stage.**

Good design considers machining

In CNC milling, the tool rotates and has a set diameter. This simple fact puts a direct limit on design. A rotating cutter cannot, for example, cut an inside corner with a radius smaller than its own. The smaller the internal radius, the smaller the tool that fits; and a smaller tool means rethinking access, rigidity and machining parameters.

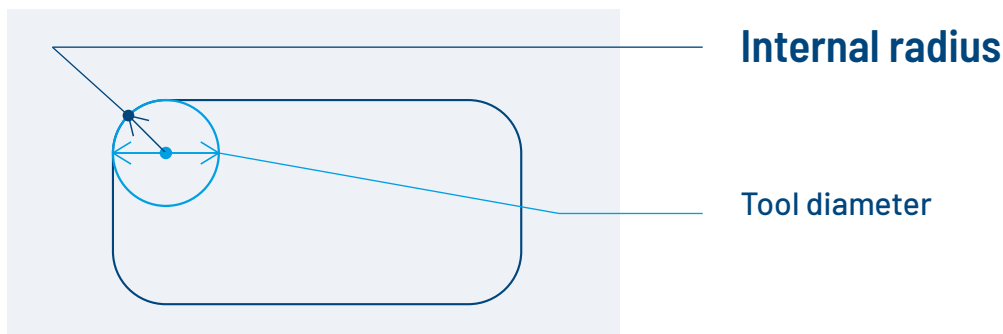
Likewise, a very deep pocket, a thin wall or a surface on the back of the part is easy to model in CAD. On the machine, however, tool length, workholding and access come into play.

Manufacturable design also takes into account how the geometry will be machined.

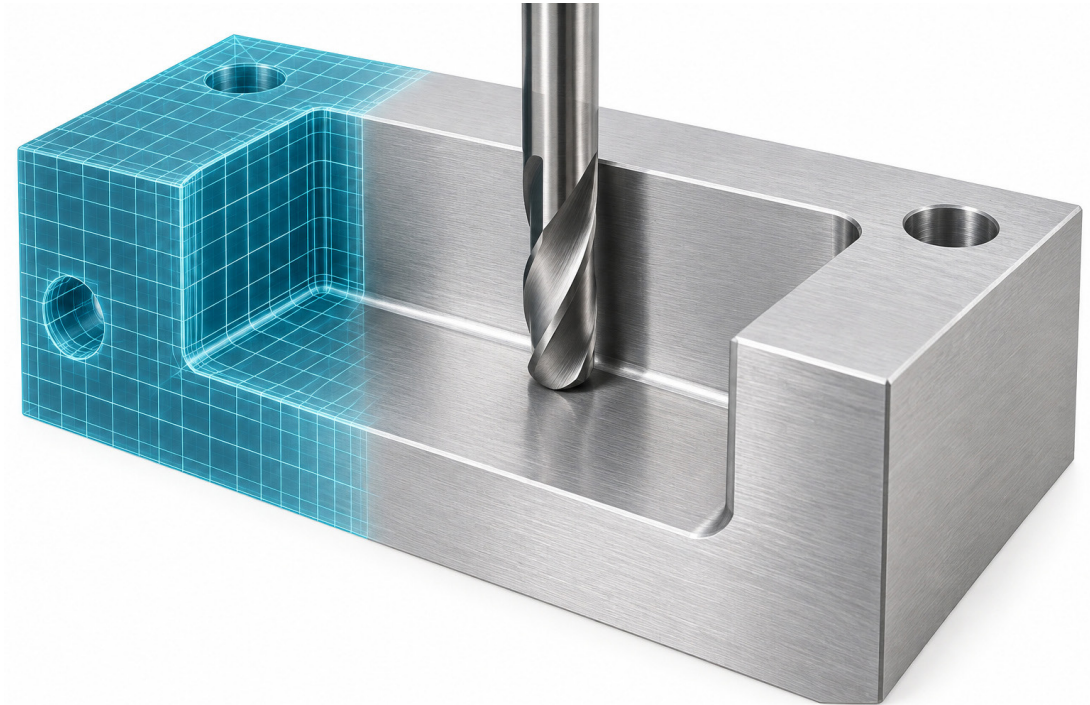
Easy in CAD, hard to cut

Moving a hole in CAD takes a few seconds. In real production, though, that change can call for a new toolpath, a different setup or a revised operation sequence.

So a design's complexity is not always obvious from how it looks. A part that looks simple may need several setups, while a more complex-looking geometry can sometimes be finished in a single setup.



Design meets production



Ready for production?

The basic production data must be settled before a part goes to the machine. The engineering drawing should show material and alloy, stock size, critical features, tolerances and tool access. Workholding, tool diameter, operation sequence, surface finish and quantity then go into the process plan.

Taken together, this turns the CAD model from mere geometry into an input for the production plan.

Design changes are part of the process

A first design cannot always be expected to become the final part unchanged. Making the physical part can reveal new information about assembly, access, tolerances, material or geometry.

Drawing a part is a matter of geometry. Making it manufacturable is the sum of many engineering decisions.

Geometry to machining plan

From CAD to toolpath

Deciding that a part is manufacturable does not end the process. Now the geometry has to become a real machining plan.

Along the way, a mounting hole may be moved, a wall thickened, an unnecessarily tight tolerance relaxed, or a feature reshaped to give the tool easier access. These changes don't mean the design has failed; they are new information from product development flowing back into the design.

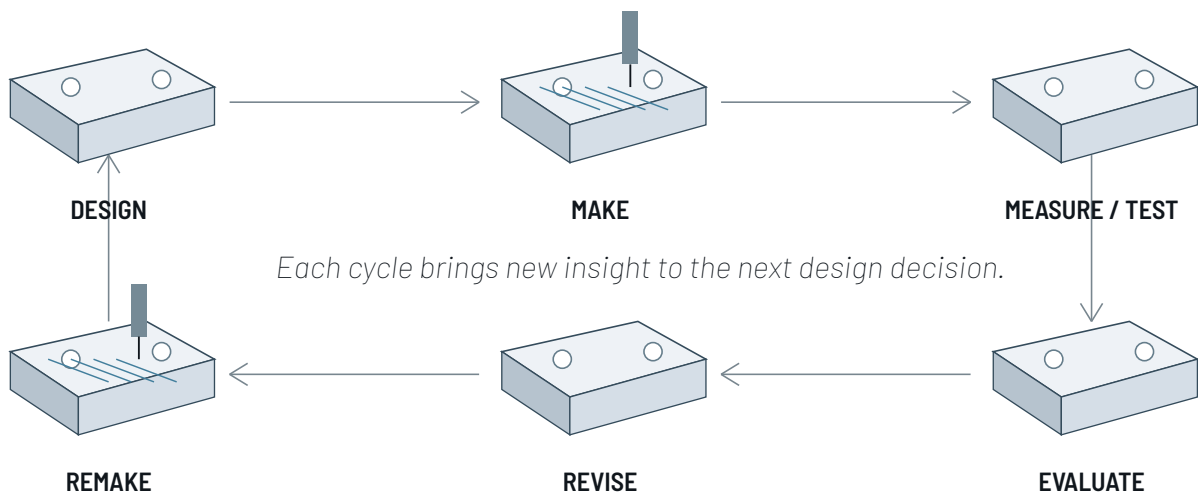
So product development often runs in this cycle:

The CAM side

The CAD model defines what will be made. In CAM, you plan how the part will be machined.

This is where you decide which tools to use, in what order to run the operations, where to clamp the part and how to split roughing and finishing. Decisions made on the drawing and in the manufacturability review feed into CAM preparation, shaping the tool list, the setup plan and the operation sequence.

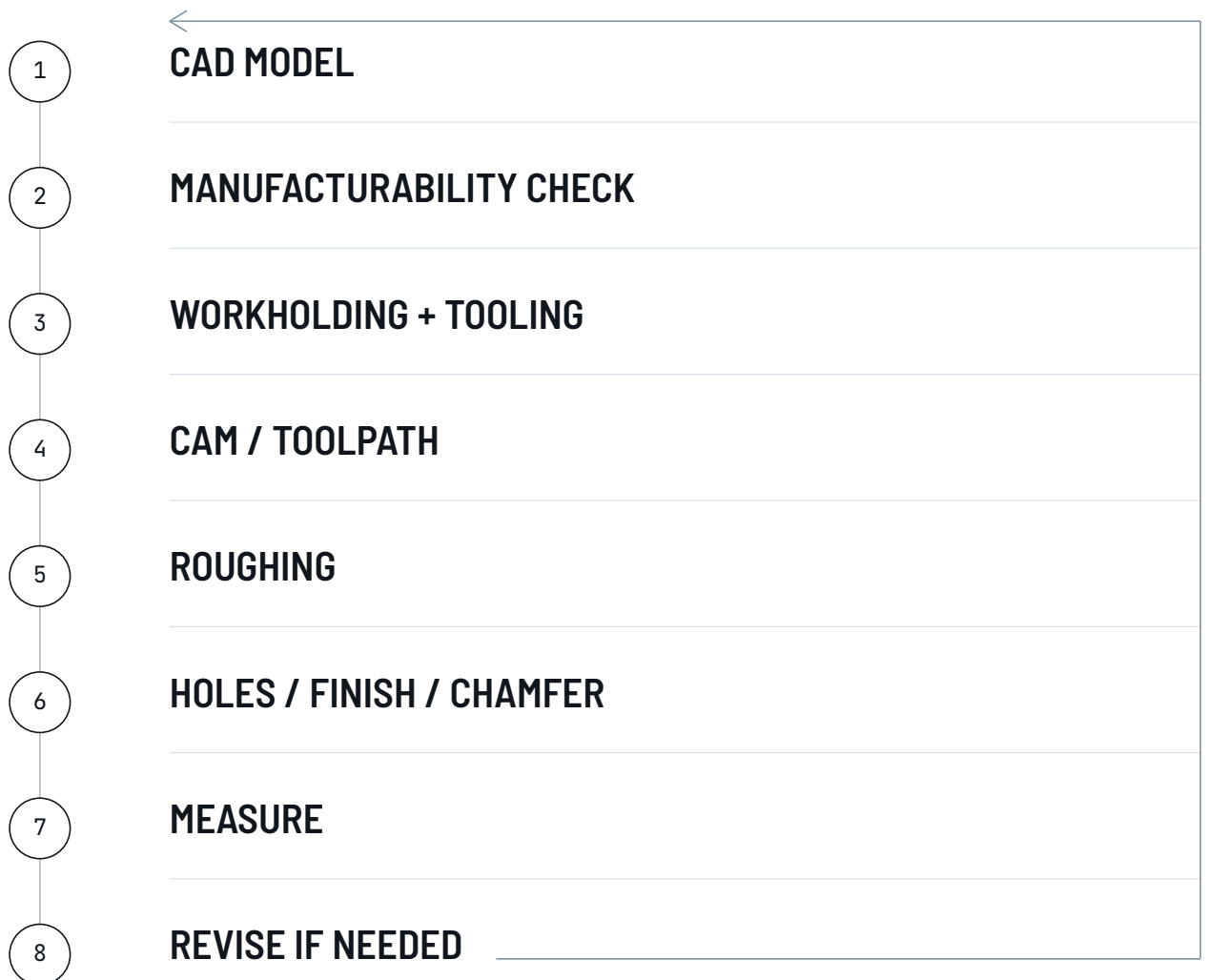
Machining a part is rarely a single step. Roughing removes the excess material, finishing sets the final size and surface, holes are drilled, edges are chamfered and the result is verified by measurement. The order of operations matters especially for workholding and for preserving the datums.



From the shop back to design

Production informs design

A real part reveals details the screen can't show. Assembly fit, tool access, ease of clamping and what the tolerances mean in practice all become clearer once the part is physically made. That is why every part you make feeds data into the next design decision.



Tool size is a production decision made before CAM.



Choose tools by operation

Not every area of a part has to be machined with the same tool. Roughing, pocketing, finishing, 3D surfacing, hole making, chamfering and threading each make different demands on cutter geometry and cutting conditions.

Choosing the right tool starts with the part's geometry, then factors in material and operation. Tool diameter, number of flutes, length of cut, stick-out and cutter geometry are weighed together.

Roughing

The goal is to remove excess material in a controlled, efficient way. Choose a tool whose diameter and reach leave the least stock for the next operation.

Pockets & slots

Tool diameter is chosen to suit the slot width and the inside corner radius. For slots, the usual approach is to use a tool slightly narrower than the slot and cut each side in a separate pass, leaving clean walls.

Finishing

A separate finishing operation with a lighter chip load can be used to reach the final size and surface. On flat faces and edges, the roughing tool can go straight on to the finishing pass, as long as its cutting edges have not started to dull. On curved and organic surfaces, a ball-nose or corner-radius end mill is preferred.

Holes

Depending on the hole's geometry and tolerance, you can use a drill, an end mill or, as a final step, a reamer. For larger holes especially, if the tool is long enough, milling the hole with an end mill by helical interpolation gives better diameter accuracy and a cleaner hole edge than drilling.

Chamfers

A chamfer mill is used for deburring, preparing edges for assembly and cutting chamfers at a set angle. Before threading, chamfering the hole edge to a suitable width is all but essential: it stops burrs forming at the edge during threading and helps the threading tool start on center.

Threads

Machine taps and thread mills, run on CNC-controlled toolpaths, make it possible to cut threads of various diameters and sizes. Tapping with a machine tap, just like tapping by hand, needs the tool to advance one pitch per revolution and demands high spindle torque at low speed. In deep or small-diameter holes, the tap can break.

Unlike a tap, a thread mill works by helical interpolation. With each orbit, the tool advances axially by one pitch, forming the thread profile. Spindle speed is set by the cutting speed; feed is calculated from the tool's cutting conditions and its helical path. So the pitch is not tied directly to each spindle revolution, as it is with a tap. With the right tool and process, this gives close control, especially on large-diameter or precision threads.

What happens as the diameter shrinks?

A smaller tool changes more than the geometry it can reach. It bends more easily, and the risk of breakage becomes more critical. The spindle speed needed to hold the same cutting speed also rises.

So in production, a small inside corner radius in CAD can sometimes mean: smaller tool → higher rpm → smaller stepdowns → longer cycle time.

CAM parameters

You've chosen the tool. Now how do you run it?

The right tool with the wrong CAM parameters won't add up to a good process.

The values you enter in the CAM software set how fast, how deep and how wide the tool engages the material. Spindle speed, feed, depth of cut and toolpath are not independent settings; they are parts of one and the same cutting condition.

Spindle speed (n)

$$n = (V_c \times 1000) / (\pi \times D)$$

V_c : Cutting speed, m/min

D : Tool diameter, mm

n : Spindle speed, rpm

Spindle speed (n) is revolutions per minute. The required rpm depends on the tool diameter and the target cutting speed.

In the same material, a smaller tool must turn faster to keep the same cutting speed. That is why small cutters benefit more from high-speed spindles.

Feed rate (F)

$$F = f_z \times z \times n$$

f_z : Feed per tooth, mm/tooth

z : Number of flutes

n : Spindle speed, rpm · F : Feed rate, mm/min

Feed rate (F) is how fast the tool travels across the part. But the feed rate alone doesn't tell you enough: feed per tooth, spindle speed and number of flutes have to be read together.

So a 3,000 mm/min feed gives a different cutting condition at 10,000 rpm than at 40,000 rpm.

Axial depth (ap)

How far the tool cuts into the material along its axis.

As depth of cut increases, more of the cutting edge engages and the load changes. Choose the depth with tool diameter, stick-out, material and workholding rigidity in mind.

Radial width (ae)

How much of the tool diameter engages the material sideways. The same tool runs under completely different loads in a full slot and in a light-stepover finishing pass.

So "same rpm + same feed" does not mean the same cut on every toolpath.

Tool stick-out

It may not appear as a cutting parameter on the CAM screen, but it has a major effect on the result. The farther the tool sticks out of the collet, the less rigid it is. So the general rule is:

Keep the tool as short as possible: only as long as the operation requires.

In CAM, the right parameter isn't a high or a low value. It's the value at which tool, material and operation work together.

Every material has character

In manufacturing, the choice of material affects everything from design and cutting tool cost to production time and the coating method. For machining time and cost in particular, material is the most important parameter: every material has its own physical properties, and different properties call for different cutting tools and cutting parameters.

So the moment a material is chosen, much of the production plan starts to take shape: tool geometry, number of flutes, speed, feed, cooling, chip evacuation and even the workholding method are reconsidered for that material.

Chips tell you about the material

Chip shape shows what is happening in the cutting zone. Brass forms short, brittle chips that are easy to evacuate during machining. Some plastics, such as POM, can form long, continuous chips, which makes clearing them from the cutting zone more important.

In other words, the chips inside the machine are a process indicator.

Where does heat go?

The energy used in cutting turns into heat, which is shared among the tool, the part and the chips.

Ideally, a large share of the heat leaves the cutting zone with the chips.

Heat that builds up in the part can cause dimensional change; heat concentrated in the tool can accelerate tool wear.

So cooling and chip evacuation are planned around the material's behavior.

Soft doesn't mean easy

One of the most common assumptions in machining is that hardness directly determines machinability.

Copper is a good example. It is soft, but because it is ductile and gummy, it can smear onto the cutting edge and form a built-up edge. Brass, with its short, brittle chips, cuts in a very different way.



**Hardness doesn't tell the whole story.
How a material behaves in the cut tells far more.**

One cutter, many materials

Material	How it cuts	Process notes	Typical uses
Aluminum	Easy to machine; with some alloys, chips can stick to the edge	Needs a sharp tool, uncoated or suitably coated, and good chip evacuation	Electronics housings, mounting plates, fixtures, machine parts
Brass	Short, brittle chips; high machinability	Sharp tool and burr control	Nozzles, small housings, fittings, engraving (printing plates, stamps)
Copper	Soft but gummy	Risk of built-up edge; needs good chip evacuation	EDM electrodes, circuit components, bearing seats, cooling blocks
POM	Machines cleanly; watch its dimensional response to heat	A sharp tool gives a good surface finish; avoid heat buildup	Bushings, gears, fixtures, sliding surfaces
PA (cast nylon)	Can form long, stringy chips	Chip evacuation matters; watch for moisture-related dimensional change	Rollers, slides, wear parts
Acrylic / PC	Heat-sensitive when cut	Needs a sharp tool; keep heat under control	Transparent covers, display parts
Composite	Fibrous and abrasive	Use wear-resistant tools such as PCD; watch for delamination and dust	Brackets, covers, carriers, housing parts

Workholding Strategy

How you hold the part changes the result

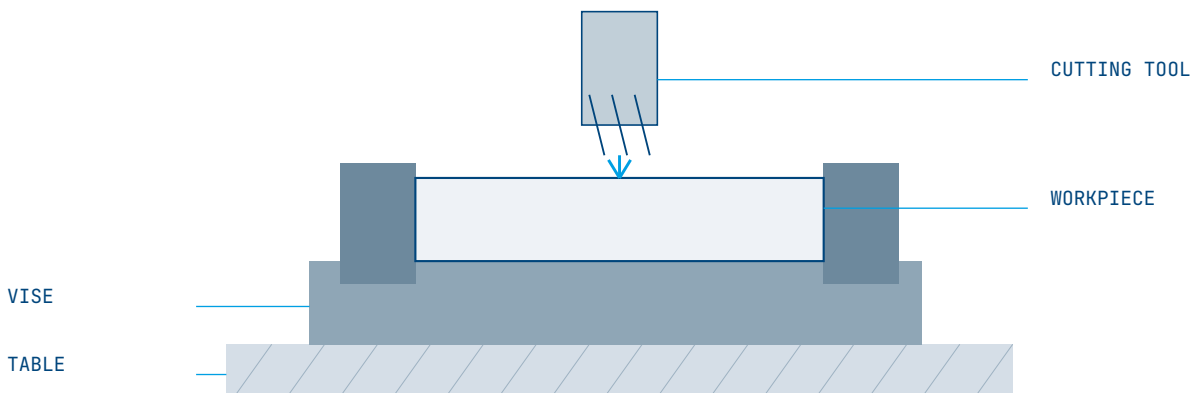
When the cutting tool meets the part, the force it generates doesn't stay in the tool. It passes from the tool through the workpiece and the workholding to the machine table. Any point in this chain that flexes or moves can affect dimensions, surface finish and process stability.

So workholding isn't just about keeping the part in place. A good workholding strategy answers three basic questions:

Where is the part's datum?

Which way will the cutting force act?

Can the tool reach the required surfaces?



Rigidity chain

MACHINE TABLE → FIXTURE / VISE → WORKPIECE → CUTTING TOOL

The most flexible link often decides the result.

Vise workholding

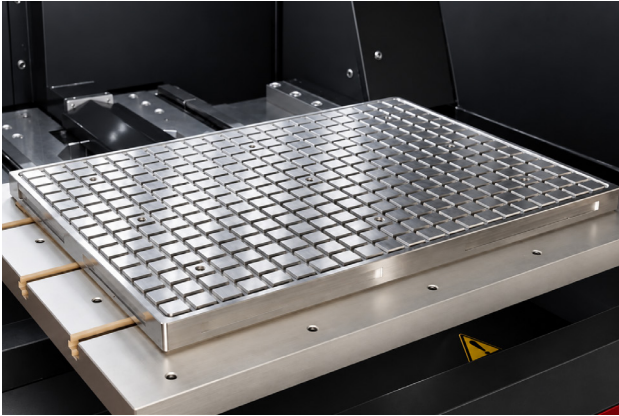
A vise is one of the most common solutions for prismatic parts with enough surface to grip. If the part stands too far above the jaws, the cutting force acts farther from the clamping point, and the part can flex and vibrate.

The basic approach here: enough grip depth + short overhang + rigid support

Fixture

In repeat production, dedicated fixtures can standardize the part's position and datums. A well-designed fixture can cut setup time and setup variation, especially when the same part is machined repeatedly.

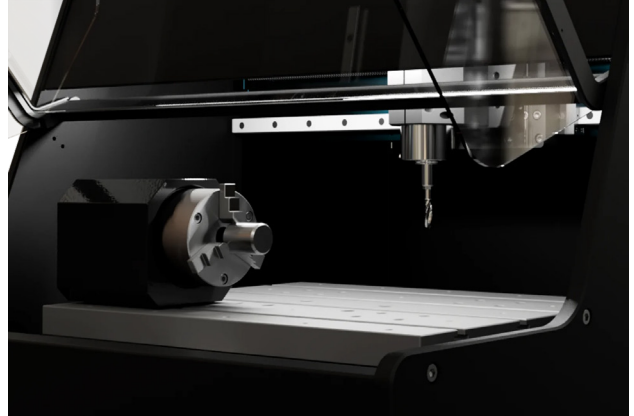
Vacuum table and 4th axis module



Vacuum table

Suits thin or wide parts, or anything hard to hold in a vise.

Vacuum spreads the holding force across the surface, so it suits sheet and plate parts especially well. But depth of cut and toolpath must be planned with lateral cutting forces in mind.



4th axis

Reduces re-clamping on cylindrical parts, features around the circumference and faces that must be machined from different angles.

The real advantage isn't just rotating the part; it's reaching new faces while keeping the same datum.

Workholding and CAM are planned together

In CAM, the toolpath can't be completed without knowing where the workholding sits.

A vise jaw, fixture component or clamping bolt can end up in the toolpath.

Likewise, the clearance left for tool access can affect how rigidly the part can be held.

So a process plan is usually read in this order:

DATUM → SETUP → TOOL ACCESS → CUT DIRECTION → CAM → MEASURE

Accuracy starts with good workholding.

The cut is done. Is the part?

**A part isn't done when it's cut;
it's done once verified.**

8 mm

PROGRAMMED DIAMETER

→ 7.95 mm

ACTUAL DIAMETER

The CNC cycle may be over: the toolpath has run, the part is off the machine and the surface looks right at first glance. But only measurement and inspection show whether the part conforms to the drawing's dimensions, tolerances and functional surfaces. So measurement isn't a separate step added at the end of production; it is the feedback step of the process.

Drawing and program look right, so why are the dimensions off?

On the computer, drawings and code are flawless. On the CNC machine, the process meets physical reality. Even if everything looks right on screen, physical forces can change the result.

For example, the actual tool diameter may differ from the programmed one. Most cutting tools are slightly under their marked size: an 8 mm end mill may measure 7.95 mm.

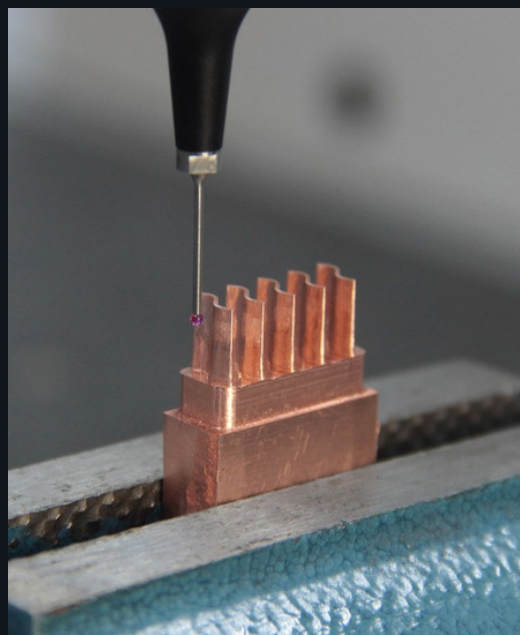
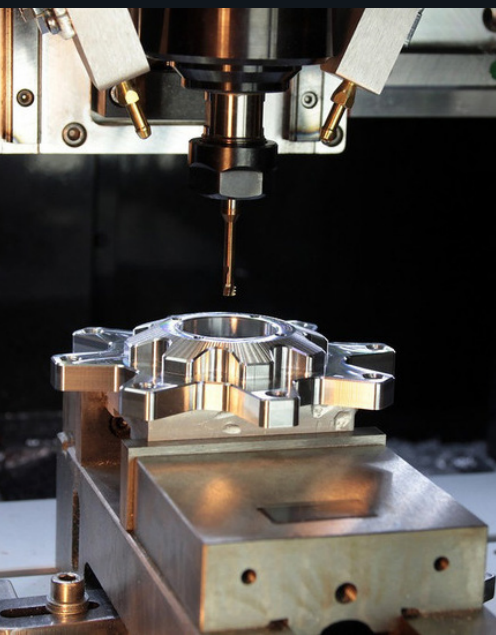
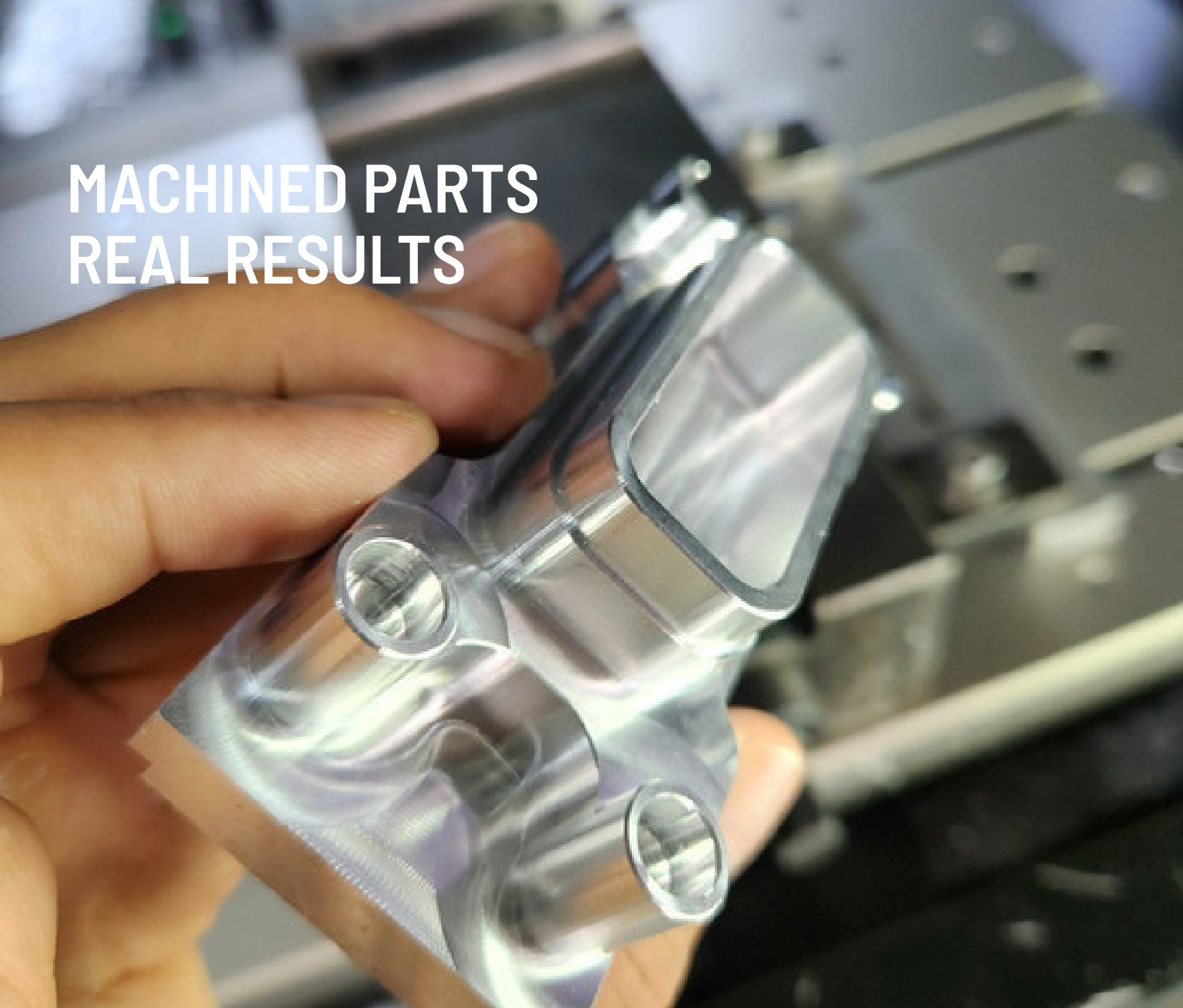
The tool may be poorly clamped, the collet damaged or the nut not fully tightened. Runout then makes the tool cut as if it were larger than its actual diameter.

The tool may be overloaded and bending as a result. Solid carbide tools may look as though they never flex, but if the length-to-diameter ratio and the load are too high, the tool bends out of line. This is called tool deflection; when it happens, the machined walls come out tapered.

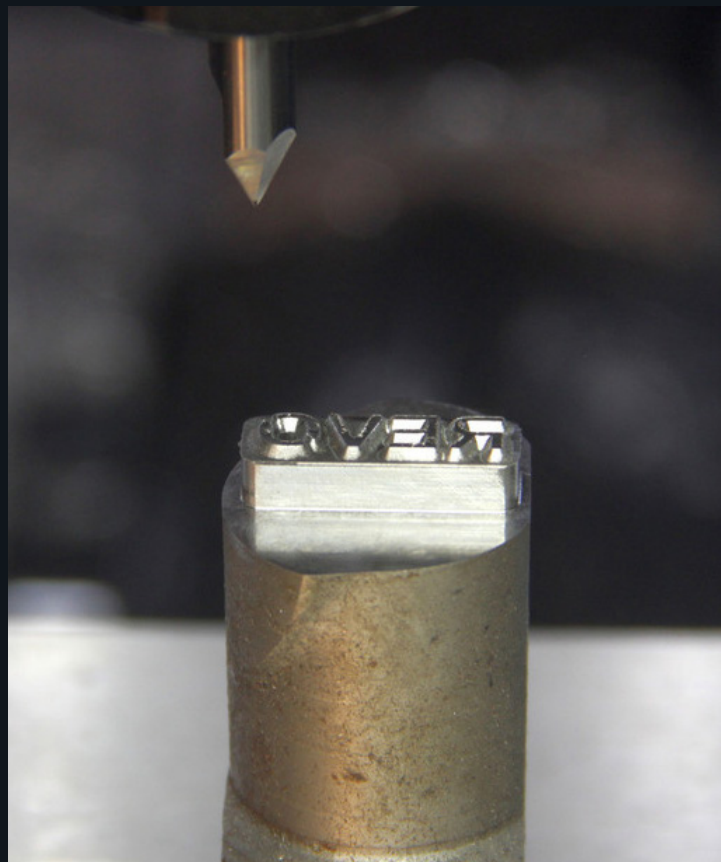
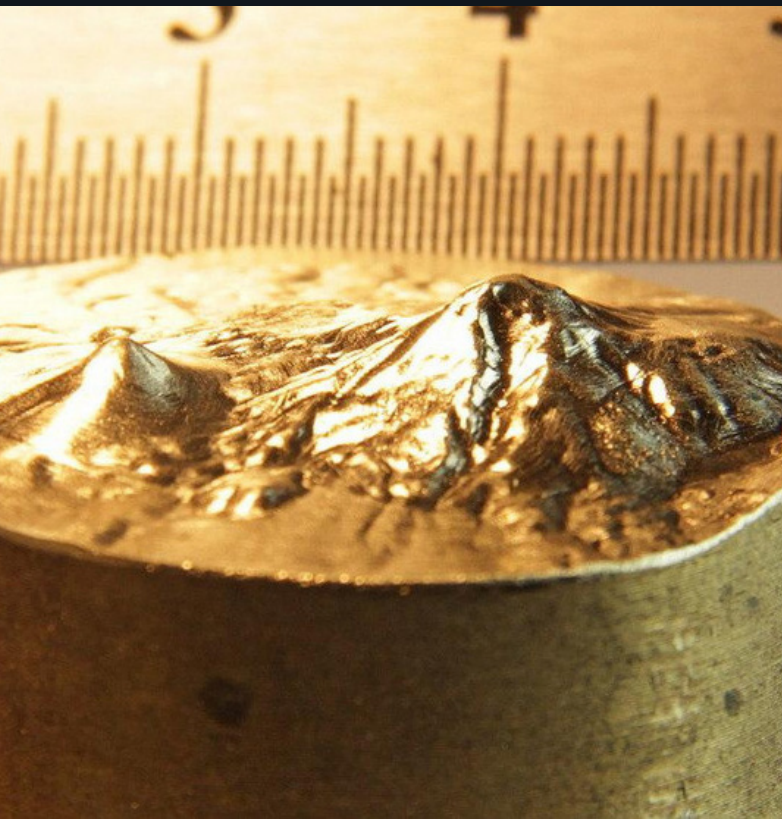
The part may be clamped in a vise without considering that the vise can distort it. As the vise is tightened, the middle of the part bows upward, so the part is out of shape before cutting even begins. Face-mill it, release it, and the middle springs back down: your surface is no longer flat.

Material elasticity can also throw dimensions off, especially in materials such as polyethylene (PE), POM and PTFE. When the tool moves in to take a 1 mm radial cut, that 1 mm move may actually remove only 0.9 mm. The 0.1 mm shortfall comes from the part compressing during the cut and then springing back.

MACHINED PARTS REAL RESULTS



Design. Chips. Part.



Many industries, one shared need

Parts, methods and production settings vary from aerospace to medical, from R&D to education. Yet in many fields the core need is similar:

- 01 **Turning ideas into physical parts.**
- 02 **Keeping control of production.**
- 03 **Responding quickly to revisions.**
- 04 **Making the part you need, when you need it.**

Each industry has its own materials, geometries, tolerances and workflow. The MATE series can be adapted to different process needs in R&D, lab, education, workshop and production settings where aluminum and other non-ferrous metals, engineering plastics and suitable composites are machined.

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MAKING ISN'T JUST FOR FACTORIES

The scale of manufacturing is changing. More and more kinds of workplaces now need to make things.

For a long time, manufacturing technology was associated with high-capacity plants, large shop floors and series-production systems.

Today, a shared need stands out across different settings, from R&D labs to universities and from design offices to professional workshops: turning an idea into a physical part, precisely and reliably.

This need has also shaped REVO's development. With more than 10 years in engineering, design and CNC technology, REVO has grown around one idea: making manufacturing capability more compact, accessible and adaptable to different working environments.

Since day one, our goal has never been simply to build a smaller CNC machine. We focused on reducing the machine's footprint, its infrastructure needs and the complexity of using it, while keeping the capabilities that professional machining requires. That approach now takes shape in the MATE series.

At REVO, we develop and manufacture compact CNC milling systems for machining aluminum and other non-ferrous metals, engineering plastics and suitable composite materials.

The MATE series was designed to meet a range of needs: from prototyping and product development to test specimens, custom parts and fixtures, and on to repeat production and long runs. In R&D centers, laboratories, universities, product development teams and professional workshops, the scale of what needs to be made is not always the same.

Sometimes it's a single prototype.

Sometimes it's remaking a part that was revised a few hours ago.

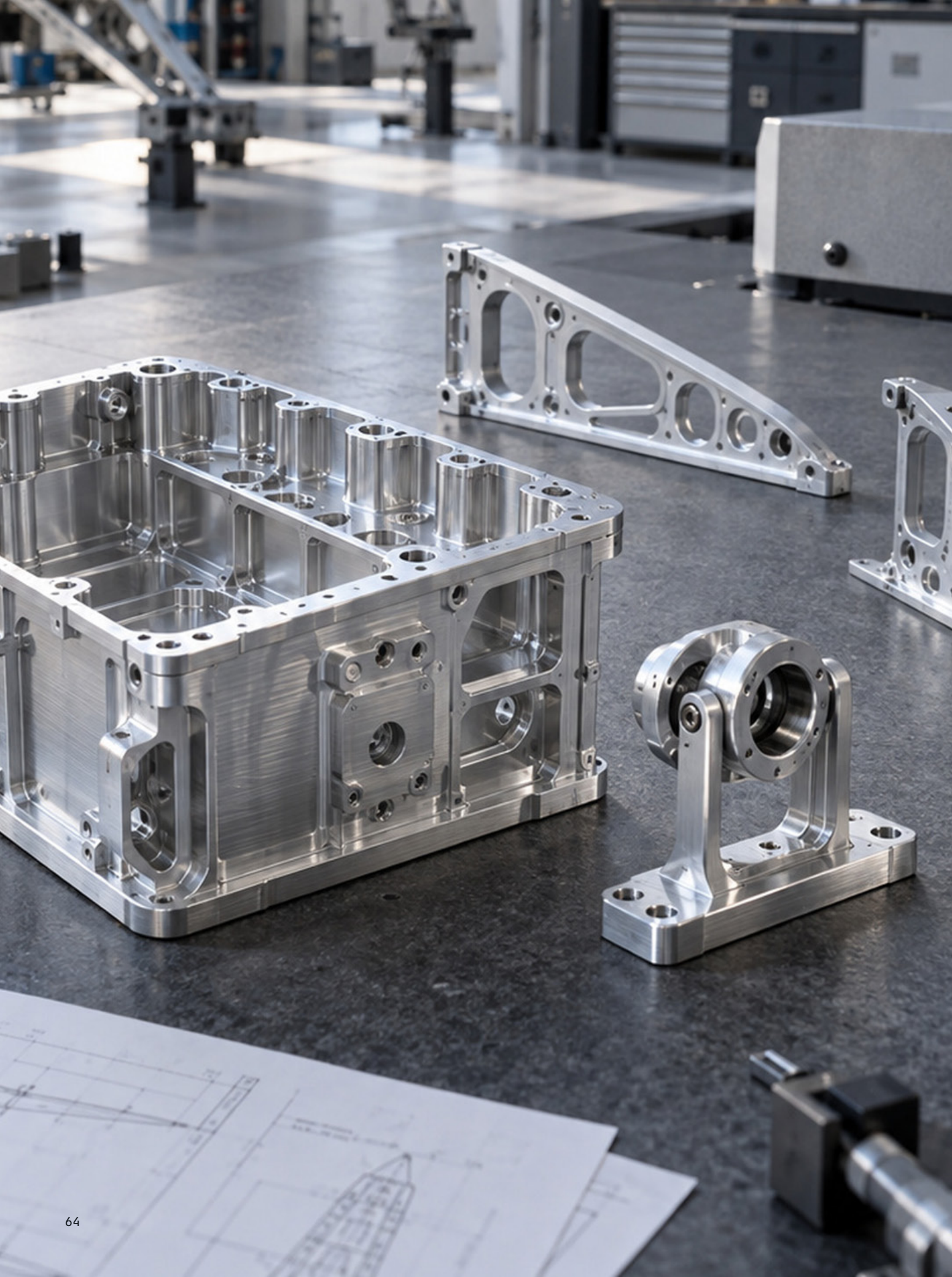
Sometimes it's a custom jig for a production line.

And sometimes it's the first physical version of a design still at the idea stage.

That is why we see compact CNC technology as an engineering approach that delivers manufacturing capability to wherever it is needed. The machine's size, infrastructure needs and the way it is used may change; the process control and engineering discipline that professional production requires do not.

The same thinking underlies REVO's approach, built on engineering, simplicity, accessibility and continuous improvement. When the right technology, the right process and the right manufacturing know-how come together, ideas can become physical parts in the lab, the workshop, the R&D center, the classroom or the factory.

**Making has no fixed address.
It belongs to anyone bringing an idea to life.**



AEROSPACE & DEFENSE

What they need

In aerospace and defense projects, product development involves many custom parts, for everything from lightweight mechanical structures to electronic and electro-optical systems.

In-house CNC machining capability can speed up the process in projects where design revisions are frequent, where new geometries must be verified quickly, or where it pays to make custom parts close to the development team.

The MATE series lends itself especially to machining small and medium-sized parts made from aluminum, engineering plastics and suitable composites.

Where it's used

- UAV and unmanned systems developers
- Avionics and electronic systems teams
- Electro-optics development teams
- Prototype workshops
- Test and validation labs
- Defense R&D and engineering teams

Example parts

- UAV motor mounts
- Avionics system housings
- Camera and electro-optical housings
- Sensor brackets
- Antenna mounts
- Battery and electronic module carriers
- Lightweight aluminum housings
- Drilling and contouring of composite panels
- Custom mounts for flight and ground testing



MEDICAL MANUFACTURING

02

What they need

In medical device development, small parts, precise mating surfaces, custom geometries and mechanical components made from a range of materials play an important role.

Whether a team is validating a new device design, making its functional parts or building test rigs, shortening the time from design to physical part has a direct impact on development.

The MATE series can be used for device parts, laboratory equipment components and custom work in aluminum and engineering plastics.

Where it's used

Medical device R&D departments
Medical product development labs
Dental R&D and prototyping labs
Biomedical research centers
Engineering teams at medical device makers
Test and validation labs

Example parts

Medical device prototype housings
Portable device housings
Display and control panel frames
Sensor holders
Laboratory instrument parts
Sample trays and holders
Internal support structures
Guide and bearing parts in engineering plastics



R&D AND PRODUCT DEVELOPMENT

03

What they need

An idea rarely becomes a product in a single cycle.

Design → Make → Test → Measure → Evaluate → Revise → Remake

This is the natural flow of product development. Waiting on supplier lead times after every design change can drag out even a small revision. Having CNC machining capability close to the development team shortens the path from design to physical part.

The MATE series can be used at different stages of product development, from first samples to functional prototypes and from experimental parts to revised versions.

Where it's used

Corporate R&D centers
Technology park firms
Product development teams
Prototyping labs
Design offices
Test and validation centers
Research labs

Example parts

Functional prototypes
Early design-validation parts
Circuit board carriers
Motor and actuator mounts
Functional parts for concept models
New versions of revised parts
Custom geometries for flow and cooling experiments
Test specimens
Custom parts for test rigs



PROFESSIONAL WORKSHOPS

04

What they need

In professional workshops, production isn't always about repeating the same part in high volumes. A single day can bring different customers, geometries, materials and batch sizes.

This variety, from one-off parts to regular production and from spare parts to customer-specific applications, calls for flexible CNC equipment that uses space efficiently and can adapt quickly to different jobs.

The MATE series can be used in professional shops where different jobs run on the same machine.

Where it's used

Precision machine shops
Custom part makers
Prototype workshops
Design and fabrication studios
Small and medium-sized manufacturers
Service and maintenance workshops
Engineering firms

Example parts

Customer-specific adapters
Made-to-measure fittings
Aluminum covers and housings
Electronics housings
Small-batch product housings
Spare parts that need to be remade
Engraved technical parts
Copper electrodes
Brass nozzles and small precision parts



OEM & MACHINE BUILDERS

What they need

When a machine or automation system is being developed, not every part it needs is a standard or series-produced component.

Sensor mounts, motor adapters, custom brackets, parts for machine revisions and assembly aids can change as the design evolves. Some are made only once; others become standard parts of the machine family over time.

Making these parts in-house keeps design, assembly, testing, maintenance and revisions moving within the same engineering loop.

Where it's used

- R&D and engineering teams at machine builders
- Automation firms
- Robotic system builders
- Custom machine design teams
- Assembly and production lines
- Maintenance and service teams

Example parts

- Servo motor and gearbox adapters
- Sensor mounting blocks
- Linear-module carriages
- Pneumatic component mounts
- End-of-arm tooling interfaces
- HMI and control panel housings
- Cable feed-throughs
- Parts for machine revisions
- Custom stops and locators
- Assembly and production fixtures
- Line-specific locating elements



EDUCATION, RESEARCH & UNIVERSITIES

06

What they need

At universities, the need for CNC machining goes beyond engineering education. A range of disciplines may need shared manufacturing facilities to build prototypes, make test rigs, produce custom parts for research or study the machinability of different materials.

This is why CNC technology can become a manufacturing tool shared by different departments in university workshops, makerspaces, prototyping centers, research laboratories and hands-on training classrooms.

The compact design of the MATE series and its 230 V single-phase supply make it easier to set up CNC machining outside traditional machine shops.

Where it's used

- Shared university workshops
- Makerspaces and fab labs
- Prototyping centers
- Research labs
- Materials research labs
- Hands-on training classrooms
- Design studios
- Project and research centers

Example parts and research

- Custom parts for research instruments
- Test rig components
- Test specimens and specimen holders
- Material cutting tests
- Robotics and mechatronics parts
- Prototypes and project builds
- Physical prototypes of design work
- Custom geometries for academic research
- Experimental studies of the cutting behavior and machinability of materials

In one project, the same CNC equipment can produce a mechanical prototype; in a research study, it can serve as an experimental tool for examining a material's cutting behavior.

REVO: 3 steps to production

Moving into production starts with choosing the right machine, but good results require weighing part, process and machine together. At REVO, we break this into three core steps:

01

Define the Need

The part to be machined is defined: its material, size, tolerances, batch size, number of operations and workholding needs. This information is the basis for choosing the right MATE model and the necessary equipment.

02

Build the Right Configuration

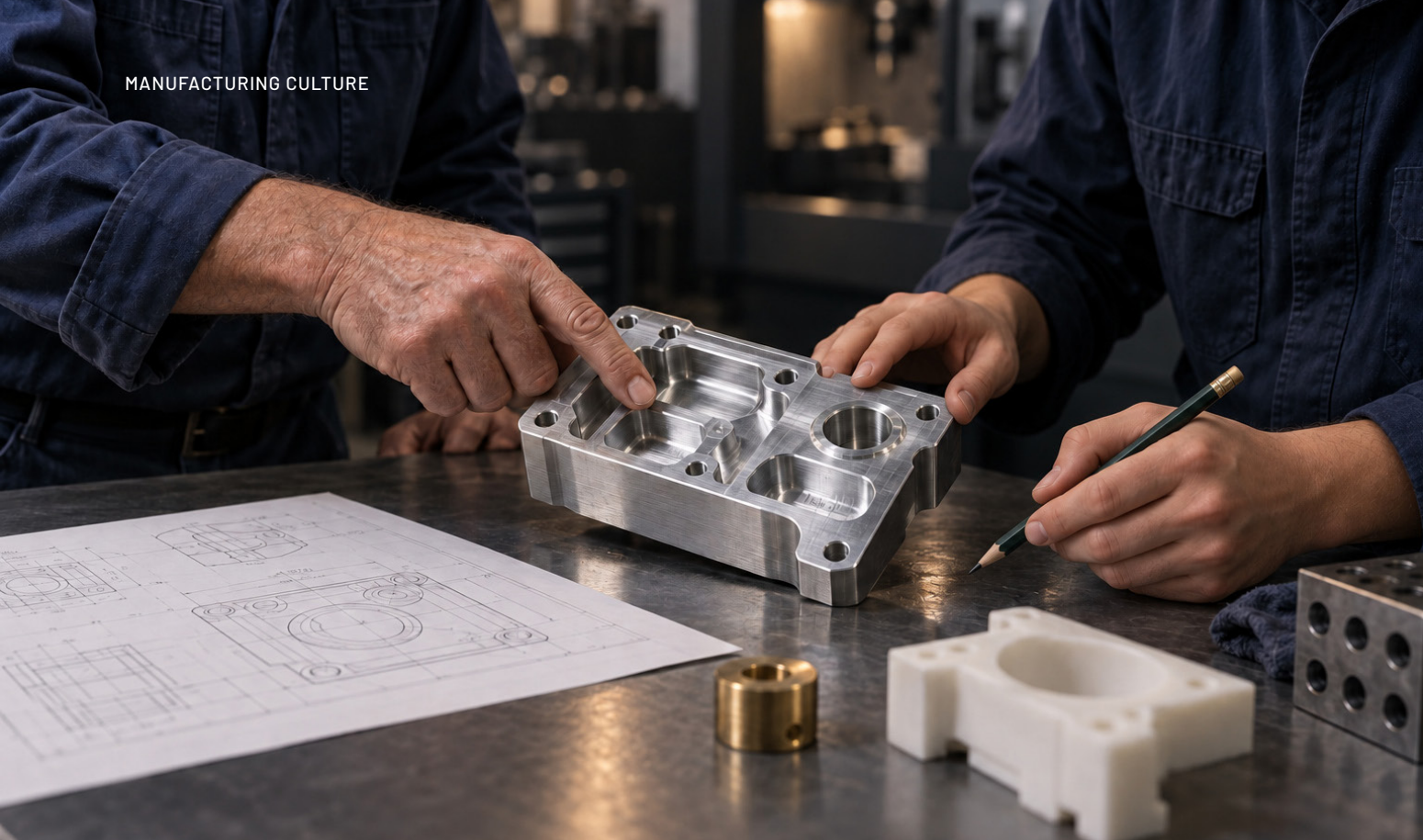
The chosen model is configured with the spindle, tool changer, 4th axis, vacuum table, probe, vise and other accessories the job requires. The aim is not to add unnecessary equipment but to build the system the process really needs.

03

Prepare and Produce

CAD/CAM preparation, tool selection, cutting parameters, workholding and zeroing are finalized. The first part is machined and measured to verify the process. After any corrections, production continues under control.

Define the part,
set up the system,
verify the process and produce.



BEYOND TECHNIQUE

Manufacturing brings to mind machines, technical drawings, tolerances, materials and processes. Each is a core part of making things.

Machining a part to the right tolerance takes technical knowledge. Running any production process efficiently is an engineering problem. Choosing the right tool, material and process takes knowledge and experience.

But the urge to make begins earlier: when we look at a problem and ask, “How can we do this better?” and when we try to turn an idea into something physical.

It also begins when the first attempt fails and we try again. This is the point where making goes beyond technique and becomes a way of thinking and working.

How does manufacturing culture form?

Manufacturing culture is reflected in the way a person, an organization or a society turns ideas into reality.

Curiosity, trial and error, measuring, learning, improving and making again are parts of this culture that feed one another.

New knowledge is created when an engineer questions how a part of their own design will be made, when a student turns an idea into a physical product, or when a business develops its own solution to a problem it faces.

Reused, this knowledge becomes experience; passed on, that experience becomes a legacy. The ability to make things is exactly the result of that legacy.

Manufacturing culture isn't built in a day

Countries differ in what they make, how they make it and what they specialize in.

Some have deep roots in machine tools and precision manufacturing; others in electronics, automotive, chemicals, textiles or aerospace. Behind these differences lie not only today's technology but also past production, the trades that developed, knowledge passed down the generations and how industry is organized.

Over time, this history of production, trades, inherited knowledge and industrial organization adds up to a country's manufacturing memory.

When a country has built machine tools for years, engineering know-how, a supplier industry, measurement technology, materials expertise, service capability and a skilled workforce grow up around that industry.

The same is true of electronics, automotive, aerospace and other fields of manufacturing.

So manufacturing capability cannot be explained by the technology of one factory. A manufacturing ecosystem grows out of knowledge and experience built up over time.

What do we believe we can make?

Manufacturing culture also has a social side.

The first reaction to a problem?

"Where can we buy this?" is one answer;

"How can we make this?" is another.

The two questions reflect different mindsets.

Curiosity, repair, design, experimentation and improvement become a more natural part of daily life in societies that value making. This culture grows stronger when children and young people engage with technology as people who make, design and transform things.

Education is one place where manufacturing culture begins

A student who learns manufacturing only by reading does not gain the same experience as one who learns by trying to make a part of their own design.

Designing, choosing materials, making, spotting mistakes, measuring and trying again bring theory face to face with physical reality. That is why, for a strong manufacturing culture, education must do more than pass knowledge on to students.

It must give them the chance to ask questions, design, build, measure and try again.

A small part a student makes today can be the start of the products they develop and the engineering problems they solve tomorrow.

Machines are tools; people create knowledge

An advanced machine can provide a strong production base. But what builds a manufacturing culture is people asking questions, understanding the process, measuring results and sharing what they learn.

- Designers consider manufacturability.
- Operators watch how the process behaves.
- Engineers analyze the results.
- Quality teams measure and verify.
- Buyers look into the right material and how to source it.

What is learned feeds back into design and process.

In a strong manufacturing culture, teams share knowledge.

Read right, an error becomes data

Production doesn't always go as expected.

Why was the part out of tolerance?
Why did the finish change?
Why did the tool wear out early?
Why did assembly go wrong?
Why didn't the first design work as expected?

Answering these questions turns an error into knowledge that can be used in the next process. The point is not to normalize errors. It is to find the cause when one occurs and build a system that keeps it from happening again.

Manufacturing culture is the ability to turn error into knowledge.

Design and production are one loop

A product begins to take shape on the CAD screen; it truly develops when it meets the material, the cutting tool, assembly and the conditions of use.
A good designer considers how it will be made.

A good production team, in turn, tries to understand why the part was designed that way.

As the two disciplines draw closer, the products become more manufacturable, easier to verify and more mature.

MAKTEK EURASIA 2026: MEET US



LET'S TALK SHOP IN PERSON

September 28 – October 3, 2026
TÜYAP İstanbul · Büyükçekmece

What's on our stand

402B

HALL

4

01

MATE family

Take a close look at the working areas, construction and spindle options of the MATE 200, MATE 400 and MATE 400 Plus.

02

Live cutting

Watch machining operations and their results in person.

03

Sample parts

Pick up machined parts and assess their materials, surfaces and geometries.

04

Your project

Talk to our team about machine, tooling, workholding and process options for your own part or drawing.

Opening hours
September 28 – October 2: 10:00–19:00
October 3: 10:00–18:00



The ability to make is a shared legacy



Making is a culture: know-how, experience and curiosity, passed down the generations, become the ability to make.

A country's manufacturing strength is the shared legacy of its engineers, technicians, teachers, master craftsmen, designers, researchers, entrepreneurs, suppliers and manufacturers. Passing on knowledge, sharing experience and involving new generations in making from an early age keep that legacy alive.

That is why manufacturing culture does not begin in the factory. It grows in schools, workshops, laboratories, universities and wherever people try to solve a problem.

A shared vocabulary

1 / 3

NUMERICAL CONTROL · SPINDLE · FEED

NC

Numerical Control. Controlling machine movements and machining operations with numerical commands. The term NC on its own does not say whether control is open-loop or closed-loop; position feedback depends on how the system is designed.

CNC

Computer Numerical Control. Numerical control performed by a computer-based control system. Programs can be stored, edited and run again. Position feedback, error compensation and monitoring capabilities vary with the machine's hardware and control system.

CAD

Computer-Aided Design

The stage in which a part is designed on a computer. This is where the geometry of the part to be made is created. The drafting and design software used for this is called CAD software.

CAM

Computer-Aided Manufacturing

Software used to plan how a part designed in CAD will be machined. The cutting tool, spindle speed, feed rate, depth of cut, toolpath strategy and similar settings are defined in CAM.

G-CODE

The command set in CNC programs that defines the type of motion and machining functions. Together with axis coordinates and F (feed), S (spindle speed) and M (miscellaneous function) commands, it forms the program. Commands and syntax can vary by control system.

SPINDLE

The main unit that turns the cutting tool. Its speed range, power, torque, runout and toolholding directly affect machining performance.

SPINDLE SPEED – RPM

The number of revolutions the tool makes per minute. The operating rpm is chosen to suit tool diameter, tool material, feed rate and workpiece material.

RAPID TRAVERSE

A positioning move in which the tool travels through the air between points at top speed, clear of the material.

FEED RATE

The speed at which the cutting tool advances across the part. Usually given in mm/min.

CUTTING SPEED – V_c

The linear distance a point on the outer surface of a rotating tool or workpiece travels per minute. At constant spindle speed and feed, a larger tool diameter means a higher cutting speed. Cutting speed is the first value to consider when setting cutting parameters. In practice, the tool material is matched to the workpiece material before anything else, and a suitable cutting speed (V_c) is taken from the manufacturer's catalog. Spindle speed (rpm) and feed are then calculated from it.

FEED PER TOOTH – f_z

The feed calculated for each cutting tooth, usually given in mm/tooth. It is found by dividing the feed rate by the spindle speed and the number of flutes. Actual chip thickness also depends on how the tool engages the material.

AXIAL DEPTH OF CUT – a_p

How deep the tool engages the material, measured along the tool axis. Usually given in mm.

RADIAL WIDTH OF CUT – a_e

How much of the tool diameter engages the material. Given as a percentage of the diameter or in mm.

A shared vocabulary

2 / 3

TOOL · HOLDER · OPERATION

TOOLPATH

The path the cutting tool follows while machining a part. It is created in CAM to suit the operation.

CUTTING TOOL

Milling cutters, drills, chamfer mills and similar tools that remove material as chips. The right tool depends on material, geometry and operation.

COLLET

A flexible sleeve that clamps the cutting tool in the spindle or tool holder. The tool goes into a collet of the right size, the collet is seated in the collet nut, and the nut is tightened onto the holder or spindle nose.

ER

Designates collet size in collet systems: ER16, ER20, ER25 and so on. The larger the collet, the larger the tool diameter it can clamp. For example, an ER16 collet holds tools up to 10 mm in diameter, while an ER20 holds up to 13 mm.

HSK

A hollow taper shank tool holder standard used where high spindle speeds and precise tool clamping are needed. Contact on both the taper and the face gives a rigid, repeatable connection.

TOOL STICK-OUT

The free length of the tool that projects beyond the collet or tool holder. As stick-out increases, rigidity drops and the tendency to vibrate can rise. So the tool is kept as short as possible: only as long as the operation requires.

RUNOUT

How far the tool deviates from its theoretical axis of rotation as it turns. Low runout matters for tool life, surface finish and precision machining. Runout can come from the cutting tool, the collet, the holder or the spindle taper.

ROUGHING

The first machining stage, in which excess material is removed quickly and under control. The priority is efficient material removal rather than reaching the final geometry. Tool or chatter marks may be left on the surfaces.

FINISHING

The machining stage that produces the part's final dimensions, geometry and surface finish. Compared with roughing, it is usually done with a cleaner, sharper tool, at lower speed and with a lighter cutting load.

CHAMFER

Breaking a sharp edge of the part at a specified angle or size. It can be applied to ease assembly, remove burrs and finish the edge.

POCKETING

Creating a cavity by removing material from a bounded area within a part.

CONTOURING

A machining operation in which the cutting tool follows the outer or inner geometry of the part. Machining the inside edges of a recess or the outside edges of a part can both be described as contouring.

INTERPOLATION

Coordinated control of two or more axes to produce linear, circular or other geometric paths. Helical interpolation combines circular motion in a plane with linear motion along the axis perpendicular to it. With a suitable thread mill, this motion can be used to cut a thread form.

3D TOUCH PROBE

A sensor used on the machine to measure a part's position, surfaces or specific geometric points. It can be used for setting the work zero, post-machining measurement and position checks.

A shared vocabulary

3 / 3

DATUM · METROLOGY · QUALITY · SETUP

MACHINE ZERO (HOME POSITION)

The starting point of all the machine's axes. This point is the machine's absolute zero and is set by the manufacturer. The position of any axis measured from it is called its absolute position.

WORK ZERO (WORK OFFSET)

The point the toolpath treats as zero. The center of a workpiece's top face, one of its corners, the center of a circle or any point in the machine's working area can serve as the program's zero position. The user can set it wherever needed.

POSITIONING ACCURACY

How close the machine gets to a commanded position. If the target is 300 mm and the measured position is 300.010 mm, the error in that single measurement is +0.010 mm. Overall positioning accuracy is assessed by repeated measurements at different targets along the axis, under defined conditions.

REPEATABILITY

The spread between the points the machine reaches when it is sent to the same target position several times, under the same conditions and from the same direction. It shows how consistently the machine can repeat a command. A low value is the most basic guarantee of consistent production and of parts that stay within specification. Positioning errors can be compensated in software, but repeatability depends entirely on the machine's mechanical capability and thermal stability.

TOLERANCE

The acceptable range of deviation of a dimension from its nominal value. Zero error (a perfect nominal dimension) is physically impossible to achieve in production, so these limits are what ensure that parts fit together without problems and perform mechanically as intended.

Making tight-tolerance parts depends on machine accuracy and rigidity, and also on control of tooling, workholding, temperature and measurement.

SURFACE ROUGHNESS – Ra

The micro-scale irregularities of a machined surface. Tool geometry, cutting parameters, rigidity, vibration and runout all affect the result. Ra is the arithmetic mean of the absolute deviations of the surface profile from the mean line over the evaluation length. It is usually given in μm and does not, on its own, describe every geometric property of a surface.

CHIPS

The pieces of material removed by the cutting tool. Their shape depends on the cutting conditions, tool geometry and workpiece material.

VACUUM TABLE

A system that uses vacuum to hold parts in place, especially thin parts or parts with large flat surfaces. Contrary to popular belief, the vacuum does not pull the part down: the air beneath the part is evacuated, and with nothing pushing back from below, atmospheric pressure presses the part onto the table. In theory this hold-down force is about 1 kg per cm^2 . So if you hold a thin 100 × 100 mm brass plate on a vacuum table, about 100 kg of atmospheric load presses down on it and keeps it in place.

4TH AXIS

Adds a rotary axis to the standard X, Y and Z motions. It allows different faces of the part to be machined without re-clamping. The letter used for the 4th axis depends on the axis it rotates about: about X it is the A axis, about Y the B axis and about Z the C axis.

Before starting

Before you clamp a part on the machine, the key production decisions must be settled.

01 CAD model and drawing checked

Dimensions, tolerances and revision details verified.

02 Material and stock defined

Material type, alloy and stock dimensions specified.

03 Critical dimensions and datums identified

Priority features for inspection clarified.

04 Part manufacturability assessed

Tool access, internal radii, pocket depths and thin walls checked.

05 Workholding chosen

Need for a vise, fixture, vacuum table or 4th axis determined.

06 Cutting tools selected

Tool type, diameter, flute count and stick-out chosen for each operation.

07 CAM operations created

Roughing, finishing, holes, chamfers and other operations sequenced.

08 Cutting parameters checked

Spindle speed, feed, fz, ap and ae values reviewed.

09 Collisions and tool access checked

Tool, holder and workholding verified in CAM simulation.

10 Work zero and tool offsets set

Reference points and tool data loaded into the machine.

11 Chip evacuation and cooling method defined

Air, mist/MQL or dust extraction chosen to suit the process.

12 First-article inspection plan set

Critical features and measurement method defined.

Preparation complete.

Let's make chips.

Making it together.

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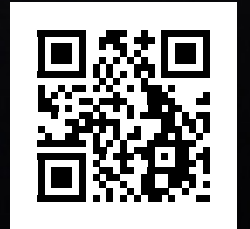


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