HOW WE PRODUCE OUR HIGH QUALITY BITS

By now, anyone who knows woodworking, knows CMT is the only orange one. CMT has been making top quality bits for over 30 years and are the manufacturer of the original and only orange router bit. CMT started as a small workshop in the center of Pesaro, Italy and has become a global leader in the production of woodworking tools. "CMT professional tools for wood" began with Osvaldo Tommassini in 1964 in response to the demands of the thriving furniture manufacturing business in the area. Today, under the careful guidance of the second generation of the Tommassini family, CMT operates two factories in the Pesaro area and distributes throughout the world.

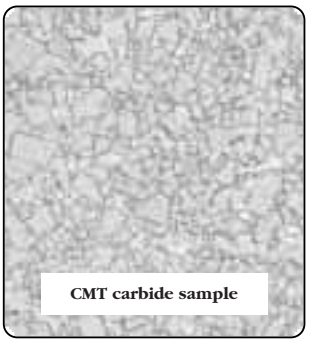
Besides orange, CMT is quality. CMT has a long-standing tradition of producing only the highest standard in tooling. Careful consideration is taken in all aspects of the business - from the selection of raw materials, to the research and design of each tool, to the technology and workmanship applied in production - right down to the details and aesthetics of packaging and the promotion of the name CMT.

The Von Moos Stahl steel plant in Lucerne, Switzerland - the birthplace of Fatigue Proof® steel used in production of all CMT bits.

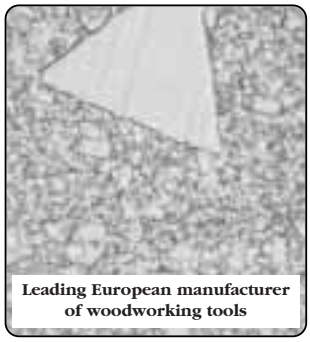
RAW MATERIALS

FATIGUE PROOF® STEEL

CMT router and boring bits start from solid bar stock steel manufactured in the Von Moos Stahl steelworks in Switzerland. Von Moos uses a hot drawing process which is a process that pulls all of the fibers of the steel in one direction resulting in extra strong and resilient bars. This provides a highly uniform steel to machine the bits from - our router bit bodies and shanks can withstand even the most demanding mechanical and thermal stresses acting as perfect shock absorbers during cutting.



CMT carbide sample



Leading European manufacturer of woodworking tools

Leading American manufacturer of woodworking tools

CMT carbide sample *- note the uniformity of granules. They are evenly distributed with no spaces or granules outside the acceptable measures of tolerance. An example of high quality carbide.* ***Leading European manufacturer of woodworking tools*** *- notice the large granules. This indicates the use of recycled carbide powder which results in oversize granules in the carbide. A large granule in the carbide of the cutting face edge can chip off, leaving a gap on the cutting edge which causes splintering when cutting.* ***Leading American manufacturer of woodworking tools*** *- note the dark gaps. This is caused by an uneven distribution of cobalt in the manufacture of the carbide, creating open spaces and making the carbide overly porous. The carbide "crumbles" easier and wears down more quickly.*

CERAMETAL TUNGSTEN CARBIDE

The carbide tips are the part of your bit that have the job of actually cutting the wood. If the carbide is not made with the correct formula, problems with edge life and sharpness will quickly evolve.

Carbide is made by creating a chemical compound between compressed carbide powder, cobalt and tungsten.

The quality of the resulting carbide depends on how uniform the granulates are and how compactly they bonded with the chemicals. (see photo) CMT uses a carbide composition specially formulated by Céramétal manufacturers in Luxembourg who produce micrograin carbide according to our carbide tip design specifications. You are guaranteed to get a long-lasting performance and multiple re-sharpenings from your carbide-tipped tool.

RESEARCH, GEOMETRY AND DESIGN

ANTI-KICKBACK DESIGN

Anti-Kickback was developed to ensure safety and is considered a standard feature on larger diameter CMT bits where risk of kickback is the highest. Kickback occurs when the bit makes the initial bite into the wood and jumps back. Due to the large amount of space between the flutes on the cutter head. CMT bits are designed with generous rounded shoulders between the flutes to stay in almost constant contact with the wood when cutting and also to make a smoother initial connection with the workpiece.

CMT designed rounded shoulders between the flutes to radically reduce dangerous kickback.

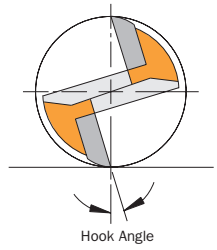
SHEAR ANGLE

Hold a bit by the shank and look at the cutting edge, you will notice that it goes either straight up and down, left to right (negative shear) or right to left (positive shear). The angle cutting edge or its "shear" will determine how the cut is made. Specific shear angles are designed to work best in certain type of materials. A shear angle gives a less choppy cut and give a cleaner finish, thus making them preferred over straight cutting edges for edge work. Negative shear cutting angles give the smoothest finish and are recommended for laminate work.

Our CMT Mortising bit (left) has a negative shear angle of 6° and our Cavetto Edge Mold (right) a positive shear angle of 15°.

HOOK ANGLE

The hook angle is sometimes called the rake and you can see it by looking down at the top of your bit - notice the angle the cutting edge makes with the overall bit diameter. (see drawing) This is the angle at which the cutting edge meets the stock and its purpose is to help leave a smoother, splinter-free finish.



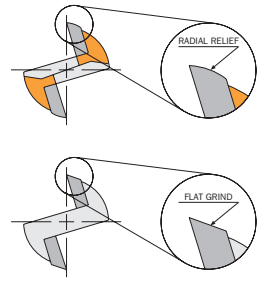
The hook angle is determined by the slant of the cutting edge towards the center of the bit.

RADIAL RELIEF

Radial relief is the curved grind on the outer cutting edge of the carbide. The presence of extra mass behind the cutting edge gives the carbide many added advantages:

- more strength behind the edge
- stays it sharper longer
- gives more resharpenings
- prevents burning
- reduces chattering

CMT includes radial relief on all straight edge bits to guarantee durability and the best highest quality performance.



Radial relief grind compared to flat grind.

CLEARANCE

A minor feature that makes a major difference in tool performance is clearance space. As the bit rotates, the tip of the cutting edge makes an outer circle as it removes stock, and the rotation of the body makes a smaller inner circle. The little space created between the rotation of the tip and the rotation of the body (see photos right) is known as the clearance and it serves as a free space for the bit to avoid coming into contact with the workpiece and burning, and as an exit for sawdust.

Notice the space created when measuring the diameter from the cutting edge (left) and from the body of the bit (right). This little space makes a big difference in the efficiency of chip and sawdust ejection.

PUTTING IT TOGETHER

TURNING

Bar stock steel is turned on a CNC lathe into the recognizable first shape of the router bit (see photos 1 and 2). Bits are centered and balanced, making the holes visible on the top and bottom of every bit that are followed in every step of production to ensure concentric machining. Notice the very smooth finish on a turned CMT bit. Even though it will be removed and refinished during later phases, we feel that starting with precision and paying attention to details means a better end product.

MILLING

After turning, the bits are milled to make the flutes and seats for the carbide tips and putting a finer finish on the bit body and shank (see photo 3). Looking at the flutes of a bit in this stage, you can see the shear angle of the bit. Milling is done on Swiss automatic and automated loading CNC machines for a perfectly smooth and accurate finish, especially the seats where the carbide tips will be brazed.

BRAZING

The milled bits are fitted with custom designed micrograin carbide tips and brazed. Particular attention to accuracy is required during this extremely important step to ensure a good bond. In brazing, the carbide tip and the steel body are fitted together and heated to 420° C. When the metals reach this temperature, an optic sensor triggers the silver induction wire which is then injected between the carbide and steel automatically. Since the metals have expanded due to the heat, the bits are immediately put into normalizing ovens as each braze is completed. The stress caused by the contrast between the brazing temperature and room temperature can cause the carbide to contract too rapidly and crack. By using normalizing ovens, the bits can be brought down to normal temperatures gradually. This also allows for brazing at higher temperatures to further guarantee a solid braze (photo 4).

PHOTO 1

PHOTO 2

PHOTO 3

TEFLON® INDUSTRIAL COATING

After brazing, the bits are sanded and degreased and then the trademark orange Teflon® Industrial coating is baked on (photo 5). Teflon® is a stratified coating that forms layers when applied. The bottom layer bonds chemically and mechanically to the tool surface while the top layer is a low friction non-stick layer of Teflon®. Between the two strata is a combination middle layer of bonding chemicals and Teflon®, so the complete Teflon® coating sticks to the tool, but nothing else does. In addition, this low friction, non-stick Teflon® coating provides advantages that you don't get from other coated tools.

DuPont tested their industrial strength coating and the results were clear - Teflon® helps tools perform better, last longer, and clean up quicker. DuPont studies have shown that Teflon® coated tools stay sharper longer and the stratified Teflon® coating binds to the tool to create a tough protective surface that is resistant to heat and friction, which means no burning. The self lubricating, non-stick finish also prevents resin and residue build up, and effectively seals out moisture so you don't need to use oils, grease or antioxidants.

PHOTO 4

PHOTO 5

PHOTO 6

PHOTO 7

PHOTO 8

PHOTO 9

GRINDING AND SHARPENING

The final phases of production are the finishing touches that serve to distinguish CMT bits from all the rest. It helps to remember that CMT bits go from step to step in production constantly being machined concentrically. Grinding takes place on the shank and the ball bearing seat, where rotation must be perfect for the bit to execute precise cuts and to guarantee that the shank fits tightly in the router collet. On these two parts of the bit, we leave a 0.8µm finish that is so smooth to the touch it feels like oil. The sharpening of the carbide tips is done on 8 axes CNC machinery to leave a razor sharp 0.4µm finish (photos 6, 7, 8). (Reminder: It is easy to cut yourself by simply handling a bit. Please use extreme caution, especially when removing router bits from the packaging or bushings in the Bit Organizer).

Lastly CMT bits are prepared for shipment. They are laser marked along the shank with CMT, the item number and "Made in Italy", which guarantees that you are buying an authentic CMT Utensili router bit (photo 9). Included with each purchase of CMT router and boring bits and saw blades are multi-lingual safety instructions and suggestions.

A bit is born - turning the body of a CMT Round Over Bit on a Swiss automatic lathe.

The CMT milling process in action.

CMT Utensili is also making an effort to help the environment through recycling. The oil and water used to cool the machines and in the manufacture of the bits is recycled on the premises and reused in production. In addition, all resulting steel waste is collected for pick up and recycling. The plastic packaging was designed to be reused for bit storage and smaller packages are recyclable.

Finely crafted CMT tools will last a lifetime when well taken care of. Always remember to clean the tools, store them in a safe place when not in use to avoid dropping and breakage, and always remember to use ear, eye and respiratory protection while working.

Sturdy, well-marked CMT packaging safely stores and transports your bits and blades and are specifically designed for life-long use.

Suggestions for safe routing

ALWAYS thoroughly check all tools for possible flaws before using.

ALWAYS wear safety glasses and ear protection.

ALWAYS thoroughly read the owners manual and manufacturer instructions before using.

ALWAYS check that at least 3/4 of the shank is securely inserted in the collet of the router.

ALWAYS use template guide collars when possible to absorb lateral bit deflection.

ALWAYS use a fence when working on the router table.

ALWAYS reduce the router speed when working with larger diameter bits.

ALWAYS keep your fence adjusted so there is some clearance between the bearing guide and the workpiece.

ALWAYS take care to remove large quantities of stock (cross section > 10 mm) in more than one pass.

ALWAYS keep your tools sharpened, clean and stored in a safe place to avoid breakage and accidents and to extend the life of your bits and blades.

NEVER use dull or defective, even suspiciously defective, tools.

NEVER force the shank entirely into the collet (bottoming out). Leave about a 1/8" space from the bottom.

NEVER force the bit into your router or overload the router.

Suggested router speeds

Bit Diameter	Maximum Speed
1" (25 mm)	24,000 RPM
1-1/4" - 2" (30-50 mm)	18,000 RPM
2-1/4" - 2-1/2" (55-65 mm)	16,000 RPM
3" - 3-1/2" (75-90 mm)	12,000 RPM