TOOLS FOR PROCESSING COMPOSITE MATERIALS

edition 2025

PROFESSIONAL TOOLS

PRODUCTION | SALES | SERVICE

ITA TOOLS

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ITA TOOLS

Company details

ITA TOOLS Company is a Polish manufacturer of professional cutting tools located in Cracow with production and service center in Mielec, Special Industrial Zone and warehouse in Wieliczka. We offer a wide range of tools for woodworking industry, furniture production and processing composite materials.

PRODUCTS

Product range includes:

- Solid carbide spiral bits
- PCD router bits and cutters
- Industrial drills
- Saw blades
- Cutter heads and pre milling cutter heads
- Interchangeable and planer knives
- CNC chuck and accessories
- Other customized tools

WAREHOUSE

Why better than other?

- Industrial tool available on stock!
- B2B system for orders collection 24/7h
- Fast delivery thanks to location in the middle of Europe
- Customized production
- Experienced staff ready to meet your specific needs

PRODUCTION & SERVICE CENTER

Full range of tools' services!

- Sharpening, regeneration, coating
- Modern CNC machine park witch machines from: WALTER®, VOLLMER®, ANCA®, DMG MORI®, HAIMER®
- Certified staff works 24/7 in 3 shifts, 7 days a week
- Perfect service at the highest level appreciated by customers

Tool service 24/7

Scan the QR code and see the newest video presentations about our company!

YouTube

MADE IN POLAND

EU

Availability & Quality

Worldwide Export

Experience & Knowledge

Innovation: Laser Ablation

PRODUCTION AND SERVICE

PCD and HM Tools

ITA TOOLS company is the supplier of professional industrial cutting tools and solutions for business. Our production center is one of the biggest and most modern machinery parks in Central Europe. Our products are distinguished by high tolerance and best precision. We are proud of our production center and tools, therefore we invite you for an individual visit or live video presentation.

Our company is a pioneer in the technology of PCD sharpening by laser ablation method. Laser ablation works by focusing a laser onto a substrate to remove material that is on its surface. Laser ablation is much more efficient, reliable and cost-effective method.

WE TAKE CARE OF YOUR TOOLS

We work 24h, 3 shifts – 7 days per week for you!

- Each tool is registered in a database on each step of theservice
- Ultrasonic cleaning or micro glass grain sandblasting depending on the tool and dirt provide the best quality
- Measurements before and after services on WALTER® ADVANCE, WALTER® HELISET and ZOLLER®
- Measurements after sharpening with an accuracy of 0.01 mm – indicating diameter before and after sharpening.
- Top quality of induction brazing by CEIA® machines
- Sharpening PCD technology provided by modern CNC machines DMG MORI®, WALTER® and VOLLMER®
- High grinding quality thanks to WALTER® machines
- Dynamic balancing with a tolerance of G2.5 thanks to HAIMER® machines

Laser ablation sharpening technology provided by DMG MORI®, unique on European scale

ITA TOOLS is a braze-welding procedure certified.
Testing standard: **PN-EN ISO 13585:2012**

15 000 m²

Production centre in Mielec, Poland: brand new facility of tools' manufacturing and sharpening service center.

Brand new and advanced CNC machines from DMG MORI®, Walter®, Vollmer® and ANCA® in combination with professional team of operators and engineers create the NEW quality level of products and services.

SAW BLADES

ITA TOOLS production

At ITA TOOLS, we prioritize continuous development and work tirelessly to deliver products that not only meet but exceed our customers' expectations.

With an innovative approach to tool production, a bold vision for the future, and a deep understanding of the latest technologies, we have built a philosophy that drives our growth and positions us as leaders in the industry.

By leveraging innovative technologies and fully automating our processes, we have revolutionized the production of circular saws. Every stage of production from material selection to technological implementation, is meticulously planned, optimized, and automated, allowing us to set new industry standards for quality and performance.

Our precision laser cutting of high-quality sheet metal and heat treatment process, conducted in a unique European furnace, make ITA TOOLS saws stand out for their exceptional strength and flatness. Tensioning processes, dynamic balancing of the discs and precision grinding ensure unmatched flatness, stiffness, and stability in the saw bodies.

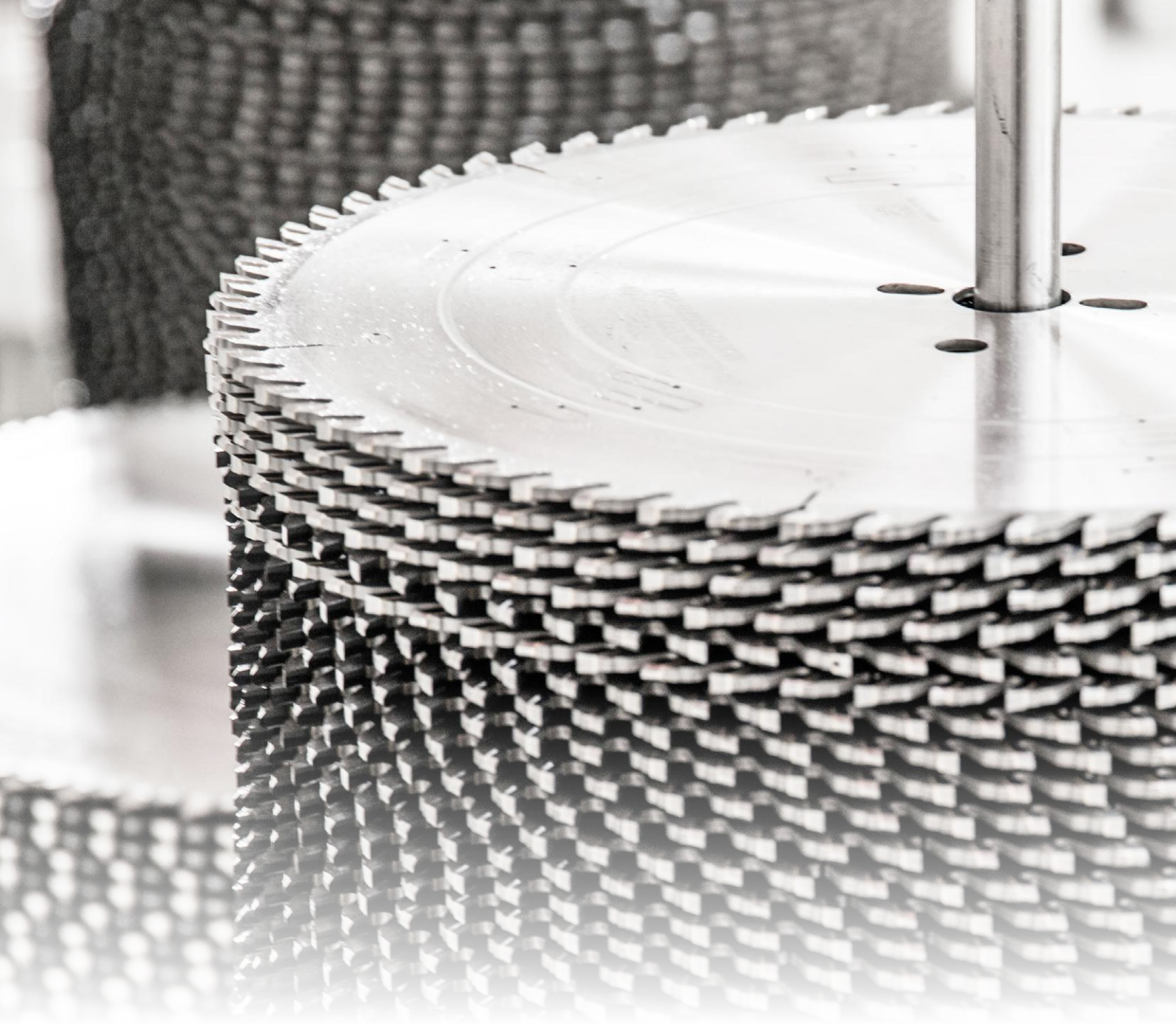
Surface grinding is performed on an automated grinder, ensuring precision down to 5 microns. The unique design of the saw body, equipped with compensation grooves, minimizes operating noise and guarantees extraordinary cutting precision. Furthermore, the innovative tooth design simplifies sharpening, greatly extending the tool's service life.

The sharpening of sintered carbide is executed on a state-of-the-art fully automated line of high-performance grinders, which are numerically controlled and operated by robots. At ITA TOOLS, each saw undergoes rigorous testing with the latest measurement technologies to ensure it meets the highest quality standards before leaving our factory.

With our comprehensive product range and wide array of options, ITA TOOLS offers endless possibilities for finding the most efficient cutting solution. We make no compromises during production — by using materials from leading manufacturers and incorporating the latest technology, we bring tangible benefits to our customers and deliver the highest quality product.

Here you can find the **the newest video** about our saw blade production

YouTube



MADE IN POLAND

Precision, efficiency, reliability – these are the features that define ITA TOOLS products. We are proud to provide solutions that contribute to the development of the wood and furniture industry around the world.

IN-HOUSE PRODUCTION

ITA TOOLS Company is a Polish manufacturer of professional cutting tools located in Cracow with production and service center in Mielec Special Industrial Zone and warehouse in Wieliczka.

HIGH QUALITY MATERIALS

High-quality tool steel sintered carbide teeth from leading manufacturers and high stocks of raw materials guarantee the best product available.

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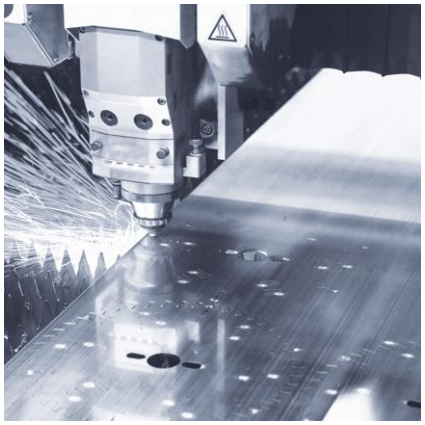
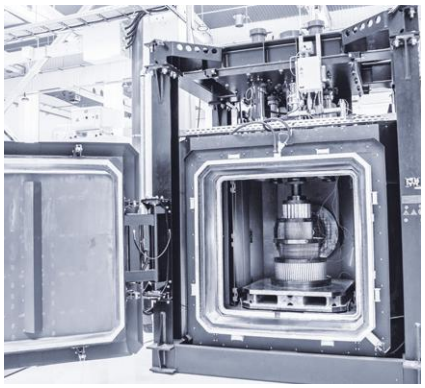


LASER CUTTING PROCESS

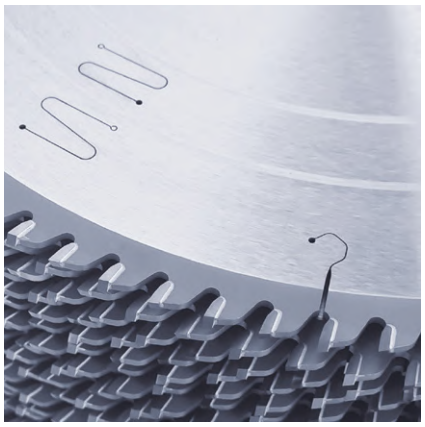
Laser Cut Steel Plates
Production process start with laser cutting of high-quality steel sheets. Cutting quality and longevity depends on the body of a tool. We use the highest quality steel which is durable, tough and flexible during cutting operations.

Expansion slots
Laser cut slots are designed to allow the blade to resist deformation from increases in temperature



HARDENING AND TEMPERING

Tool steel is processed in a special press furnace. Saw discs made of tool steel are hardened and tempered which ensures the best durability of the tool.



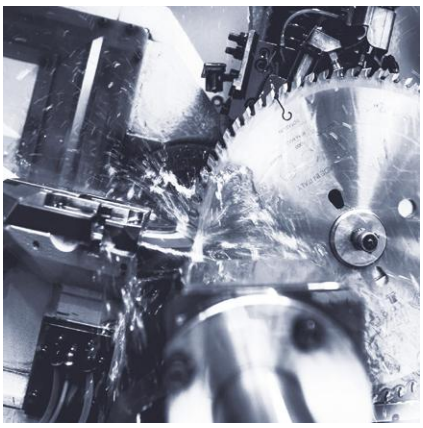
GRINDING, TENSIONING AND DISC BALANCING

To ensure the best performance of the tool, flatting and plate tensioning processes are required. Tensioning processes, dynamic balancing of the discs, and precision grinding ensure unmatched flatness, stiffness and stability in the saw bodies. Surface grinding is performed on an automated grinder, ensuring highest precision.

SOLDERING OF CARBIDE TIPS

Tips require the best quality carbide. Different applications require different gades. We have access to the widest range of HM tips and use only the highest quality carbides from top producer.

CERATIZIT GROUP



SHARPENING BLADES AND CUTTING ANGLES

Process of sharpening is imperative to the production of the tool. Fully automated and numerically controlled grinding machines allow any type of angle and shape of the blade. the innovative tooth design simplifies sharpening, greatly extending the tool's service life.

LASER MARKING

All ITA TOOS products are easy identifiable thanks to the laser marking process. A unique QR code clearly identifies the tool and allows you to track its sharpening and regeneration history.

FINAL TESTING AND QUALITY CONTROL

Quality control is our top priority. Each saw undergoes rigorous tests using the latest measurement technologies. This is a guarantee that every saw leaving our factory meets the highest quality standards.

LARGE STOCKS

We guarantee large stock levels – our tools are always available immediately.

PACKAGING AND DELIVERY

Blade packaging is made from strong and sturdy materials protecting the tool from any damage in transportation. Fast delivery thanks to the localization in the centre of Europe.

SAW TIPS FOR WOOD SAWING

from leading manufacturer CERATIZIT®

Improved carbide grades for wood sawing offer you even more flexibility: whether it is for softwood or hardwood, for the sawing of fibre or particle boards – our continuously growing selection of KCR grades has successfully proved its value on the market.

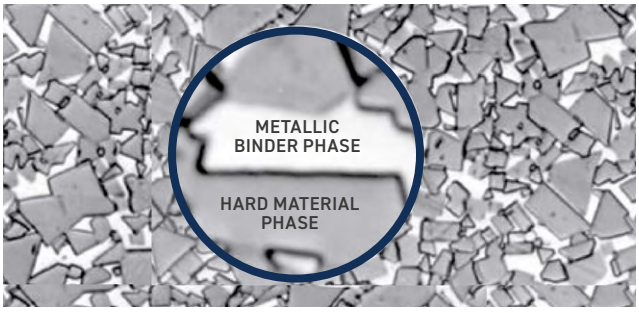
All of our carbide grades for saw tips and strobe blanks presented here can be surface-treated to simplify your brazing process, thus offering faster and easier further processing.

CHOOSE THE BEST QUALITY

Criteria relevant for application:

- Wear resistance, hardness
- Compressive strength
- Impact strength
- Transverse rupture strength
- Tribological properties
- Specific weight
- Magnetic properties
- Modulus of elasticity, rigidity
- Thermal properties
- Corrosion resistance, resistance to oxidation
- Toughness

CEMENTED CARBIDE STRUCTURE



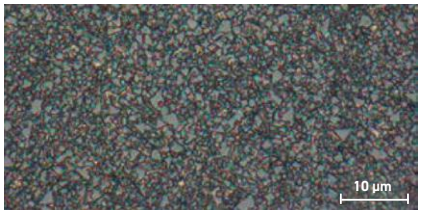
Micrograph of WC-Co carbide

The hard material provides the necessary

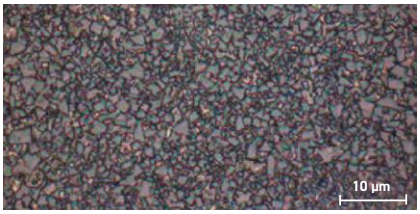
- ▲Hardness
- ▲Wear resistance

The metallic binder provides

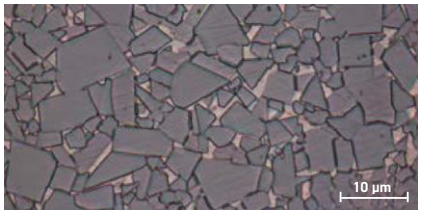
- ▲Toughness



Submicron grain



Fine / medium grain



Coarse grain

CERATIZIT® is a high-technology engineering group specialised in hard material solutions.

CERATIZIT grade code	Binder [m %]	Grain size	Hardness		Fracture toughness (KiC) [MPa*m½]	Transverse rupture strength [MPa]	Applications
			HV10	HRA			
KCR05+	3.0	ultrafine	2160	94.5	7.8	2900	CHIPBOARD
KCR06	3.0	submicron	1950	93.8	8.5	2600	SOFT WOOD
KCR10	4.0	fine	1780	91.7	10.1	2800	HARD WOOD

LASER ABLATION

The biggest advantages over other traditional sharpening methods.

We are pioneers in sharpening tools using the laser ablation method in the furniture industry.

INNOVATION

THE HIGHEST PRECISION

Maintained precision even with the most complex profiles, e.g. with tools for floor panels.

AUTOMATION

Fully automatic machines speed up the sharpening process.

INCREASED TOOL LIFE

A more precise surface of the blade translates into better machining quality and less frequently required tool's service.

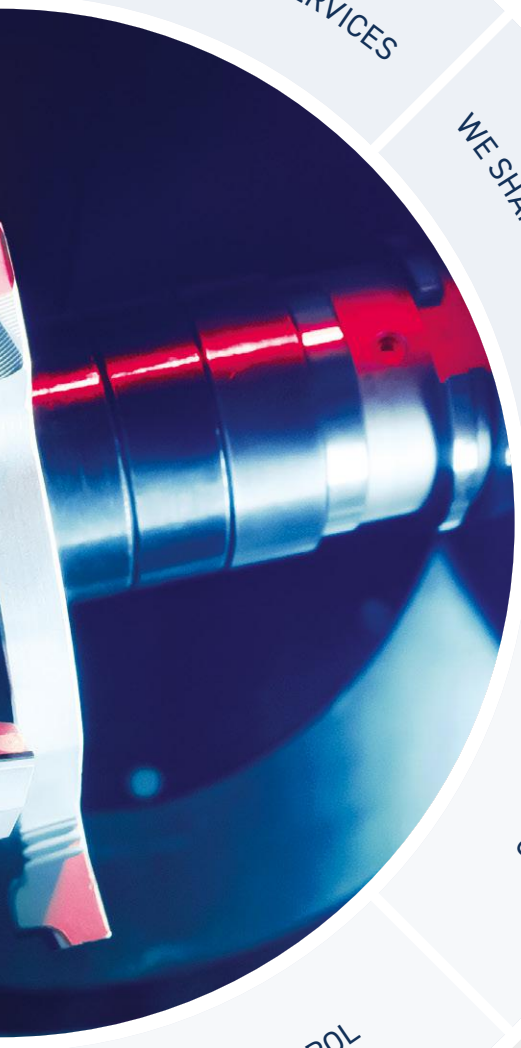
WHAT IS ABLATION?

In the ablation process, we use laser beams to remove nicks formed on the blade. Thanks to that we are obtaining unprecedented smoothness of the blade in a short time. It allows for accomplishing even better-finished surfaces of the processed materials.

- PCD is processed at the same time as well as the binder.
- Tool sharpening is possible with chip breaker.
- Perfect blade finish.
- The minimum radius is 15 µm.
- Sharpening Entire Tool Sets PCD.
- Longer tool life.

We sharpen tools with a diameter of **up to 320 mm**, height **up to 350 mm**, weight **up to 25 kg**.

WIDE RANGE OF SERVICES



WE SHARPEN EVERY ANGLE

Thanks to the laser, we are able to sharpen the angle from 15 microns.

OPTIMIZATION

We have the ability to sharpen the entire set of tools in one cycle, without the need to disassemble the tool, while maintaining an even diameter of the blades.

QUALITY CONTROL

Thanks to the built-in camera, the grade of the tools is checked before each sharpening which allows to determine the minimum amount of material that should be collected in order to sharpen the tool as well as possible.

B2B SALES SYSTEM

Cooperation at the highest level

PERMANENT ACCESS TO THE SYSTEM 24/7

Unlimited access to the company ITA TOOLS

ACCESS TO INVOICES AND PAYMENTS

Download invoices directly from your account.

INTUITIVE PROCESS OF PRODUCT ORDERING

Simple way for placing orders independently.

SIMPLE PRODUCT SEARCHING SYSTEM

Wide range of filters enabling the selection of appropriate tools.

INTUITIVE AND USER FRIENDLY SYSTEM

System is based on the most common customer requirements and is constantly being developed.

SCAN THE CODE
AND FILL OUT THE FORM

Further information about the B2B sales system can be found here:

www.b2b-itatools.pl

SEARCH PRODUCT BY THE TYPE OF MACHINE

Filters enabling the selection of both tools for machines as well as blades for power tools.

ORDER STATUS MONITORING

The ability to check order status on your own.

ACCESS TO THE ORDER HISTORY AND INVOICES

Full history track of your offers, orders, invoices in one place.

ACCESS TO STOCK

Access to actual product stock 24/7.

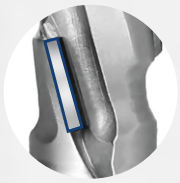
ACCESS TO ACTUAL PROMOTIONS

Instant information about all current promotions for B2B users.

Database of dedicated tools for Beam Saws and Edgebanders.

DIAMOND ROUTER BITS

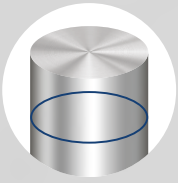
ITA TOOLS production



Polished back edge of PCD insert
reduces chip adhesion.

Deep channels for
easy chip ejection.

Ideal for machining
wood-based and
composite materials.



H6 chuck tolerance
reduces run-out increasing tool life.

PCD from
top quality
European
manufactures.

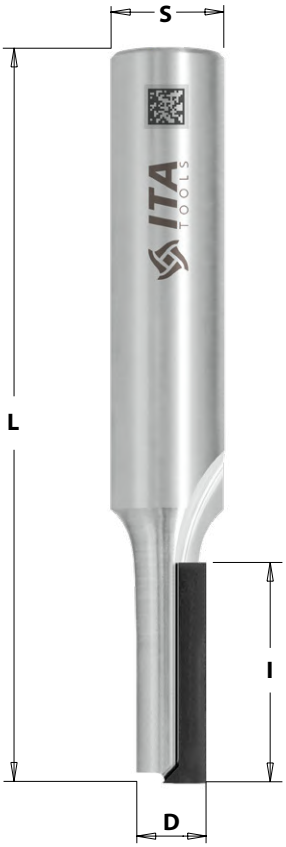
PCD teeth sharpened with an innovative **laser ablation method**. The previously unseen sharpness of the teeth translates into an ideal surface of the processed material.

Special design
reduces noise level
during working.

Dynamic balancing in G2.5 class
eliminates vibrations even at maximum speed.

Shank surface roughness Ra ≤ 0,3 µm
reduces CNC spindle wear and eliminates runout.

DT1



Z1 | RH | LASER ABLATION

Technical details:

- One full negative or straight PCD blade
- Body made from tungsten carbide hardness of 93,8 HRA
- Can be resharpened:
  H2,5 - (2-3 sharpening operations),
  H3 - (3-4 sharpening operations)

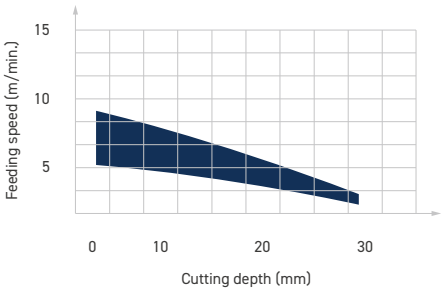
Application:

CUTTING | JOINTING | RABBETING | GROOVING

Materials:

RAW MDF ●●● | LAMINATED MDF ●●● | RAW CHIPBOARD ●●● | LAMINATED CHIPBOARD ●●● | PLYWOOD ●○○

LAMINATED PLYWOOD ●○○ | GLASS FIBER/ CARBON FIBER ●○○ | CORIAN® / HPL ●○○ | ALUMINIUM ●○○ | FIBER CEMENT ●○○



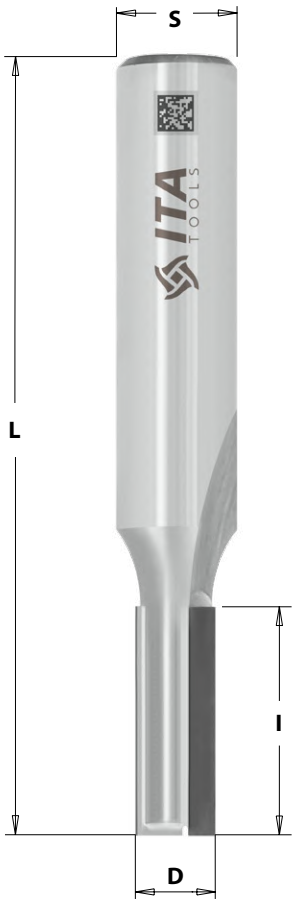
Results shown in this diagram are purely empirical, based merely on informative and could change depending of kind of work and type of material.

D mm	I mm	L mm	S mm	Z	α	PCD H mm	BODY	ARTICLE
4	12	70	6	1	0°	2,5	HM	DT1.04.012.06.0MR
5	10	60	6	1	Neg.	3,0	HM	DT1.05.010.06.0MR
5	20	70	6	1	Neg.	3,0	HM	DT1.05.020.06.0MR
6	12	60	6	1	Neg.	3,0	HM	DT1.06.012.06.0MR

Table continued on the next page ▶

D mm	I mm	L mm	S mm	Z	α	PCD H mm	BODY	ARTICLE
6	12	70	8	1	Neg.	3,0	HM	DT1.06.012.08.0MR
6	12	70	10	1	Neg.	3,0	HM	DT1.06.012.10.0MR
6	20	70	6	1	0°	3,0	HM	DT1.06.020.06.0MR
6	22	75	12	1	Neg.	3,0	HM	DT1.06.022.12.0MR
6,4	12,7	64,5	6,4	1	Neg.	2,5	HM	DT1.06.012.06.5MR2
8	15	70	8	1	Neg.	3,0	HM	DT1.08.015.08.0MR
8	20	70	8	1	Neg.	3,0	HM	DT1.08.020.08.0MR
8	23	75	12	1	0°	3,0	HM	DT1.08.023.12.0MR
9,5	15,9	77,2	9,5	1	Neg.	5	HM	DT1.09.015.09.5MR
10	15	70	10	1	Neg.	3,0	HM	DT1.10.015.10.0MR
12	20	73	12	1	Neg.	3,0	HM	DT1.12.020.12.0MR

DT2



Z2 | RH | LASER ABLATION

Technical details:

- Two full negative or straight PCD tips
- Body made from tungsten carbide hardness of 93,8 HRA or stainless steel
- Can be resharpened:
  H2 - (2-3 sharpening operations),
  H3 - (3-4 sharpening operations)

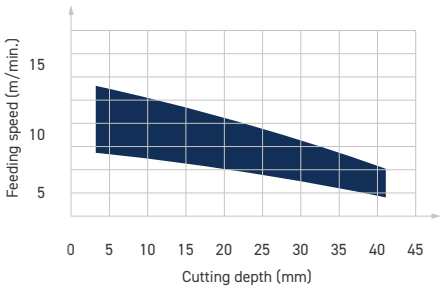
Application:

CUTTING | JOINTING | RABBETING | GROOVING

Materials:

RAW MDF ●●● | LAMINATED MDF ●●● | RAW CHIPBOARD ●●● | LAMINATED CHIPBOARD ●●● | FIBER CEMENT ●●●

GLASS FIBER/ CARBON FIBER ●●○ | CORIAN® / HPL ●●○ | PLYWOOD ●○○ | LAMINATED PLYWOOD ●○○ | ALUMINIUM ●○○



Results shown in this diagram are purely empirical, based merely on informative and could change depending of kind of work and type of material.

D mm	I mm	L mm	S mm	Z	α	PCD H mm	BODY	ARTICLE
6	10	75	12	2	Neg.	3,0	HM	DT2.06.010.12.0MR
6,4	12,7	71	9,5	2	0°	2,5	HM	DT2.06.012.09.5MR
6,4	19	63,5	6,4	2	0°	2	HM	DT2.06.019.06.5MR
8	15	70	8	2	Neg.	3,0	HM	DT2.08.015.08.0MR

Table continued on the next page ▶

D mm	I mm	L mm	S mm	Z	α	PCD H mm	BODY	ARTICLE
8	15	70	10	2	Neg.	3,0	HM	DT2.08.015.10.0MR
8	20	70	8	2	Neg.	3,0	HM	DT2.08.020.08.0MR
8	22	75	12	2	Neg.	3,0	HM	DT2.08.022.12.0MR
9	15	71,5	10	2	Neg.	2,5	HM	DT2.09.015.10.2MR
9	15	71,5	10	2	Neg.	2,5	HM	DT2.09.021.10.2MR
9,5	12,7	70	12,7	2	0°	2,5	HM	DT2.09.012.12.5MR
9,5	22,2	76,5	9,5	2	0°	3,5	HM	DT2.09.022.09.5MR
10	10	73	12	2	Neg.	3,0	HM	DT2.10.010.12.0MR
10	15	70	10	2	Neg.	3,0	HM	DT2.10.015.10.0MR
10	22	70	12	2	Neg.	3,0	HM	DT2.10.022.12.0MR
10	15	70	8	2	Neg.	3,0	HM	DT2.10.015.08.0MR
12	15	73	12	2	Neg.	3,0	HM	DT2.12.015.12.0MR
12	20	73	12	2	Neg.	3,0	HM	DT2.12.020.12.0MR
12,7	15,9	71,5	12,7	2	Neg.	2,5	HM	DT2.12.015.12.5MR

Sizes in inches:

D inch	I inch	L inch	S inch	Z	α	PCD H mm	BODY	ARTICLE
1/4	1/2	2 3/4	1/4	2	0°	2,5	HM	DT2.06.012.12.5MR
1/4	3/4	2 3/4	1/4	2	0°	2,0	HM	DT2.06.019.06.5MR
3/8	1/2	2 3/4	1/2	2	0°	2,5	HM	DT2.09.012.12.5MR
3/8	7/8	3	3/8	2	0°	3,0	HM	DT2.09.022.09.5MR
1/2	1	3	1/2	2	Neg.	3,0	HM	DT2.12.025.12.5MR

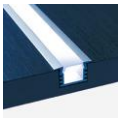
DT2
LED

Z2 | RH | LASER ABLATION

Technical details:

- Two full positive and negative PCD tips
- Body made from stainless steel
- Can be resharpened:
  H2 - (2-3 sharpening operations)

Application:



GROOVING LED

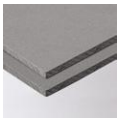
Materials:

RAW MDF ●●●

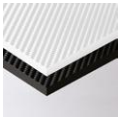
LAMINATED MDF ●●●

RAW CHIPBOARD ●●●

LAMINATED CHIPBOARD ●●●



FIBER CEMENT ●●●



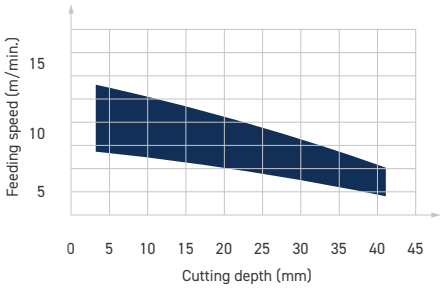
GLASS FIBER/ CARBON FIBER ●●○

CORIAN® / HPL ●●○

PLYWOOD ●○○

LAMINATED PLYWOOD ●○○

ALUMINIUM ●○○



Results shown in this diagram are purely empirical, based merely on informative and could change depending of kind of work and type of material.

D mm	I mm	L mm	S mm	Z	α	PCD H mm	BODY	ARTICLE
14	12	60	8	2	Pos./Neg.	2,0	STAINLESS STEEL	DT2.14.012.08.0SR
15	12	60	8	2	Pos./Neg.	2,0	STAINLESS STEEL	DT2.15.012.08.0SR
16	12	63	8	2	Pos./Neg.	2,0	STAINLESS STEEL	DT2.16.012.08.0SR
17	12	60	8	2	Pos./Neg.	2,0	STAINLESS STEEL	DT2.17.012.08.0SR
18	12	63	8	2	Pos./Neg.	2,0	STAINLESS STEEL	DT2.18.012.08.0SR

DTS
positive-negative

Z2+1 | RH | LASER ABLATION

Technical details:

- Two full positive and negative PCD blades
- Body made from tungsten carbide hardness of 93,8 HRA, DENSIMET® or stainless steel
- Can be resharpened:
  H3,5 - (3-5 sharpening operations)
- PCD plunge tip at the bottom to drill

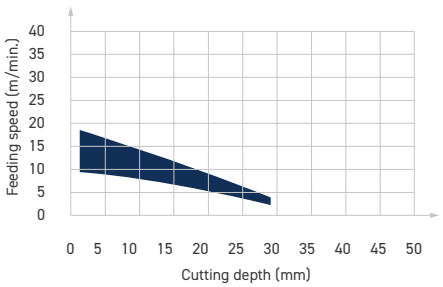
Application:

CUTTING | NESTING | JOINTING | RABBETING | GROOVING

Materials:

RAW MDF	LAMINATED MDF	RAW CHIPBOARD	LAMINATED CHIPBOARD	FIBER CEMENT
●●●	●●●	●●●	●●●	●●●

GLASS FIBER/ CARBON FIBER	CORIAN® /HPL	PLYWOOD	LAMINATED PLYWOOD	ALUMINIUM
●●●	●●●	●●○	●●○	●○○



Results shown in this diagram are purely empirical, based merely on informative and could change depending of kind of work and type of material.

D mm	I mm	L mm	S mm	Z	α	PCD H mm	BODY	ARTICLE
8	15	70	8	2+1	Pos.-Neg.	3,5	HM	DTS.08.015.08.0MR
8	15	70	12	2+1	Pos.-Neg.	3,5	DENSIMET®	DTS.08.015.12.0DR
8	20	70	12	2+1	Pos.-Neg.	3,5	DENSIMET®	DTS.08.020.12.0DR

Table continued on the next page ▶

D mm	I mm	L mm	S mm	Z	α	PCD H mm	BODY	ARTICLE
10	15	70	10	2+1	Pos.-Neg.	3,5	HM	DTS.10.015.10.0MR
10	15	70	12	2+1	Pos.-Neg.	3,5	DENSIMET®	DTS.10.015.12.0DR
10	20	70	12	2+1	Pos.-Neg.	3,5	DENSIMET®	DTS.10.020.12.0DR
12	15	70	12	2+1	Pos.-Neg.	3,5	HM	DTS.12.015.12.0MR
12	15	70	12	2+1	Pos.-Neg.	3,5	DENSIMET®	DTS.12.015.12.0DR
12	20	70	12	2+1	Pos.-Neg.	3,5	HM	DTS.12.020.12.0MR
12	20	70	12	2+1	Pos.-Neg.	3,5	DENSIMET®	DTS.12.020.12.0DR
12	25	70	12	2+1	Pos.-Neg.	3,5	DENSIMET®	DTS.12.025.12.0DR
12,7	25,4	76	12,7	2+1	Pos.-Neg.	3,5	HM	DTS.12.025.12.5MR
20	25	70	20	2+1	Pos.-Neg.	3,5	STAINLESS STEEL	DTS.20.025.20.0SR

FDT | FDH

Z2 | RH | LASER ABLATION

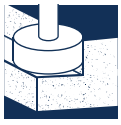
Technical details:

- Full double PCD tips,
- Body made from stainless steel > 28 HRC
- Approval class of shank H6
- The shank surface roughness Ra ≤0,3 µm
- Height of PCD tip 4 mm
- Can be resharpened (3-4 times)

Advantages:

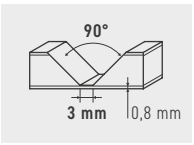
Excelent finish of machining elements, quiet work.

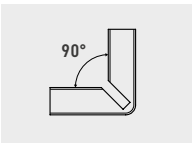
Application:



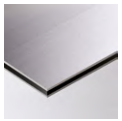
RABBETING

BENDING



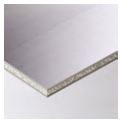


Materials:



ALUCOBOND®

●●●



ALUCOBOND® A2

●●●

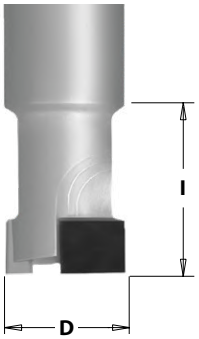
FDT for Cutting:

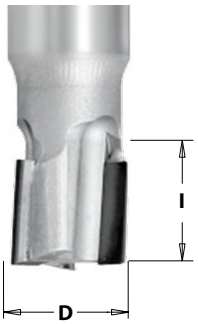
D mm	D_1 mm	I mm	L mm	S mm	α	ARTICLE
12	7	6,5	80	12	45°	FDT.12.006.12.0SR

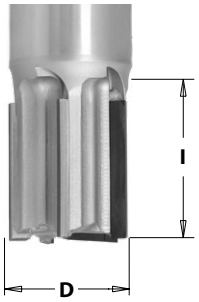
FDH for Bending:

D mm	D_1 mm	I mm	L mm	S mm	α	ARTICLE
12	2	6	55	12	45°	FDH.12.006.12.0SR
18	3	7,75	50	16	45°	FDH.18.007.16.0SR

DT1/2/3/R/5







RH

LASER ABLATION

Technical details:

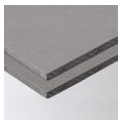
- PCD tips,
- Body made from stainless steel > 28 HRC + HM + DENSIMET
- Approval class of shank H6
- The shank surface roughness Ra ≤0,3 µm
- Can be resharpened (3-4 times)

Application:

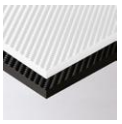
CUTTING

GROOVING

Materials:



FIBER CEMENT ●●●



GLASS FIBER/ CARBON FIBER ●●●

CORIAN® /HPL ●●●

ALUMINIUM ●●●

D mm	I mm	L mm	S mm	Z	PCD H mm	BODY	ARTICLE
6	5	50	6	1	3	HM	DT1.06.005.06.0MR
6	11	50	6	1	3	HM	DT1.06.011.06.0MR
12	5	55	12	2	2,5	STAINLESS STEEL	DT2.12.005.12.0SR
12	15	85	12	3	3	STAINLESS STEEL	DT3.12.015.12.0SR
12	15	70	12	3	3,5	DENSIMET®	DT3.12.015.12.0DR
12	15	70	12	4	3	DENSIMET®	DTR.12.019.12.0DR*
16	10	130	16	5	3	STAINLESS STEEL	DT5.16.010.16.2SR
18	22	100	20	5	3	STAINLESS STEEL	DT5.18.022.20.0SR
20	22	80	20	5	3	STAINLESS STEEL	DT5.18.022.20.0SR

*with chipbreaker

SPIRAL BITS FOR COMPOSITES

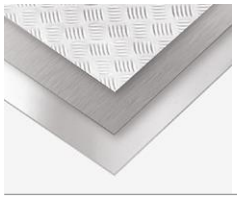
Tool personalization,
wide rande of geomatries
and sizes.

Processing of composite
materials, plastics, aluminum.

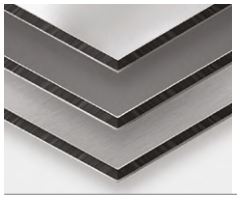
High stock of standard
dimensions – available
24/7

Materials

Plexi
Material commonly used as an alternative to glass due to its lightweight nature, shatter-resistant properties, and optical clarity. It is highly durable, resistant to UV light, and can be easily molded or shaped into different forms, making it versatile for a wide range of applications.

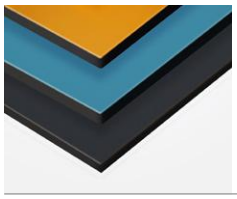


Aluminum Plates
Material available in various sizes and thicknesses.
Hot and cold rolled plates, which allows them to maintain their excellent parameters. Aluminum plates are characterized primarily by ease of processing.

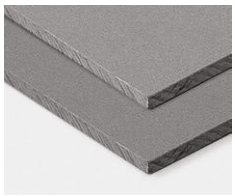


Composite Board AL/PE/AL
Material characterized by lightness, stiffness and durability. They are made of two layers of aluminum with a thickness of 0.3 - 0.5 mm, connected by a core made of low-density polyethylene.
Materials with names such as **ALUCOBOND®, DIBOND®, STACBOND®,PLABOND®**

Composite Board A2
Material characterized by lightness, stiffness and durability. They are made of two layers of aluminum with a thickness of 0.3-0.5 mm, connected by a non-flammable mineral core.
Materials with names such as **ETALBOND®A2, QBOND®A2**

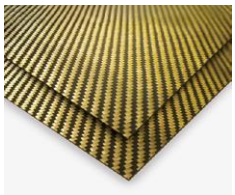


High Pressure Laminate
Laminate produced under high pressure. This type of boards are made of several or a dozen or so layers of paper impregnated with resin. Under great pressure and high temperature, an extremely resistant material with very good visual properties is created.



Fiber Cement Board
Fiber-cement boards are made of cement, minerals,
cellulose fibers and fillers. During the production process, thin layers of material are placed on top of each other and then, after completing the slow hardening process, very tightly compressed.

CFK
Carbon Fiber Reinforced Plastic is a high-performance composite material made from carbon fibers embedded in a polymer resin matrix. It is known for its exceptional strength-to-weight ratio, making it significantly lighter yet stronger than traditional materials like steel or aluminum.



GFK
Glass Fiber Reinforced Plastic, also known as GRP is a composite material made from a polymer matrix reinforced with glass fibers. It is known for its excellent strength-to-weight ratio, durability, and resistance to environmental factors such as moisture, chemicals, and UV radiation.

PROTECTIVE COATING:

A coating is a layer that covers the surface of an object. Its main function is to protect or improve the mechanical, physical or chemical properties of the tool.

For tribological coatings that are mainly used to optimize friction coefficient, the thickness is usually between 1 to 5 microns.

Advantages of using protective coatings on tools are as follows:

- Tools become more resistant to abrasion
- Friction coefficient is reduced
- Corrosion resistance of the tools is increased
- Tool wear is slowed down, which leads to longer tool life
- Adhesion of the processed material to the surface is reduced
- Operating parameters such as feed and rotational speed can be increased, compared to uncoated tools
- Work optimization is increased by reducing downtime needed for tool replacement.

Coating Specification:

NAME	HARDNESS GPa	HARDNESS HV 0,05	FRICTION COEFFICIENT	COATING THICKNESS µm	INDEX
AlTiN	33	3350	0,5	1-4	**.ATR**
TiSiN	35	3570	0,5	1-4	**.TSR**
NaDia	36	3650	0,01-0,05	1-4	**.XTR**
PLATINIUM	30	3000	0,2	1-4	**.PR**
HC	50-60	5000-6000	0,1-0,2	1-2	**.HCR**

Application:

MATERIALS	TiSiN	AlTiN	NaDia	PLATINUM	HC
Solid Wood	★	-	★	★	★
Chipboard	★	-	★	★	★
Plywood	★	-	★	★	★
Aluminum	-	★	★	-	★
Plastics	★	★	★	-	★
Composites	-	★	★	-	★

★ - Recommended coating

AlTiN Coating

Specification:

- Colour: Anthracite
- Hardness: 5000-6000[HV 0,05]
- Thickness: 1-2[µm]
- Ffriction coefficient: 0,1-0,2
- Index: .HCR/L

Application:

- Automotive industry
- Airline industry
- Production of injection molds

Information:

The HC coating is known for its high hardness, which makes it perfect for processing aluminum alloys and composite materials. It is thinner than standard PVD coatings, resulting in a sharper cutting edge. Moreover, it enhances the heat resistance of the tool by reducing the coefficient of friction and preventing the material being processed from sticking to the tool.

TiSiN Coating

Specification:

- Colour: Copper-like
- Hardness: 3570 [HV 0,05]
- Thickness: 1-4 [µm]
- Friction coefficient: 0,5
- Index: .TSR

Application:

- Solid wood
- Laminated chipboard
- Plywood
- Aluminum
- Plastics

Information:

The coating exhibits excellent wear resistance even at high temperatures, allowing for prolonged tool life and reduced need for replacement.

NaDia Coating

Specification:

- Colour: Black
- Hardness: 3650 [HV 0,05]
- Thickness: 1-4 [µm]
- Friction coefficient: 0.01-0.05
- Index: .XTR

Application:

- Solid wood
- Laminated chipboard
- Plywood
- Aluminum
- Plastics

Information:

The coating has been developed to meet the specific needs of the wood industry. It is highly durable and can also be used in the processing of aluminum and plastics. This coating is unique in that it is applied at low temperatures, resulting in increased hardness and a lower friction coefficient.

PLATINIUM Coating

Specification:

- Colour: Nonuniform (gold, purple, blue)
- Hardness: 300 [HV 0,05]
- Thickness: 1-4 [µm]
- Friction coefficienta: 0.02
- Index: .PR

Application:

- MDF
- Laminated chipboard
- Chipboard
- Plywood

Information:

Introducing an innovative two-layer PVD coating designed specifically for processing hard materials. This unique combination of hard and tribological layers allows for the optimization of the friction coefficient, significantly reducing the sticking of processed materials on the tool surface. By applying this coating, you can extend the life of your tool significantly while achieving the highest quality results after processing.

HC Coating

Specification:

- Colour: Gray
- Hardness: 3350 [HV 0,05]
- Thickness: 1-4 [µm]
- Friction coefficient: 0,5
- Index: .ATR

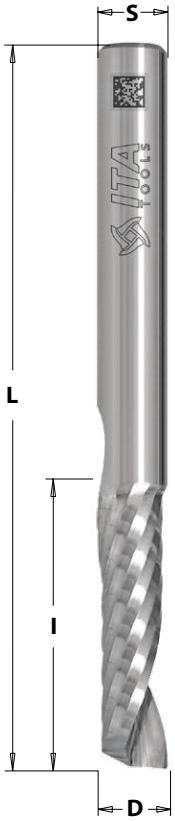
Application:

- Aluminum
- Plastics
- Composite materials

Info:

Coating with hardness and high player performance. Available in aluminum alloys with a higher admixture of silicon, the additional coating slows down the process of tool use and the sticking of cuttings to the cutting edges.

ST01 - 198RP
positive



VHM | Z1

Technical details:

- 1 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking

Application:

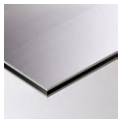

CUTTING

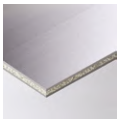

JOINTING

Materials:


PLEXI ●●●


PLASTICS ●●●


ALUCOBOND® ●●○


ALUCOBOND® A2 ●●○


CORIAN® / HPL ●○○


RAW MDF ●○○


RAW CHIPBOARD ●○○

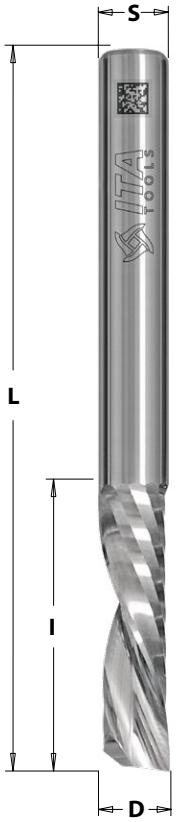
D mm	I mm	L mm	S mm	ARTICLE
2	6	60	6	ST01.02.006.060.06R
3	6	60	3	ST01.03.006.060.03R
3	6	60	6	ST01.03.006.060.06R
3	10	60	6	ST01.03.010.060.06R
3	12	60	3	ST01.03.012.060.03R
3	12	60	6	ST01.03.012.060.06WR
3	22	60	3	ST01.03.022.060.03R
3	22	60	6	ST01.03.022.060.06R
4	8	60	4	ST01.04.008.060.04R
4	8	60	6	ST01.04.008.060.06R
4	12	60	4	ST01.04.012.060.04R

Table continued on the next page ▶

D mm	I mm	L mm	S mm	ARTICLE
4	12	60	6	ST01.04.012.060.06R
4	15	60	4	ST01.04.015.060.04R
4	15	60	6	ST01.04.015.060.06R
4	22	60	6	ST01.04.022.060.06R
5	12	60	6	ST01.05.012.060.06R▲
5	15	60	5	ST01.05.015.060.05R
5	15	60	6	ST01.05.015.060.06R
5	40	100	8	ST01.05.040.100.08R
6	12	60	6	ST01.06.012.060.06R
6	22	60	6	ST01.06.022.060.06R
6	32	70	6	ST01.06.032.070.06R
8	22	60	8	ST01.08.022.060.08R
8	32	80	8	ST01.08.032.080.08R
10	35	80	10	ST01.10.035.080.10R
10	42	80	10	ST01.10.042.080.10R
10	55	100	10	ST01.10.055.100.10R
12	35	80	12	ST01.12.035.080.12R
12	42	90	12	ST01.12.042.090.12R

Detailed information on protective coatings can be found on pages: 58-61.

ST51 -198RPn
negative



VHM | Z1 | RH

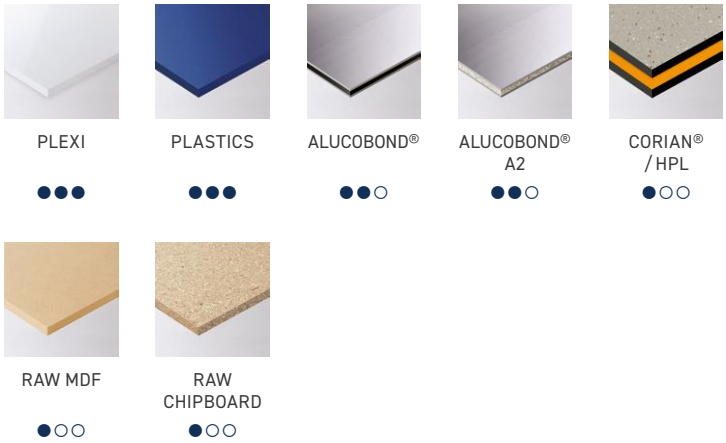
Technical details:

- 1 flute spiral cutter
- Negative - downward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking

Application:

CUTTING | JOINTING | RABBETING | GROOVING

Materials:



PLEXI	PLASTICS	ALUCOBOND®	ALUCOBOND® A2	CORIAN® / HPL
●●●	●●●	●●○	●●○	●○○

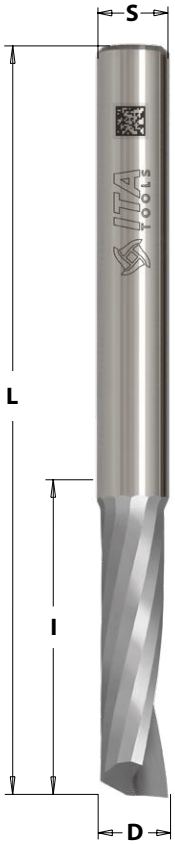
RAW MDF	RAW CHIPBOARD
●○○	●○○

D mm	I mm	L mm	S mm	ARTICLE
2	6	60	6	ST51.02.006.060.06R
3	6	60	3	ST51.03.006.060.03R
3	6	60	6	ST51.03.006.060.06R
3	12	60	3	ST51.03.012.060.03R
3	12	60	6	ST51.03.012.060.06R
4	8	60	4	ST51.04.008.060.04R
4	8	60	6	ST51.04.008.060.06R
4	12	60	4	ST51.04.012.060.04R
4	12	60	6	ST51.04.012.060.06R
5	15	60	5	ST51.05.015.060.05R
5	15	60	6	ST51.05.015.060.06R
6	12	60	6	ST51.06.012.060.06R

Detailed information on protective coatings can be found on pages: 58-61.

ST28 - 198RPs
positive

VHM | Z1 | RH



Technical details:

- 1 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking
- Low helix prevents lifting material
- Perfect for thin materials from 1mm to 8mm

Application:

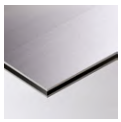

CUTTING

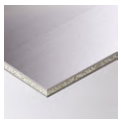

JOINTING

Materials:


PLEXI ●●●


PLASTICS ●●●


ALUCOBOND® ●●○


ALUCOBOND® A2 ●●○


CORIAN® / HPL ●○○


RAW MDF ●○○


RAW CHIPBOARD ●○○

D mm	I mm	L mm	S mm	ARTICLE
2	6	60	3	ST28.02.006.060.03R
3	8	60	3	ST28.03.008.060.03R
3	12	60	3	ST28.03.012.060.03R
3	12	60	6	ST28.03.012.060.06R
4	8	60	4	ST28.04.008.060.04R
4	12	60	4	ST28.04.012.060.04R
4	12	60	6	ST28.04.012.060.06R
4	22	60	6	ST28.04.022.060.06R
5	8	60	5	ST28.05.008.060.05R
5	12	60	6	ST28.05.012.060.06R

Table continued on the next page ▶

D mm	I mm	L mm	S mm	ARTICLE
6	12	60	6	ST28.06.012.060.06R
6	22	60	6	ST28.06.022.060.06R
8	12	60	8	ST28.08.012.060.08R
10	22	60	10	ST28.10.022.060.10R

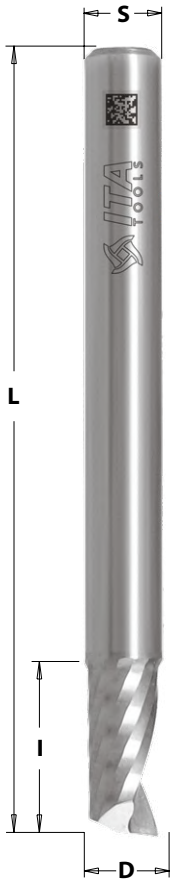
Sizes in inches:

D inch	I inch	L inch	S inch	ARTICLE
1/8	5/16	2 1/2	1/8	ST28.32.794.635.32R
3/16	5/16	2 1/2	3/16	ST28.48.794.635.48R
3/16	5/8	2 1/2	3/16	ST28.48.159.635.48R
1/4	1/2	2 1/2	1/4	ST28.64.127.635.64R
1/4	1	2 1/2	1/4	ST28.64.254.635.64R
3/8	1	2 1/2	3/8	ST28.95.254.635.95R

Detailed information on protective coatings can be found on pages: 58-61.

ST36 - 198RPf
Super Finish
positive

NEW | VHM | Z1 | RH



Technical details:

- 1 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking
- Special geometry for mirror-like finish

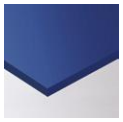
Application:

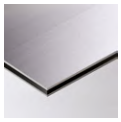

CUTTING

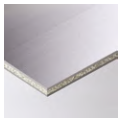

JOINTING

Materials:


PLEXI ●●●


PLASTICS ●●●


ALUCOBOND® ●●○


ALUCOBOND® A2 ●●○


CORIAN® / HPL ●○○

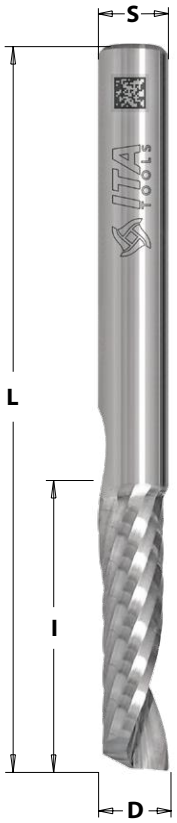

RAW MDF ●○○


RAW CHIPBOARD ●○○

D mm	I mm	L mm	S mm	ARTICLE
2	7	60	6	ST36.02.007.060.06R
3	7	60	6	ST36.03.007.060.06R
3	12	60	6	ST36.03.012.060.06R
4	8	60	6	ST36.04.008.060.06R
4	13	60	6	ST36.04.013.060.06R
5	15	60	6	ST36.05.015.060.06R
6	12	60	6	ST36.06.012.60.060R
6	22	60	6	ST36.06.022.060.06R
8	32	80	8	ST36.08.032.080.08R

Detailed information on protective coatings can be found on pages: 58-61.

SP01 - 198Ra
positive



VHM | Z1 | RH

Technical details:

- 1 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking

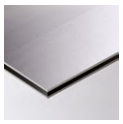
Application:

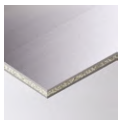

CUTTING


JOINTING

Materials:


ALUMINUM ●●●


ALUCOBOND® ●●●


ALUCOBOND® A2 ●●●


PLASTICS ●●○


CORIAN® / HPL ●○○


RAW MDF ●○○


RAW CHIPBOARD ●○○

D mm	I mm	L mm	S mm	ARTICLE
3	6	60	3	SP01.03.006.060.03R
3	6	60	6	SP01.03.006.060.06R
3	12	60	3	SP01.03.012.060.03R
3	12	60	6	SP01.03.012.060.06R
3	22	60	6	SP01.03.022.060.06R
4	8	60	4	SP01.04.008.060.04R
4	8	60	6	SP01.04.008.060.06R
4	12	60	4	SP01.04.012.060.04R
4	12	60	6	SP01.04.012.060.06R
4	15	60	6	SP01.04.015.060.06R
4	22	60	6	SP01.04.022.060.06R

Table continued on the next page ▶

D mm	I mm	L mm	S mm	ARTICLE
5	15	60	5	SP01.05.015.060.05R
5	15	60	6	SP01.05.015.060.06R
6	12	60	6	SP01.06.012.060.06R
6	22	60	6	SP01.06.022.060.06R
8	22	60	8	SP01.08.022.060.08R
8	22	70	8	SP01.08.022.070.08R
8	32	80	8	SP01.08.032.080.08R
8	45	100	8	SP01.08.045.100.08R
10	22	60	10	SP01.10.022.060.10R
10	35	80	10	SP01.10.035.080.10R
10	42	80	10	SP01.10.042.080.10R
10	55	100	10	SP01.10.055.100.10R
12	35	80	12	SP01.12.035.080.12R
12	42	90	12	SP01.12.042.090.12R

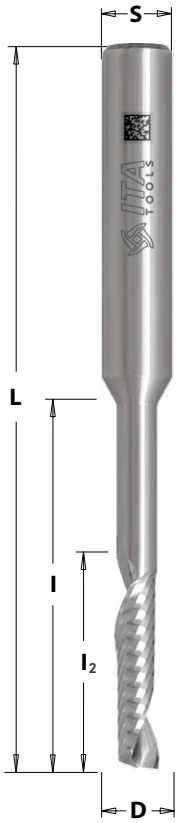
Sizes in inches:

D inch	I inch	L inch	S inch	ARTICLE
1/8	1/4	2 1/2	1/8	SP01.32.635.635.32R
1/8	1/2	2 1/2	1/8	SP01.32.127.635.32R
3/16	5/16	2 1/2	3/16	SP01.48.794.635.48R
3/16	5/8	2 1/2	3/16	SP01.48.159.635.48R
1/4	1/2	2 1/2	1/4	SP01.64.127.635.64R
1/4	1	2 1/2	1/4	SP01.64.254.635.64R
3/8	1	2 1/2	3/8	SP01.95.254.635.95R
1/2	1 1/2	3 1/2	1/2	SP01.13.381.889.13R

Detailed information on protective coatings can be found on pages: 58-61.

SP02
positive

NEW | VHM | Z1 | RH



Technical details:

- Single blade cutter, positive with lowering
- Perfect finishing of cutting edge - the polished chip groove
- Chip discharge upward
- Special type of carbide - increased tool life
- Possibility of using variety coatings
- Cutting, grooving
- Spiral angle 30°

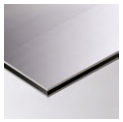
Application:

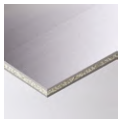

CUTTING


JOINTING

Materials:


ALUMINUM ●●●


ALUCOBOND® ●●●


ALUCOBOND® A2 ●●●

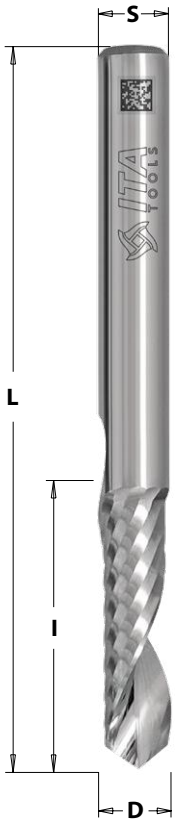

PLASTICS ●●○


ALU / PVC PROFILES ●●●

D mm	l mm	l_2 mm	L mm	S mm	Z	ARTICLE
3	40	16	80	8	1	SP02.03.016.080.08R
4	40	16	80	8	1	SP02.04.016.080.08R
5	40	20	80	8	1	SP02.05.020.080.08R
6	40	22	80	8	1	SP02.06.022.080.08R
8	45	25	100	8	1	SP02.08.025.100.08R
10	40	20	80	10	1	SP02.10.020.080.10R
10	60	15	100	10	1	SP02.10.015.100.10R
10	80	22	120	10	1	SP02.10.022.120.10R

Detailed information on protective coatings can be found on pages: 58-61.

SP15
positive



VHM | Z1 | RH

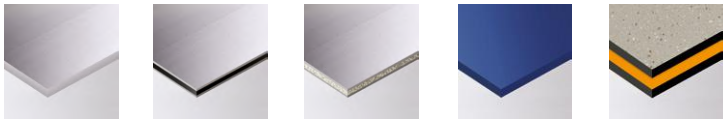
Technical details:

- 1 flute spiral cutter
- Positive withdrilling V-point 90°
- Finishing geometry
- Polished spiral prevents material sticking

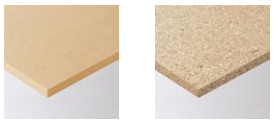
Application:

CUTTING | JOINTING | RABBETING | GROOVING

Materials:



ALUMINIUM ●●● | ALUCOBOND® ●●● | ALUCOBOND® A2 ●●● | PLASTICS ●●○ | CORIAN® / HPL ●○○

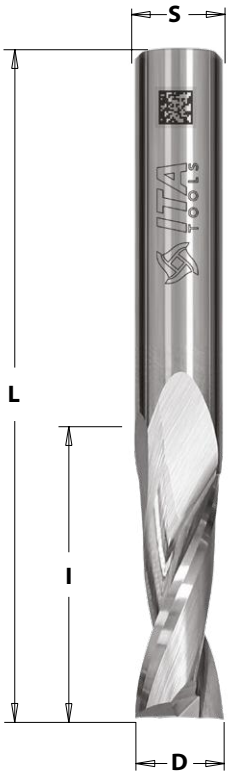


RAW MDF ●○○ | RAW CHIPBOARD ●○○

D mm	I mm	I_2 mm	L mm	S mm	Z	ARTICLE
5	25	35	80	8	1	SP15.05.025.080.08R
5	25	45	100	8	1	SP15.05.025.100.08R
5	35	55	100	8	1	SP15.05.035.100.08R
6	25	45	80	8	1	SP15.06.025.080.08R

Detailed information on protective coatings can be found on pages: 58-61.

SQ01 - 186Ra
positive



VHM | Z2 | RH

Technical details:

- 2 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking

Application:

CUTTING

JOINTING

Materials:

ALUMINIUM ●●●

RAW MDF ●●○

RAW CHIPBOARD ●●○

PLASTICS ●○○

CORIAN® / HPL ●○○

D mm	I mm	L mm	S mm	ARTICLE
3	10	60	3	SQ01.03.010.060.03R
3	12	60	6	SQ01.03.012.060.06R
4	10	60	4	SQ01.04.010.060.04R
4	12	60	6	SQ01.04.012.060.06R
5	12	60	5	SQ01.05.012.060.05R
5	22	60	5	SQ01.05.022.060.05R
6	12	60	6	SQ01.06.012.060.06R
6	22	60	6	SQ01.06.022.060.06R
6	40	120	6	SQ01.06.040.120.06R
8	22	60	8	SQ01.08.022.060.08R
8	35	80	8	SQ01.08.035.080.08R
8	40	100	8	SQ01.08.040.100.08R
10	22	60	10	SQ01.10.022.060.10R
10	35	80	10	SQ01.10.035.080.10R
10	45	100	10	SQ01.10.045.100.10R

Table continued on the next page ▶

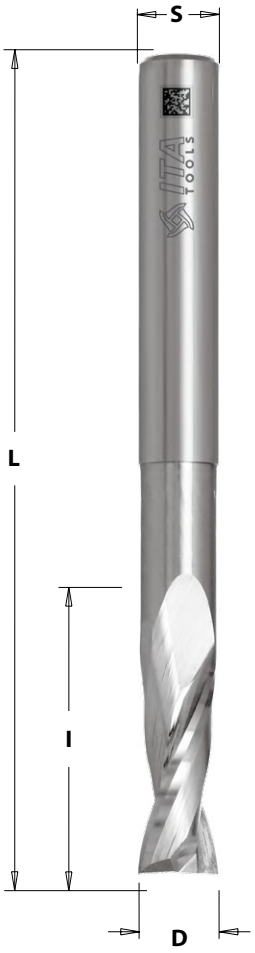
D mm	I mm	L mm	S mm	ARTICLE
12	25	70	12	SQ01.12.025.070.12R
12	42	90	12	SQ01.12.042.090.12R
12	45	90	12	SQ01.12.045.090.12R
16	35	80	16	SQ01.16.035.080.16R
16	55	110	16	SQ01.16.055.110.16R
20	45	90	20	SQ01.20.045.090.20R

Sizes in inches:

D inch	I inch	L inch	S inch	ARTICLE
3/4	1 3/4	3 1/2	3/4	SQ01.19.445.889.19R

Detailed information on protective coatings can be found on pages: 58-61.

SQ02
positive



VHM | Z2 | RH

Technical details:
- 2 flute spiral cutter with lowering
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking

Application:


CUTTING

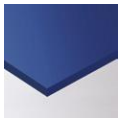

JOINTING

Materials:


ALUMINIUM ●●●


RAW MDF ●●○


RAW CHIPBOARD ●●○


PLASTICS ●○○


CORIAN® / HPL ●○○

Work parameters:

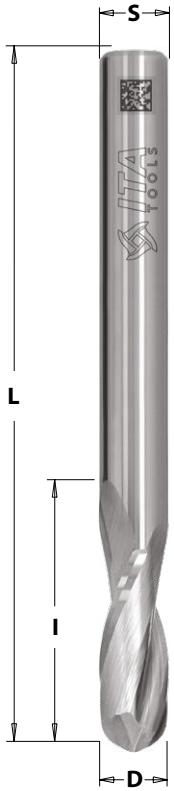
ALUMINUM
- RPM 10 000 - 18 000
- feed 0,8 - 2 m/min

PLASTICS
- RPM 16 000 - 24 000
- feed 2 - 6 m/min

D mm	I mm	L mm	S mm	I_2 mm	Z	ARTICLE
6	22	80	6	45	2	SQ02.06.022.080.06R
7	22	100	8	42	2	SQ02.07.022.100.08R
8	20	80	8	45	2	SQ02.08.020.080.08R
8	22	105	8	65	2	SQ02.08.022.105.08R
10	25	90	10	50	2	SQ02.10.025.090.10R
10	25	100	10	50	2	SQ02.10.025.100.10R
10	25	100	10	80	2	SQ02.10.025.120.10R
11	15	110	12	65	2	SQ02.11.015.110.12R
12	25	105	12	65	2	SQ02.12.025.105.12R
12	25	120	12	85	2	SQ02.12.025.120.12R

Detailed information on protective coatings can be found on pages: 58-61.

SQ31 - 199Ra
positive



VHM | Z2 | RH

Technical details:

- 2 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking
- Round nose

Application:


CUTTING


JOINTING

Materials:


ALUMINIUM ●●●


RAW MDF ●●○


RAW CHIPBOARD ●●○


PLASTICS ●○○


CORIAN® / HPL ●○○

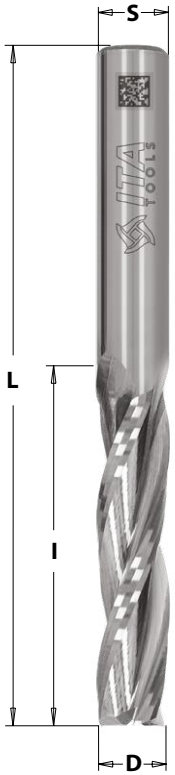
D mm	I mm	L mm	S mm	R mm	ARTICLE
3	10	60	3	1,5	SQ31.03.010.060.03R
3	10	60	6	1,5	SQ31.03.010.060.06R
4	10	60	4	2	SQ31.04.010.060.04R
4	12	60	6	2	SQ31.04.012.060.06R
5	12	60	5	2,5	SQ31.05.012.060.05R
6	22	60	6	3	SQ31.06.022.060.06R
8	22	60	8	4	SQ31.08.022.060.08R
10	22	60	10	5	SQ31.10.022.060.10R
10	45	100	10	5	SQ31.10.045.100.10R
12	25	70	12	6	SQ31.12.025.070.12R
12	42	90	12	6	SQ31.12.042.090.12R
16	35	90	16	8	SQ31.16.035.090.16R

Sizes in inches:

D inch	**I** inch	**L** inch	**S** inch	**R** inch	**ARTICLE**
1/8	1/2	2 1/2	1/8	1/16	SQ31.32.953.635.32R
3/16	5/8	2 1/2	3/16	3/32	SQ31.48.159.635.48R
1/4	1	2 1/2	1/4	1/8	SQ31.64.254.635.64R
1/2	1	3 1/4	1/2	1/4	SQ31.13.254.826.13R
5/8	1 1/2	3 1/2	5/8	5/16	SQ31.16.381.889.16R
3/4	1 3/4	3 1/2	3/4	3/8	SQ31.19.445.889.19R

Detailed information on protective coatings can be found on pages: 58-61.

SR01 - 193Ra
positive



VHM | Z3 | RH

Technical details:

- 3 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking

Application:

CUTTING

JOINTING

Materials:

ALUMINIUM ●●●

RAW MDF ●●○

RAW CHIPBOARD ●●○

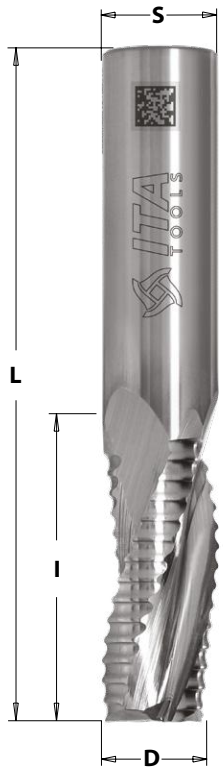
PLASTICS ●○○

CORIAN® / HPL ●○○

D mm	I mm	L mm	S mm	ARTICLE
4	12	60	4	SR01.04.012.060.04R
6	22	60	6	SR01.06.022.060.06R
8	35	80	8	SR01.08.035.080.08R
10	32	80	10	SR01.10.032.080.10R
12	32	90	12	SR01.12.032.090.12R
16	55	110	16	SR01.16.055.110.16R
20	60	120	20	SR01.20.060.120.20R

Detailed information on protective coatings can be found on pages: 58-61.

SR33 - 195Ra
positive



VHM | Z3 | RH

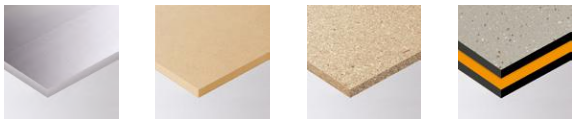
Technical details:

- 3 flute spiral cutter
- Positive - upward chip ejection
- Roughing geometry
- Polished spiral prevents material sticking

Application:

CUTTING | JOINTING

Materials:



ALUMINIUM	RAW MDF	RAW CHIPBOARD	CORIAN® / HPL
●●●	●●○	●●○	●●○

D mm	I mm	L mm	S mm	ARTICLE
6	22	60	6	SR33.06.022.060.06R
8	32	70	8	SR33.08.032.070.08R
10	32	80	10	SR33.10.032.080.10R
10	65	115	10	SR33.10.065.115.10R
12	32	80	12	SR33.12.032.080.12R
16	32	90	16	SR33.16.032.090.16R
16	55	110	16	SR33.16.055.110.16R
20	32	80	20	SR33.20.032.080.20R
20	60	120	20	SR33.20.060.120.20R
25	35	80	25	SR33.25.035.080.20R

Sizes in inches:

D inch	I inch	L inch	S inch	ARTICLE
3/4	1 3/4	3 1/2	3/4	SR33.19.445.889.19R

Detailed information on protective coatings can be found on pages: 58-61.

CPS
positive

VHM **RH**

Technical details:

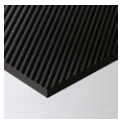
- Multi-edge geometry
- Positive - upward chip ejection
- Geometry adapted to the processing of composites, preventing delamination and pulling out of glass and carbon fibers

Application:


CUTTING


JOINTING

Materials:


CARBON FIBER ●●○

GLASS FIBER ●●○

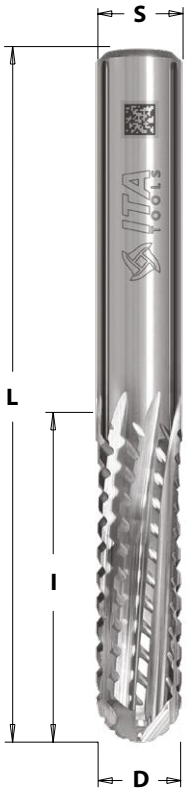

CORIAN® / HPL ●●○


RAW MDF ●○○

D mm	I mm	L mm	S mm	ARTICLE
3	10	45	3	CPS.03.010.045.03R
4	15	60	4	CPS.04.015.060.04R
4	15	60	6	CPS.04.015.060.06R
6	25	70	6	CPS.06.025.070.06R
8	30	80	8	CPS.08.030.080.08R
10	35	80	10	CPS.10.035.080.10R
12	40	90	12	CPS.12.040.090.12R

Detailed information on protective coatings can be found on pages: 58-61.

CPU
positive



VHM **RH**

Technical details:

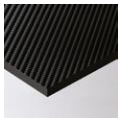
- Multi-edge geometry
- Positive - upward chip ejection
- Geometry adapted to the processing of composites, preventing delamination and pulling out of glass and carbon fibers
- Round nose

Application:


CUTTING


JOINTING

Materials:


CARBON FIBER ●●○

GLASS FIBER ●●○


CORIAN® / HPL ●●○


RAW MDF ●○○

D mm	I mm	L mm	S mm	R	ARTICLE
3	10	45	3	1,5	CPU.03.010.045.03R
4	15	60	4	2	CPU.04.015.060.04R
8	30	80	8	4	CPU.08.030.080.08R
10	35	80	10	5	CPU.10.035.080.10R
12	40	90	12	6	CPU.12.040.090.12R

Detailed information on protective coatings can be found on pages: 58-61.

CSS
straight

VHM **RH**

Technical details:

- Multi-edge geometry
- Straight- chip ejection to the side
- Geometry adapted to the processing of composites, preventing delamination and pulling out of glass and carbon fibers

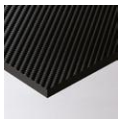
Application:


CUTTING


JOINTING


GROOVING

Materials:


CARBON FIBER ●●○

GLASS FIBER ●●○

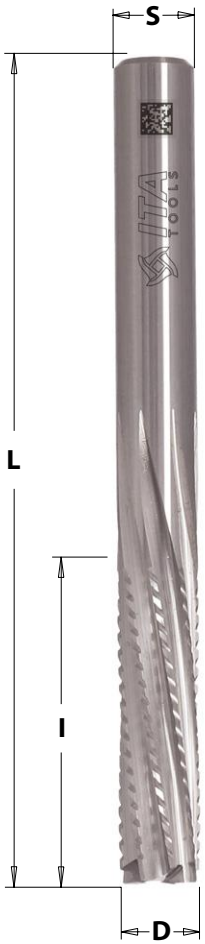

CORIAN® / HPL ●●○


RAW MDF ●○○

D mm	I mm	L mm	S mm	ARTICLE
3	10	45	3	CSS.03.010.045.03R
4	15	60	4	CSS.04.015.060.04R
4	15	60	6	CSS.04.015.060.06R
8	30	80	8	CSS.08.030.080.08R
10	35	80	10	CSS.10.035.080.10R
12	40	90	12	CSS.12.040.090.12R
6	20	60	6	CSS.06.020.060.06R

Detailed information on protective coatings can be found on pages: 58-61.

CVS
negative



VHM **RH**

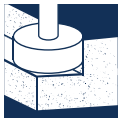
Technical details:

- Multi-edge geometry
- Negative - downward chip ejection
- Geometry adapted to the processing of composites, preventing delamination and pulling out of glass and carbon fibers

Application:

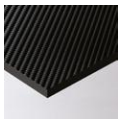

CUTTING


JOINTING


RABBETING


GROOVING

Materials:


CARBON FIBER ●●○

GLASS FIBER ●●○


CORIAN® / HPL ●●○


RAW MDF ●○○

D mm	I mm	L mm	S mm	ARTICLE
3	10	45	3	CVS.03.010.045.03R
3	10	60	6	CVS.03.010.060.06R
4	15	60	4	CVS.04.015.060.04R
5	15	60	5	CVS.05.015.060.05R
6	20	70	6	CVS.06.020.070.06R
8	30	80	8	CVS.08.030.080.08R
10	35	80	10	CVS.10.035.080.10R
12	40	90	12	CVS.12.040.090.12R

Detailed information on protective coatings can be found on pages: 58-61.

CNS / CNV / CNR
positive-negative

VHM **RH**

Technical details:

- Multi-edge geometry
- Straight- chip ejection to the side
- Geometry adapted to the processing of composites, preventing delamination and pulling out of glass and carbon fibers
- 3 versions of the tip:
  - CNS - standard
  - CNR - rosette
  - CNV - drilling


CNS


CNR

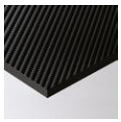

CNV

Application:


CUTTING


JOINTING

Materials:


CARBON FIBER ●●○

GLASS FIBER ●●○

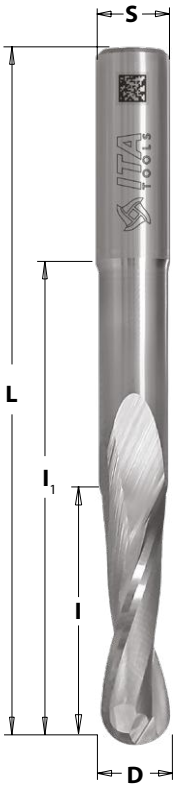

CORIAN® / HPL ●●○

D mm	**I** mm	**L** mm	**S** mm	**ARTICLE** STANDARD TIP	**ARTICLE** ROSETTE TIP	**ARTICLE** DRILLING TIP
3	10	45	3	-	CNR.03.010.045.03R	-
3	10	60	6	-	CNR.03.010.060.06R	-
4	18	60	4	CNS.04.018.060.04R	CNR.04.018.060.04R	-
4	22	60	5	-	CNR.04.022.060.05R	-
4	22	60	6	-	CNR.04.022.060.06R	CNV.04.022.060.06R
6	15	60	6	-	CNR.06.015.060.06R	-
6	24	60	6	-	CNR.06.024.060.06R	-
6	25	70	6	CNS.06.025.070.06R	CNR.06.025.070.06R	CNV.06.025.070.06R
6	30	70	6	-	CNR.06.030.070.06R	-
8	25	80	8	-	CNR.08.025.080.08R	-

D mm	**l** mm	**L** mm	**S** mm	**ARTICLE** STANDARD TIP	**ARTICLE** ROSETTE TIP	**ARTICLE** DRILLING TIP
8	35	80	8	-	CNR.08.035.080.08R	-
8	30	80	8	CNS.08.030.080.08R	CNR.08.030.080.08R	CNV.08.030.080.08R
10	30	90	10	CNS.10.030.090.10R	CNR.10.030.090.10R	CNV.10.030.090.10R
10	35	80	10	-	CNR.10.035.080.10R	-
12	30	90	12	CNS.12.030.090.12R	CNR.12.030.090.12R	CNV.12.030.090.12R
16	45	100	16	-	CNR.16.045.100.16R	-

Detailed information on protective coatings can be found on pages: 58-61.

SQ32 - 199Rm
positive



VHM | Z2 | RH

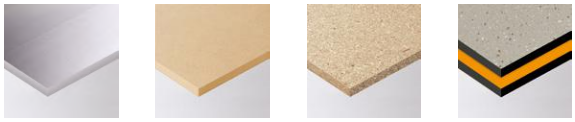
Technical details:

- 2 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking
- Extended body with lowering
- Round nose

Application:

CUTTING | JOINTING | 3D MODELS

Materials:



ALUMINIUM ●●● | RAW MDF ●●○ | RAW CHIPBOARD ●●○ | CORIAN® / HPL ●○○

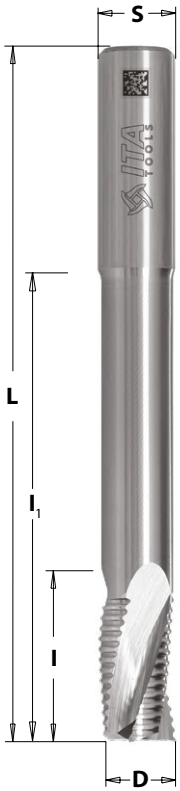
D mm	l_1 mm	l mm	L mm	S mm	R mm	ARTICLE
4	25	10	60	6	2	SQ32.04.010.060.06R
6	45	22	80	6	3	SQ32.06.022.080.06R
8	65	22	100	8	4	SQ32.08.022.100.08R
8	85	22	120	8	4	SQ32.08.022.120.08R
10	75	20	110	10	5	SQ32.10.020.110.10R
10	100	30	150	10	5	SQ32.10.030.150.10R
12	80	30	120	12	6	SQ32.12.030.120.12R
12	120	30	160	12	6	SQ32.12.030.160.12R
16	100	40	150	16	8	SQ32.16.040.150.16R
16	150	40	200	16	8	SQ32.16.040.200.16R
20	100	40	150	20	10	SQ32.20.040.150.20R
20	150	40	200	20	10	SQ32.20.040.200.20R
20	200	40	250	20	10	SQ32.20.040.250.20R

Sizes in inches:

D inch	**l_1** inch	**l** inch	**L** inch	**S** inch	**R** inch	**ARTICLE**
3/16	1	5/8	2 1/2	3/16	3/32	SQ32.48.159.635.48R
1/4	1 3/4	1	3 1/4	1/4	1/8	SQ32.64.254.826.64R
3/8	2 1/2	1	4	3/8	3/19	SQ32.95.254.102.95R
1/2	3 1/4	1 1/4	5	1/2	1/4	SQ32.13.318.127.13R
5/8	4	1 3/4	6	5/8	5/16	SQ32.16.445.152.16R
3/4	6	1 3/4	8	3/4	3/8	SQ32.19.445.203.19R

Detailed information on protective coatings can be found on pages: 58-61.

SR34 - 195Rm
positive



VHM | Z3 | RH

Technical details:

- 3 flute spiral cutter
- Positive - upward chip ejection
- Roughing geometry
- Polished spiral prevents material sticking
- Extended body with lowering

Application:


CUTTING


JOINTING

3D MODELS

Materials:


ALUMINIUM ●●●


RAW MDF ●●○


RAW CHIPBOARD ●●○


CORIAN® / HPL ●○○

D mm	l_1 mm	l mm	L mm	S mm	ARTICLE
16	100	40	150	16	SR34.16.040.150.16R
16	150	40	200	16	SR34.16.040.200.16R
20	200	40	250	20	SR34.20.040.250.20R
25	200	40	250	25	SR34.25.040.250.25R

Sizes in inches:

D inch	l_1 inch	l inch	L inch	S inch	ARTICLE
5/8	4	1 3/4	6	5/8	SR34.16.445.152.16R
3/4	6	1 3/4	8	3/4	SR34.19.445.203.19R

Detailed information on protective coatings can be found on pages: 58-61.

SR02 - 193Rm
positive

VHM | RH | Z3

Technical details:

- 3 flute spiral cutter
- Positive - upward chip ejection
- Finishing geometry
- Polished spiral prevents material sticking
- Extended body with lowering
- Round nose

Application:

CUTTING | JOINTING | 3D MODELS

Materials:

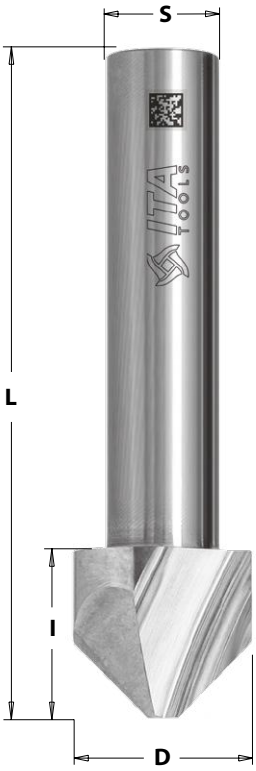
ALUMINIUM	RAW MDF	RAW CHIPBOARD	CORIAN® / HPL
●●●	●●○	●●○	●○○

D mm	I mm	I_1 mm	L mm	S mm	ARTICLE
16	40	100	150	16	SR02.16.040.150.16R
16	40	150	200	16	SR02.16.040.200.16R
20	40	150	200	20	SR02.20.040.200.20R

Detailed information on protective coatings can be found on pages: 58-61.

FVH - 915Ra

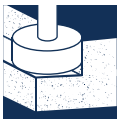
VHM RH



Technical details:

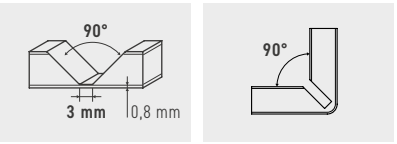
- Dibond bend cutter, 4 different types: V-90, V-108, V-135, 1,8mm

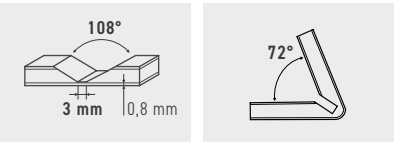
Application:

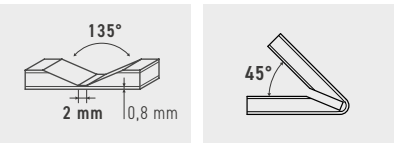


RABBETING

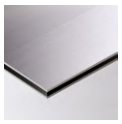
BENDING







Materials:



ALUCOBOND®

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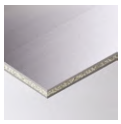


ALUCOBOND® A2

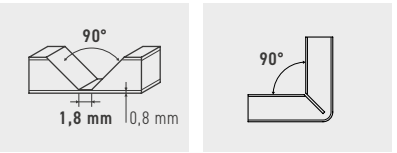
●●●

D mm	I mm	L mm	S mm	α	ARTICLE
16	15	60	10	90°	FVH.16.015.060.10Ra1
16	15	60	12	90°	FVH.16.015.060.12Ra1
16	15	60	12	108°	FVH.16.015.060.12Ra2
18	15	60	12	135°	FVH.18.015.060.12Ra3

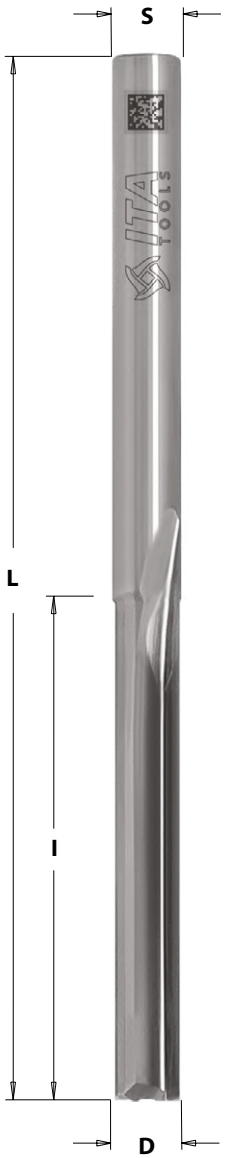
Dibond bend cutter Z1, 1,8 mm:

D mm	I mm	L mm	S mm	α	ARTICLE
10	4,12	50	10	90°	FVH.10.004.050.10Ra1

Detailed information on protective coatings can be found on pages: 58-61.



SY26 - 912RPi
straight



VHM | RH | Z2

Technical details:

- 2 straight blades cutter
- Straight-chip ejection to the side
- Polished spiral prevent material sticking

Application:

CUTTING | JOINTING | GROOVING

Materials:

RAW MDF ●●○ | RAW CHIPBOARD ●●○ | CORIAN® / HPL ●○○ | PLASTICS ●○○

D mm	I mm	L mm	S mm	ARTICLE
3	15	60	3	SY26.03.015.060.03R
4	15	60	4	SY26.04.015.060.04R
4	15	75	4	SY26.04.015.075.04R
5	15	75	5	SY26.05.015.075.05R
6	20	70	6	SY26.06.020.070.06R
6	25	60	6	SY26.06.025.060.06R
6	42	90	6	SY26.06.042.090.06R
8	70	120	8	SY26.08.070.120.08R
12	20	100	12	SY26.12.020.100.12R
12	50	140	12	SY26.12.050.140.12R
12	70	140	12	SY26.12.070.140.12R
16	40	160	16	SY26.16.040.160.16R
20	30	273	20	SY26.20.030.273.20R

Detailed information on protective coatings can be found on pages: 58-61.

SY26.XR - 912XRi
straight

VHM | RH | Z2

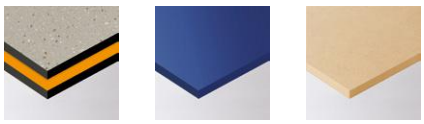
Technical details:

- 2 straight blades cutter
- Straight-chip ejection to the side
- Polished spiral prevents material sticking
- NaDia coating

Application:

CUTTING | JOINTING | GROOVING

Materials:

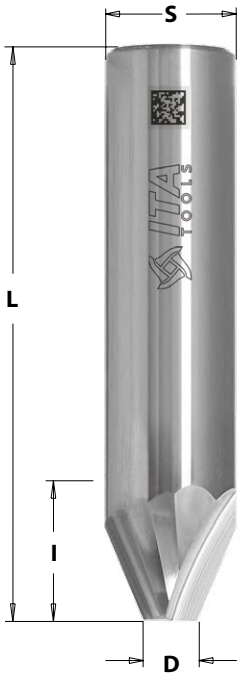


CORIAN® / HPL ●●● | PLASTICS ●●● | RAW MDF ●●○

D mm	I mm	L mm	S mm	ARTICLE
4	15	60	4	SY26.04.015.060.04XR
6	15	60	6	SY26.06.015.060.06XR
8	15	60	8	SY26.08.015.060.08XR
10	15	60	10	SY26.10.015.060.10XR

Detailed information on protective coatings can be found on pages: 58-61.

FVH - 957
FVI - 915Rs



VHM **RH** **Z2** **Z4**

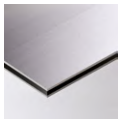
Technical details:

- Chamfer cutter, 3 different types: V-22,5°, V-30°, V-45°
- Special type of carbide - increased tool life
- R2 and R3 radius cutters
- Possibility of using variety coatings

Application:

CHAMFERING

Materials:



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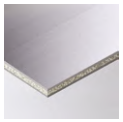


ALUCOBOND® A2

●●○

RAW CHIPBOARD

●●○

PLASTICS

●○○

D mm	D_1 mm	I mm	L mm	S mm	α	ARTICLE
14	5,7	10	55	14	22,5°	FVH.14.010.055.14R
20	3	7,5	70	20	45°	FVH.20.007.070.20R

Z4 for Chamfering:

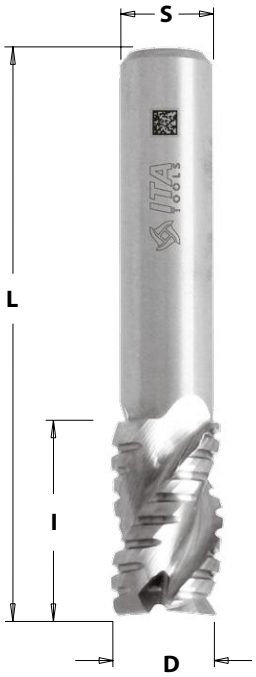
D mm	I mm	L mm	S mm	α	ARTICLE
12	6	70	12	90°	FVH.12.006.070.12R4

Z2 for Rounding:

D mm	D_1 mm	I mm	L mm	S mm	R mm	ARTICLE
10	2	2	60	10	2	FVI.10.002.060.10R2
10	2	3	60	10	3	FVI.10.003.060.10R3

Detailed information on protective coatings can be found on pages: 58-61.

SW03 - S93
positive



VHM **Z3** **RH** **LH**

Technical details:

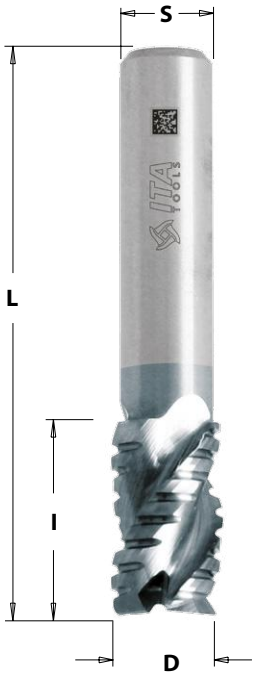
- Three flute router bit with chip breaker
- Right and left rotating cutter
- Polished chip flute prevents material sticking
- Upward chip ejection
- Special type of carbide with increased tool life
- Coating possible

Application:

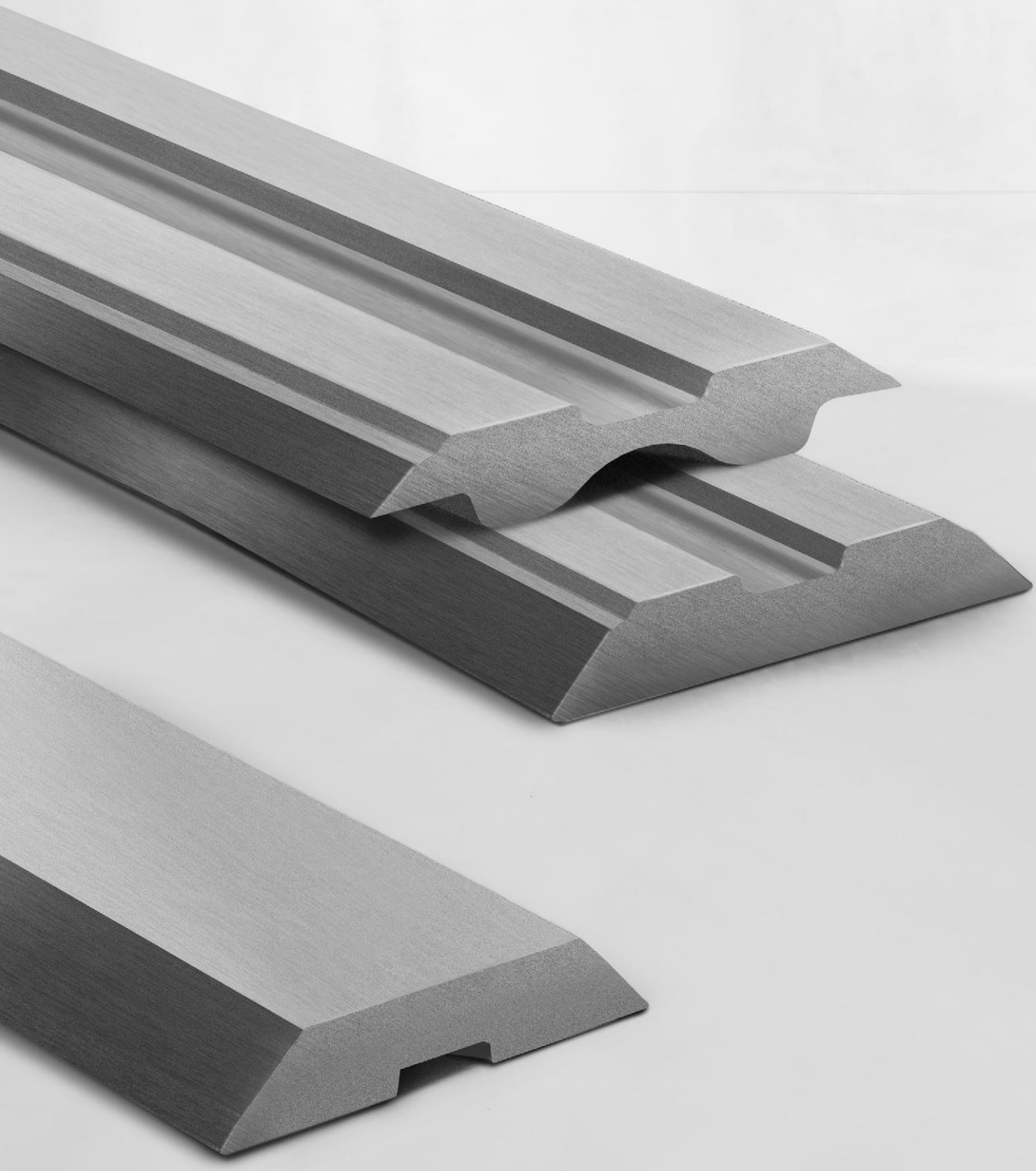
For milling cross-sections of PVC profiles in machines for shaped, flashless joining of profiles. Designed for use on GRAF SYNERGY machines.

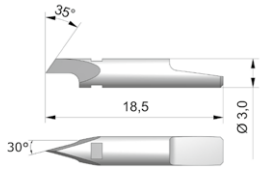
D mm	I mm	L mm	S mm	ARTICLE
6	10	30	5	SW03.06.010.030.05R
6	10	30	5	SW03.06.010.030.05L

Detailed information on protective coatings can be found on pages: 58-61.

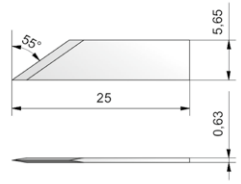


KNIVES FOR CUTTING PLOTTERS

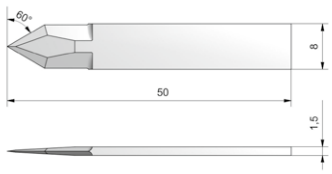




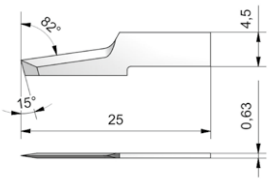
ARTICLE	MACHINE	TECHNICAL DETAILS	
ITA.2	Zünd Z2 Esko BLD-KC102 (i-102)	Type*	R, Z, K
		Pre-cut	1,43 x Tm
		Post-cut	---
		Max. cut depth	1,00 mm



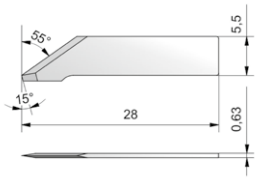
ARTICLE	MACHINE	TECHNICAL DETAILS	
ITA.16	Zünd Z16 Esko BLD-SF216 (i-216) Bullmer B16	Type*	F, Z, O
		Pre-cut	0,73 x Tm
		Post-cut	---
		Max. cut depth	7,40 mm



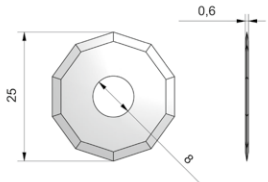
ARTICLE	MACHINE	TECHNICAL DETAILS	
ITA.44	Zünd Z44	Type*	F, Z
		Pre-cut	0,58 x Tm
		Post-cut	0,58 x Tm
		Max. cut depth	14,00 mm



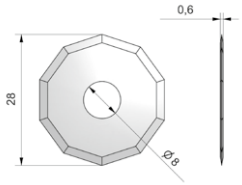
ARTICLE	MACHINE	TECHNICAL DETAILS	
ITA.41	Zünd Z41	Type*	F, O
		Pre-cut	0,8 + 0,18 x Tm
		Post-cut	1,20 mm
		Max. cut depth	11,30 mm



ARTICLE	MACHINE	TECHNICAL DETAILS	
ITA.42	Zünd Z42 Bullmer 107506	Type*	F, O
		Pre-cut	0,05 + 0,7 x Tm
		Post-cut	0,80 mm
		Max. cut depth	7,80 mm



ARTICLE	MACHINE	TECHNICAL DETAILS	
ITA.50	Zünd Z50 Esko BLD-RC110	Type*	Rot
		Max. cut depth	3,50 mm



ARTICLE	MACHINE	TECHNICAL DETAILS	
ITA.51	Zünd Z51	Type*	Rot
		Max. cut depth	5,00 mm

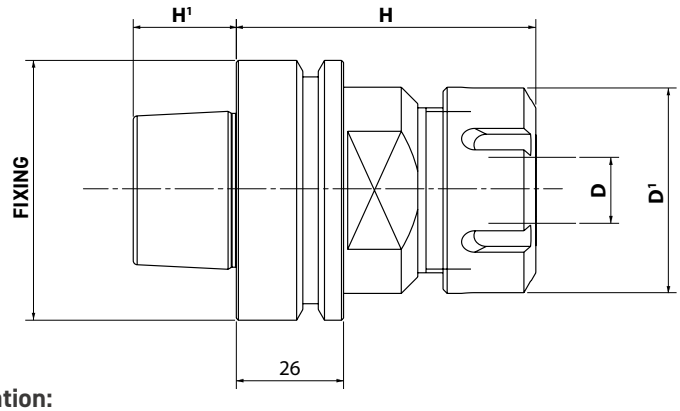
LEGEND | Types of knives

F - Flat
R - Arbor
Z - Drag knive
O - Oscillating
Rot - Rotary
Round - Round blade
P - Passe-partout
K - Kiss-Cut
T - Tangent

CHUCKS & ACCESSORIES

HSK63F
DIN 69893

RH **LH**

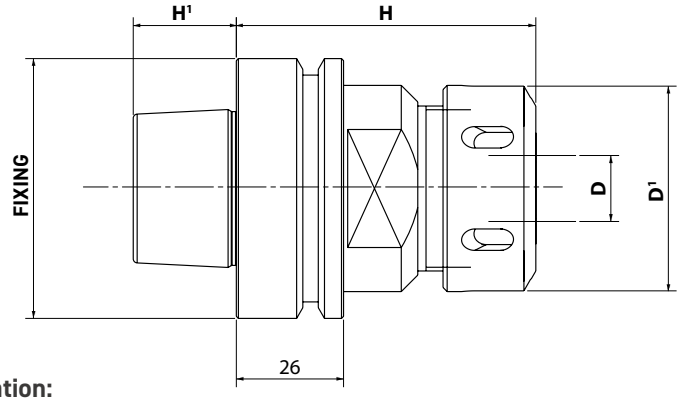


Application:
For machines type: BIESSE, EIMA, HOMAG, SCM, IMA (from 9/94), WEEKE, DUBUS, BUSELLATO.

FIXING	SLEEVES	D mm		D¹ mm	H mm	H¹ mm	ROTATION	ARTICLE
		min.	max.					
HSK63F	ER32	3	20	50	73	25	RH	H6FPDX20
HSK63F	ER32	3	20	50	73	25	RH	H6FPDX20SCM
HSK63F	ER40	4	30	63	80	25	RH	H6FPDX26
HSK63F	ER40	4	30	63	80	25	RH	H6FPDX26SCM
HSK50F	ER32	3	20	50	65	20	RH	H5FPDX20BS

HSK63F
with Bearing Nut

RH **LH**



Application:
For machines type: BIESSE, EIMA, HOMAG, SCM, IMA (from 9/94), WEEKE, DUBUS, BUSELLATO.

FIXING	SLEEVES	D mm		D¹ mm	H mm	H¹ mm	ROTATION	ARTICLE
		min.	max.					
HSK63F	ER32	3	20	50	73	25	RH	H6FPDX20.BN *
HSK63F	ER40	4	30	63	80	25	RH	H6FPDX26.BN *
HSK63F	EOC25	2	25	60	80	25	RH	H6FPDX25.BN *
HSK63F	EOC25	2	25	60	80	25	RH	H6FPDX25

*** blind hole**

HSK63F
HYDRO

RH **LH**

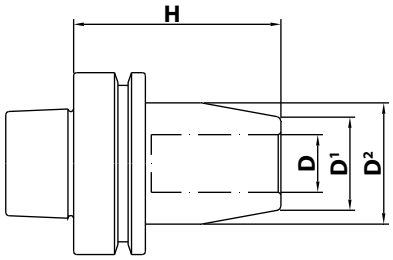
Advantages:
- Highest quality of fixing provides evenly work all knives together
- Lack of collets and fixing nuts are minimizing vibrations

Application:
Precise HYDRO chuck allows perfect connection the tool with chuck. Thermal clamping the shank in the chuck guarantee low vibration below μ3m. For self-assembly, the tool in the chuck is necessary additional instrumentation.

D^1 mm	D^2 mm	D^3 mm	H^1 mm	H^2 mm	H^3 mm	H^4 mm	ARTICLE
12	22	43,5	75	49	18	40	H6FPDXHYDRO12
16	26	48	75	49	28	50	H6FPDXHYDRO16
20	30	52	75	49	30	52	H6FPDXHYDRO20

HSK63F
THERMO

RH
LH

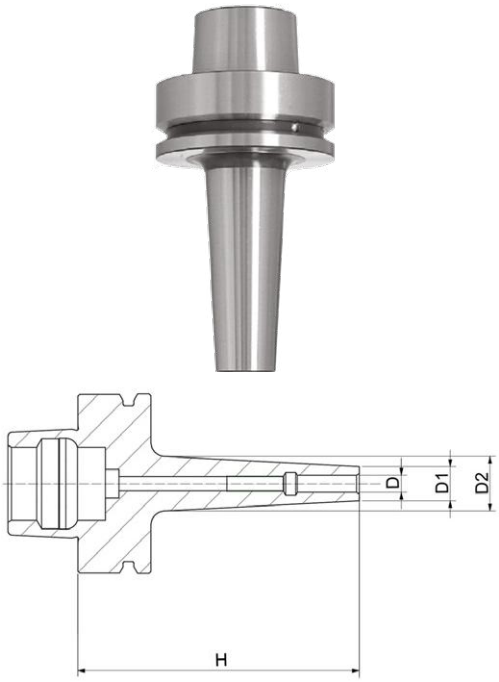


Advantages:
- Highest quality of fixing provides evenly work all knives together
- Lack of collets and fixing nuts are minimizing vibrations
- The power of clamp around 1300 Nm

Application:
Precise THERMO chuck allows perfect connection the tool with chuck. Thermal clamping the shank in the chuck guarantee low vibration below 3μm. For self-assembly, the tool in the chuck is necessary additional instrumentation.

FIXING	D mm	D^1 mm	D^2 mm	H mm	ROTATION	ARTICLE
HSK63F	6	21	29	76	RH/LH	H6FPDXTHERMO06
HSK63F	8	21	29	76	RH/LH	H6FPDXTHERMO08
HSK63F	10	24	32	76	RH/LH	H6FPDXTHERMO10
HSK63F	12	24	32	76	RH/LH	H6FPDXTHERMO12
HSK63F	16	27	34	76	RH/LH	H6FPDXTHERMO16
HSK63F	20	33	42	76	RH/LH	H6FPDXTHERMO20
HSK63F	25	44	53	76	RH/LH	H6FPDXTHERMO25

H6FPDX
THERMO SLIM



RH **LH**

Advantages:

- Highest quality of fixing provides evenly work all knives together
- Lack of collets and fixing nuts are minimizing vibrations
- The power of clamp around 1300 Nm

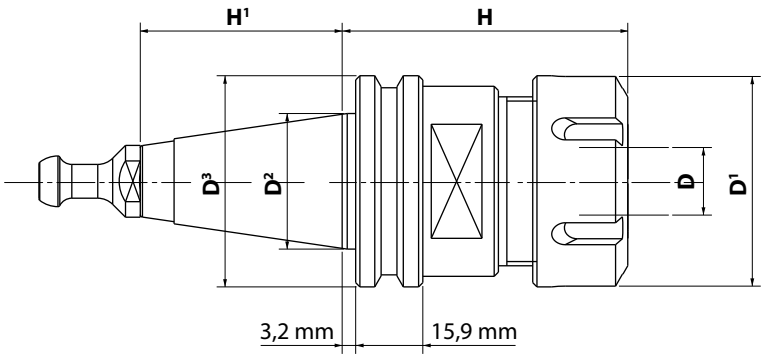
Application:

Precise THERMO chuck allows perfect connection the tool with chuck. Thermal clamping the shank in the chuck guarantee low vibration below 3µm. For self-assembly, the tool in the chuck is necessary additional instrumentation.

FIXING	D^1 mm	D^2 mm	D^3 mm	H mm	ROTATION	ARTICLE
HSK63F	6	12	19,3	100	RH/LH	H6FPDXTHERMO06.A100M
HSK63F	6	12	24,8	150	RH/LH	H6FPDXTHERMO06.A150M
HSK63F	6	12	29,7	200	RH/LH	H6FPDXTHERMO06.A200M
HSK63F	8	21	28,3	100	RH/LH	H6FPDXTHERMO08.A100M
HSK63F	8	21	33,5	150	RH/LH	H6FPDXTHERMO08.A150M
HSK63F	8	21	38,7	200	RH/LH	H6FPDXTHERMO08.A200M
HSK63F	10	16	23,2	100	RH/LH	H6FPDXTHERMO10.A100M
HSK63F	10	16	28,5	150	RH/LH	H6FPDXTHERMO10.A150M
HSK63F	10	16	33,7	200	RH/LH	H6FPDXTHERMO10.A200M
HSK63F	12	18	25,3	100	RH/LH	H6FPDXTHERMO12.A100M
HSK63F	12	18	30,5	150	RH/LH	H6FPDXTHERMO12.A150M
HSK63F	12	18	35,7	200	RH/LH	H6FPDXTHERMO12.A200M
HSK63F	16	22	29,26	100	RH/LH	H6FPDXTHERMO16.A100M
HSK63F	16	22	34,2	150	RH/LH	H6FPDXTHERMO16.A150M
HSK63F	16	22	35	200	RH/LH	H6FPDXTHERMO16.A200M
HSK63F	20	26	32,9	100	RH/LH	H6FPDXTHERMO20.A100M
HSK63F	20	26	38,2	150	RH/LH	H6FPDXTHERMO20.A150M
HSK63F	20	26	43,5	200	RH/LH	H6FPDXTHERMO20.A200M
HSK63F	25	31	38,56	100	RH/LH	H6FPDXTHERMO25.A100M
HSK63F	25	31	43,7	150	RH/LH	H6FPDXTHERMO25.A150M
HSK63F	25	31	46	200	RH/LH	H6FPDXTHERMO25.A200M

ISO30
DIN 69871

RH **LH**



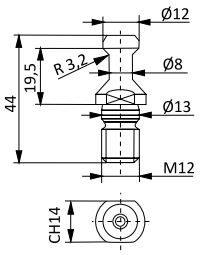
Application:
For CNC machines: BIESSE, COSMEC, MASTERWOOD®.

FIXING	COLLET	D mm		D¹ mm	D² mm	D³ mm	H mm	H¹ mm	ROTATION	ARTICLE
		min.	max.							
ISO 30	ER32	3	20	50	31,75	50	50	47,8	RH	B30PDX20
ISO 30	ER32	3	20	50	31,75	50	50	47,8	RH	B30PDX20N
ISO 30	ER40	4	30	63	31,75	50	57	47,8	RH	B30PDX26

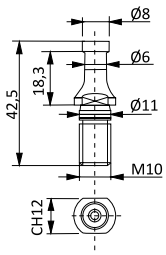
Application:
For CNC machines: MORBIDELLI, EIMA, DUBUS, WEEKE.

FIXING	COLLET	D mm		D¹ mm	D² mm	D³ mm	H mm	H¹ mm	ROTATION	ARTICLE
		min.	max.							
ISO 30	ER32	3	20	50	31,75	50	68	47,8	RH	I30PDX20
ISO 30	ER32	3	20	50	31,75	50	68	47,8	LH	I30PSX20
ISO 30	ER40	4	30	63	31,75	50	68	47,8	RH	I30PDX26
ISO 30	ER40	4	30	63	31,75	50	68	47,8	LH	I30PSX26
ISO 30	EOC25	2	25	60	31,75	50	70	47,8	RH	I30PDX25
ISO 30	EOC25	2	25	60	31,75	50	70	47,8	LH	I30PSX25

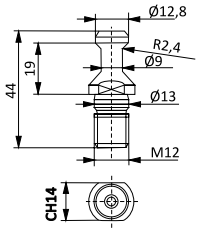
CDM/930
Pull Studs for ISO Chucks



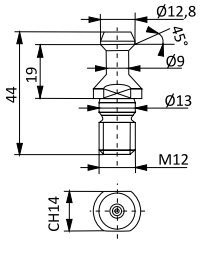
MACHINE TYPE	ARTICLE
BIESSE, MASTERWOOD, COSMEC, ELETTROMANDRINI HSD	CDM12BIE



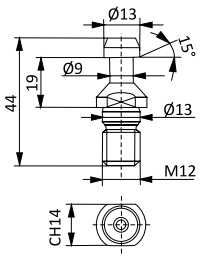
MACHINE TYPE	ARTICLE
SCM, MORBIDELLI	CDM10SCM



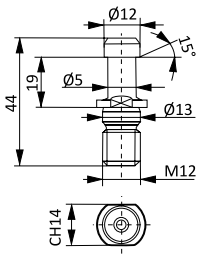
MACHINE TYPE	ARTICLE
CMS	CDM12CMS



MACHINE TYPE	ARTICLE
ALBERTI, MASTERWOOD, ELETTROMANDRINI G. COLOMBO	CDM12ALB



MACHINE TYPE	ARTICLE
IMA, MAKA, WEEKE, BULLERI, REICHENBACHER, BUSELLATO, ESSETEAM, ELETTROMANDRINI ELTE	CDM10SCM



MACHINE TYPE	ARTICLE
ISO30DIN 7388/2A	930TIR11

HSK.63F/ISO.30
Universal Assembly Supports for Chucks

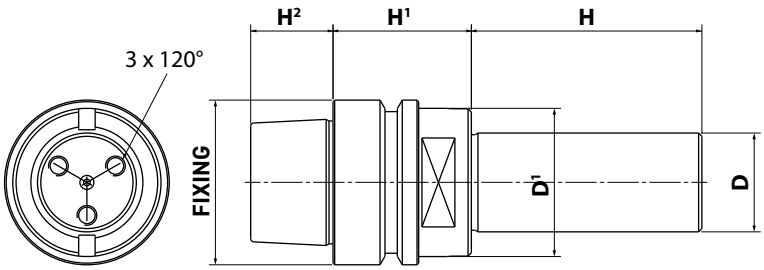
INFO	D mm	ARTICLE
Universal assembly supports for chucks HSK-F63	63	HSK.63F.Support
Universal assembly support for chucks ISO30	50	ISO.30.Support

Application:

Universal assembly supports for HSK-63F and ISO30 chucks.
Thanks to the bi-directional roller bearings, which clamp the left-hand rotation to the flange, the system offers the highest protection to the tool taper and clamps are no longer needed.

HSK63F
DIN 69893

RH
LH



Application:
For machines type: BIESSE, EIMA, HOMAG, SCM, IMA (from 9/94), WEEKE, DUBUS, BUSELLATO, MASTERWOOD®.

FIXING	D mm	D¹ mm	H mm	H¹ mm	H² mm	ARTICLE
HSK63F	30	45	70	42	25	H6FAPF30.70
HSK63F	30	45	80	42	25	H6FAPF30.80
HSK63F	30	45	100	42	25	H6FAPF30.100
HSK63F	30	45	150	42	25	H6FAPF30.150

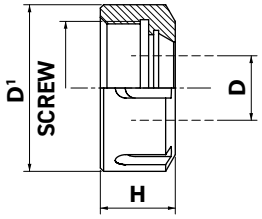
Spacer rings:

D mm	F mm	I mm	ARTICLE
50	30	0,2	TUL.50.30.002
50	30	0,5	TUL.50.30.005
50	30	1	TUL.50.30.01
50	30	2	TUL.50.30.02
50	30	3	TUL.50.30.03
50	30	5	TUL.50.30.05
50	30	6	TUL.50.30.06

Extension for Precision Collets

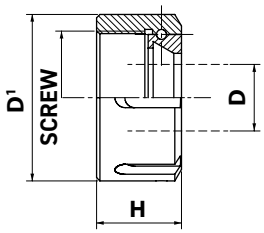
FIXING	D mm	L mm	ARTICLE
ER32	20	160	183.ER32.S20.160
ER25M	25	160	183.ER25.S25.L160
ER25M	20	200	183.ER25.S20.L200
ER25M	20	160	183.ER25.S20.L160
ER25M	20	100	183.ER25.S20.L100
ER20	20	160	183.ER20.S20.L160
ER16M	25	130	183.ER16.S25.L130
ER16M	25	100	183.ER16.S25.L100
ER16M	20	270	183.ER16.S20.L270
ER16M	20	200	183.ER16.S20.L200
ER16M	20	160	183.ER16.S20.L160
ER16M	16	130	183.ER16.S16.L130
ER16M	16	100	183.ER16.S16.L100
ER11M	16	160	183.ER11.S16.L160
ER11M	16	130	183.ER11.S16.L130

Fixing Nuts for Chucks ISO/ HSK Standard
DIN 6499



COLLET	D mm		D¹ mm	H mm	SCREW	ROTATION	ARTICLE
	min.	max.					
ER32	3	20	50	22,5	M40x1,5	RH	932GHCOD
ER32	3	20	50	22,5	M40x1,5	LH	932GHCOS

Fixing Nuts for Chucks ISO/ HSK with bearing



COLLET	D mm		D¹ mm	H mm	SCREW	ROTATION	ARTICLE
	min.	max.					
ER32	3	3	50	26	M40x1,5	RH	932GHRSD
ER32	3	3	50	26	M40x1,5	LH	932GHRSS

Other dimensions are available on request: www.ita.tools

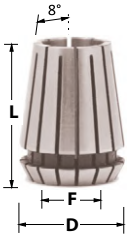
EOC16
DIN6388

L mm	D mm	F mm	ARTICLE
40	25,5	2	EOC16D02
40	25,5	3	EOC16D03
40	25,5	4	EOC16D04
40	25,5	5	EOC16D05
40	25,5	6	EOC16D06
40	25,5	7	EOC16D07
40	25,5	8	EOC16D08
40	25,5	10	EOC16D10
40	25,5	12	EOC16D12
40	25,5	14	EOC16D14
40	25,5	16	EOC16D16

EOC25
DIN6388

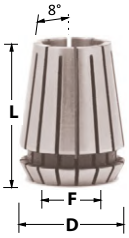
L mm	D mm	F mm	ARTICLE
52	35	3	EOC25D03
52	35	6	EOC25D06
52	35	8	EOC25D08
52	35	10	EOC25D10
52	35	12	EOC25D12
52	35	16	EOC25D16
52	35	20	EOC25D20
52	35	25	EOC25D25

ER11
DIN6499



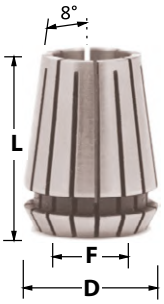
L mm	D mm	F mm	ARTICLE
18	11,5	2	ER11D02
18	11,5	3	ER11D03
18	11,5	4	ER11D04
18	11,5	5	ER11D05
18	11,5	6	ER11D06

ER16
DIN6499



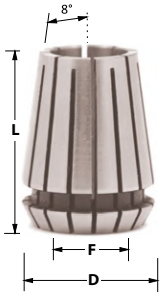
L mm	D mm	F mm	ARTICLE
28	17	2	ER16D02
28	17	3	ER16D03
28	17	4	ER16D04
28	17	5	ER16D05
28	17	6	ER16D06
28	17	7	ER16D07
28	17	8	ER16D08
28	17	9	ER16D09
28	17	10	ER16D10

ER20
DIN6499



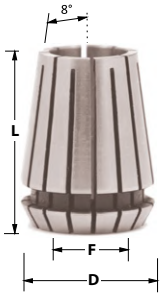
L mm	D mm	F mm	ARTICLE
32	21	2	ER20D02
32	21	3	ER20D03
32	21	4	ER20D04
32	21	5	ER20D05
32	21	6	ER20D06
32	21	7	ER20D07
32	21	8	ER20D08
32	21	9	ER20D09
32	21	10	ER20D10
32	21	11	ER20D11
32	21	12	ER20D12
32	21	13	ER20D13

ER25
DIN6499



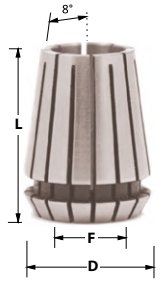
L mm	D mm	F mm	ARTICLE
34	26	10	ER25D10
34	26	12	ER25D12
34	26	16	ER25D16

ER32
DIN6499



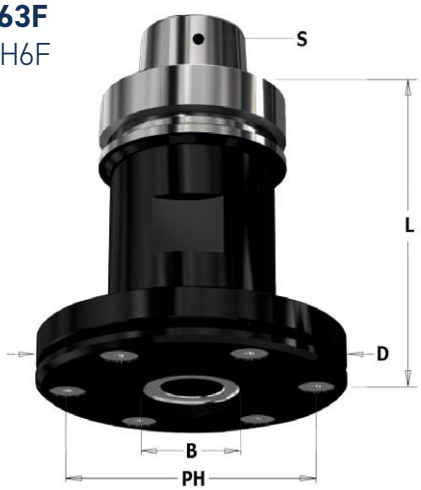
L mm	D mm	F mm	ARTICLE
40	33	3	ER32D03
40	33	4	ER32D04
40	33	6	ER32D06
40	33	8	ER32D08
40	33	10	ER32D10
40	33	12	ER32D12
40	33	14	ER32D14
40	33	16	ER32D16
40	33	20	ER32D20

ER40
DIN6499



L mm	D mm	F mm	ARTICLE
46	41	6	ER40D06
46	41	10	ER40D10
46	41	12	ER40D12
46	41	20	ER40D20
46	41	25	ER40D25

HSK63F
SBA.H6F



RH
LH

Advantages:

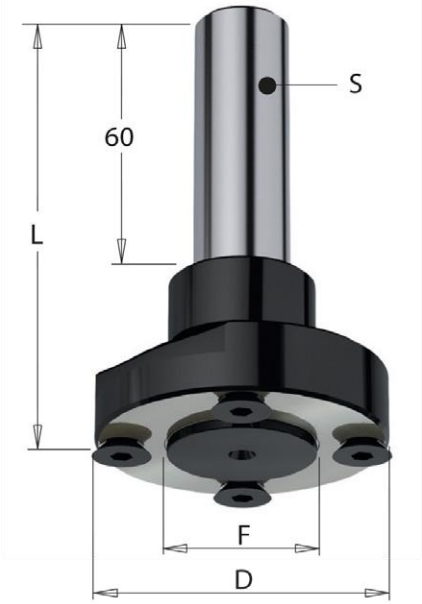
- High precision, extreme reliability and perfect tool centering
- Made of very high strength special steel, precision ground on all mating surfaces
- Very high transmissible power

Application:

Precise HSK Chuck for grooving blade specifically designed for right or left-hand rotation with self-locking antagonist threads.

FIXING	D mm	B mm	L mm	PH	ARTICLE	MAX SAW BLADE DIAMETER mm
HSK63F	59	30	78	4/M6/48	SBA.H6F.30.250	250
HSK63F	98	30	94	6/M6/80	SBA.H6F.30.300	300
HSK63F	110	30	40	6/M6/80	SBA.H6F.30.350	350

SBA.S20
Saw Blade Arbor with Parallel Shank



RH **LH**

Advantages:

- Extreme precision and reliability
- Perfect tool centering and defect-free rotation
- Made from extremely high resistant steel
- Precision grinding on all jointed parts
- Extreme high rotation performance > 15 HP – 20.000 RPM
- For very efficient sizing on extreme unprecedented high feed speed
- Excellent finishing quality on the workpiece and longer tool life
- Sturdy design with reduced height to increase the work space between the machine and the piece.
- Interchangeable collet clamps with radial grooves for secure parallel tool clamping and wide clamping tolerance (-0.7mm)

Application:

Saw blade arbor with parallel shank for machining centres, point-to-point machines and CNC routers.

Safety tips:

The TW-006 TORQUE SCREWDRIVER is recommended for the proper fastening of screws.

S mm	D mm	B mm	L mm	PH	ARTICLE	MAX SAW BLADE DIAMETER mm
20	59	30	97,5	4/M6/48	SBA.S20.30.250	250

Spare parts:

990.116.00 - SCREWS M6x8.7x12 TSPEI	**991.064.00** - SPANNER 4mm

Other dimensions are available on request: **www.ita.tools**

991
CNC Spanners

INFO	W	ARTICLE
C-SPANNERS	45 - 50	991.123.00
C-SPANNERS	58 - 62 - 65	991.283.00

993/940
CNC Spanners

ER/ETS	ARTICLE
32	932CHVST
40	940CHVST

925
CNC Spanners

EOC	ARTICLE
25	925CHVOC

940
Dynamometric spanners

MOCOWANIE	ARTICLE
ER40/ETS	940CHVST.DYN
ER32/ETS	932CHVST.DYN
ER25/ETC	925CHVST.DYN
EOC25	925CHVOC.DYN.M

I30.CNC.BIE
Tool Holder Clamp CNC

Application:
Tool holder clamp for BIESSE machines.

INFO	ARTICLE
Tool Holder Clamp SK30 BIESSE machines	I30.CNC.BIE

DUST
Kinetic Dust Extractor
with Precision Collets

RH

Advantages:

- Fixing collet made of steel
- The unique arrangement and geometry of the blades cause the chip to be thrown upwards directly into the extraction unit
- The shape of the blades reduces the noise generated during operation
- Very easy to use
- Increases tool life and reduces production costs
- Recomended for nesting and routing operations
- Replaces the standard clamping nut
- Suitable for any collet chucks with standard router bits
- Available for: ER32, ER40, EOC25 collets

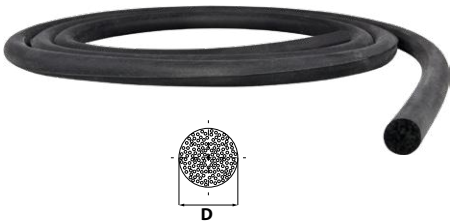
INFO	ARTICLE
Kinetic dust extractor - collet EOC25	EOC25.DUST
Kinetic dust extractor - collet ER40	ER40.DUST
Kinetic dust extractor - collet ER32	ER32.DUST

Spare parts:

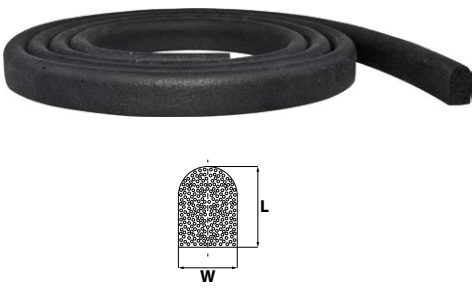
WR.DUST - CNC SPANNER

EPDM
Rope of Cellular Rubber Round

Application:
For template production, sealing grid tables, seals in machines with console tables.

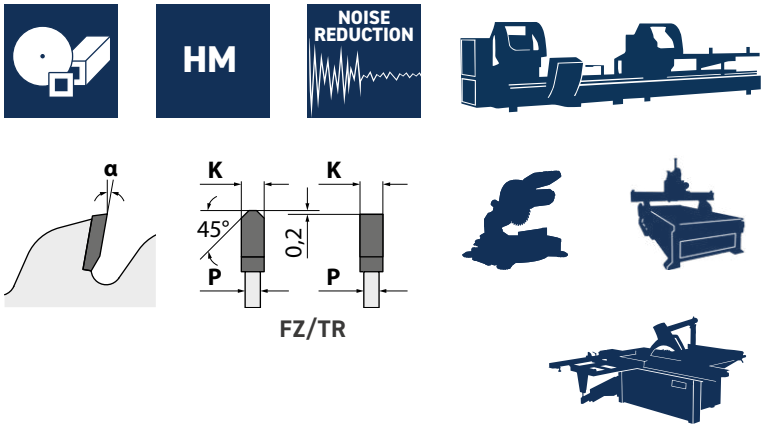


D mm	ARTICLE
6	EPDM06
7	EPDM07
8	EPDM08



W x **L** mm	ARTICLE
6 x 10	EPDM6X10
6 x 8	EPDM6X8
6 x 10	EPDM6X10

PA1



Application:

Circular saw blade for cutting of non-ferrous profiles, plastic profiles (ex. PVC), etc., with wall thickness till 7 mm. The material must always be well clamped to avoid vibration. Narrow toothed saw blades for sawing thin walled non-ferrous and plastic profiles.

Machines:

For double cross cutting machines, CNC machines, mitre cutting machines, etc. Negative hook angle suited for cutting above.

Materials:

For cutting of non-ferrous profiles, plastic profiles (ex. PVC), etc., with wall thickness till 7 mm

Technical details:

Circular saw blade with triple chip flat grinded carbide teeth (HW). With negative hook angle and reinforced body for higher resistance to side hits and reduce vibrations. Suited for cutting from above. Blades are silenced.

Materials:

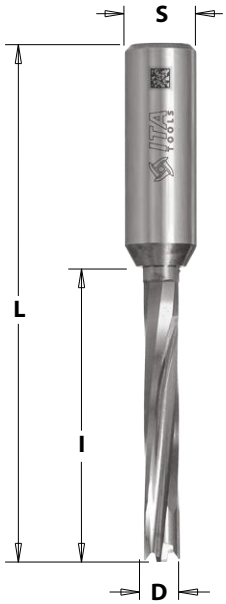
ALUMINIUM | PLASTICS | PLEXIGLASS | ALUMINIUM PROFILES | PVC PROFILES

D mm	F mm	PH	Z	K mm	P mm	α	ARTICLE
300	30	PH03	96	3,2	2,6	-5°	PA1.300030096.N00
300	30	PH03	96	3,2	2,6	5°	PA1.300030096.P00
330	30	PH03	102	3,6	3,0	-5°	PA1.330030102.N00
330	30	PH03	102	3,6	3,0	5°	PA1.330030102.P00
350	30	PH03	108	3,6	3,0	-5°	PA1.350030108.N00
350	30	PH03	108	3,6	3,0	5°	PA1.350030108.P00
350	32	4/11/63	108	3,6	3,0	-5°	PA1.350032108.N00

Table continued on the next page ▶

D mm	F mm	PH	Z	K mm	P mm	α	ARTICLE
350	32	2/11/63	108	3,6	3,0	5°	PA1.350032108.P00
400	30	PH03	120	4,0	3,2	-5°	PA1.400030120.N00
400	30	PH03	120	4,0	3,2	5°	PA1.400030120.P00
400	32	2/11/63	120	4,0	3,2	-5°	PA1.400032120.N00
400	32	2/11/63	120	4,0	3,2	5°	PA1.400032120.P00
450	30	PH03	128	4,0	3,2	-5°	PA1.450030128.N00
450	30	PH03	128	4,0	3,2	5°	PA1.450030128.P00
450	32	2/11/63	128	4,0	3,2	-5°	PA1.450032128.N00
450	32	2/11/63	128	4,0	3,2	5°	PA1.450032128.P00
500	30	2/10,5/70	140	4,2	3,4	-5°	PA1.500030140.N00
500	30	2/10,5/70	140	4,2	3,4	5°	PA1.500030140.P00
500	32	2/11/63	140	4,2	3,4	-5°	PA1.500032140.N00
550	32	2/11/63	140	4,2	3,4	5°	PA1.500032140.P00
550	30	2/10,5/70	140	4,2	3,4	5°	PA1.550030140.P00
550	30	2/10,5/70	168	4,2	3,4	5°	PA1.550030168.P00
550	32	2/11/63	140	4,2	3,4	5°	PA1.550032140.P00
600	32	2/11/63	144	4,6	4,0	5°	PA1.600032144.P00
600	40	2/11/63	140	4,6	4,0	5°	PA1.600040140.P00

BBXV



VHM | Z2 | V2 | RH | LH

Technical details:

- Premium quality super strength steel shank for improved resistance and durability
- Flute length in premium quality HWM
- 2 cutting edges [Z2] + 2 curved ground spurs [V2]
- 2 spiral flutes
- Parallel shank with driving flat and adjustable screw length
- Recommended feed speed 1 ÷ 4m/minute – RPM 6000

Application:

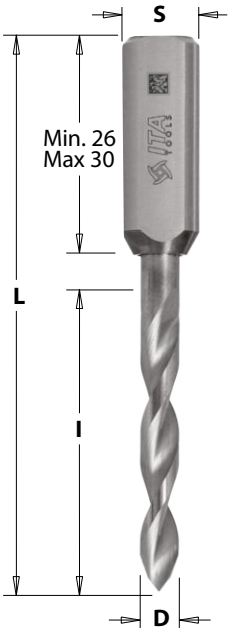
Ideal for chipboard, MDF, HDF and laminates. No center-point or spurs means perfect bores in low-thickness panels. For use on boring machines equipped with adaptors and/or with chucks.

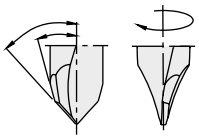
D mm	l mm	L mm	S mm	ARTICLE RH	ARTICLE LH
5	30	70	10x27	BBXV.050.030.070.02R	BBXV.050.030.070.02L
6	30	70	10x27	BBXV.060.030.070.02R	BBXV.060.030.070.02L
7	30	70	10x27	BBXV.070.030.070.02R	BBXV.070.030.070.02L
8	30	70	10x24	BBXV.080.030.070.02R	BBXV.080.030.070.02L
10	30	70	10x26	BBXV.100.030.070.02R	BBXV.100.030.070.02L

Spare parts:

	
BBS1.M5.10	BBS1.M5.11

TBV2





VHM **Z2** **RH** **LH**

Technical details:

- Premium quality super-strength steel shank
- High quality HWM body
- 2 precision ground cutting edges [Z2] - double angle
- 2 spiral flutes
- Parallel shank with driving flat and adjustable screw length

Application:

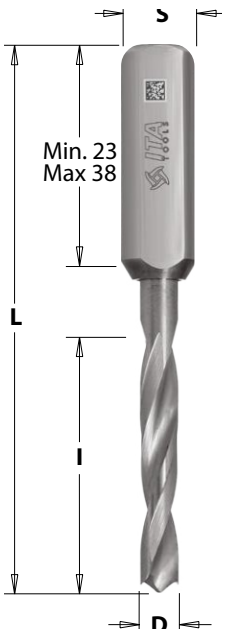
For drilling through holes in solid wood, wood derivatives and laminates.
For use on boring machine centres equipped with adaptors and/or chucks.

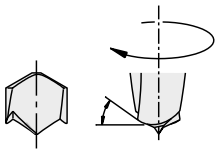
D mm	l mm	L mm	S mm	ARTICLE RH	ARTICLE LH
3	27	70	10x30	TBV2.030.027.070.02R	TBV2.030.027.070.02L
4	35	70	10x26	TBV2.040.035.070.01R	TBV2.040.035.070.01L
5	35	70	10x26	TBV2.050.035.070.01R	TBV2.050.035.070.01L
6	35	70	10x26	TBV2.060.035.070.01R	TBV2.060.035.070.01L
8	35	70	10x26	TBV2.080.035.070.01R	TBV2.080.035.070.01L
10	35	70	10x27	TBV2.100.035.070.01R	TBV2.100.035.070.01L

Spare parts:

	
BBS1.M5.08	BBS1.M5.11

BBV5 | BBV6





VHM **Z2** **V2** **RH** **LH**

Technical details:

- Premium quality super-strength steel shank
- High quality HWM body
- Centre point
- 2 cutting edges [Z2]
- 2 spiral flutes
- 2 curved, negatively ground spurs [V2]
- Parallel shank with driving flat and adjustable screw length

Application:

For drilling blind holes in solid wood, wood derivatives and laminates.
For use on boring machines equipped with adaptors and/or with chucks.

BBV5

D mm	l mm	L mm	S mm	ARTICLE RH	ARTICLE LH
2	12	57,5	10x27	BBV5.020.012.057.01R	BBV5.020.012.057.01L
3	18	57,5	10x25	BBV5.030.018.057.01R	BBV5.030.018.057.01L
4	20	57,5	10x25	BBV5.040.020.057.01R	BBV5.040.020.057.01L
5	22	57,5	10x23	BBV5.050.022.057.01R	BBV5.050.022.057.01L
6	22	57,5	10x25	BBV5.060.022.057.01R	BBV5.060.022.057.01L
8	22	57,5	10x25	BBV5.080.022.057.01R	BBV5.080.022.057.01L
10	22	57,5	10x25	BBV5.100.022.057.01R	BBV5.100.022.057.01L

BBV6

D mm	l mm	L mm	S mm	ARTICLE RH	ARTICLE LH
2	12	70	10x39	BBV6.020.012.070.03R	BBV6.020.012.070.03L
3	18	70	10x38	BBV6.030.018.070.03R	BBV6.030.018.070.03L
4	27	70	10x30	BBV6.040.027.070.02R	BBV6.040.027.070.02L
5	30	70	10x28	BBV6.050.030.070.02R	BBV6.050.030.070.02L
6	30	70	10x29	BBV6.060.030.070.02R	BBV6.060.030.070.02L
8	35	70	10x22	BBV6.080.035.070.01R	BBV6.080.035.070.01L
10	35	70	10x25	BBV6.100.035.070.01R	BBV6.100.035.070.01L

Spare parts:

	
BBS1.M5.10	BBS1.M5.11

Index materials


RAW MDF


LAMINATED MDF

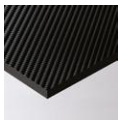

RAW CHIPBOARD


LAMINATED CHIPBOARD


PLYWOOD


LAMINATED PLYWOOD

GLAS FIBER


CARBON FIBER


CORIAN/HPL

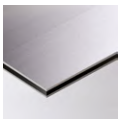

SOFT SOLID WOOD

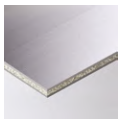

HARD SOLID WOOD


EXOTIC WOOD


HPL


ALUMINUM


ALUCOBOND®


ALUCOBOND® A2


PLASTICS


PLEXIGLAS


SOLID WOOD DRY AND WET MULTI-RIP

Working operations


NESTING


JOINTING


RABBETING


PLANNING


GROOVING


DOOR LOCK


CUTTING


PROFILING


CHAMFERING

MATERIALS / MODELS	ACRYLIC	PE poly ethylene	PE-LD low pressure poly ethylene	PE-HD high pressure poly ethylene	ABS	PETF polyesters	PW poly-carbonate	PVC polyvinyl chloride	PA polyamide	POM polyoxy-methylene	PMMA poly(methyl methacry-late)	HDPE high density poly ethylene	ALUCO-BOND®	ETAL-BOND® A2
ST01R / ST28R / ST51R	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●○	●●●	●●●	●●○	○○○
ST36R *	●●●*	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●○	●●●	●●●	●●○	○○○
SP01R	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●●	○○○
SP02R	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○
SP15R	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○
SQ01R	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	○○○	○○○
SQ02R	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○
SQ31R	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○
SR01R	●●○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○
SR33R	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●●	○○○	●●●	○○○	○○○
CNR / CNV / CNS	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
CPS / CSS / CVS / CPU	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
SQ32R / SR02R / SR34R	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●○○	○○○	○○○	○○○	○○○
FVHRa1 / FVHRa2 / FVHRa3	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●●	●○○
SY26R	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○
SY26XR	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○
FVH 22,5°/30°/45°	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●●○	●○○	○○○
DT2	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
DTS	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
DT3	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
DT5	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
FFR	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
FDT.12.006.12.0SR	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●○	●●●
FDH.18.007.16.0SR	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●○	●●●
FDH.30.005.12.0SR	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●○	●●●
SW03R/SW03L	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○

LEGEND: ●●● - excellent quality ●●○ - good quality ●○○ - sufficient quality ○○○ - not to apply

* perfect finish of acrylic material

CORIAN®	FOAM	GRAPHITE	GFK fiberglass	CFK carbonglass	TEXTOLITE	HPL compact board	HONEYCOMB	SANDWICH (without steel)	ALUMINUM	MDF	MODELING BOARD	FIBER CEMENT BOARD	STYROFOAM	PVC & ALU PROFILES ON GRAF SYNERGY MACHINES	PVC PROFILES	ALU PROFILES
●○○	○○○	○○○	○○○	○○○	○○○	●○○	●○○	○○○	○○○	●○○	○○○	○○○	○○○	○○○	●●●	○○○
●○○	○○○	○○○	○○○	○○○	○○○	●○○	●○○	○○○	○○○	●○○	○○○	○○○	○○○	○○○	●●●	○○○
●○○	○○○	○○○	○○○	○○○	○○○	●○○	●○○	○○○	●●●	●○○	○○○	○○○	○○○	○○○	●●○	●●●
○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●●	●●●
○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●●	●○○
●○○	●○○	○○○	○○○	○○○	○○○	●●○	●●○	●●○	●●●	●●○	●●○	○○○	○○○	○○○	●○○	●●●
○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●●	●●●
●○○	○○○	○○○	○○○	○○○	○○○	●○○	●○○	○○○	●●●	●●●	●●●	○○○	○○○	○○○	●○○	○○○
●○○	○○○	○○○	○○○	○○○	○○○	●○○	○○○	●○○	●●●	●●●	●●●	○○○	○○○	○○○	●○○	●○○
●○○	○○○	●○○	○○○	○○○	●○○	●●○	○○○	●●○	●●●	●●●	●●●	○○○	○○○	○○○	○○○	●○○
○○○	○○○	●●●	●●●	●●●	●●●	●●○	●○○	●●○	○○○	●○○	○○○	●○○	○○○	○○○	○○○	○○○
●●○	○○○	●●○	●●●	●●●	●●○	●●○	●●○	●●○	○○○	●○○	○○○	●○○	●●●	○○○	○○○	○○○
○○○	●○○	●○○	○○○	○○○	○○○	●○○	●○○	●○○	●●●	●●●	●●●	○○○	●●○	○○○	○○○	●○○
○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○
●○○	●●●	○○○	○○○	○○○	○○○	●○○	●○○	○○○	○○○	●●○	●○○	●○○	○○○	○○○	●○○	○○○
●●○	●●●	○○○	○○○	○○○	○○○	●●●	●●○	●●○	○○○	●●○	●○○	●○○	○○○	○○○	●○○	○○○
●○○	○○○	○○○	○○○	○○○	○○○	●○○	○○○	○○○	○○○	●●○	●○○	●○○	○○○	○○○	○○○	○○○
●●●	○○○	●●●	●●●	●●●	●●●	●●○	●○○	●●○	●○○	●●●	●○○	●●●	○○○	○○○	○○○	○○○
●●●	○○○	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●○○	●●●	●○○	●●●	○○○	○○○	○○○	○○○
●●○	○○○	●●●	●●●	●●●	●●●	●●●	●●●	●●●	○○○	●●●	●○○	●●○	○○○	○○○	○○○	○○○
●●●	○○○	●●●	●●●	●●●	●●●	●○○	●○○	●●○	●○○	●●●	●○○	●●○	○○○	○○○	○○○	○○○
●○○	○○○	●●●	●●●	●●●	●●●	●●○	●○○	●●○	●○○	●●●	●●●	●●●	●●○	○○○	○○○	○○○
●●○	○○○	●○○	●○○	●○○	●○○	●○○	○○○	○○○	○○○	●●●	○○○	●○○	○○○	○○○	○○○	○○○
●●●	○○○	●●○	●●●	●●●	●●●	●●●	○○○	●●○	●○○	●●●	○○○	●●○	○○○	○○○	○○○	○○○
●●●	○○○	●●○	●●●	●●●	●●●	●●●	○○○	●●○	●○○	●●●	○○○	●●○	○○○	○○○	○○○	○○○
○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	○○○	●●●	○○○	○○○

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