

The background of the entire page is a grayscale image of various industrial machine parts, including gears, drill bits, and circular components. In the top right corner, the word "LEUCO" is written in a bold, sans-serif font, with the "U" highlighted in a vibrant purple color. Below this, the words "COMPOSITE MACHINING" are printed in a smaller, bold, sans-serif font. The lower half of the image features a large, curved, metallic-looking surface, possibly a part of a machine. In the foreground, two drill bits are shown: one is a standard double-flute drill bit, and the other is a more complex, multi-fluted drill bit. Both bits are positioned vertically, with their tips pointing towards the center. The bottom of the image is a solid purple band. On the left side of this band, there are two circular icons: one showing a cross-section of a drill bit and the other showing a cross-section of a hole. On the right side of the purple band, there is a block of text in white, followed by the company's website address. The overall design is clean and professional, emphasizing the company's focus on precision tooling for composite machining.

LEUCO

COMPOSITE MACHINING

Precision tools for milling, drilling
and cutting of fiber-reinforced plastics

LEUCO
WEGSKAL
SYSTEM

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www.leuco.com

→ FIBER-REINFORCED PLASTICS & WOOD

IMPORTANCE

Today, lightweight materials contribute considerably toward solving the demand for a better use of resources. Fiber-reinforced plastics and other composite materials have the greatest potential in this respect.

Composites are used on the broad mass market. Due to their material properties, composites can be used in many sectors because they combine high resistance and stiffness with low weight. Constructions based on carbon-fiber reinforced plastics (CFRP), can be, depending on the application, up to 80 % lighter than steel constructions and 50 % lighter than aluminum constructions, with double strength and stiffness.

FIELDS OF APPLICATION

Composites are used in the aerospace industry, the automotive industry, in wind energy technology, machine and plant engineering as well as in the sports and leisure sector.

CHALLENGE

When machining composites, you always face the problem of inhomogeneous material structures. In fiber-reinforced plastics, different fibers and fiber orientations can be combined with many matrix types. The fibers are extremely abrasive and brittle, the plastic matrix is heat-sensitive and soft. Sandwich constructions have inner honeycomb layers and hard top layers. A perfect cutting quality without bevel inconsistencies, protruding fibers or delamination is not easy to achieve.

COMMON GROUND BETWEEN FIBER-REINFORCED PLASTICS & WOOD-BASED MATERIALS

Wood is the oldest fiber material known in the world. Machining this material is part of LEUCO's everyday business. It suggests itself to transfer our expertise in milling and drilling of wood-based materials to fiber-reinforced materials such as CFRP and benefit from it. This is what LEUCO does, bringing in additional features such as cutting, floating trimming units and many more.

More than 60 years of experience in providing solutions for the machining of fiber-reinforced materials – tool solutions for many industries

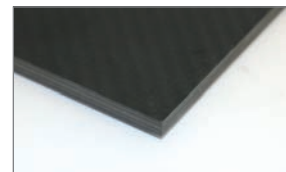


→ MATERIALS & TOOLS

Many composite materials have been designed to match application-specific needs and satisfy the corresponding requirements. Fiber-reinforced materials can be categorized according to the fiber used and the matrix. Sandwich constructions are distinguished by their core layer: honeycomb core or foam core.

CFRP – CARBON-FIBER REINFORCED PLASTIC

Highest strength and rigidity combined with very low density make CFRP the lightweight construction material of the future. The positive characteristics of carbon fiber materials stand in conflict with their difficult machining properties. Cutting tools must be able to resist the material's extreme abrasiveness – **here LEUCO offers diamond-tipped tools combining maximum edge life and excellent cutting quality.**



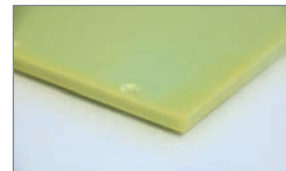
CFRC – CARBON-FIBER REINFORCED CARBON

CFRC is characterized by high heat resistance. Due to the carbon matrix, the fiber-matrix adhesion is significantly worse than with CFRP, which often leads to delamination and cutting edge breakage. **This can be efficiently prevented by using LEUCO's p-System shank-type cutter.**



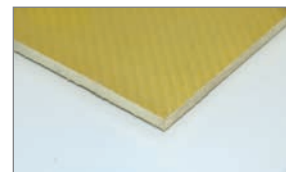
GRP – GLASS-FIBER REINFORCED PLASTIC

GRP is used in many applications because this material is relatively cheap, while still significantly improving, thanks to the glass fibers, the technical properties of plastic. Glass fibers are also characterized by high abrasiveness – **diamond-tipped tools provide for long edge life.**



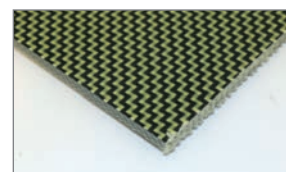
AFRP – ARAMID-FIBER REINFORCED PLASTIC

Their low density makes aramid fibers extremely light, and they also feature high tensile strength. In contrast to carbon fibers and glass fibers, aramid fibers exhibit ductile behavior instead of brittleness. When machining AFRP, extreme fraying of the fibers frequently occurs. **The p-System shank-type cutter from LEUCO guarantees best cutting and drilling results.**



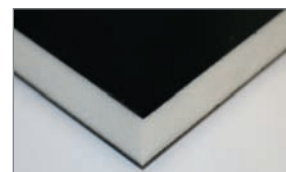
VARIOUS FIBERS (HYBRID FABRICS) IN PLASTIC

Different fibers are often interwoven to combine the positive properties of the individual fibers. However, this even increases the challenges of machining. **For such composites as well, LEUCO offers individual tool solutions.**



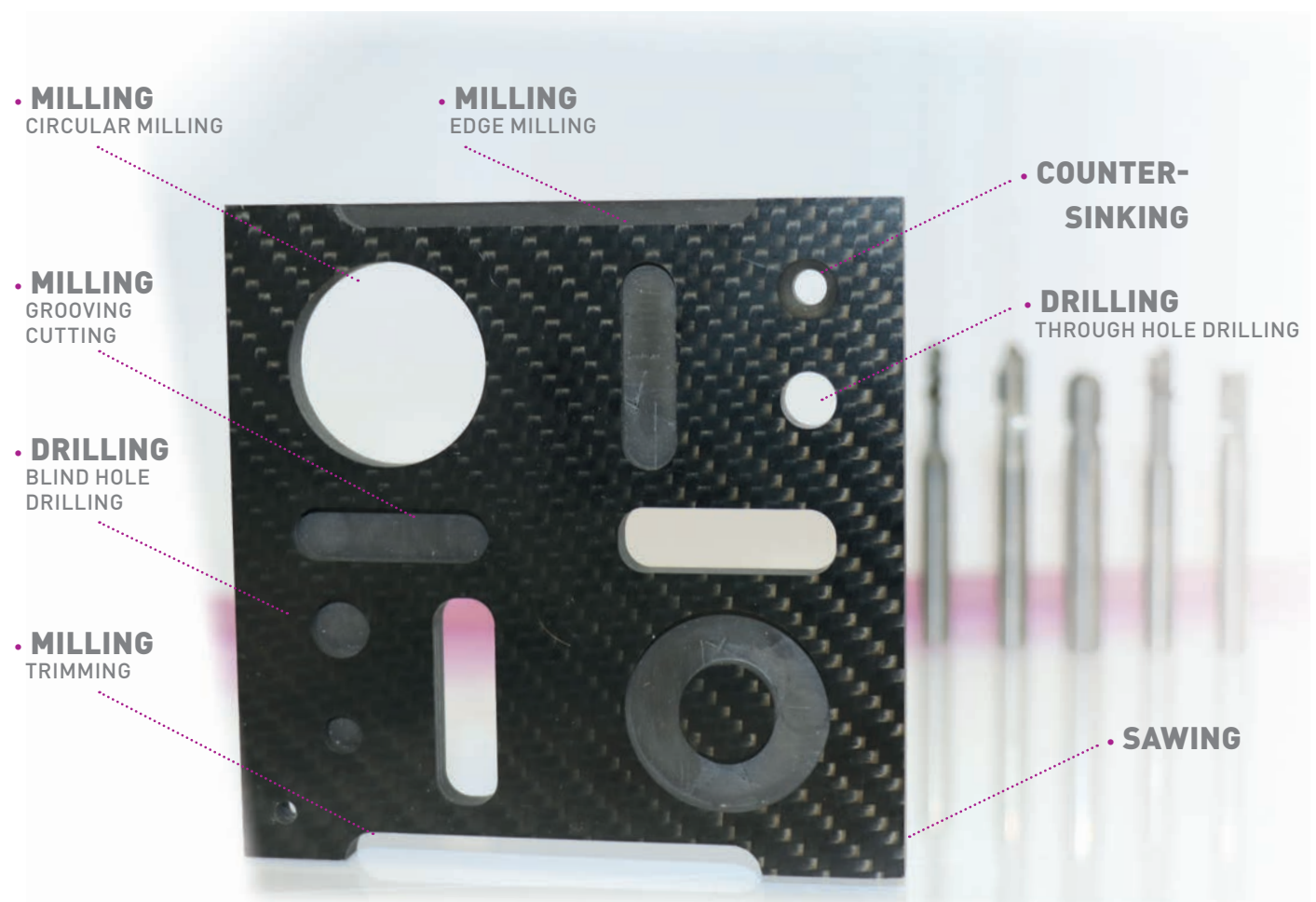
SANDWICH CONSTRUCTIONS

Sandwich constructions with honeycomb core or foam core are frequently used in the aviation and automotive industries. The challenge with machining is not to destroy the delicate honeycomb or foam cores. **LEUCO provides special cutters and drill bits as well as circular saw blades for this purpose.**



→ APPLICATIONS

Components made of fiber-reinforced plastics and other composites are produced with a near net shape, but reworking is almost always necessary. Machining processes are very often applied for such rework tasks. They have proven to provide higher dimensional accuracy and flexibility compared to water jet cutting and laser processing.



→ MILLING

Milling is used to create perfect external and internal contours and functional surfaces. Furthermore, circular milling or wave milling processes can be used to produce holes in the required quality. Frequent problems related to milling are insufficient cutting quality (protruding fibers, delamination, bevel inconsistencies) and short edge life.

LEUCO's diamond-tipped p-System shank-type cutters combine the good cutting quality and sharpness of solid tungsten carbide cutters with the long edge life of diamond cutting material.

→ DRILLING AND COUNTERSINKING

Drilling and countersinking are mainly used for preparing joints such as riveted joints, for example. Problems occur when the drill bit enters and exits the material. Pressure and tensile forces of the drill separate the individual composite layers from each other, thus causing delamination or chipping.

The special tip geometry of LEUCO's high-performance drill bit with centering point and spurs effectively reduces the forces created during drilling, preventing delamination and protruding fibers.

→ SAWING

Sawing is used for similar purposes as peripheral milling. It can replace trimming with a milling cutter and is highly effective and economical for straight dividing cuts.

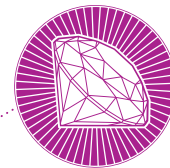
LEUCO's diamond-tipped nn-system DP flex saw blades and DIAREX sizing saw blades guarantee best cutting quality for materials such as CFRP, GFRP and AFRP.

→ YOUR BENEFITS WITH LEUCO

- LEUCO draws from many years of experience in the field of wood-working, a long-established technology benefiting from mature concepts. Fiber-reinforced materials are very new, state-of-the-art materials with properties quite different from those of metals. There is, however, an interesting analogy between these two materials. Fiber-reinforced materials and wood-based materials exhibit almost the same behavior in terms of machining.

- Benefit from LEUCO's more than 60 years of experience in providing solutions for the machining of fiber-reinforced materials.

EXPERIENCE



INNOVATIONS & PATENTS

- The fibers used for composite materials are generally hard and abrasive. Carbon fibers, for example, have diamond-like structures that are best machined with diamond cutting materials. LEUCO consistently uses diamond-tipped cutting edges, since tungsten carbide wears out too quickly and diamond material layers adhere insufficiently and easily burst off. Solid diamond cutting edges can be ground to higher sharpness than laminated tools and have a long service life.

- The proven p-System tools for milling and our high-performance drill bits with their special cutting geometry position themselves with unique selling points. To complement them, LEUCO offers a large variety of other tools. Talk to us about your specific requirements.

CONSULTING

- Based on various basic tool types and in collaboration with customers, LEUCO develops special solutions, tailored to meet all requirements. The following aspects are always taken into consideration:

- Machine, material and material tension
- Machining task and requirements in terms of machining quality
- Economic aspects

PJ system®



- **VERY HIGH ANGLE OF INCLINATION OF THE CUTTING EDGE**
NO DELAMINATION, SINCE PRESSURE ACTS ON BOTH MATERIAL SURFACES

- **DIAMOND CUTTING MATERIAL (DP)**
CARBON FIBERS HAVE DIAMOND-LIKE STRUCTURES, ONLY DIAMOND IS HARD ENOUGH TO SERVE AS A CUTTING MATERIAL

- **VERY HIGH ANGLE OF INCLINATION OF THE CUTTING EDGE**
EXCELLENT CUTTING QUALITY AND LONG EDGE LIFE

- **VERY HIGH ANGLE OF INCLINATION OF THE CUTTING EDGE**
NO CHIPPING, SINCE DIAMOND DOES NOT RECEIVE DIRECT BLOWS

- **PLUNGING WITH PLUNGE TIP**
NO PREDRILLING REQUIRED

- **LESS DUST AND MORE REAL CHIPS**
REDUCED HEALTH RISKS

- **WEAR-RESISTANT TOOL BODY MADE OF TUNGSTEN CARBIDE**
– OTHERS WOULD USE IT FOR CUTTING.



EXCLUSIVELY
FROM
LEUCO

**LEUCO
PATENT**

LEUCO
PJ system



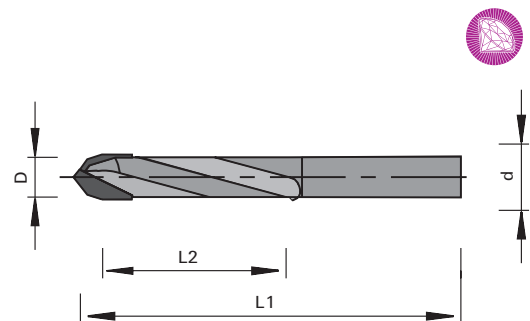
→ DRILL BITS & COUNTERSINKS

Drilling into fiber-reinforced plastics leads to significant wear of common carbide drill bits or delamination of the component. LEUCO offers a special patented drill bit geometry in tungsten carbide, combining long tool life with excellent machining quality. Its range also includes diamond-tipped drill bits for long edge life in abrasive materials.

→ DP through-hole drill bits

Ø D	L2	d	L1	Z
5	35	10	70	1
6	35	10	70	1
8	35	10	70	1
10	35	10	70	1
[mm]	[mm]	[mm]	[mm]	

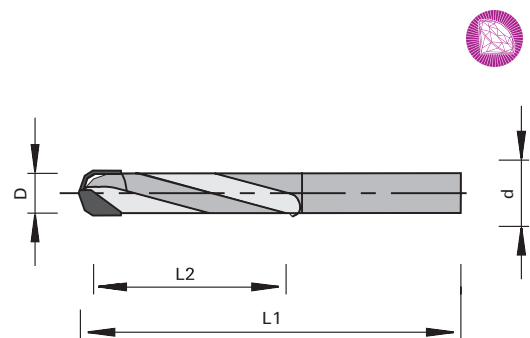
Additional dimensions and special configurations are possible



→ Blind Hole Bits DP

Ø D	L2	d	L1	Z
5	35	10	70	2
6	35	10	70	2
8	35	10	70	2
10	35	10	70	2
[mm]	[mm]	[mm]	[mm]	

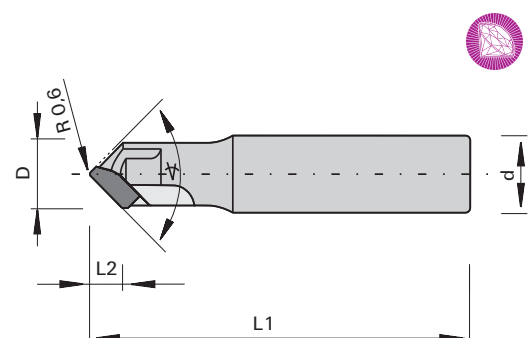
Additional dimensions and special configurations are possible



→ DP cone countersink bits

Ø D	L2	d	α	L1	Z
14	7	16	90	80,5	1
[mm]	[mm]	[mm]	[°]	[mm]	

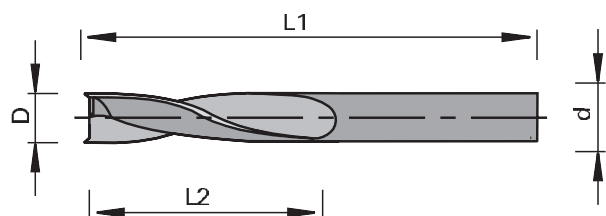
Additional dimensions and special configurations are possible



→ VHW high-performance drill bits

Ø D	L2	d	L1	Z
4	26	6	57,5	2
5	31	6	70	2
6	31	6	70	2
7	31	8	70	2
8	31	8	70	2
9	31	10	70	2
10	31	10	70	2
11	31	12	70	2
12	31	12	70	2
13	31	14	70	2
14	31	14	70	2
15	31	16	70	2
16	31	16	70	2
[mm]	[mm]	[mm]	[mm]	

Additional dimensions and special configurations are possible



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- PATENTED BIT GEOMETRY
- PRECISE CENTERING
- NO PUSH-OUT OR PEEL-UP DELAMINATION
- NO PROTRUDING FIBERS
- NO CHIPPING
- LONG EDGE LIFE
- UNIVERSAL APPLICATION

LEUCO

→ MILLING CUTTERS

Milling of fiber-reinforced plastics is done in many industries, with very different requirements for milling tools. What material is to be machined? What machining method is to be used? Using robust and rigid CNC machines or more unstable robots?

LEUCO offers a vast range of shank-type cutters for machining composites. The range of tools extends from simple double-edge and three-edge shank-type cutters for standard applications to the patented p-System cutter featuring excellent edge life and cutting quality. This range is supplemented by cutters with a large number of teeth, which allow high cutting speeds and can therefore be used very economically.

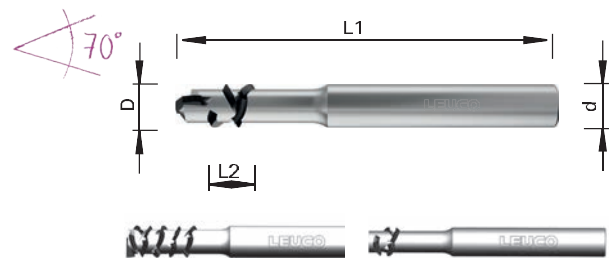
→ LEUCO p-System DP compression milling cutters



Ø D	L2	d	L1	Z
8	7,2	8	70	1
10	10,3	10	70	1
12		12	70	1
16		16	70	1
[mm]	[mm]	[mm]	[mm]	

With and without plunge tip

Additional dimensions and special configurations are possible



Top: version with plunge tip

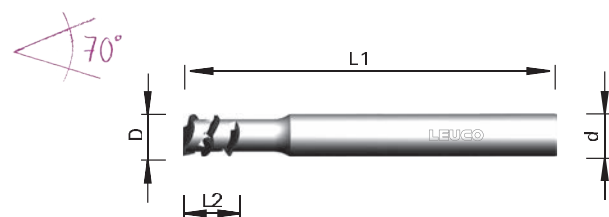
Bottom left: with face cutting edge, bottom right: without plunge tip

→ LEUCO p-System DP shank-type groove cutters



Ø D	L2	d	L1	Z
8	10	8	70	1+1
10	10	10	70	1+1
12	10	12	70	1+1
16	10	16	70	1+1
[mm]	[mm]	[mm]	[mm]	

Additional dimensions and special configurations are possible

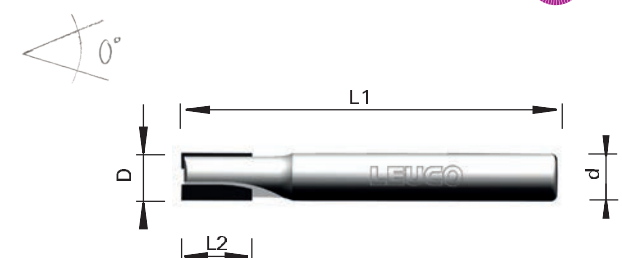


→ Double-edge DP shank-type cutters



Ø D	L2	d	L1	Z
4	6	6	65	2
5	7,5	6	65	2
6	9	6	65	2
8	12	8	65	2
10	15	10	65	2
12	18	12	65	2
[mm]	[mm]	[mm]	[mm]	

Additional dimensions and special configurations are possible

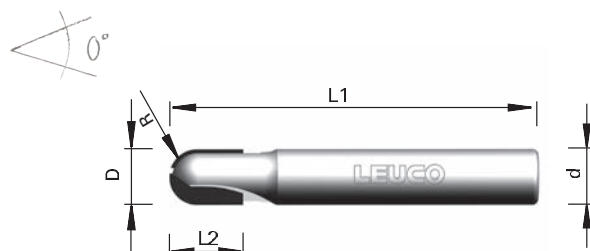


→ Double-edge DP shank-type radius cutters



Ø D	L2	d	R	L1	Z
4	6	6	2	65	2
5	7,5	6	2,5	65	2
6	9	6	3	65	2
8	12	8	4	65	2
10	15	10	5	65	2
12	18	12	6	65	2
[mm]	[mm]	[mm]	[mm]	[mm]	

Additional dimensions and special configurations are possible

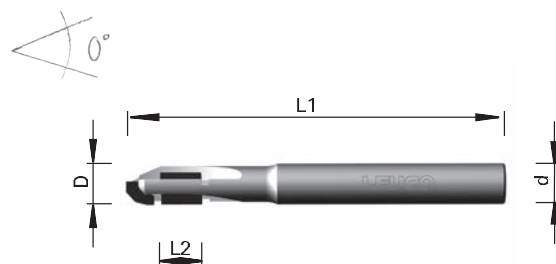


→ Three-edge DP shank-type cutters



Ø D	L2	d	L1	Z
8	7,5	8	70	3
[mm]	[mm]	[mm]	[mm]	

Additional dimensions and special configurations are possible

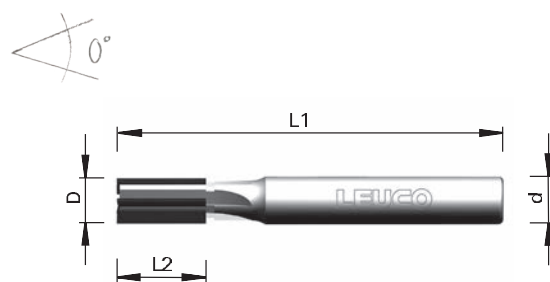


→ Multi-tooth DP shank-type cutters



Ø D	L2	d	L1	Z
6	15	8	65	5
8	15	8	65	5/7
10	15	10	65	7
12	15	12	65	7/9
16	15	16	65	11/13
[mm]	[mm]	[mm]	[mm]	

Additional dimensions and special configurations are possible

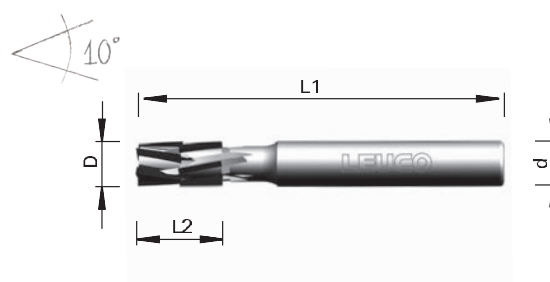


→ Multi-tooth DP compression milling cutters



Ø D	L2	d		L1	Z
8	15	8	-	65	5
10	15	10	-	65	5
12	15	12	-	65	5
16	15	16	-	65	7
[mm]	[mm]	[mm]		[mm]	

Additional dimensions and special configurations are possible



→ SAW BLADES

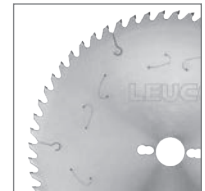
Sawing is the most effective machining method for long straight contours. This method is still rather unknown for fiber-reinforced plastics. LEUCO saw blades achieve good cutting quality at high feed rates. This combination is made possible by the saw tooth geometry of LEUCO nn-System and g5-System tools, which allows for scoring.

→ DIAREX Sizing Saw Blade DP



Ø D	B	b	d	Z	tooth configuration
250	3,2	2,2	30	50	HR-FA
303	3,2	2,2	30	65	HR-FA
350	3,2	2,2	30	65	HR-FA
[mm]	[mm]	[mm]	[mm]	[mm]	

HR-FA



Design and benefits

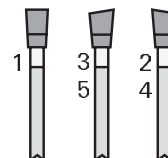
- Excellent cutting quality (on top) thanks to prescoring effect and reduced cutting pressure
- Special fine-grained DP grade
- Resharpener area 2 mm

BEST SOLUTION
for CFRP, GFRP, thin
materials (max.
material thickness
10 mm)

→ Sizing saw blades DP „G5“



Ø D	B	b	d	Z	tooth configuration
300	3,2	2,2	30	100	G5
350	3,2	2,2	30	100	G5
[mm]	[mm]	[mm]	[mm]	[mm]	



Design and benefits

- Reduced cutting pressure thanks to „aggressive“ cutting geometry
- Noise reduction by laser ornaments, both at idle and during cutting
- Finest cutting quality in fiber-reinforced plastics
- Resharpener area 3.5 mm

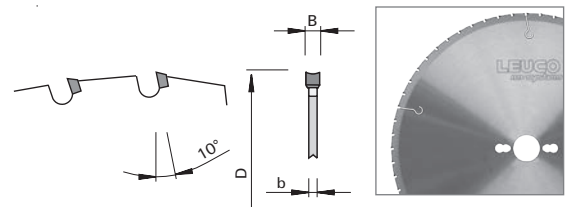
→ Sizing saw blades DP „HR“ – nn-System DP flex

nn/system

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Ø D	B	b	d	Z	tooth configuration
50	2,5	2,0	16	16	HR
110	2,5	2,0	22	24	HR
180	2,5	2,0	30	36	HR
250	2,5	2,0	30	50	HR
303	2,5	2,0	30	60	HR
[mm]	[mm]	[mm]	[mm]	[mm]	



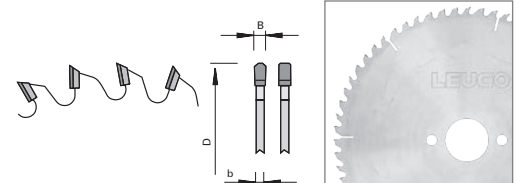
Design and benefits

- ! Hardly perceivable noise
- ! Highest economic efficiency and productivity thanks to extremely long edge life
- ! Reduced cutting pressure due to hollow back geometry, enabling best cutting quality without chipping when the saw blade enters and exits the material
- ! Resharpenable up to 2 times

→ Sizing saw blades DP „TR-F-FA“ pos.-neg.



Ø D	B	b	d	Z	tooth configuration
303	3,2	2,2	30	56	TR-F-FA
350	3,5	2,5	30	63	TR-F-FA
[mm]	[mm]	[mm]	[mm]	[mm]	



Design and benefits

- ! For sizing cuts in CFRP, GFRP, fiber cement boards, resin-impregnated panel material
- ! Asymmetric gullet geometry
- ! Tooth configuration: triple chip - flat with chamfer, with alternating positive-negative hook angle
- ! Low cutting pressure
- ! Resharpening area 3.5 mm

→ ACCESSORIES

But tools are not alone responsible for successful machining. Often, it is only by intelligently combining tools, chucks and, if applicable, aggregate technology that the optimal and most economical machining results are achieved.

CLAMPING ELEMENTS FOR CNC TECHNOLOGY AT LEUCO

Collet chucks are devices of the past. These are mechanical clamping elements with all the disadvantages of wear and loss of accuracy. LEUCO relies on modern and highly accurate clamping elements for precision tools such as „LEUCO ps-System“ (hydraulic expansion clamping technology) or shrink chucks. State-of-the-art clamping chucks also contribute to your tool's edge life. LEUCO offers all you need.

Clamping system

Collet chuck

Hydro clamping chuck for ps-System

Heat shrink-fit chuck

TRIBOS power shrink-fit chuck



Rotational accuracy	+	++	+++	+++
	0,02 - 0,06 mm	< 0,006 mm	< 0,003 mm	< 0,003 mm
Rigidity	++	++	+++	++
Calming	++	+++	+	++
Unbalance	++	++	+++	++
Handling	++	+++	+	+

+++ very good

++ good

+ moderate

AGGREGATES

Many components made of fiber-reinforced materials have complicated geometries, large component tolerances or just very thin walls, which involves time-consuming efforts or problems during machining. In such cases, great economic potential lies in the combination of tools with adequate aggregates. For example, p-System milling tools can be used with floating trimming units for machining thin components without having to program the exact contours into the CNC unit. It is possible to create accurate countersink depths and recesses in component surfaces, although the component has large tolerances. No need for accurate programming – prefer floating trimming units!



→ LEUCO – PRODUCT RANGE

OVERVIEW OF TOOLS, FIELDS OF APPLICATION AND SUITABILITY

		MATERIAL						APPLICATION									
		CFK	CFC	GFK	AFK	HONEYCOMB	SANDWICH - FOAM	Joining Thin Materials (< 3 mm)	Joining Thick Materials (> 3 mm)	Dividing Cuts	Edge Trimming	Grooving	Template Copying Milling	Plunge Cutting and Circular Plungeing	Through-Hole Drilling	Blind Hole Drilling	Countersinking
MILLING CUTTERS	Double-edge DP shank-type cutters	++	++	++			+++	✓	✓	✓	✓	✓		✓			
	Double-edge DP shank-type radius cutters	++	++	++								✓	✓	✓			
	Three-edge DP shank-type cutters	++	++	++			+++	✓	✓	✓	✓	✓		✓			
	Multi-tooth DP shank-type cutters	+++	++	+++			+++	✓	✓	✓	✓	✓		✓			
	Multi-tooth DP compression milling cutters	+++	++	+++	++	++	++	✓	✓	✓	✓			✓			
	p-System DP compression milling cutters	+++	+++	+++	+++	++		✓*	✓	✓	✓			✓			
	p-System DP shank-type groove cutters	+++	+++	+++	+++	++	++				✓	✓					
DRILL BITS & COUNTERSINKS	DP through-hole drill bits	++	++	++		++	++								✓		
	Blind Hole Bits DP	++	++	++		++	++									✓	
	VHW high-performance drill bits	+++	+++	+++	+++	+++	+++								✓	✓	
	DP cone countersink bits	+++	++	+++	++	++	++										✓
SAW BLADES	DIAREX Sizing Saw Blade DP	+++	+++	+++	+++	++	+++	✓	✓	✓							
	Sizing saw blades DP „G5“	+++	+++	++	++	+++	++	✓	✓	✓							
	Sizing saw blades DP „HR“ – nn-System DP flex	++	++	++	++	+++	++	✓	✓	✓							
	Sizing saw blades DP „TR-F-FA“ pos.-neg.		++		++		++		✓	✓							

+++ well suited

++ suitable

✓ possible

✓* possible with aggregate

THIS IS LEUCO

In 1954, businessman Willi Ledermann and engineer Josef Störzer founded the Ledermann & Co. company – and the LEUCO brand was born.

Today, more than 60 years on, LEUCO is one of world's leading full-range suppliers of carbide and diamond-tipped machine tools for wood, plastic and composite material processing. The portfolio covers the entire spectrum of machine tools and clamping equipment. A worldwide sharpening service and customized co-development of optimum tool solutions with our customers rounds off our portfolio and numbers among the strengths of a leading innovative full-range supplier of a wide variety of machine tool solutions.

LEUCO sells directly to customers. Our customers are engaged in all areas of wood processing, from saw mills to the finished product, and in a

wide variety of plastic and composite material processing fields.

Around 1,200 employees work for LEUCO across the globe. The company has subsidiaries in Australia, Belgium, Great Britain, France, Japan, Malaysia, Poland, Russia, Singapore, Switzerland, South Africa, Thailand, Ukraine, USA and Belarus.

Inventiveness and technical know-how have been the heart of LEUCO from the first. Numerous patents for cutters, drill bits and saw blades result from this innovative power.

**MORE THAN
60 YEARS
OF EXPERIENCE IN
PROVIDING SOLUTIONS
FOR THE MACHINING OF
FIBER-REINFORCED
MATERIALS.**



Ledermann GmbH & Co. KG
Willi-Ledermann-Straße 1
72160 Horb am Neckar / Germany

T +49 (0) 74 51/93 0
F +49 (0) 74 51/93 270

michael.kitzlinger@leuco.com
martin.dressler@leuco.com
www.leuco.com