

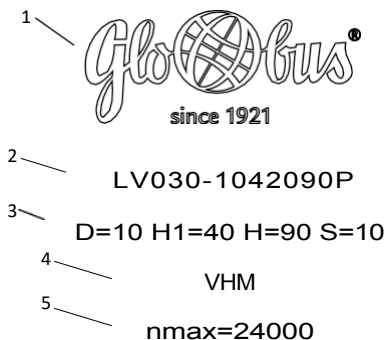
Operating/user manual **SOLID VHM END MILLS**



GENERAL INFORMATION

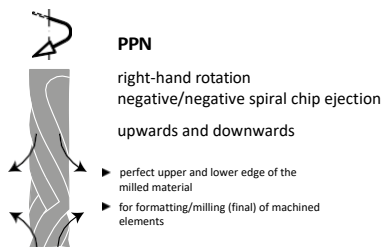
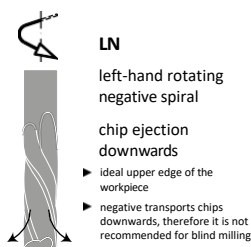
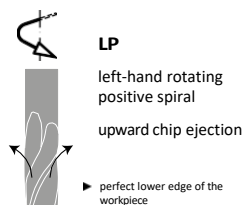
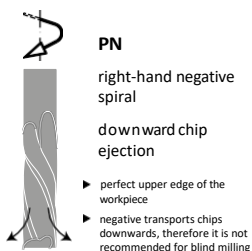
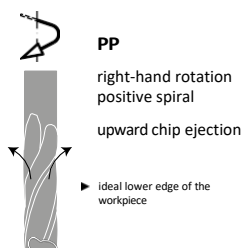
Basic recommendations for the use and safe operation of carbide end mills in accordance with PN-EN 847-1.

MARKING (on the body or packaging)



1. Tool manufacturer/brand.
2. Manufacturer index.
3. Tool type/size.
4. Cutter blade material, e.g.:
VHM/HM - cemented carbide
5. Maximum cutter speed RPM.

TYPES OF SPIRALS IN VHM END MILLS



EXPLANATION OF SYMBOLS USED

Pictogram	Explanation
	Before removing the tool/shank cutter from the packaging, read the information leaflet.
	Caution: The tool has a very sharp blade, so protect your hands, legs and/or feet when removing the cutter from the packaging or when mounting it on the machine spindle.
	When working with the shank cutter, wear protective gloves to increase your safety.
	During operation (the material cutting process), chips/sparks/filings may be ejected, so always wear safety goggles to protect your eyes.
	Wear a dust mask when machining materials.
	Use ear defenders, as excessive noise may occur during work.
	Wear protective footwear and protect your feet from various hazardous situations that may occur during work.
	Protect the tool from moisture and avoid exposing the end mill to direct or indirect contact with water.

1. TOOL INSTALLATION AND MOUNTING

- 1.1. Only trained persons with experience and knowledge of machining are permitted to operate the tool.
- 1.2. Disconnect the machine tool from the mains power supply.
- 1.3. Thoroughly clean the cutter shank and the inside of the collet and clamping nut. Use compressed air or a clean, dry cloth.
- 1.4. The clamping surfaces in the holder should be cleaned of dirt, grease, oil and water.
- 1.5. The cutter shank with the maximum free length marking must be partially covered by the collet or sleeve. It is recommended that the VHM end mill be clamped in the milling machine holder to at least 2/3 of the height of the shank. Clamping too shallow may result in increased runout, tearing or breaking of the tool!
- 1.6. The tool must be clamped in such a way that it cannot loosen uncontrollably during operation.
- 1.8. It is prohibited to use loosely fitted reduction sleeves in milling machine holders.
- 1.9. Do not modify the cutter shanks or change the geometry of the carbide blades. Any modification will result in a loss of cutting properties.

2. INSPECTION BEFORE USE

- 2.1. Before starting work, the cutter should be visually inspected.
- 2.2. If cracks, chips or excessive bluntness are found, the tool must be withdrawn from service.
- 2.3. The use of damaged cutters is prohibited.
- 2.4. Do not work with a blunt cutter – cutting resistance increases, leading to overload and damage to the tool. Sharpening should be performed when there is 0.1÷0.2 mm wear/blunting on the surface of the blade edge.

3. TOOL SELECTION / WORK

- 3.1. Before starting work, all guards fitted to the machine tool must be installed.
- 3.2. Before starting work, make sure that you have selected the correct cutter, including the correct shape and geometry of the blades for the type of material being machined and the desired result of your work.
- 3.3. Check that the direction of spindle rotation is consistent with the direction intended for the cutter.
- 3.4. Rotational speeds - observe the maximum speeds marked on the tool. Working at too low speeds causes the cutter to "choke" and become damaged.
- 3.5. Chip removal - it is necessary to use sufficiently efficient chip extraction systems. Lack of extraction causes increased resistance and overheating of the tool.
- 3.6. Cooling - for aluminium cutters, it is recommended to use a coolant, which extends the service life of the tool (preferably in the form of an oil mist spray).
- 3.7. Cutting depth - do not exceed the maximum length of the working part of the cutter marked on the tool.

- 4. SHARPENING MILLING CUTTERS**
- 4.1. VHM end mills should be sharpened on professional, specialised CNC sharpening machines that ensure minimal radial runout and repeatable cutting angles.
 - 4.2. Sharpening may only be performed by qualified personnel.
 - 4.3. Sharpening must be carried out without burning the surface of the cutter blades. Burning reduces the service life of the cutter.
 - 4.4. During sharpening, intensive cooling must be used to prevent overheating and structural changes in the cemented carbide, as this leads to a reduction in the durability and service life of the cutter.
 - 4.5. REMEMBER that sharpening the tooth/teeth of a VHM end mill will reduce the working diameter of the cutter by approx. $0.2 \div 0.4$ mm (depending on the radius of the blade edge blunting that occurred before sharpening).
 - 4.6. Tool balancing - after sharpening or repair, check the balance of the cutter. An unbalanced tool causes vibrations and poor machining quality.
- 5. HEALTH AND SAFETY RULES**
- 5.1. Follow the recommendations of the milling machine/CNC machining centre manufacturer contained in the operating manual or technical and operational documentation (DTR).
 - 5.2. Working with a damaged cutter is prohibited.
 - 5.3. Use appropriate personal protective equipment: safety goggles, work gloves, work clothing, safety footwear.

MAXIMUM ROTATION SPEED OF VHM MILLING CUTTERS DEPENDING ON DIAMETER

CUTTER DIAMETER D [mm]	MAXIMUM ROTATION SPEED N _{max} [rpm]	RECOMMENDED OPERATING SPEED [rpm]
Ø 3	24,000	18,000 ÷ 20,000
Ø 4	24,000	14,000 ÷ 15,000
Ø 5	24,000	11,000 ÷ 12,000
Ø 6	24,000	9,000 ÷ 10,000
Ø 8	24,000	7,000 ÷ 8,000
Ø 10	24,000	5,500 ÷ 6,000
Ø 12	24,000	4,500 ÷ 5,000
Ø 16	24,000	3,500 ÷ 4,000
Ø 20	24,000	2,800 ÷ 3,000
Ø 25	24,000	2,200 ÷ 2,400

REMEMBER that the recommended operating speeds depend on the cutting parameters, the type of machining and the grade of the material being machined.

EXAMPLE CUTTING PARAMETERS DEPENDING ON THE TYPE OF OF THE WORKING MATERIAL

WORKING MATERIAL	ROTATIONAL SPEED n [rpm]	FEED Vf [m/min]
SOFT WOOD		
Pine, spruce, linden	18,000 ÷ 24,000	4 ÷ 12
HARD WOOD		
Oak, beech, ash	16,000 ÷ 22,000	3 ÷ 10
WOOD-BASED MATERIALS		
Chipboard, MDF, HDF	16,000 ÷ 20,000	4 ÷ 15
Multilayer plywood	16,000 ÷ 22,000	3 ÷ 10
ALUMINIUM AND ALLOYS		
Aluminium profiles	4000 ÷ 12000	0.4 ÷ 2
DIBOND/ALUCOBOND panels	4000 ÷ 12000	0.4 ÷ 2
PLASTICS		
PE, PP, PVC, PLEXIGLASS	12,000 ÷ 18,000	2 ÷ 8
COMPOSITES		
Glass fibre (GFK)	12,000 ÷ 18,000	2 ÷ 8
Carbon fibre (CFK)	12,000–18,000	2 ÷ 8
HPL laminates	12,000 ÷ 18,000	2 ÷ 8

CALCULATION FORMULAS:

Rotational speed

[rpm=rpm]

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

Feed per tooth

[mm/tooth]

$$fz = Vf / n \times Z$$

Total feed

[m/min or mm/min]

$$Vf = fz \times Z \times n$$

where:

Vc = cutting speed [m/min] D =

cutter diameter [mm]

fz = feed per tooth [mm/tooth]

Vf = total/working feed rate [m/min or mm/min]

Z = number of blades

n = rotational speed [rpm]



NOTE: End mills used contrary to the above recommendations and notes cannot be subject to complaint, except for obvious material defects or obvious manufacturing defects. End mills damaged as a result of incorrect selection for the nature of the work cannot be subject to complaint either.

DIAGNOSTICS AND TROUBLESHOOTING - EXAMPLES

PROBLEM	PROBABLE CAUSE	SOLUTION
Rapid blade dulling	Cutting parameters too high	Reduce Vc and fz
	Incorrect tool material	Select the appropriate VHM grade
Blade chipping	Excessive machine runout	Check the rigidity of the mounting
	Incorrect geometry	Change the spiral angle or cutter type
Rough surface	Blunt tool	Replace or sharpen the cutter
	Incorrect feed rate	Adjust the cutting parameters
Vibrations during operation	Unbalanced tool	Check balance
	Improperly mounted cutter	Check the mounting in the holder
Material burning	Excessive speed	Reduce speed
	No chip extraction	Check the extraction system
Tool wandering	Insufficient rigidity of the system	Shorten the free length of the cutter
	Excessive load	Reduce the cutting depth

GOOD PRACTICES

The starting point is the catalogue: Always start with the parameters recommended by the manufacturer

milling cutter.

Listen to the machine: Vibrations and loud operation are a sign that the parameters are probably too aggressive.

Observe the chips: Dust means that fz is too small. Thick, jagged chips and a poor surface – fz is too large. Ideal chips are shiny and springy.

Change one parameter at a time: When adjusting the settings, change either n or vf to see the effect of the change clearly.

Experience is key: Over time, you will learn to "feel" the process and select the ideal parameters for a specific machine, tool and material.

OTHER IMPORTANT INFORMATION

TOOL CLEANING/MAINTENANCE

Immediately after use, clean the tool with agents that do not react with metals, e.g. GO Cleaner or GO Cleaner+ tool cleaning fluid, removing any dirt accumulated during operation from its surface. Deposits accumulated on the disc should be removed frequently, which can also be done with hot water with dissolved soda or other cleaning agents and a soft brush. Excessive deposits significantly impairs the performance of the saw. After cleaning the tool, it should be preserved with corrosion protection agents, e.g. protective oil M, ANTYKOL M-100 oil, etc.

TRANSPORT / STORAGE CONDITIONS

The product must be transported and stored in its original, undamaged packaging, with the blade secured. The product must be stored in covered, closed and dry rooms, at an ambient temperature between +5°C and +30°C.

APPROVALS / STANDARDS

The product is manufactured in accordance with the internal standards of Fabryka Pił i Narzędzi WAPIENICA Sp. z o. o. based in Bielsko-Biała. The product complies with Polish and European Union law.

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