

Absolute Top Form –
Our Specialised Tools for
the Efficient Machining of
Aluminium

Highest Productivity
When Milling and Drilling
Aluminium

Hufschmied. Europe's Leading Manufacturer
for Material-specific Tools.



From Practical Approach to Practical Application: The Perfect Solution for Every Task

Precise and Efficient – Specialised Tools for the Machining of Aluminium Components

To increase productivity for your company, we support you with technical advice for the milling of aluminium

We analyse the requirements of your company and develop bespoke technical solutions for you.

With our know-how and the possibilities offered by our Hufschmied Test Centre we optimise your production processes

Aluminium is light, resistant against corrosion, has a high conductivity and is easy to weld. Thus, this material can be deployed in a great variety of settings and plays an important role not limited to aerospace and automotive industries.

Milling aluminium

Aluminium is a lightweight construction material that, nowadays, is deployed in just about every area of life. To this effect, there are a large number of different alloys now available – ranging from very soft to high-strength materials – as used in automotive and aerospace construction. Strength values and other properties of aluminium can be influenced very flexibly by alloying.

- **Milling pure aluminium and soft aluminium alloys**

Suitable for the machining of aluminium are milling cutters and drills with various coatings. Pure aluminium is best machined with the single-edge tools of the SHARP-Line. We recommend tools from the UNIVERSAL or SHARP-Line for the milling of soft aluminium alloys. Here the focus is on the quality of the cut surface and the absence of any burrs. The cutter geometries of the SHARP-Line and the UNIVERSAL-Line offer a high service life combined with perfect surface qualities without the formation of burrs.

- **Milling medium-strength aluminium alloys**

For the machining of medium-strength aluminium materials, we recommend the use of our PROTO-Line tools with two or three cutting edges. These tools feature polished blades and thus offer the optimum in chip removal, service life and feed rates.

- **Milling hard aluminium alloys**

Hufschmied tools, can be tailored to the relevant requirement profile by PVD coatings or monocrystalline diamond coatings. This enables an optimum in cost-efficiency when milling aluminium. The specially developed HC402 ball nose cutters and HC402 torus cutters are perfectly suited for the machining of these materials at especially high rotational speeds.

- **Friction Stir Welding with Hufschmied FSW-Pins**

High-performance welding pins for the up-to-date friction stir welding of lightweight construction components. When joining sheets of aluminium or Al-alloys, an absolute joint tightness is in high demand in sectors like automotive and aerospace industry, in shipbuilding or in medical engineering. The technology of choice hereby is: friction stir welding.



Milling aluminium dibond

Composite panels made from aluminium and polymers are especially popular in the advertising industry, trade fair construction and enclosure construction. Their polymer core makes these materials markedly lightweight and as a sheet material, it can be machined very easily. Engraving or lettering can be incorporated into the aluminium of top or base layer so they have a metallic finish, thus making the material interesting for the manufacturing of signage. Aluminium dibond can be folded with ease so that nearly every conceivable three-dimensional structure can be achieved.

- **Polished blades for burr-free machining without smearing**

UNIVERSAL-Line tools by Hufschmied have the advantage that, due to their polished cutting blades, the accrued chip volume can be removed without smearing. The machined surfaces are burr-free and are able to meet even the most rigorous quality requirements. We are more than happy to advise you on rebate processing of aluminium dibond materials and on the dimensioning of the necessary tools. Best suited to the processing of a composite material made from aluminium and polyamide are the single-blade tools of the UNIVERSAL-Line as well as KD-polymer drills.

The Right Performance for Every Challenge

Increased Economic Efficiency and Process Reliability
with Process-optimised Tools by Hufschmied

Milling extruded aluminium

Nowadays, extruded aluminium profiles make an appearance in quite a variety of sectors. Their use spans from window frame profiles to interior structural wall components to uses in the automotive industry. When machining extruded aluminium profiles, the focus normally is on the absence of any burrs as well as a good surface quality of the milled edges. Furthermore, the milling process consistently releases stresses within the material feeding back to the tool.

- **Special substrate material for optimal force transmission**

Shank- and torus cutters of the CA402 series are configured in such a way that they can effortlessly meet the requirements for component quality in extruded aluminium profiles. They absorb feed-back forces within their specially developed substrate material and thus prevent damage to the blade edge let alone tool breakage.

For exterior-facing aluminium profiles, as found in the construction of vehicles or window frames, we recommend single-blade milling cutters from our UNIVERSAL-Line and milling cutters from series CA402. Their special blade geometry and their construction from a particular hard metal substrate allow them to also be used in robotic machining centres.

Pins for Friction Stir Welding

Research into friction stir welding comparing welding pins made from tool steel with carbide pins.

In the following analysis, two materials for welding pins used for friction stir welding were tested under increased stresses. The focus hereby is on the widely-used tool steels as a representative of material of lower strength (tool steel 1.2344) and carbide (G30) as a representative of material of higher strength. As the first step, a test was performed with tools made from tool steel.

Process forces in friction stir welding

The applied process forces are acting on the welding pin in a discontinuous fashion whilst simultaneously impacting upon it. This is the reason why material properties such as, for example, strength and toughness are essential for the application of an FSW welding tool.

Welding test with tool steel

It can be demonstrated in tests with tools made from tool steel that process settings and the resulting stresses on the welding pin can result in the shearing of the welding pin. On the other hand, the advantage of tool steel lies in low manufacturing costs and a comparatively high fracture resistance?

Welding test with carbide

Tests with tools made from carbide have shown that welding pins made from comparatively higher-strength materials (carbide) are especially suited for FSW applications entailing higher stresses. Furthermore, hardness and high-temperature strength favour the wear performance of friction stir welding tools. **We recommend the use of SC-FSW pins.**



SC pins have a superior L/D ratio as compared to steel pins.

Customer benefit:

- Narrower welding seam possible (up to 50% narrower) for identical sheet thickness (Al).
- Thicker weld with identical PIN diameter. Smaller PIN diameters make reduced process forces possible (important for machine design).

Polished pins made from HSS-E and SC display a significantly increased surface quality as compared to milled/turned pins.

Customer benefit:

- Less adhesions of aluminium = longer travel distance.
- Improved thermal balance within the welding zone.

Polished pins made from HSS-E and SC display a significantly better radial run-out as compared to milled/ turned pins.

Customer benefit:

- More even welding seam achieved by a uniform thermal balance.

All pins are available in a variety of materials X

- X=S1 to S3 for steel (S1=1.2343, S2=1.2344, S3=MP159)
- X=H for HSS-E high-speed steel
- X=V for carbide
- X=K for ceramics

Welding test with tool steel



Shearing of welding pin



Compared to steel pins, SC pins can achieve thinner welding seams due to their superior L/D ratio.

Pins for Friction Stir Welding

XRSPZYMG*

FSW-PINS round
cylindrical with thread



Achievable seam depths:
L2 from 2 to 25

Straight, round, cylindrical pins with a thread are mostly used in welding situations where the seam depth can be approached from the outside.

XRSUZYM*

FSW-PINS round
cylindrical with thread, with shoulder

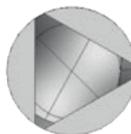


Achievable seam depths:
L2 from 2 to 25

Straight, round, cylindrical pins with a thread are mostly used in welding situations where the seam depth can be approached from the outside.

XRSPZYMG3K*

FSW-PIN
cylindrical with thread, 3 faces



Achievable seam depths:
L2 from 2 to 25

Straight, round, cylindrical pins with 3 faces and a thread are mostly used in welding situations where the seam can be approached from the outside and where a high level of material intermixing is desired.

XRSUZYM3K*

FSW-PIN
cylindrical with thread, 3 faces, with shoulder



Achievable seam depths:
L2 from 2 to 25

Straight, round, cylindrical pins with 3 faces and a thread are mostly used in welding situations where the seam can be approached from the outside and where a high level of material intermixing is desired.

* All pins are available in a variety of materials X:

- X=S1 to S3 for steel (S1=1.2343, S2=1.2344, S3=MP159)
- X=H for HSS-E high-speed steel
- X=V for carbide
- X=K for ceramics

Pins for Friction Stir Welding

XRSPZYM3KH*

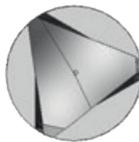
FSW-PIN

cylindrical, 3 faces with thread, spiralsed



Achievable seam depths:

L2 from 2 to 25
FSW-Pins with saw-tooth interlocking
on request



Straight, round, spiralsed, cylindrical pins with a thread are mostly used in welding situations where the seam depth can be approached from the outside and where a high level of material intermixing across the seam diameter is desired.

XRSUZYM3KH*

FSW-PIN

cylindrical, 3 faces, spiralsed, with shoulder



Achievable seam depths:

L2 from 2 to 25
FSW-Pins with saw-tooth interlocking
on request



Straight, round, spiralsed, cylindrical pins with a thread are mostly used in welding situations where the seam depth can be approached from the outside and where a high level of material intermixing across the seam diameter is desired.

On request, HSS-E pins and SC pins can be PVD-coated to significantly improve service life.
Available coatings: SLX and TL5-20

For all pins and pin chucks, the corresponding FSW shoulders are also available.
Please contact one of our sales representatives for the definition of shoulder geometries.

Pins for Friction Stir Welding

XRSPSMG*

FSW-PINS round
conical with thread

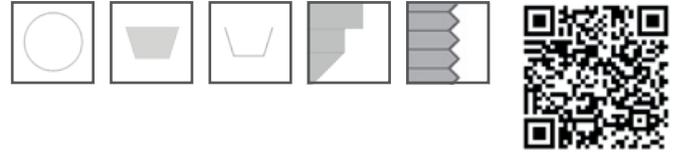


Achievable seam depth:
L2 from 2 to 25
Other profiles on request

Conical pins with a thread are mostly used in welding situations where the seam depth is approached from above.

XRSUSMG*

FSW-PINS round
conical with a thread, with shoulder

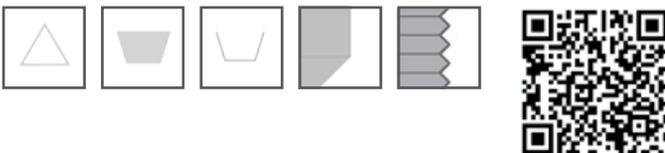


Achievable seam depth:
L2 from 2 to 25

Conical pins with a thread are mostly used in welding situations where the seam depth is approached from above.

XRSPSMG3K*

FSW-PIN
conical with thread, 3 faces

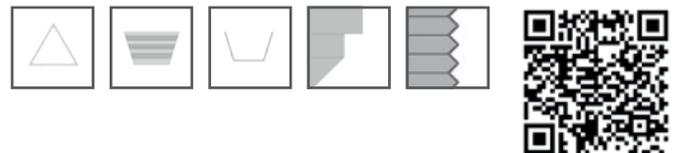


Achievable seam depth:
L2 from 2 to 25

Conical pins with 3 faces and a thread are mostly used in welding situations where the seam is approached from the outside and where a high level of material intermixing is desired.

XRSUSMG3K*

FSW-PIN
conical with thread, 3 faces, with shoulder



Achievable seam depth:
L2 from 2 to 25

Conical pins with 3 faces and a thread are mostly used in welding situations where the seam is approached from the outside and where a high level of material intermixing is desired.

* All pins are available in a variety of materials X:

- X=S1 to S3 for steel (S1=1.2343, S2=1.2344, S3=MP159)
- X=H for HSS-E high-speed steel
- X=V for carbide
- X=K for ceramics

Rotating shoulders and pin chucks specific on request

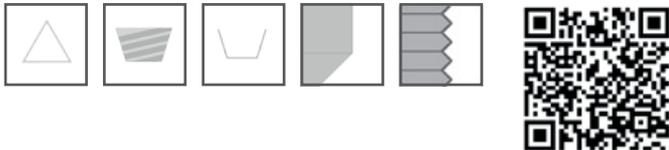


Pins for Friction Stir Welding

XRSPSMG3KH*

FSW-PIN

conical, 3 faces with thread, spiralsed



Achievable seam depth:

L2 from 2 to 25
FSW-Pins with saw-tooth interlocking
on request

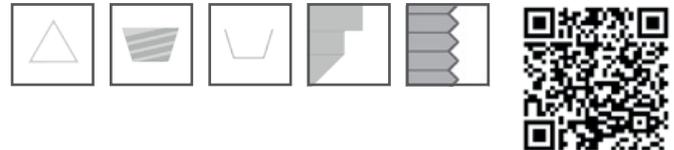


Conical spiralsed pins with 3 faces and a thread are mostly used in welding situations where the seam is approached from the outside and where a high level of material intermixing at the depth of the seam is desired.

XRSUSMG3KH*

FSW-PIN

conical, 3 faces with thread, spiralsed, with shoulder



Achievable seam depth:

L2 from 2 to 25
FSW-Pins with saw-tooth interlocking
on request



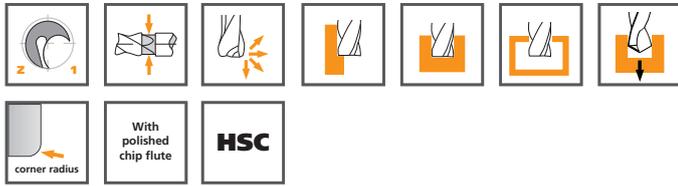
Conical spiralsed pins with 3 squares and a thread are mostly used in welding situations where the seam is approached from the outside and where a high level of material intermixing at the depth of the seam is desired.

HSC Milling Cutters

130AL

HSC-cutter Z1

right-hand twist, right-hand cutting



Diameter range:

1.0 to 10.0 mm

Available blade lengths:

From 1xD to 5xD

Available coating:

AL X

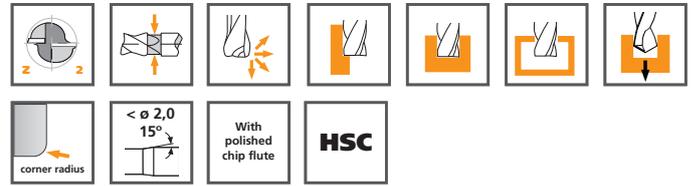


On request, we also offer this tool
in a down-milling version: Tool **131AL**

102AL

HSC milling cutter Z2

right-hand twist, right-hand cutting



Diameter range:

1.0 to 10.0 mm

Available blade lengths:

From 1xD to 5xD

Available coating:

AL X

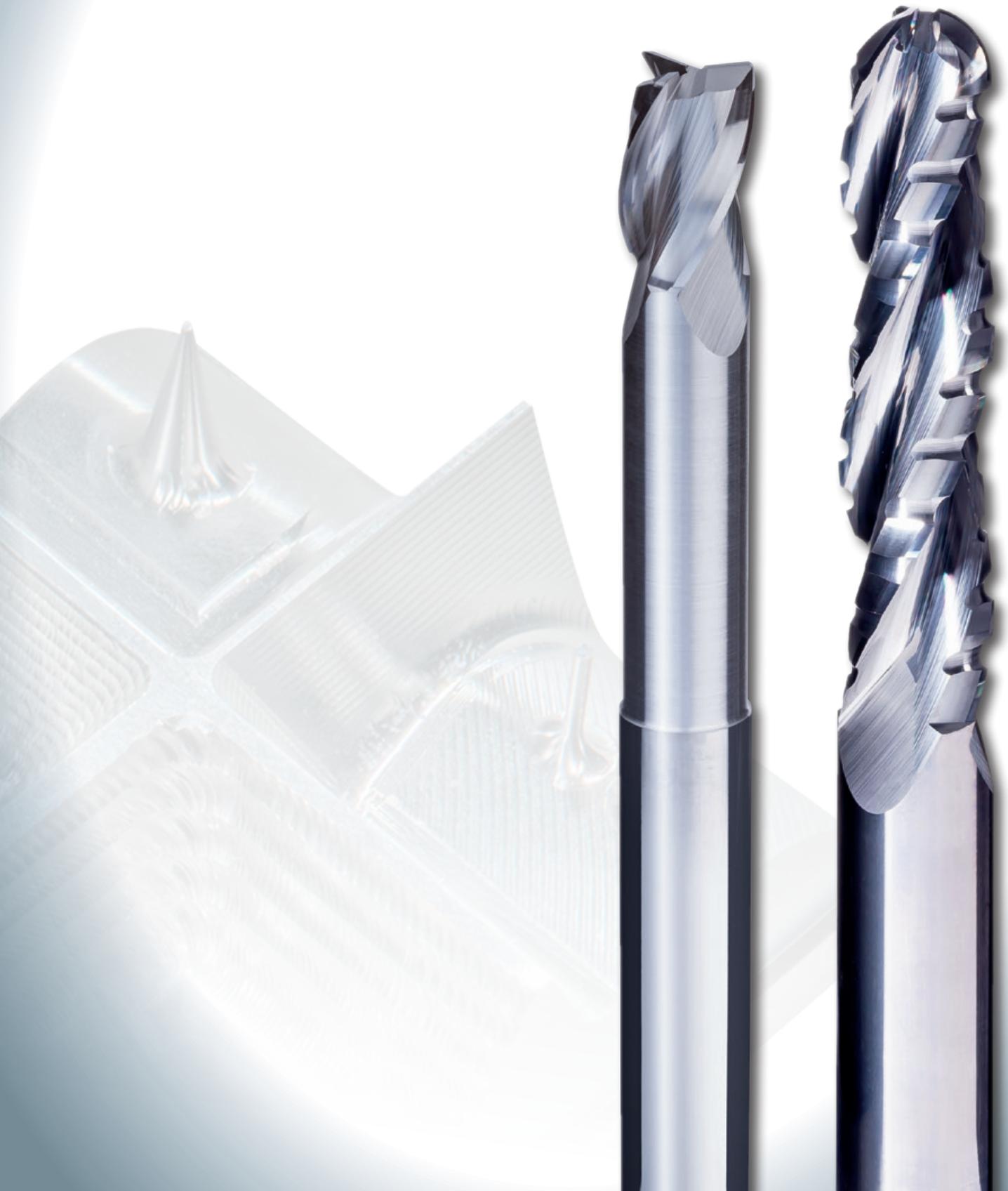


On request, we also offer this tool
in a down-milling version: Tool **104AL**

ALX coating

ALX is a TiB_2 -PVD coating with a hardness of about 4000HV and a layer thickness of about 2 μm . A TiB_2 coating prevents the adhesion of aluminium particles thus avoiding any edge build-up.

Tools for the Machining of Block Aluminium



SC tools – milling cutters

HC452

HSC copy mill Z2

right-hand twist – right-hand cutting



$\lambda_s = 35^\circ$
 $\gamma_s = 18^\circ$

With polished chip flute



Diameter range:

2.0 to 20.0 mm

Available blade lengths:

From 1,0xD to 4xD

Available coatings:

DIP – standard

ALX – on request

TL5 – on request



HC402

HSC torus cutter Z2

right-hand twist – right-hand cutting



$\lambda_s = 20^\circ$
 $\gamma_s = 16^\circ$

With polished chip flute

15°

corner radius



Diameter range:

1.0 to 20.0 mm

Available blade lengths:

From 1,2xD to 8xD

Available coatings:

DIP – standard

ALX – on request

TL5 – on request



HC402-40

HSC torus finishing cutter Z2

right-hand twist – right-hand cutting



$\lambda_s = 40^\circ$
 $\gamma_s = 16^\circ$

With polished chip flute

15°

corner radius



Diameter range:

1.0 to 20.0 mm

Available blade lengths:

From 1,2xD to 5xD

Available coatings:

DIP – standard

ALX – on request

TL5 – on request



HC403BD „WOLVERINE“

ALU volume cutter Z3 BD ZR

right-hand twist – right-hand cutting



$\lambda_s = 20^\circ$
 $\gamma_s = 18^\circ$

corner radius

torus

DIP®

χ α β



Diameter range:

3.0 to 20.0 mm

Available blade lengths:

From 1,5xD to 5xD

Available coatings:

TL5-20 DIP3s

DIP5 – standard

DIP5+ DIP6p

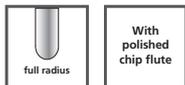


SC tools – milling cutters

HC453SR

HSC copy cutter Z3

right-hand twist – right-hand cutting



Diameter range:

6.0 to 25.0 mm

Available blade lengths:

From 1xD to 8xD

Available coatings:

DIP – standard

ALX – on request

TL5 – on request



HC453

HSC copy cutter Z3

right-hand twist – right-hand cutting



Diameter range:

6.0 to 25.0 mm

Available blade lengths:

From 1xD to 6xD

Available coatings:

DIP – standard

ALX – on request

TL5 – on request



HC403SR

HSC torus cutter Z3

right-hand twist – right-hand cutting



Diameter range:

6.0 to 25.0 mm

Available blade lengths:

From 1.5xD to 8xD

Available coatings:

DIP – standard

ALX – on request

TL5 – on request



HC403

HSC torus cutter Z3

right-hand twist – right-hand cutting



Diameter range:

6.0 to 25.0 mm

Available blade lengths:

From 1.5xD to 8xD

Available coatings:

DIP – standard

ALX – on request

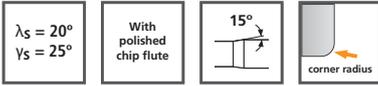
TL5 – on request



SC tools – milling cutters

130M

MINI-HSC milling cutter Z1
right-hand twist – right-hand cutting

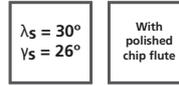


Diameter range:
0.2 to 1.0 mm
Available blade lengths:
From 1xD to 3xD
Available coatings:
TLX – standard
ALX – on request



110FPRM

Mini full radius cutter Z1
right-hand twist – right-hand cutting



Diameter range:
0.2 to 1.0 mm
Available blade lengths:
From 1xD to 3xD
Available coatings:
ALX



SC tools - drills

AD200

Drill Z2

straight – grooved



$\lambda_s = 30^\circ$
 $\gamma_s = 15^\circ$

With polished chip flute



Diameter range:

0.5 to 20.0 mm

Achievable drill depths:

up to 20xD

Available coatings:

DIP – standard	SLX
ALX – on request	TL5-20
TL5 – on request	DIP3s



AD401

SHADOW-Drill Z2

spiralised



$\lambda_s = 20^\circ$
 $\gamma_s = 25^\circ$

With polished chip flute



0,05 - 0,2
x 45°



Diameter range:

0.5 to 20.0 mm

Achievable drill depths:

up to 15xD

Available coatings:

DIP – standard	SLX
ALX – on request	TL5-20
TL5 – on request	DIP3s



AD201

Spiral drill



$\lambda_s = 20^\circ$
 $\gamma_s = 25^\circ$

With polished chip flute



0,05 - 0,2
x 45°



Diameter range:

0.5 to 20.0 mm

Achievable drill depths:

up to 18xD

Available coatings:

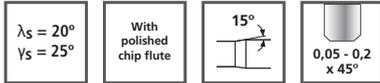
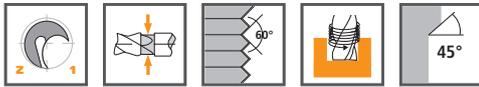
DIP – standard	SLX
ALX – on request	TL5-20
TL5 – on request	DIP3s



SC tools – thread cutters

110GF

Thread cutter Z1 up to 5xD



Diameter range:

M1.2 - M12

Achievable thread depths:

up to 10xD

Available coatings:

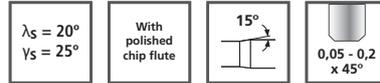
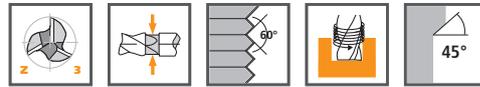
DIP – standard

ALX – on request



HC403GF

Thread cutter Z3 3xD



Diameter range:

M2.0 bis M16

Achievable thread depths:

up to 3xD

Available coatings:

DIP – standard

ALX – on request

TLX – on request

SLX

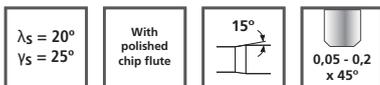
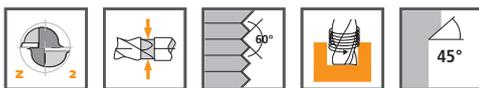
TL5-20

DIP3s



AD201GF

Drill thread cutter Z2 3xD



Diameter range:

M2.0 bis M16

Achievable thread depths:

up to 3xD

Available coatings:

DIP – standard

ALX – on request

TLX – on request

SLX

TL5-20

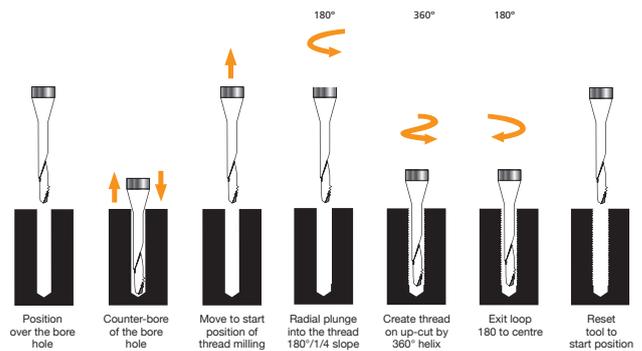
DIP3s



SC tools

The following three diagrams illustrate the strategy employed by our SC thread cutters in the machining of aluminium block material.

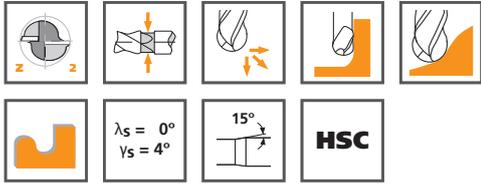
Orbital Thread Milling TMO



PCD tools – milling cutters

P100RG/RZ

PCD ball-nose cutter Z2
Straight – right-hand cutting

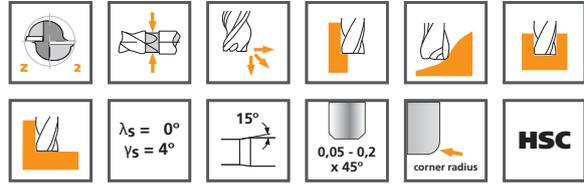


Diameter range:
3.0 to 16.0 mm
Available blade lengths:
up to 20 mm



P100 G/Z/SC

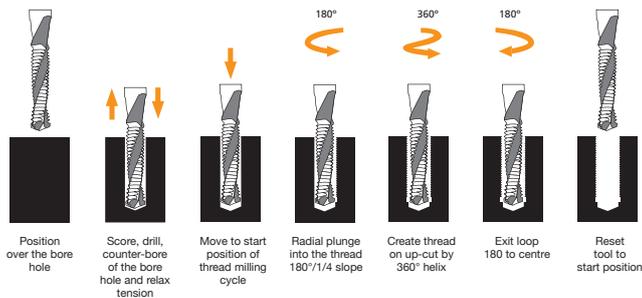
PCD torus cutter Z2
Straight – right-hand cutting



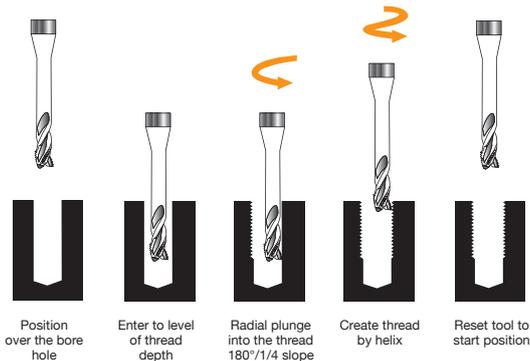
Diameter range:
3.0 to 16.0 mm
Available blade lengths:
up to 20 mm



Drill Thread Milling with Countersink Step



Circular Thread Milling



PCD tools

Tools with cutting blades made from polycrystalline diamond are mostly deployed for pre-finishing and finishing tasks in the machining of aluminium that depend on a high surface quality. However, they are not as variable as solid carbide tools when it comes to their geometric characteristics.

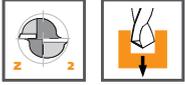
The Z geometry with its 2° positive plate positioning is designed for light up-milling processes.

G stands for the straight positioning of the cutting plates at 0° and SC for down-milling, i.e. 2° negative positioning.

PCD tools - drills

P201

PCD spiral drill Z2
spiralised



$\lambda_s = 10^\circ$
 $\gamma_s = 25^\circ$



Diameter range:

3.0 to 12.0 mm

Achievable drill depths:

up to 10xD



P211

PCD spiral drill Z2



$\lambda_s = 10^\circ$
 $\gamma_s = 25^\circ$



Diameter range:

2,0 to 16.0 mm

Achievable drill depths:

up to 15xD



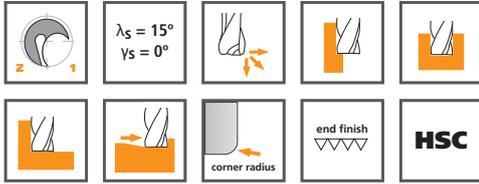
Solid-head PCD tools

Solid-head PCD tools are necessary for abrasive materials. They offer the advantage that – similar to SC tools – the entire geometry is fashioned into the polycrystalline diamond head. However, due to their structure, these tools are not suitable for ultra-precision machining.

MCD tools – milling cutters

M112

MCD end mill cutter Z1 GR
Straight, right-hand cutting

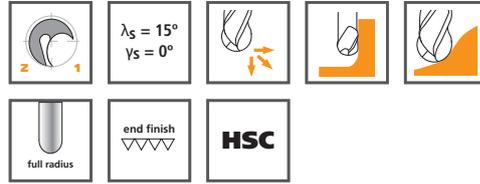


Diameter range:
1.0 to 12.0 mm
Available blade lengths:
up to 20 mm



M112R

MCD ball nose cutter Z1 GR
Straight - right-hand cutting



Diameter range:
1.0 to 12.0 mm
Available blade lengths:
up to 20 mm



Coatings:

- ALX** A TiB₂-PVD coating with a hardness of about 4000HV and a layer thickness of about 2 µm.
A TiB coating prevents the adhesion of aluminium particles thus avoiding any edge build-up
- TLX** A TiAlN-PVD-coating with a hardness of about 3800HV and a layer thickness of about 4 µm
- TL5** A ta-C layer of amorphous carbon with a hardness of about 5000HV and a layer thickness of about 0.8 µm
- TL5-20** A ta-C layer of amorphous carbon with a hardness of about 5000HV and a layer thickness of about 2 µm
- SLX** A ZrN layer of high chemical stability and a layer thickness of about 3 µm
- DIP** Nanocrystalline diamond coating
- DIP3S** Nanocrystalline diamond coating for aluminium
- DIP3P** Microcrystalline diamond coating for extruded profiles containing Si
- DIP5P** Microcrystalline diamond coating - for high-strength aluminium casting alloys
- DIP6P** Microcrystalline diamond coating – for highly-siliceous, abrasive aluminium alloys

User knowledge for the optimisation of the production process

The comprehensive concept that makes the processing of challenging materials faster and better

Hufschmied impresses by an in-depth user knowledge, qualified process consultancy and high-quality products for economically efficient machining processes. Leading suppliers from the automotive and aerospace industries have been successfully relying on Hufschmied for years. We are manufacturing our process-optimised tools in state-of-the-art manufacturing facilities and safeguard their quality by using high-end measuring machines of the latest generation.

Whatever processing task you have to master, at Hufschmied not only will you find the perfect tool for it, but user advice in the form of our in-house developed Time-Saving-Concept.

With this systematic user support, an impressive decrease of processing time together with a significant increase in processing quality of polymer machining is made possible. Simply follow our recommendation and you will see: With these innovative tools, you, too, can manufacture even more efficiently



*Ralph R. Hufschmied
Managing Director*



The quickest way to find out everything about Hufschmied Zerspanungssysteme: Just scan the QR code and off you go!

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