

**YOUR PARTNER IN THE
AUTOMOTIVE INDUSTRY**
Engine valves

Premium grinding tools since 1919
www.tyrolit.com

TYROLIT

TYROLIT Group

A global company

As one of the world's leading manufacturers of bonded grinding, cutting, sawing, drilling and dressing tools as well as a system supplier of tools and machines for the construction industry, the family-run company TYROLIT has been synonymous with top quality products, innovative spirit and outstanding service since 1919.

Day in, day out, the experts at TYROLIT work on delivering tailor-made solutions for customers around the world, helping to make their businesses successful. Around 80,000 available products set the standard in a wide variety of industries.



TYROLIT company headquarters in Schwaz, Austria

TYROLIT business units



Metal/Precision

From precision machining in the engine and gearbox industry to the production of cut-off wheels with diameters up to 2,000 mm for the steel industry – the TYROLIT product range in the Metal & Precision business unit includes high-tech tools for a wide variety of applications.

Trade

Thanks to its global sales network, in addition to premium product solutions in the three core areas of cutting, grinding and surface treatment, the Trade business unit of TYROLIT guarantees truly customer-focused marketing support.

Construction

In the Construction business unit, TYROLIT is a leading system supplier of drilling systems, wall and wire saws, floor saws and tools for the surface grinding of concrete motorways.

Stone–Ceramics–Glass

Our tailored diamond tools and grinding solutions in the Stone – Ceramics – Glass business unit are impressive in their exceptional performance and quality.

A competent partner in the valve industry

Valves for combustion engines are produced in huge numbers every day. It is therefore extremely important to manufacturers to optimise costs. This necessity can only be met through automation and the use of state-of-the-art technologies.

With its extensive expertise of the industry, TYROLIT helps its customers to optimise grinding processes and therefore lower component costs.

Our services for the machining of engine valves at a glance



Expertise & experience Professional industry know-how

TYROLIT has long-standing experience in the automotive industry, particularly in the machining of engine valves. Thanks to its close cooperation with technical institutes and automotive suppliers, TYROLIT always has all the latest knowledge about component machining.

TYROLIT has placed particular focus on the automotive industry, and always puts together a perfectly tailored package for customers consisting of grinding solutions and attractive services.

Advantages for you

- + Customised solutions from a single source
- + Individually adapted tool specifications for machines and processes
- + Optimum tool design for maximum cost efficiency
- + Hosting of workshops and training courses



Global presence On your doorstep

Global presence

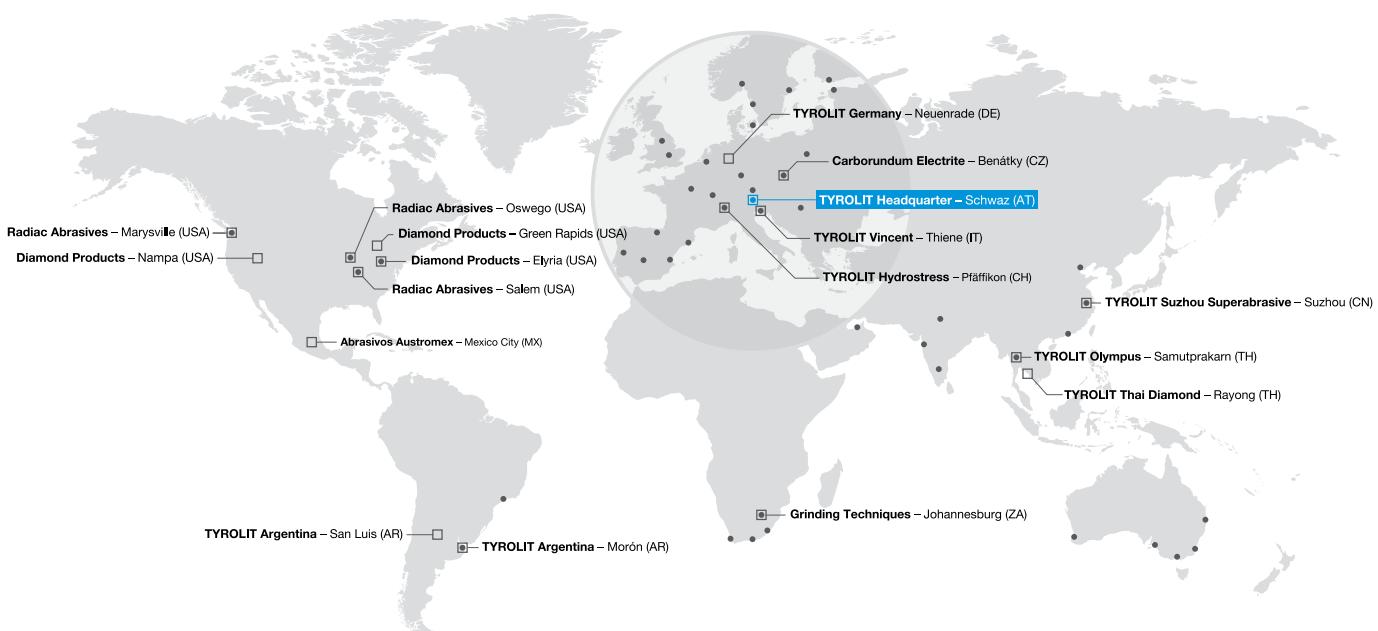
TYROLIT believes in thinking and acting globally. With a worldwide sales network currently in 65 countries and with our own production plants in 12 countries on five continents, we offer our customers all the advantages of a globally operating company.

Local availability

Think globally, act locally – in your national language and right on your doorstep. This is the principle we follow in dealing with our customers. Local contacts on your doorstep and a global team of specialist application engineers ensure optimum customer support and first-class service.

Advantages for you

- + Global presence with local contacts
- + Short reaction and service times

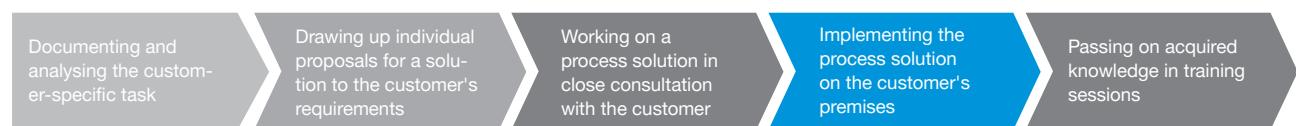


Application technology The best team for your application

An experienced team of specialist application engineers are at our customers' side all over the world, and works to produce the most cost-effective solutions. All employees in the various countries have excellent links to our headquarters in Austria, where they obtain thorough support on all technical issues.

Together with our customers, TYROLIT application engineers improve grinding processes with the goal of cutting component costs.

TYROLIT application technology in practice



Advantages for you

- + The global presence of our application engineers
- + Process solutions and optimisations in close cooperation with customers
- + Close collaboration with specialist institutes
- + Internal and external seminars and training courses



Engine valves

Function and everyday stresses

Valves are components under high thermal and mechanical stress, and are also exposed to corrosive influences. The mechanical stresses are produced by the valve disc bending under combustion pressure, the hard impact on closing, and inertial forces due to high acceleration.

The top of the exhaust valve is heated as it opens by the hot emissions exiting through it. Intake valves reach temperatures from 300 °C to 500 °C, exhaust valves 600 °C to 800 °C. If the valve seat is not perfectly tight during the combustion phase, local overheating and melting can occur, leading to valve failure. Using TYROLIT grinding wheels to machine the valve seat ensures optimum surface and dimensional tolerances.

To improve heat conduction through the stem, when requirements are particularly stringent it is made hollow and filled with sodium (sodium cooling). This enables valve temperatures to be lowered by up to 100 °C. The valve head and stem are connected by friction welding. TYROLIT's centreless grinding wheels are especially suitable here for machining the projecting weld seam. The definitive factors here are short grinding times and a long tool life.

To reduce wear, the valve seat can be armoured by welding on Stellite – a special hard metal alloy. The weld seam represents a lot of stock to remove, and is also extremely hard due to the influence of temperature. TYROLIT offers a wide range of products for the cost-effective machining of weld seams like these.

The valve material must be highly resistant to heat and scaling. Special materials were developed for this purpose (see material overview on page 8).

Experienced TYROLIT application engineers have been preoccupied with the grinding of engine valves for many years, and are therefore able to recommend a suitable grinding wheel specification for each specific material.

Quality criteria and challenges

- + Requirements for geometry and surface
- + More stock must be removed due to friction welding on the stem and welding on the seat
- + One component consists of different materials (valve head and stem)
- + Diverse materials (e.g. nickel-chromium alloys)

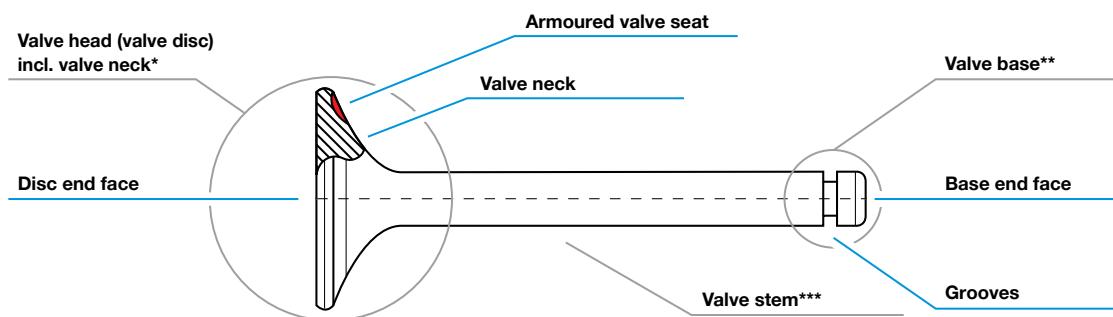


Engine valves

Structure and requirements

Valves are exposed to major forces, high acceleration and enormous temperature fluctuations. It therefore follows that the requirements for this high-performance component are very exacting.

TYROLIT's engine valve production concepts always reflect the state of the art. This knowledge creates the foundation for new generations of grinding tools.



* Geometric requirements $\geq \pm 10\mu\text{m}$ | Surface requirements for valve seat: $Rz \leq 2.5\mu\text{m}$ | Surface requirements for valve neck: $Rz \leq 4 - 10\mu\text{m}$ | Surface requirements for disc end face: $Rz \leq 20\mu\text{m}$ | Surface requirements for valve head Ø (disc): $Rz \leq 20\mu\text{m}$

** Geometric requirements within $\pm 5\mu\text{m}$ | Surface requirements for grooves: $Rz \leq 8\mu\text{m}$ | Surface requirements for base end face: $Rz \leq 2.5\mu\text{m}$

*** Straightness: $6\mu\text{m}$ | Roundness: $5\mu\text{m}$ | Surface requirements: $Rz \leq 1.2\mu\text{m}$

Material overview

Due to the high stresses these components face, new, innovative materials that satisfy the component requirements are employed. The grinding tools also have to be adapted to these new materials. Here, our customers receive intensive support from the TYROLIT application technology team.

Overview of the most important materials

Material designation	Intake valve		Exhaust valve		
	S	O	A	RA	R
Material number (DIN)	1.4718	1.4718	1.4871	1.4882	1.4785
Abbreviated designation	X 45 Cr Si 9 3	X 85 Cr Mo V 18 2	X 53 Cr Mn Ni	X 50 Cr Mn Ni Nb	X 60 Cr Mn Mo
Description	Intake valve under normal load, stem material for bimetallic valves	Intake valve under increased load, wear-resistant	Intake & exhaust valve with high thermal and wear resistance, standard exhaust valve with hard Stellite zone for cars	Intake & exhaust valve with high durability and thermal and wear resistance, standard exhaust valve with or without hard Stellite zone for HGVs	Intake & exhaust valve with high durability and thermal and wear resistance, standard exhaust valve without hard Stellite zone for HGVs

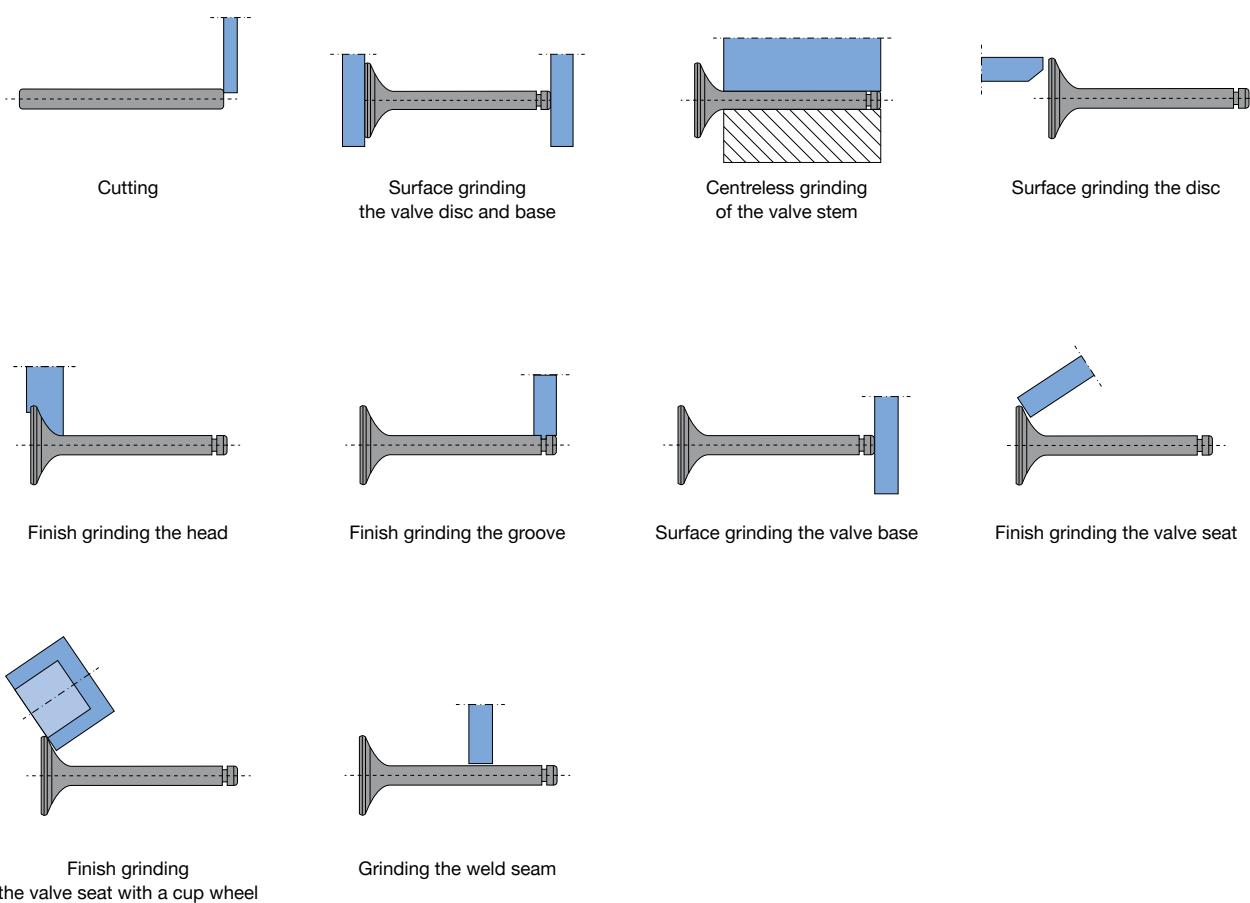
Machining an engine valve

Numerous different work operations are required to produce an engine valve, from the delivery of the raw material until final inspection of the finished product.

Grinding is a major element in the engine valve machining chain, and is therefore largely responsible for component quality. Optimised grinding processes enable valve manufacturers to reduce grinding costs. In its product portfolio, TYROLIT has all the cutting and grinding tools necessary for producing an engine valve, and

can provide specially adapted grinding tools for the entire production process.

Moreover, the TYROLIT application technology team provides assistance in designing grinding tools and setting the optimum parameters.



Customised solutions Tailor-made for your industry

Owing to their different applications, the machining of engine valves presents a particular challenge during grinding. Over many decades, TYROLIT has gathered well-founded expertise in the machining of valves, and provides its customers with on-site support.

Engine valves play a vital role in the optimisation of combustion engines. Because of the high acceleration and temperature influences to which they are exposed, valves are high-performance components that meet extremely stringent requirements

regarding machining quality. New, improved materials and component properties come into use. In addition, there is the pressure to constantly cut the cost of production and the number of individual work operations. Due to its close collaboration

with valve manufacturers, TYROLIT is always up to date with the latest state of the art, and can provide the required quality tools for the most exacting standards from its vast product portfolio.

Machining concepts

Grinding position	Grinding process	Product recommendation
Valve base	Cutting	POLARIS BASIC LW / POLARIS PLUS LW TYROLIT METAL-BONDED CBN GRINDING WHEEL SECUR CUT-OFF WHEELS
Valve neck and head Valve seat Groove	External cylindrical grinding	POLARIS BASIC LW / POLARIS PLUS LW GENIS 2/GENIS 2-CF CSS ULTRA
Disc end face Base end face	Side grinding	CENTURIA TYROLIT METAL-BONDED CBN GRINDING WHEEL
Valve stem	Centreless grinding	CSS ULTRA/REGULATOR GENIS 2/GENIS 2-CF

Grinding tools for the valve industry



POLARIS BASIC/PLUS

Electroplated CBN grinding tools for external cylindrical grinding

With its POLARIS product line, TYROLIT is the market and technology leader in the production of electroplated grinding tools. State-of-the-art production facilities, expertise and application engineering expertise are prerequisites for long tool lifetimes. Even

the smallest axial or radial run-out errors or any unbalance reduce the lifetime of grinding tools. With the POLARIS PLUS version, the zones with the highest levels of tool wear can be specifically reinforced, further extending the life of the grinding wheel.



Advantages for you

- + Maximum tool life
- + Maximum profile accuracy
- + Constant optimisation
- + Replating option
- + Customised production



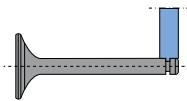
Lightweight core

- + Weight reduction up to 50%
- + Computational FEM simulation
- + Reduction in vibration
- + Reduction of maintenance intervals

Grinding applications

As in many other sectors, the trend towards superabrasives is also very noticeable in the valve industry.

The advantages of electroplated TYROLIT tools from the POLARIS family are especially appreciated in the mass production of engine valves. Long tool lifetimes, short grinding cycles and reduced non-productive times (no dressing) assuring customers with cost-effective results.



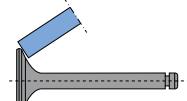
Grooves

Groove profiles can be formed precisely with accuracy down to the micrometre. An extremely long tool life is possible, thanks to the high profile retention of POLARIS grinding tools.



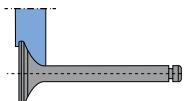
Valve base (cutting)

Easy-cutting specifications combined with long lifetimes lead to cost-effective solutions for our customers.



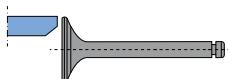
Valve seat

Electroplated grinding tools are used to pre-grind the valve seat. Finish grinding is performed using vitrified bonded grinding tools.



Head geometry

After forging, the valve head is given its final shape. POLARIS tools are capable of achieving high stock removal rates while simultaneously producing the specified surface finishes and satisfying the geometric requirements.



Disc end face

POLARIS grinding tools are ideal for the side grinding of end faces.

GENIS 2/GENIS 2-CF

Vitrified bonded CBN grinding tools for external cylindrical grinding

With the GENIS 2 product line, TYROLIT defines a new performance level and a wider range of applications for external cylindrical grinding with vitrified bonded CBN tools. GENIS 2 is characterised by a high-strength bond with excellent moistening

properties, which securely binds the CBN grain. Low bond volumes enable very open, cool-grinding and extremely easy-cutting specifications with a long lifetime. GENIS 2 is also available with a CF core.



Advantages for you

- + High cost efficiency
- + Wide range of applications
- + High running precision
- + Optimum grain utilisation
- + Replating option



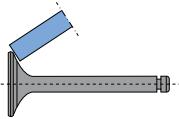
CF core

- + Low weight
- + Best damping
- + Simultaneous machining

Grinding applications

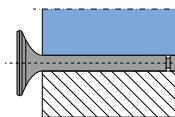
Vitrified bonded superabrasives are increasingly taking over the centre ground in the valve industry.

Vitrified bonded CBN tools from the GENIS family come into their own in highly sensitive processes, such as the grinding of valve seats and stems. Regular dressing guarantees constant component quality throughout the lifetime of the grinding wheel.



Valve seat

GENIS 2 grinding tools are especially suitable for giving the valve seat its final finish. The geometry and surface of the valve seat have extremely narrow tolerances because of the stringent sealing requirements.



Valve stem

With vitrified bonded CBN grinding tools, centreless grinding can be used both for pre-grinding and finish grinding the valve stem. To reduce the weight, alternative core materials such as aluminium or CFK can be used.



CSS ULTRA/CSS REGULATOR

Vitrified bonded grinding tools for external cylindrical grinding & regulating wheel for centreless grinding

With the CSS ULTRA product line, TYROLIT has created a sustainable grinding wheel micro-architecture through the use of new, high-quality components and innovative sintering technology.

The CSS REGULATOR from TYROLIT is manufactured as a unitised version. The extremely high compaction ensures uniform quality of the regulating wheel.



Advantages for you

- + Long lifetime
- + Good profile retention
- + Cool grinding
- + Shorter grinding time/higher productivity



- + Good profile retention
- + High coefficient of friction
- + Constant grinding pressure

Grinding applications

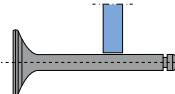
Nearly all grinding processes in engine valve production can be performed using conventional, vitrified bonded grinding wheels.

Advantages of using conventional abrasives include the simple profiling of the wheels, and the economical production of smaller batch sizes. Here, TYROLIT is a system supplier. This way, grinding and dressing tools can be perfectly matched to one another.



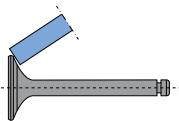
Grooves

The challenge lies in keeping to the highly precise groove profile with accuracy down to the micrometre. CCS Ultra grinding wheels combined with TYROLIT diamond profile roller dressers deliver optimum grinding results.



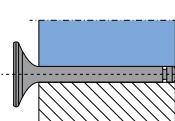
Weld seam

In bimetallic valves, the projecting weld seam needs to be removed. The extremely wear-resistant bond of the CSS Ultra enables cost-effective grinding.



Valve seat

Valve seats – sometimes armoured with Stellite – have the narrowest tolerances on this component. CSS Ultra products are ideal for this grinding operation because of their profile retention.



Valve stem

The conventional CSS Ultra grinding wheel combined with the CSS Regulator regulating wheel constitutes the ideal solution for centreless grinding of the valve stem.



Head geometry

CSS Ultra grinding wheels are absolutely ideal for machining the valve head and neck. High stock removal rates and shortened grinding times mean lower component costs.

CENTURIA

Resin-bonded grinding tools for side grinding

With its CENTURIA product line, Tyrolit offers a complete range of conventional, resin-bonded tools for surface grinding. Different surface grinding methods are used for the efficient production of functional surfaces that must

satisfy exacting requirements in terms of evenness, plane parallelism and surface finish. Either both faces are machined simultaneously (double side face grinding), or just one face is machined using single wheels, rings or cup wheels.

The components are often mass-produced, which means they face stringent requirements with respect to process stability.



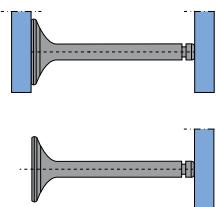
Advantages for you

- + Cool grinding
- + Long lifetime
- + Constant grinding behaviour

Grinding applications

Resin-bonded grinding discs from TYROLIT are especially suitable for mass-produced components. Process stability and component quality are our top priorities.

The CENTURIA has been a fixture in the TYROLIT product portfolio for many years, and has proven its worth in machining the end face of engine valves.



End faces

CENTURIA grinding tools are suitable for surface grinding both the disc and the end of the stem. One option is to grind both ends simultaneously using double side face grinding.



METAL-BONDED CBN GRINDING TOOLS

Metal-bonded grinding wheels are the be-all and end-all when it comes to high stock removal rates and long lifetimes. The metal bond is unrivalled among

bond systems for binding the grain securely in the matrix. This bond is particularly suitable for applications in which stock removal is of prime importance.

However, metal-bonded wheels with finer grit sizes are also excellent for the finish grinding of surfaces.



Advantages for you

- + Maximum accuracy
- + Best concentricity
- + Long tool lifetimes

Grinding applications

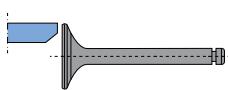
Metal-bonded TYROLIT CBN grinding tools have impressive bond properties due to their huge efficiency and profile accuracy.

These CBN tools also boast extremely high stock removal rates. This makes shortened grinding times possible, while complying with component tolerances.

Valve base (cutting)

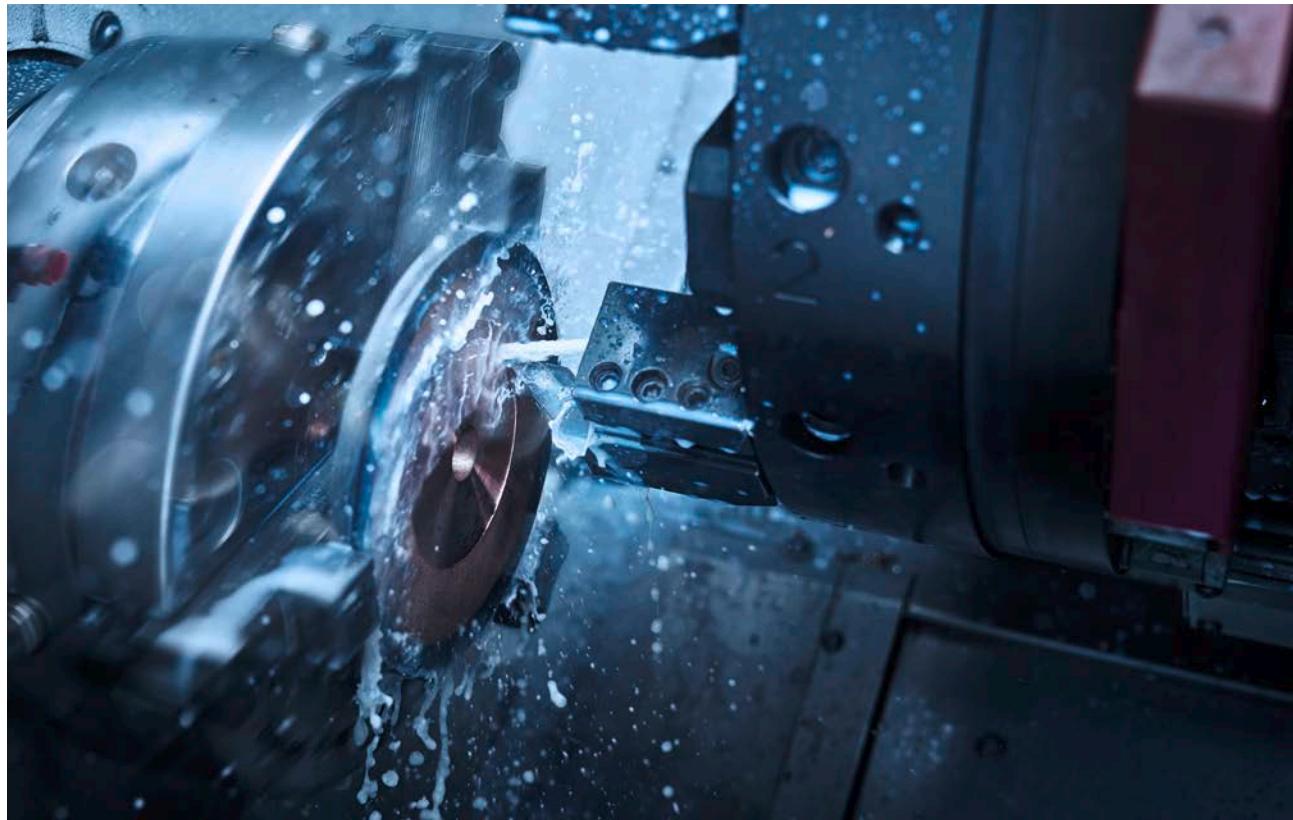


With their high adhesion strength, metal-bonded grinding wheels are perfect for cutting valves. Easy cutting with good profile retention – these properties guarantee maximum tool lifetimes.



Disc end face

Metal-bonded grinding wheels with finer grit sizes are especially suitable for finish grinding the end face of the disc.



DIAMOND DRESSING TOOLS

In addition to its extensive range of grinding tools, TYROLIT also supplies the associated dressing tools. The job of dressing tools is to achieve a geometric profile and the desired wheel topography. The harmonised system of TYROLIT diamond dressing tools and corresponding grinding wheel reduces thermal stress on the workpiece, enabling optimum grinding results.



Advantages for you

- + Maximum profile and dimensional accuracy
- + Long lifetime
- + Harmonised system



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