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Ultrasonic tire - Rubber cutting

Texturized rubber cutting: the special ultrasonic cutting blades developed and produced within the Sonic Power blades - knifes are able to cut the extruded textured rubber with thickness from 1 mm up to 55 mm.

Ultrasonic tires cutting using special blades developed and manufactured by Sonic Power's mechanical department are capable of slicing through texturized 1mm and even 5mm thick extruded rubber.
The ultrasonic cross cut process provides the advantage of getting rid of the need to vulcanize the rubber.

The tire can be cut with accurate angles reaching up to 22°, considerably increasing the cohesion of the sliced section.

Our Tire cutting kits and components are easily adaptable to existing machine designs.

- A suitable amplitude and feed rate increase the cutting quality
- The key factors affecting the cutter are the knife's angle, size, shape and thickness
- High power, more suitable for high-class cars, car tread cutting
- Common cutter types: 82mm,100mm, 255mm, 305mm, 350mm
- The cutting speed depends on the angle and thickness of the cut tire rubber
- The key factors affecting the cutter are the knife's angle, size, shape and thickness
- For semi-steel tires, radial tires and other inner liner and sidewall cutting using standard grade titanium
- For semi-steel tires, radial tires and other inner liner and sidewall cutting using **hardened Ferro titanium**

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Ultrasonic tire and rubber Cutting

The knifes is widely used in rubber industry for cutting tires in desired size accurately and precisely. Integrated with advanced technology, this **Ultrasonic Rubber Cutter for Tire Industries**.

Ultrasonic cutter vibrates its blade 20,000 - 40,000 times per second (20 - 40 kHz). Because of this movement, the ultrasonic cutter can easily cut resin, rubber, nonwoven fabric and composite materials. Besides being excellent in maintainability, our products are environment-friendly as they do not substantially discharge any crumbs, waste water, noise, or smoke.

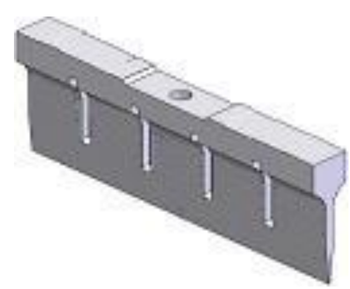
40kHz Stiletto Cutting knife

For more than thirty years, SONIC POWER has been a leader in ultrasonic rubber cutting. SONIC POWER's broad capabilities and global presence enable equipment builders and tire manufacturers around the world to quickly and economically adapt to cutting processes in the rubber industry. With technical centers and sales support centers worldwide, SONIC POWER is always close by, ready to understand and fulfill the needs of its customers when requested.

40kHz Cutting knife

With ultrasonic cutting, SONIC POWER's application knowledge and expertise are unsurpassed, specifically with its ability to utilize Finite Element Analysis (FEA) by skilled engineers to analyze the most critical of factors during the acoustical tooling development process. SONIC POWER has a long history of being a partner with tire manufacturers and tire machine builders.

Some of these partnerships have pushed the boundaries of our technology, to what was once uncommon is now Standard in the industry



30kHz Cutting knife

20kHz Cutting knife

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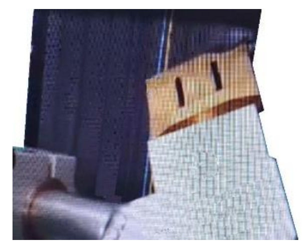
Benefits of SONIC POWER Ultrasonic Rubber Cutting

- **Very high precision cutting —** the cuts are smooth, clear, and clean.
- **Repeatable cutting —** the blade output is monitored by a closed loop electrical circuit to provide consistent cuts time after time.
- **Cool temperature —** little heat is imparted to the rubber.
- **Dry —** no lubrication is needed since the vibrating cutting tool passes smoothly through the rubber, while ultrasonically vibrating at 20,000 to 40,000 cycles per second, depending on the application.
- **Low energy consumption —** the vibrating cutting horn is only activated when cutting, yielding approximately 100 watts or less during a typical thin material application.
- **Ease of integration into automation —** the ultrasonic rubber cutting process is simple enough to upgrade into existing machinery or implement into new machinery.



The Four-Part Ultrasonic Rubber Cutting System

- **Power Supply —** also called the generator. Converts 50/60Hz AC electric voltage into high-frequency electrical energy. Depending on the application, frequencies can be 20kHz to 40kHz.
- **Converter —** an electro-mechanical device that receives the electrical energy from the power supply and converts it into high-frequency mechanical vibrations.
- **Booster —** sits between the converter and horn (blade). Provides rigidity to the stack and controls the amplitude (range of motion) of the cutting horn.
- **Cutting Horn —** also referred to as the blade horn.

A wide array of configurations are available, each custom engineered for the specific application to ensure exacting, long-term performance. With typical ultrasonic rubber cutting applications, the angle of the blade horn, thickness and type of rubber, and the style of cut ultimately affect the cutting speed. Two main styles of cut are prevalent—plunge and traverse.

SONIC POWER has been able to achieve low skive angles in numerous applications with a variety of blade horns. Several 40kHz examples of blade horns are listed below, but depending on the application, SONIC POWER can tailor a solution to meet the most demanding of customer needs.

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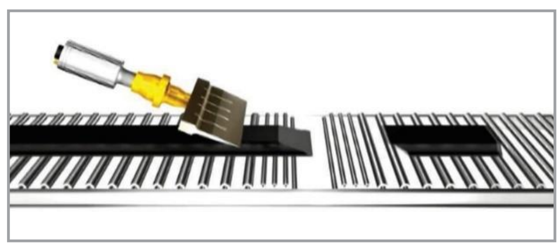
Half Wave Blade Horns for Ultrasonic Rubber Cutting

	Length	Material	RC60 material	Coating (optional)	Booster
40kHzstiletto	2.5” (63.5 mm)	Titanium	Ferro Titanium	TiN	1:1
40kHz	3.25” (82.5mm)	Titanium	Ferro Titanium	TiN	1:1
30kHz	4.33” (110mm)	Titanium	Ferro Titanium	TiN	1:1
30kHz	7” (180 mm)	Titanium	Ferro Titanium	TiN	1:1
30kHzstiletto	3.5”(90mm)	Titanium	Ferro Titanium	TiN	1:1
20kHz	5” (127mm)	Titanium	Ferro Titanium	TiN	1:1
20kHz	10” (254mm)	Titanium	Ferro Titanium	TiN	1:1
20kHz	12” (305mm)	Titanium	Ferro Titanium	TiN	1:1

Traverse Cut



Plunge Cut

*TiN - Titanium Nitride

TiN coated 30 kHz

Ultrasonic "Tire cutting" 20-40 kHz

TiN (titanium nitrade)

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Datasheet of the Titanium nitride nickel coating

Titanium nitride (**TiN**; sometimes known as **Tinite**) is an extremely hard ceramic material, often used as a coating on titanium alloys, steel, carbide, and aluminum components to improve the substrate's surface properties.

Applied as a thin coating, TiN is used to harden and protect cutting and sliding surfaces, for decorative purposes (due to its golden appearance), and as a **non-toxic exterior for medical implants**. In most applications a coating of less than 5 micrometers (0.00020 in) is applied.

TiN has a Vickers hardness of 1800–2100, a modulus of elasticity of 251 GPa, a thermal expansion coefficient of 9.35×10^{-6} K^{-1}, and a superconducting transition temperature of 5.6 K.

TiN will oxidize at 800 °C in a normal atmosphere. TiN has a brown color, and appears gold when applied as a coating. It is chemically stable at 20 °C, according to laboratory tests, but can be slowly attacked by concentrated acid solutions with rising temperatures. Depending on the substrate material and surface finish, TiN will have a coefficient of friction ranging from 0.4 to 0.9 against another TiN surface (non-lubricated). The typical TiN formation has a crystal structure of NaCl-type with a roughly 1:1 stoichiometry; TiN_x compounds with *x* ranging from 0.6 to 1.2 are, however, thermodynamically stable.

TiN becomes superconducting at cryogenic temperatures, with critical temperature up to 6.0 K for single crystals. Superconductivity in thin-film TiN has been studied extensively, with the superconducting properties strongly varying depending on sample preparation, up to complete suppression of superconductivity at a superconductor-insulator transition. A thin film of TiN was chilled to near absolute zero, converting it into the first known super insulator, with resistance suddenly increasing by a factor of 100,000.

	Titanium Gr5
Color TiN	Gold
Weight Ti, g/cm^3	4.42
Elastic Modulus Ti, GPa	107 - 122
Coefficient of Thermal Expansion Ti, $m\ m^{-1}\ °C^{-1}$	9.4×10^{-6}
Proof strength Ti, Rp0.2 MPa min	825 - 910
Tensile strength Ti, Rm MPa min	895
Elongation Ti, A % min	10
Hardness TiN outermost layer, HV	2 900 - 3 100
Hardness Ti_2N second layer, HV	1 200 - 1 500
Hardness Ti, HV	330
Melting point Ti, °C	1 604 - 1 660
Thermal conductivity Ti, W/m-K	6.7
Friction TiN against steel, dry, µ	0.5
Friction TiN against TiN, dry, µ	0.4
Coating structure	Arc

General remarks:	All data are approximate values they depend on application environment- and test conditions.
Coating hardness:	Measured by nano indentation according to ISO 14577. For multilayers the difference of the hardness variates.
Coefficient of the friction:	Determined by ball-on-hand disk test in dry condition with a steel ball accordingly, to ASTM G99. During run-in the given values may be exited.
Max service temperature C:	These are approximate values out of the field. Due to thermodynamic laws there is a dependency of pressure in application.