Cutting Fluids for Medical Engineering Industry

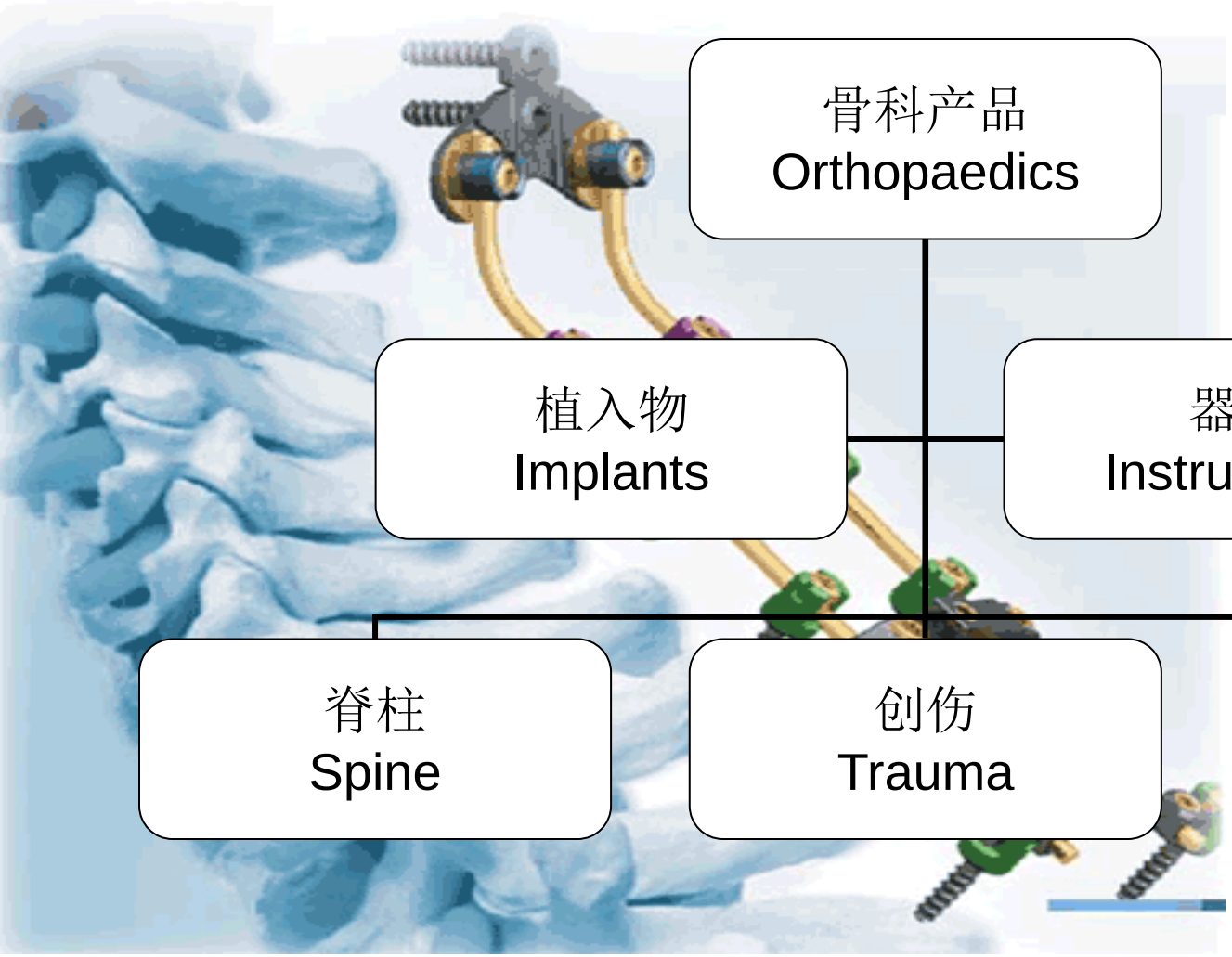
医疗行业金属加工液

FUCHS PETROLUB AG
FUCHS CHINA

Summary 概要

- Products of medical industry 医疗行业产品
- Machining process and material 加工材质和过程
- Cleaning process and standard 清洗程序和标准
- Cutting fluid for medical 医疗切削液

Products of medical industry
医疗行业产品



骨科产品
Orthopaedics

植入物
Implants

器械
Instruments

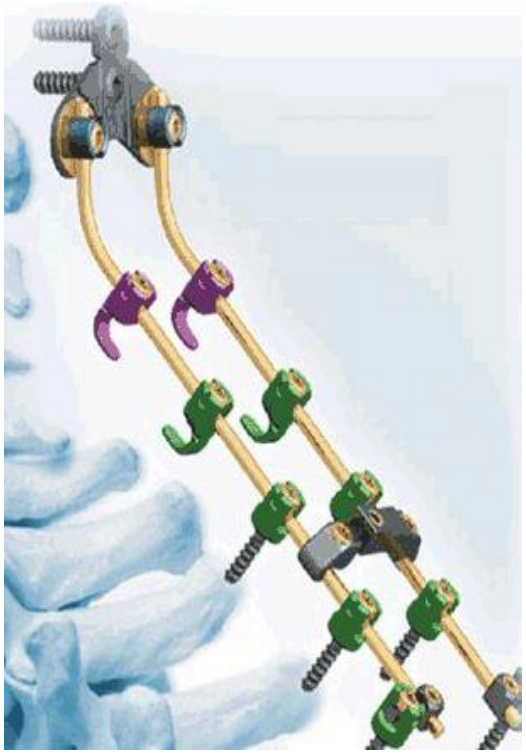
脊柱
Spine

创伤
Trauma

关节
Joint

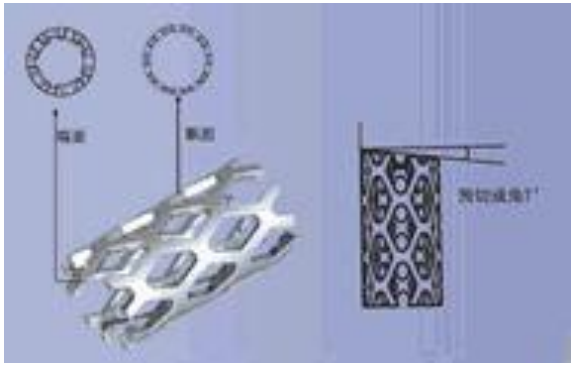
Spinal Implant Products

脊柱植入



万向螺钉**Multi-Axial Screw**

Milestone 椎间融合器 **Milestone Intervertebral Fusion Cage**



钛网系统**Titanium Mesh System**

Cervi-Lock 颈椎前路钢板系统 **Cervi-Lock Anterior Cervical Plate System**

UPASS 5.5脊柱内固定系统 **Intraspinal Fixation System**

Trauma Products

创伤产品

常规创伤产品
Conventional Trauma Products

锁定接骨板

Locking Plate

Joint Products

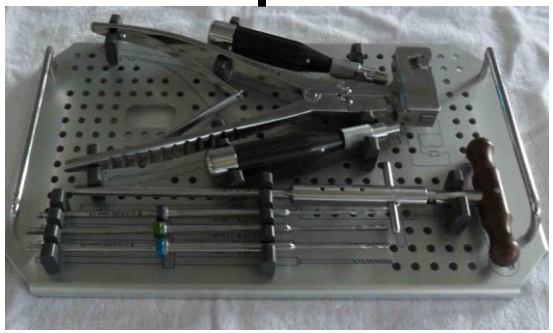
联接产品

膝关节
Knee

髋关节
Hip

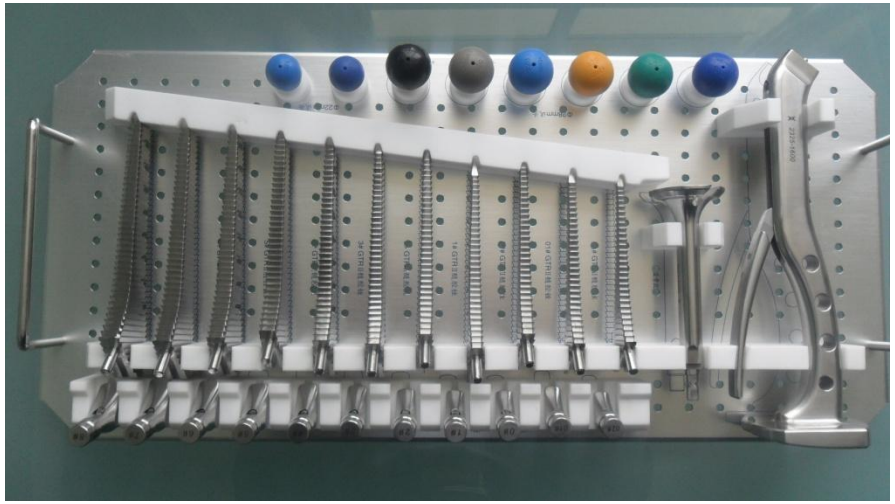
Instruments

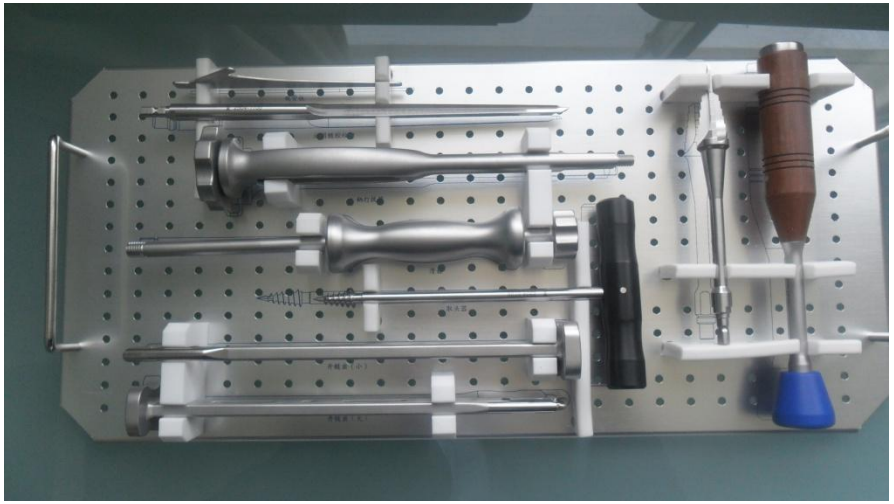
医疗器械

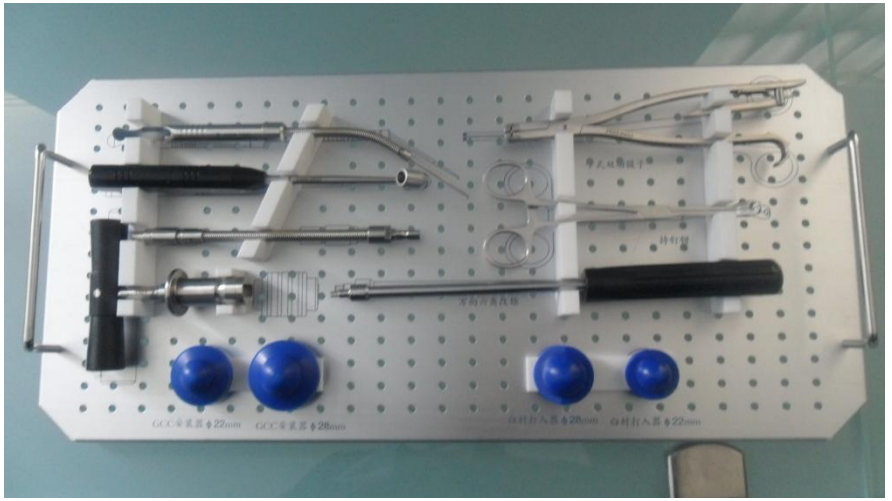


Instruments

医疗器械







Instruments

医疗器械

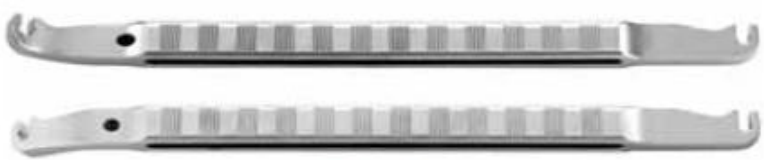
PARALLEL COMPRESSOR / DISTRACTOR

平行加压钳/撑开钳

Instruments

医疗器械

Lateral Implant Holder
5484211



In Situ Benders
Left 5484255
Right 5484260

Coronal Benders
Left 5484265
Right 5484270

Beale Rod Reducer, Slots
5484134

Machining process and material
加工工艺和材质

- Machining process 加工工程

Machine：precision, automated machines, Less cutting allowances (very small parts)

设备：精密自动化设备，较小切削量（非常小的部件）。

- Tools 工具

Cemented carbide tools with coating (machining titanium alloy and steel). Screwing tooling is also very popular in medical instrument machining.

带涂层的硬质合金刀具（加工钛合金和钢）。螺纹工具在医疗器械加工过程中非常普遍。

- Machining 加工

Critical material (titanium, steel, magnesium and plastic) and critical machining processes (small parts with deep hole drilling and turning).

主要材质（钛、钢、镁和塑料），主要工艺（小部件、深钻孔和车削）。

Machining process and material
加工工艺和材质

Specific properties of Titanium and Titanium alloys 钛和钛合金特点

- The low thermal conductivity leads to high temperate and wear of the tool

  低导热系数导致设备发烫和增加磨损；
- The low modulus of elasticity leads to a stronger deflection of the Titanium parts during machining

  低弹性导致加工工程中钛合金部件精度偏移加大
- Titanium tends to weld with the cutting tool

  钛合金容易粘刀

Due to this some general rules can be derived: 对应法则如下：

- The machine tool and the clamping should be stiff 加工刀具和夹具要硬
- The cutting tool should be sharp 切刀要锋利
- The titanium part has to be cooled sufficiently to take away the heat and to avoid the creation of highly flammable Titanium dust （fire risk is the most important issue when using cutting oil. Corrosion protection behavior (including spindle) is the key point of coolant.）钛工件必须被充分冷却，带走热量，避免热量堆积导致钛粉燃烧（起火风险是用切削油的关键因素）。防锈（包括主轴）是切削液重要因素。

(Source: Klocke / König 2008, Peters / Leyens 2002)

Machining process and material
加工工艺和材质

Specific properties of a coolant to machine Titanium and Titanium alloys
加工钛和钛合金的冷却液的特性：

- Specially designed for heavy duty machining

特别为重负荷加工设计

- Excellent anti-wear properties

优秀的抗磨损性

- Excellent extreme pressure properties

突出的极压性

- High lubricity (phosphoric ester)

高润滑性（磷酸酯）

- High emulsion stability (high pressure)

高乳化液稳定性（高压力下）

- Outstanding wetting and flushing properties (cooling)

优秀的湿润和冲洗性能（冷却）

- High sump life

长寿命

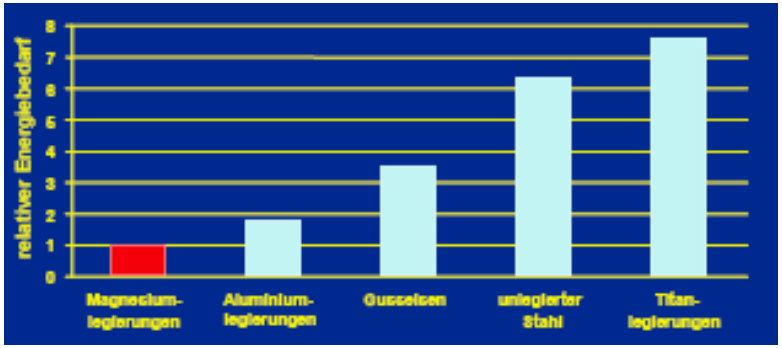
- According to company specifications

针对规格要求量身定做

Machining process and materials
加工工艺和材质

Properties of Magnesium 镁的属性

- Low specific weight (30 % < than AL) 重量轻（比铝轻30%以上）
- Excellent workability and castability 优良的加工和铸造性能



Benefits of Magnesium Machining 镁加工好处

- Short chips, 5 - 10 > tool life, low cutting forces, high cutting speed,

碎片小，刀具寿命长，低切削力、高切削速度

- high surface quality, low tool wear, high heat dissipation

表面要求高，刀具低磨损，高散热性

Disadvantages of wet Magnesium Machining 湿镁加工的劣势

- Magnesium reacts with water generates hydrogen (oxyhydrogen) deflagration

镁容易与水反应产生氢（氢氧）产生爆炸

- Increased salinity due to the dissolved Magnesium

镁溶解，增加盐度

- Corrosion / Staining 生锈/污渍
- Deposits in the machine and the coolant tubes 在机床和冷却液

管道容易产生沉淀

- pH- value change pH值变化快

Machining process and material
加工工艺和材质

Specific properties of a coolant to machine Magnesium 加工镁的切削液特性

- Selection of suitable raw materials 选择合适的原材料
- Emulsifiers which are suitable for the high Magnesium dissolving 选择适合高镁溶解的润滑剂
- Buffer systems which avoid the pH-increase as far as possible 尽可能避免缓冲系统中的pH值变化增加；
- Special corrosion protection additives with anti-staining character 特殊防锈防腐蚀的添加剂

State of the art of wet Magnesium machining (coolant of 3rd generation)

第三代湿镁加工产品的优势：

- Sump life more then one year 乳化液寿命超过一年
- Monitoring and maintenance comparable with conventional emulsions
- 监测和维护与常规切削液一样简单
- Reduced explosion risk due to with safety equipment optimized machine tools

减少设备爆炸风险，延长刀具寿命

- Significantly increased productivity due to reduced machine down time

减少设备故障次数，显著增加生产量

Machining process and materials
加工工艺和材质

Properties of Plastic（critical material）

塑料的属性（关键材料）

- Low specific weight 比重轻
- Loose structure 松散结构

Plastic machining 塑料加工

- Dry machining for most of plastic parts, but surface quality need to be improved

大多数塑料件都干加工，表面质量要求提高

- As for the properties of plastic, coolant is easily absorbed by plastic chips, which would lead to stability problem.

由于塑料冷却液容易被塑料吸收，容易导致乳化液不稳定

- Not only meet the requirement of machining, but also meet the requirement of structure and toxicity (coolant would easier go inside the parts.)

不止满足加工要求，同时满足结构、毒性要求（冷却液容易进入塑料件内部）。

Cleaning process and standard
清洗程序和标准

Cleaning process 清洗程序

how to select cleaner 如何选择清洗剂

--all chemicals (including lubricant) using in medical industry should be harmless, some customer even prohibit some element according to the process. Any formulation change should be informed first. 所有用于医疗行业的化学品（包括润滑油）都必须是无害的。有一些客户甚至要求加工过程中禁止某些元素。任何的配方变动都必须事先告知。

--cleaner is one of the most important chemical for the process.
清洗剂是程序中最重要的化学元素之一。

--as for the consider of safety and environment protection, water miscible cleaner is more popular. 考虑到安全、环境保护的因素，水溶性清洗剂使用较普遍。

--alkaline cleaner is recommended, which have better cleaning behavior for oil, inorganic salt, metallic oxide and Protein dirt.
推荐使用碱性清洗剂，更容易去除油污、无机盐、金属氧化物和蛋白质污垢。

Cleaning process and standard
清洗程序和标准

Cleaning process 清洗程序

--there are usually cleaning and rinsing process to ensure as less residue as possible.

通常情况，清洗程序和过程都要求少残留；

--cleaning process is using cleaner sometime with ultrasonic to remove oil and other residue.

清洗过程使用清洗剂，有时与超声波配合使用去除油污和其他残留；

--and then rinsing with DI water at dust-free plant.

然后用去离子水在无尘车间清洗；

Cleaning process and standard
清洗程序和标准

Rules and standards 标准和法则

--ASTM F2459 - Standard Test Method for Extracting Residue from Metallic Medical Components and Quantifying via Gravimetric Analysis从医用金属部件提取残留物并通过重力分析进行量化的试验方法

--ASTM F2847 - Standard Practice for Reporting and Assessment of Residues on Single Use Implants报告和评定一次性植入物上残留物的标准操作规程

--ASTM E2314 - Standard Test Method for Determination of Effectiveness of Cleaning Processes for Reusable Medical Instruments Using a Microbiologic Method (Simulated Use Test)用微生物法测定可再用医疗器械用清洁工艺有效性的标准试验方法(模拟使用试验)

--ASTM D7225 - Standard Guide for Blood Cleaning Efficiency of Detergents and Washer-Disinfectors洗涤剂和垫圈消毒器的血液清洁效果的标准指南

Products
产品

Plates and screws:
ECOCOOL MEDISTAR
ECOCUT 7520 LE-S
ECOCUT 8516
ECOCUT HFN 13 LE UNI
ECOCOOL 7630

Prosthetic dentistry implants:
PLANTOCUT Mikro 10 SR
ECOCUT 7520 LE-S
ECOCUT 8516
ECOCUT HFN 13 LE UNI

Artificial spinal discs:
ECOCOOL MEDISTAR
ECOCUT 7520 LE-S
ECOCUT 8516
ECOCUT HFN 13 LE UNI
ECOCOOL 7630

Degradable magnesium alloy implants:
Ecocool 2516 MG-Medi
Ecocut MiKro Plus 20

Artificial hip joints:
Ecocut HFN 5 W
Ecocool TN 2525 HP
Ecocool 7630

Artificial knee joints:
Ecocut HFN 5 W
Ecocol TN 2525 HP
ECOCUT 7520 LE-S
ECOCUT 8516
Ecocut HFN 13 LE UNI
Ecocool 7630

MEDIZINTECHNIK ALLGEMEIN

Feinschneiden:
RENOFORM HBO-REIHE
RENOFORM ZSB-REIHE

Komponentenreinigung:
RENOCLEAN MEDI-REIHE

Special Lubricants for the Machining of Titanium and Cobalt Alloys and Stainless Steels
钛、钴合金和不锈钢加工的特殊润滑剂

- Titanium and cobalt alloys along with stainless steels are often used in implants or surgical instruments 钛钴合金和不锈钢通常用来制造植入物件或外科仪器
- Biocompatibility is the reason why just these three material groups are used
  生物兼容性是使用该类材料的原因
- FUCHS has gathered valuable know-how from aerospace industries which also focus on titanium 福斯在同样关注钛材料的航空工业获取丰富的经验
- FUCHS product portfolio includes a corresponding metalworking fluid for every process stage – ranging from non-water-miscible to neat and from high-pressure to universal oils 福斯拥有各个加工环节的金属加工液，水溶性到纯油性，高压力到通用油

Product name	description
ECOCOOL 7630	Water miscible,excellent lubricity and cooling behavior. 水溶性，良好润滑性和冷却性。
ECOCUT 7520 LE-S	Low mist,good extreme pressure properties to reach better surface quality 高压力低油污，表面质量高
Ecocut HFN 13 LE UNI	Low mist,high flash point,excellent lubricity properties 高闪点低油污，优秀润滑性
Ecocut 628 LE	Low mist,high flash point,excellent lubricity properties,using in turning 高闪点、低油污，车削加工优秀润滑性
PLANTOCUT 22 SR	Synthetic ester based on natural raw materials with low water-pollution potential, rapidly biodegradable 采用低水污染的天然合成脂，快速生物降解性

Special Lubricants for the Machining of Magnesium and its Alloys 镁和镁合金加工润滑剂

- The use of magnesium alloys as absorbable materials is still at the research stage.
  将镁合金作为可吸收材料使用尚处于研发阶段。

- As magnesium reacts with water to form hydrogen and magnesium hydroxide, any machining process with water-miscible metalworking fluids poses a particular challenge which FUCHS can control with specially-formulated products.
  镁会根水反应形成氢气和氢氧化镁，福斯拥有特殊配方的产品来控制每一个使用水溶性切削液的加工环节。

- FUCHS uses a special watermiscible metalworking fluid which effectively inhibits hydrogen formation.
  福斯使用特殊的水溶性金属加工液，完全有效抑制氢气的生成。

Product Name	Description
ECOCOOL 2516 MG-MEDI	Water-miscible metalworking for the machining of magnesium, good emulsion stability even with magnesium-hardened water 镁加工水溶性切削液，优秀的乳化液稳定性，即使在镁硬化水中。
ECOCUT HFN 16 LE	Mineral oil-based, neat metalworking oil specially formulated for the machining of magnesium。矿物油，纯油专为加工镁设计配方。
UNIFLUID 32	Multipurpose oil based on synthetic esters, excellent EP characteristics 多用途合成脂，优秀的极压性能。

Special Lubricants for plastic
塑料加工润滑剂

- Easy to machine, loose structure易切削，材质疏松。
- High stability requirement for coolant 对切削液的稳定性要求较高，使用寿命较短。
- Not only meet the requirement of machining, but also meet the requirement of structure and toxicity切削液不仅需通过切削性能测试，还需通过病理毒性测试

产品名称	描述
ECOCOOL 7630	Water miscible, excellent lubricity and cooling behavior. 水溶性，良好的润滑性和冷却性。
Ecocool S 761	Water miscible, excellent lubricity and cooling behavior, low residue. 水溶性，良好的润滑性和冷却性，低残留。

Machining Medical Materials with Minimum Quantity Lubrication
医疗材质微量润滑剂

- In the field of chip-forming machining, the MQL concept is gaining acceptance, even for extremely difficult to machine metals.
  在切屑形成的区域，微量润滑油逐渐被使用认可，即使是难难加工材料。

- MQL is particularly suitable for the drilling of holes in implant plates or for the micro-milling of the shape memory alloy Nitinol which display very high adhesion forces.
  微量润滑油尤其适用于植入材料的钻孔加工或记忆性合金镍钛诺等拥有很强的粘附力的微量铣削加工。

- Both FUCHS products offer the following properties: 福斯产品可以提供如下性能

- Rapidly biodegradable 快速生物降解
- Neutral odor 微弱气味
- Forms no deposits 无残留
- Good tool life 优良的刀具使用寿命
- Non- toxic 无毒
- Non-water polluting 无水污染

产品名称	描述
PLANTOCUT 22 SR	Synthetic esters based on natural raw materials with low water pollution potential and rapidly biodegradable. 。低水污染天然材料合成脂，快速生物降解性。
ECOCUT MIKRO PLUS 20	Minimum Quantity Lubricant based on fatty alcohols, excellent cooling and no residues.脂肪醇微量润滑，用量小，良好的冷却性，无残留。

Thank you for your interest in Fuchs!
Do you have any questions?
感谢您关注福斯！欢迎提问。

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