

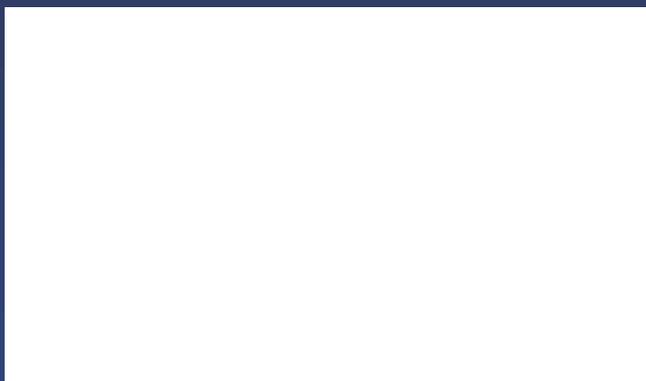
**FUCHS Industrial Lubricants**

## **Innovative lubricants require experienced application engineers**

Every lubricant change should be preceded by expert consultation on the application in question. Only then can the best lubricant system be selected. Experienced FUCHS engineers will be glad to advise on products for the application in question and also on our full range of lubricants.



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## Specialties for Specialists



Bild: BVMed

## Cutting Fluids for Medical Applications

LUBRICANTS.  
TECHNOLOGY.  
PEOPLE.



# OUR LUBRICANTS KEEP THE WORLD MOVING

For over 80 years now, we have been concentrating all our activities and all of our research expertise on the development of innovative lubricants. This specialization has resulted in our company growing continuously, not only geographically but also technically and in terms of application areas.

Today, FUCHS is a globally-active, German company synonymous for high-performance lubricants and related specialties for nearly all fields of application and industries.





### **What sets our products apart.**

We develop application-specific lubricants specifically for our partner's processes. Together with our customers, we strive to create perfect lubricant solutions. This co-operation we term a "development partnership" and Fuchs brings the expertise associated with being the world's largest independent lubricant company. Our independence is important, it means we are open to new. We are open to new approaches, open to new visions – the prerequisites for innovation. And innovations are a hallmark of FUCHS.

Together, we can achieve more.

# **Lubricant Specialists for the Medical Industry.**

The world is changing. Increases in life expectancy spurred by growing awareness of "healthy lifestyles" in the West and increasing populations in emerging countries, is creating a greater demand for implants, medical equipment and surgical instruments. As implants remain in the body for at least 15 years or even longer and are permanently subject to cyclic loads, very high demands such as excellent bio-compatibility are made on the quality of the materials used. Apart from the material itself, surface finish is a decisive factor in the functionality of an implant.

Stainless steels, cobalt and chrome alloys as well as ceramics but above all titanium alloys are mostly used. These materials are characterized by high tensile strength, resistance to fatigue and thus by difficult and cost-intensive machining. For these reasons, cutting fluid selection plays an essential role in guaranteeing the highest medical standards while maintaining machining efficiency. For each processing step, FUCHS offers an optimum product, from water-miscible and straight metalworking fluids to fluids for Minimum Quantity Lubrication applications to special universal oils which display excellent properties for both machining operations and machine tool hydraulics.

All of our cutting fluids fulfill the highest technical standards with an emphasis on long tool life, high cutting performance, excellent surface finish and outstanding removability. At the same time, optimum safety at work as well as good skin compatibility, low evaporation losses and high flashpoint criteria are fulfilled. FUCHS is particularly well prepared for the trend towards rapidly biodegradable metalworking fluids with its PLANTOCUT series of products.

Because hydrogen is created during chip-forming machining with emulsions, the use of magnesium as an absorbable implant material poses a special challenge which FUCHS has successfully overcome with special, newly-developed products. The advantage of magnesium, which is also present in the body, is its automatic degradation which eliminates the need for further surgery after the implant has been fitted. We are also fully conversant with the latest cleaning processes through our participation in the NMI research project into innovative cleaning procedures in medical engineering as well as the enormously important certification process. Reassure yourself about the effective and efficient application of the latest high-tech cutting fluids and comprehensive service offer from the initial consultation to routine subsequent checks from the number one lubricant specialist.

## **Highest lubricant performance.**

Cutting fluids in the medical engineering industry along with the manufacturing methods as well as the final cleaning of the components are an integral part of the component licensing. This means that every change must be examined for influence on the life or the sterility of the component.

Very high demands are thus made on the lubricants and the corresponding cleaners.

## **Special demands.**

When developing innovative solutions, cooperation with the lubricant manufacturer starting at the development phase is crucial. Firstly, to guarantee the economics of the process and to prolong tool life. Secondly, to perform the process with the maximum reliability. One possible risk is the drag-in of contaminants which could cause problems during final cleaning.

## **Specialists for the machining of medical engineering materials.**

The materials used in the medical sector pose great demands on a cutting fluid. Special demands are made on material compatibility, foaming, high-pressure stability and lubricity. FUCHS has a perfect cutting fluid for every material.

## Tried and Tested at Leading Medical Engineering Companies.

### Machining:

#### Water-miscible cutting fluids

Multifunctional:  
**ECOCUT  
TN 2525 HP-BFH**

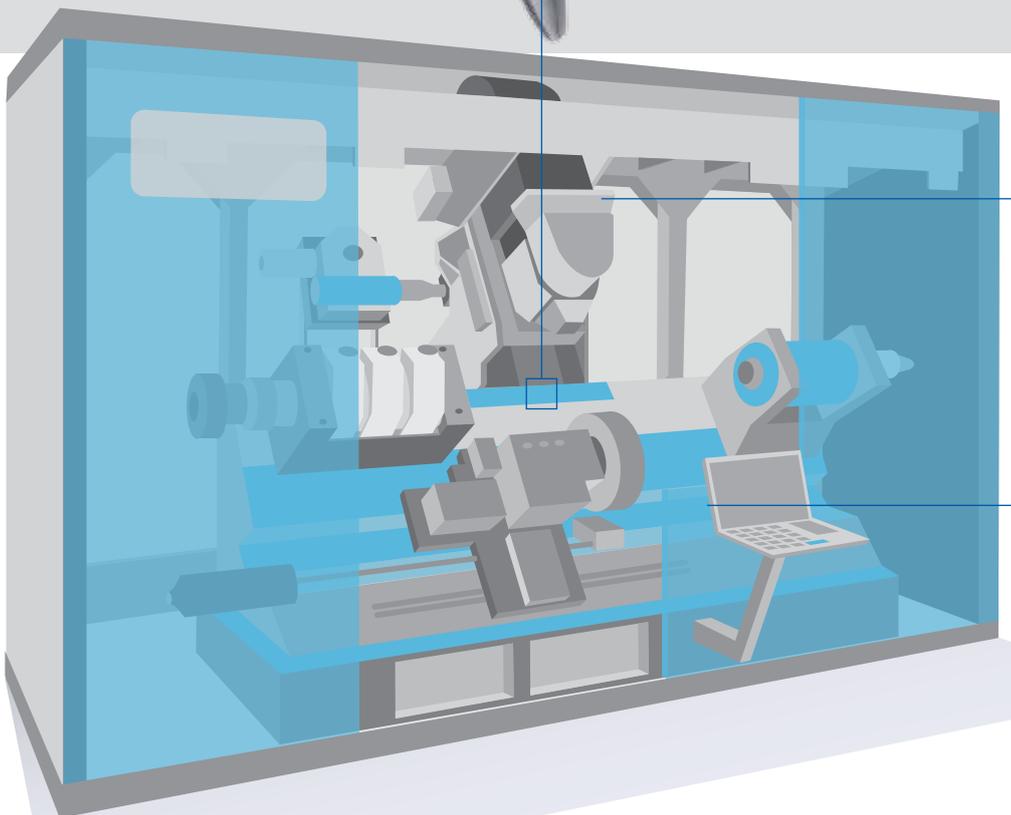
#### Straight cutting fluids

Multifunctional:  
**UNIFLUID-SERIES  
PLANTOCUT 10 SR**

Ceramics:  
**PLANTOCUT 10 SR  
ECOCUT HS+  
ECOCUT FE**

Plastics:  
**ECOCUT HS+**

Titanium:  
**ECOCUT 7520 LE-S**



Hydraulic oils:  
**RENOLIN ZAF-SERIES  
UNIFLUID**

Slideway oils:  
**RENEP CGLP 220  
RENEP CGLP 68**

The information given here reflects the current state-of-the-art and the best of our knowledge and developments. Subject to amendment.  
Date 05 / 2013

## Non-Cytotoxic Cutting Fluids.

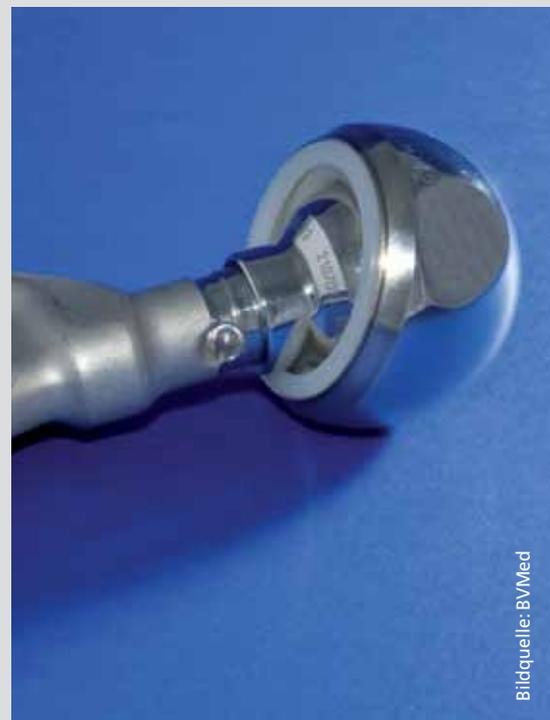
The ability of a substance to damage tissue cells is described as cytotoxicity. This characteristic plays an important role in the manufacturing of implants because these have to grow together with body tissues to function as planned. If however, traces of cutting fluid residues remain on the implant which cannot be completely removed during final cleaning, there may be a risk of complications developing such as the implant working loose or that its integration by cell fusion may be impaired. To avoid such risks, FUCHS has a number of non-cytotoxic cutting fluids in its product line-up for all chip-forming processes on the common implant materials so that all conceivable medical engineering applications can be performed without risk. These products fulfill the highest demands on the machining of medical engineering materials. PLANTOCUT 10 SR is rapidly biodegradable along with offering very high machining performance; ECOCUT 7520 LE-S is not water-miscible and is recommended for applications which demand very good surface finishes. Both products have passed cytotoxicity tests.

For the machining of ceramics, only tools with non-geometrically defined cutting edges are used. In particular for grinding operations on aluminium or zircon oxides, which are often used for hip joint balls, knee joints or medical instruments, the lubricant plays an important role because even the smallest of flaws can lead to cracks and breakages because of the brittleness of ceramics. Research by the University of Iowa has shown that the use of certain straight cutting fluids causes  $Al(OH)_3$  and  $Me_2SiO_3$  to be formed on surfaces which allows easier material removal and significantly less below-surface damage. Here again, we recommend the two non-cytotoxic cutting fluids ECOCUT HS + and ECOCUT FE.

The two multifunctional oils UNIFLUID 10 and UNIFLUID 32 are also non-cytotoxic and are perfect as cutting fluids and hydraulic oils. The experience which FUCHS has gathered in numerous research and development projects and practical trials with leading medical engineering companies means that the company has the first-class technical knowhow necessary to select the optimum cutting fluid. In addition, we have a wealth of experience with cutting fluids for the aerospace industry where almost identical materials and processes are used as in the medical engineering sector.

Product name	Properties	Application
<b>ECOCUT 7520 LE-S</b>	Low misting and evaporation (improved workplace hygiene), straight, non-cytotoxic, generates excellent surface finishes, long tool life.	Especially suitable for difficult-to-machine materials such as titanium, cobalt-chrome alloys, chrome-nickel alloys and other high-alloy steels. For deep-hole drilling, broaching and thread cutting.
<b>PLANTOCUT 10 SR</b>	Synthetic esters based on harvestable raw materials, low water pollution potential, straight, non-cytotoxic, almost fully biodegradable. Optimized wetting, cooling and flushing, minimal workplace pollution, very low evaporation losses and very high flashpoint.	Universally-applicable, especially for the machining and grinding of difficult-to-machine materials (titanium, cobalt, stainless steels).
<b>ECOCUT HS +</b>	Based on semi-synthetic, aromatic-free hydrocarbons, straight, non-cytotoxic, good flushing, low foaming, good corrosion protection, low odour.	Especially suitable for the high-speed grinding of CoCr steels and ceramics. Also for other grinding operations and honing.
<b>ECOCUT FE</b>	Based on aromatic-free hydrocarbons, straight, non-cytotoxic, low viscosity, outstanding surface finishes, very long product life, good flushing, extremely low evaporation, minimal workplace pollution.	Optimized for tool grinding, superfinishing and the fine grinding of ceramics.

# ECOCOOL / ECOCUT



# Medica Engineering Manufacturing Processes.



FUCHS Expertise



FUCHS Expertise

## Shaping

- turning
- milling
- drilling
- thread cutting
- grinding
- polishing

## Initial cleaning

- separate ultrasonic cleaning of the individual components
- examining the condition of the oil-free surface

## Laser printing

Every product gets its own serial number. This ensures full traceability if necessary.



## Final cleaning

Multi-stage cleaning process for all components.

## Packing

The contents must be perfectly protected and product quality must not be compromised.

## Sterilization

All relevant safety protocols and standards must be observed when medical products are sterilized to ensure that the required quality is maintained.



## Special Lubricants

To improve the machining of high-tensile and ductile materials such as titanium, FUCHS has developed ECOCOOL TN 2525 HP, a new high-pressure and high-performance cutting fluid. It is suitable for use at pressures of over 100 bar and because it is free of boron or biocides, it requires very little maintenance. High pressure machining generates early chip breakage and thus significantly better surface finishes and longer tool life because the heat normally generated when titanium is machined is significantly lowered. An increase in cutting speed may also be realized. In addition, synthetic ester-based cutting fluids are well-suited to high-pressure machining because of their outstanding air release behaviour.

Product name	Properties	Application
<b>ECOCOOL TN 2525 HP-BFH</b>	Water-miscible, high lubricity, boron-free, free of biocides.	For high pressure applications > 100 bar.

## Multifunctional Oils

By using the two special, non-cytotoxic multipurpose oils UNIFLUID 10 and UNIFLUID 32, which can be used as cutting oils as well as hydraulic oils, cross-contamination can be prevented so that no problems arise when components are finally cleaned. Cleaners are easily saturated with contaminants and cleaning performance then suffers. In addition, mixtures can impair the functionality and service life of cutting fluids. Disadvantages caused by leakage losses via components or chips are eliminated by the use of universal oils. Large potential savings and lower maintenance and monitoring costs can be achieved by internal recycling while maintaining optimum performance. With its universal fluids, FUCHS products can offer significant cost reductions. Both products are suitable for about 80 % of all machining processes on materials which are used in medical engineering applications.

Product name	Properties	Application
<b>UNIFLUID 32</b>	Multipurpose oils based on synthetic esters, non-cytotoxic, rapidly biodegradable, non-water polluting, high flashpoint, can be recycled.	High cutting and machining performance, for machining and hydraulics.
<b>UNIFLUID 10</b>	Multipurpose oils based on synthetic esters, non-cytotoxic, rapidly biodegradable, non-water polluting, high flashpoint, high-pressure stable, homogenous recycling possible.	For machining and machine lubrication.

The information given here reflects the current state-of-the-art and the best of our knowledge and developments.

Subject to amendment. Date 05 / 2013. Images: BVMed



## Magnesium Machining Absorbtion

The use of magnesium alloys for the use of body-absorbable components is in its infancy. However, FUCHS already has suitable cutting fluids in its product portfolio for these implant materials. The absorbtion characteristics of this implant material, which is primarily used for broken bones, can be influenced by geometry and the machining process. Porous implants as well as solid implants are used. FUCHS has already gathered comprehensive experience with this material from the automotive sector. As magnesium reacts with water to form magnesium hydroxide while releasing hydrogen, all machining operations with water-miscible cutting fluids pose considerable challenges which FUCHS has succeeded in controlling with specially matched products. As the hydrogen formation increases when porous magnesium implants are machined due to the larger surface area, FUCHS uses special water-miscible cutting fluids which largely inhibit hydrogen formation. But straight cutting fluids based on highly-refined mineral oils and synthetic esters can also be used.

Product name	Properties	Application
<b>ECOCOOL 2516 MG-SERIES</b>	Water-miscible, Good emulsion stability.	For magnesium machining.
<b>ECOCUT HFN 16 LE</b>	Non-water-miscible, based on mineral oil.	For magnesium machining.
<b>UNIFLUID 10</b>	Multipurpose oils based on synthetic esters, high pressure suitability.	For machining and machine lubrication, magnesium machining.

## Minimum Quantity Lubrication

Minimum Quantity Lubrication is gaining increasing acceptance in the area of chip-forming operations on very difficult-to-machine metals. The reduction in the amount of cutting fluid used results in significant cost savings.

Minimum Quantity Lubrication is ideally suited to the drilling of implant plates or the micro-milling of the "shape-memory" alloy Nitinol which displays an extraordinary tendency to form cutting edge build-up.

PLANTO MIKRO UNI and ECOCUT MIKRO PLUS 20 are recommended for Minimum Quantity Lubrication applications. These products are characterized by the following properties:

- neutral odour
- no residue formation
- extend tool life
- non-toxic
- low water pollution potential

PLANTO MIKRO UNI is ester-based; ECOCUT MIKRO PLUS 20 contains fatty alcohols. Both products are suitable for internal and external fluid feeds in 1 and 2 channel systems.

Product name	Properties	Application
<b>PLANTO MIKRO UNI</b>	Synthetic esters based on harvestable raw materials, low water pollution potential.	Minimum Quantity Lubrication.
<b>ECOCUT MIKRO PLUS 20</b>	Based on fatty alcohols, good cooling, no residues.	Minimum Quantity Lubrication.

### Note

The information contained in this product information is based on the experience and know-how of FUCHS EUROPE SCHMIERSTOFFE GMBH in the development and manufacturing of lubricants and represents the current state-of-the-art. The performance of our products can be influenced by a series of factors, especially the specific use, the method of application, the operational environment, component pre-treatment, possible external contamination, etc. For this reason, universally-valid statements about the function of our products are not possible. The information given in this product information represents general, non-binding guidelines. No warranty expressed or implied is given concerning the properties of the product or its suitability for any given application.

We therefore recommend that you consult a FUCHS EUROPE SCHMIERSTOFFE GMBH application engineer to discuss application conditions and the performance criteria of the products before the product is used. It is the responsibility of the user to test the functional suitability of the product and to use it with the corresponding care.

Our products undergo continuous improvement. We therefore retain the right to change our product program, the products, and their manufacturing processes as well as all details of our product information sheets at any time and without warning. With the publication of this product information, all previous editions cease to be valid.

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