

FUCHS Cutting Fluids influence on High speed Cutting Operations –

High Tech Lubricants for high Tech Process

Pudasaini Ravindra 29th March

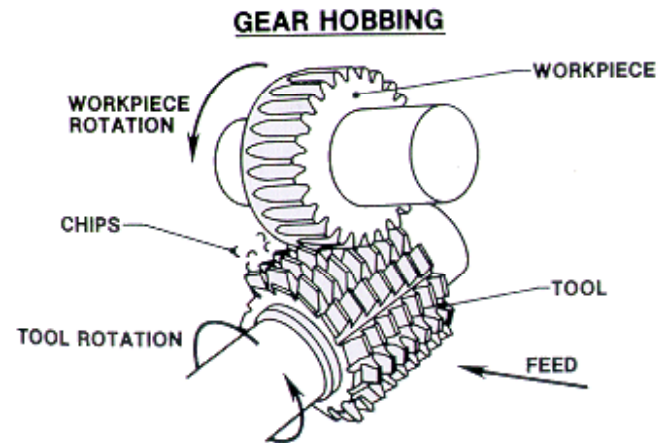




- Gear Hobbing Operations 滚齿加工
- Broaching Operations 拉削加工
- Deep Hole Drilling Operations 深孔转加工
- Grinding Operations 磨削加工
- Honing Operations 珩磨加工

Gear Hobbing

齿轮滚加工



加工工艺



- It is a gear generating process that uses a helical hob cutter
这是一个齿轮产生过程，采用螺旋滚刀
- The cutters and blanks rotate in a timed relationship
刀具和毛坯旋转时间的关系
- It cuts several teeth on a progressive basis
它切削几个牙齿
- It is used for high production runs
是用于大批量生产
- Cutting oil encloses 15 % of the production Cost
切削油包含15 %的生产成本
- In this operation the feed rate up to 350 m/min
在这个工艺的进给速度可达350米/分钟

Gear Hobbing & Its Problem

刀具与切削液的特殊难题



Picture shows effects on gear cutting hob after overheating (color distortion)

Overheating Causing Tool Wear 过热引起刀具磨损

Excessive heat on tool face and flank leading to cratering, chipping and edge welding 刀具面和侧面过多的热量, 导致缩孔, 形成凹坑和边部烧结

Causes: 原因

- Excessive feeds and speeds not matching tool's material and work piece machine-ability 过度的加工速度和过快的进给量
- Wrong type of Cutting Fluid 错误的切削液类型
- Cutting fluid has poor wetting performance 切削液渗透性不好
- Foaming of cutting fluid can increase temperatures within machine, fluid and work holdings 切削液起泡可以增加机器 切削液和工件的温度

Outstanding Fluids for Gear Hobbing Application 适用加工主体零件的高效产品



Operation 加工方式: Gear Hobbing 滚齿

Material 材质: High Alloy High Speed Steel 高速钢

Products 产品: Neat Cutting Oils 切削油

High Performance Neat Cutting Oils 高效切削油

ECOCUT HFN 32 LE

ECOCUT 628 LE

Products have Following Properties 产品性能如下:

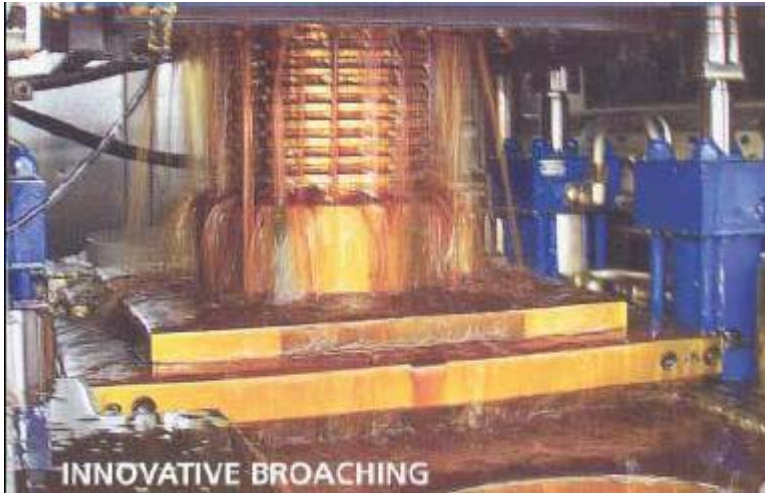
Approvals:

GLEASON PEAUTER

Higher Flash Point	高闪点
Low Odor:	低味
No residue	无残留
Excellent Tools Life	卓越的刀具寿命
Non toxic	无毒
Low mist:	低烟雾

Gear Broaching

拉削



Machining Characteristics 加工工艺

- This process uses a single pass for finished shapes
这个过程是一次能完成成品的形状
- It uses a multipoint cutting tool (broach)
它使用一个多点刀具
- It has the roughing and finishing teeth on the same tool
它具有粗加工和精加工齿在同一工刀具上
- In this operation machine surfaces are parallel to axis of tool motion
在这种工艺机器表面平行对刀具运动轴
- The cutting speed up to 92 m/min
切削速度可达92米/分钟

High Performance Fluids for Broaching Application 适用加工主体零件的高效产品



Operation: Broaching 加工方式: 拉削

Material: 20CrMnO (Alloy Steel) 材质:

Products 产品: Neat Cutting Oils & Water miscible Cutting fluids 切削油 & 切削液

High Performance Neat Cutting Oils 高效切削油

ECOCUT 715 LE
ECOCUT 732 LE

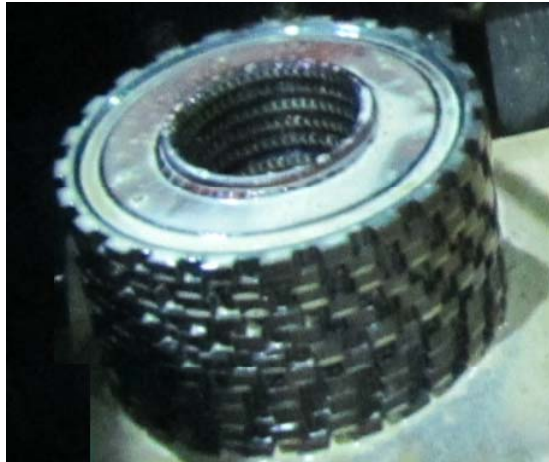
ECOCUT 8516
ECOCUT 8524
ECOCUT 8532

Products have Following Properties 产品性能如下:

Higher Flash Point	高闪点
Low Odor:	低味
No residue	无残留
Excellent Tools Life	卓越的刀具寿命
Non toxic	无毒
Not water Polluting	无水污染

Approvals: KARL KLINK

High Performance Fluids for Broaching Application 适用加工主体零件的高效产品



Operation 加工方式: Broaching 拉削

Material 材质: Cast Iron, Alloy Steel 铸铁, 合金钢

Products 产品: Water miscible Cutting fluids 切削液

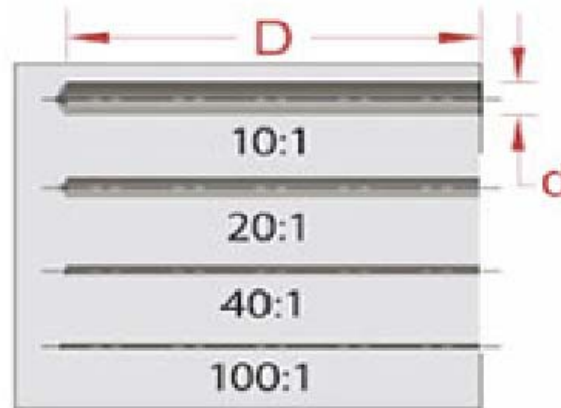
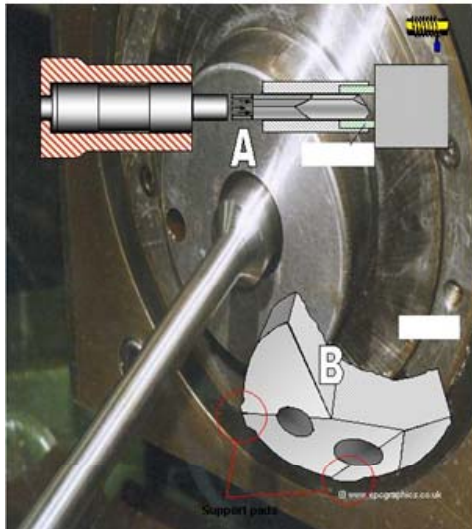
High Performance Cutting Fluids 高效切削液

ECOCOOL 800 NBF C

Products have Following Properties 产品性能如下:

Excellent EP	卓越的极压性能
Low Odor	低味
No residue	无残留
Excellent Tools Life	卓越的刀具寿命
Longer Sump Life	长寿命
Easy Maintenance	易维护

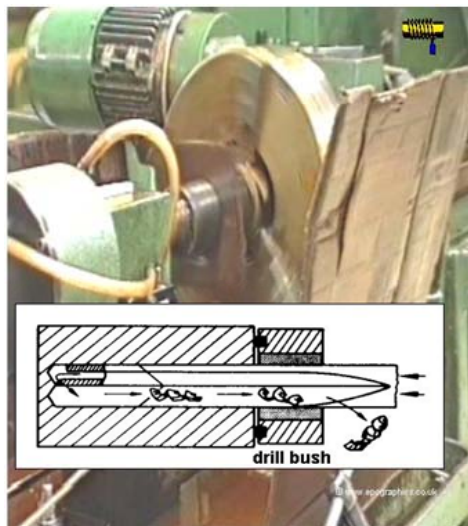
Deep Hole Drilling 深孔钻



Depth to Diameter

Machining Characteristics 加工工艺

- A deep hole is defined by its depth to diameter ratio ($D:d$), typically greater than 10:1 深孔定义为直径之比深度 ($D:d$), 通常大于10:1
- Good finish, tight diameter control and straightness are part of the finished process 好的表面光洁度, 严格的直径精度是完成的过程的一部分
- Drilling speed is dictated by the diameter of the hole. A large diameter hole can be drilled faster than a small diameter hole because the stiffness of the larger drill shaft resists warping. 钻井速度取决于孔的直径。大直径孔可钻到一个小直径孔更快, 因为较大的钻轴的刚度抵抗翘曲
- Deep hole drilling or gun drilling is a specialized operation used to machine long, slender holes 枪钻深孔钻或是一个专门经营用于加工长, 细长的孔
- A lathe spindle that rotates at very high speeds, typically around 7,000 rpm 车床主轴的旋转速度非常高, 一般在7000 rpm



Burning by loss of effective lubrication & cooling 润滑和冷却不足导致的烧伤损坏



In any severe cutting process it is essential to ensure a plentiful supply of lubricant to the cutting surfaces at all times.

在任何苛刻的切削环境下，必须时刻保证足量供给的润滑油。

In this example of deep-hole drilling, the lubricant flow was blocked only for a very short time. Resulting in overheating and re-tempering of the tool which had to be re-ground.

例如，深孔钻时，润滑油供给只是被中断了一小会，结果导致刀具过热和冷却，必须重新研磨。

Note the colour change in the overheated tool compared with the new undamaged bit.

注意刀具颜色变化（过热刀具与新的未被损坏的刀具相比较）

High-pressure coolant is introduced around the outside of the tool

高压冷却液是在工具外部使用

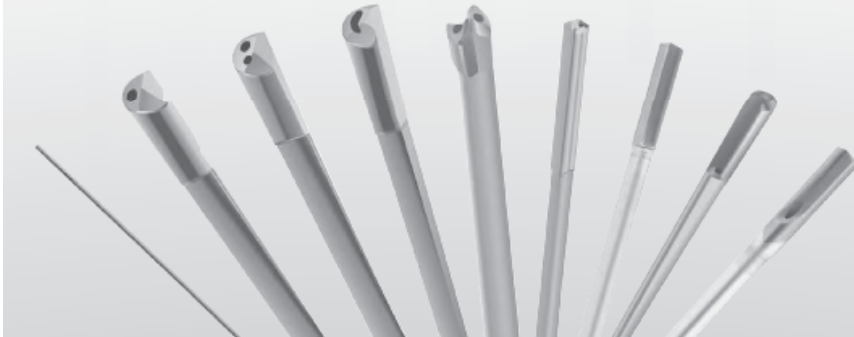
Chips are discharged through the tool center and machine spindle

排屑通过工具和机床主轴中心

High penetration rates and power requirements compared to gun drill tooling

高穿透率和功率的要求相比，枪钻加工

High Performance Fluids for Deep Hole Drilling Application 适用加工主体零件的高效产品



Operation 加工方式 :Deep Hole Drilling 深孔钻

Material 材质: Stainless Steel, Alloy Steel

Products 产品: Neat Cutting Oils& Water miscible Cutting fluids 切削油 & 切削液

High Performance Neat Cutting Oils 高效切削油

ECOCUT 610 LE

ECOCUT 615 LE

ECOCUT 715 LE



Products have Following Properties 产品性能如下:

Approvals:

NAGEL MACHINES

Higher Flash Point

Low Odor

No residue

Excellent Tools Life

Non toxic

Not water Polluting

高闪点

低味

无残留

卓越的刀具寿命

无毒

无水污染

High Performance Fluids for Deep Hole Drilling Application 适用加工主体零件的高效产品



Operation 加工方式 Deep Hole Drilling 深孔钻

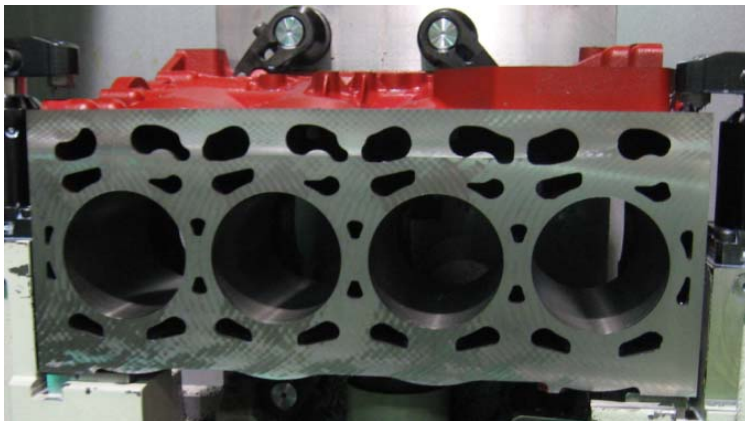
Material 材质: Cast Iron, Alloy Steel

Products 产品: Water miscible Cutting fluids 切削液

High Performance Cutting Fluids 高效切削液

ECOCOOL 800 NBF C

ECOCOOL 700 NBF C



Products have Following Properties 产品性能如下:

Excellent EP

卓越的极压性能

Low Odor

低味

No residue

无残留

Excellent Cp properties

非常好的防锈性能

Excellent Tools Life

卓越的刀具寿命

Longer Sump Life

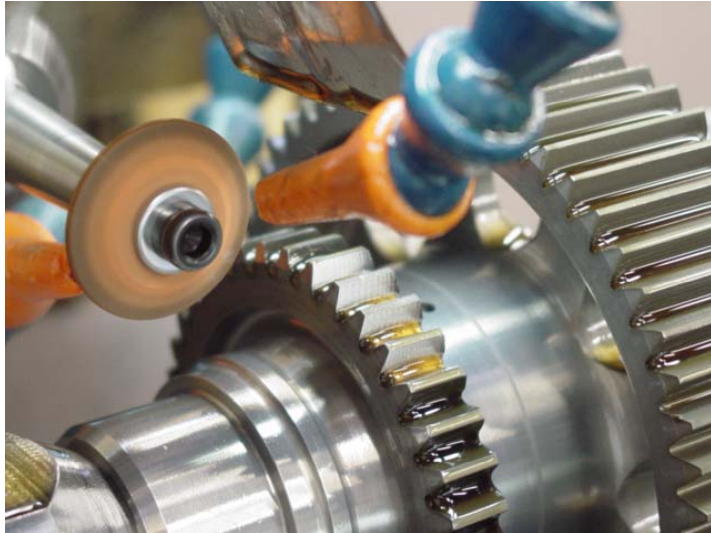
长寿命

Easy Maintenance

易维护

Grinding Operations

磨削加工



Process Characteristics 加工工艺

➤ Firstly the chips are very thin - around 1 micron compared with more than 20 micron in many other processes. Secondly the cut is always at a negative rake angle illustrated in the diagram on the right. These two factors contribute to the exceptionally high specific cutting forces and hence high heat production

先，铁削是非常薄的约1微米与20微米以上的更其他的加工工艺比。其次，将始终是在右边的图表说明了一个负前角。这两个因素有助于异常高的特定的切削力，因此高产热

➤ Cooling is hence of special importance in grinding compared with other manufacturing techniques.

冷却是特别重要的研磨与其他制造技术相比

High Performance Fluids for Grinding Application 适用加工主体零件的高效产品



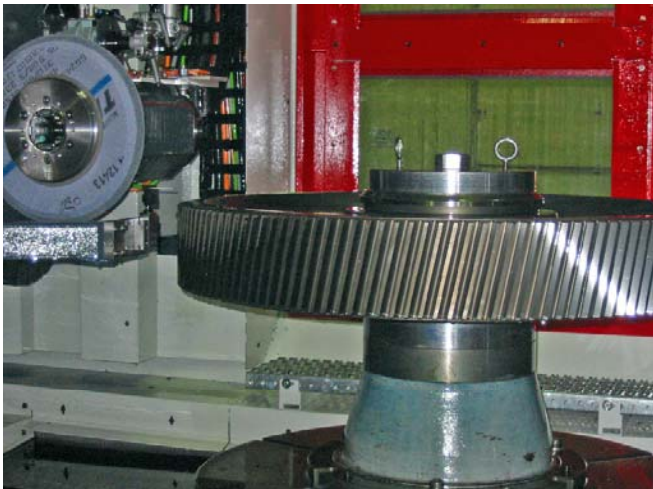
Operation 加工方式: Grinding 磨削

Material 材质:

Products 产品: Neat Cutting Oils & Water miscible Cutting fluids 切削油 & 切削液

High Performance Neat Cutting Oils 高效切削油

ECOCUT HSG 211 LE
ECOCUT HFN 13 LE UNI
ECOCUT HFN 10 LE



Products have Following Properties 产品性能如下:

Higher Flash Point	高闪点
Low Odor	低味
No residue	无残留
Excellent Tools Life	卓越的刀具寿命
Non toxic	无毒
Not water Polluting	无水污染

High Performance Fluids for Grinding Application 适用加工主体零件的高效产品



Operation 加工方式: Grinding 磨削

Material 材质:

Products 产品: Water miscible Cutting fluids 切削液

High Performance Cutting Fluids 高效切削液

ECOCOOL SYN 430
ECOCOOL S 67 NA
ECOCOOL S-HL
ECOCOOL SYN 5588



Crankshaft for the Ship Engine

Products have Following Properties 产品性能如下:

Higher Flash Point	高闪点
Low Odor	低味
No residue	无残留
Excellent Tools Life	卓越的刀具寿命
Non toxic	无毒
Not water Polluting	无水污染



Process Characteristics 加工工艺

- Honing is a fine sizing and finishing process that removes extremely small amounts of material – usually less than 20 microns. Honing removes surface roughness and can correct some degree of out-of-roundness

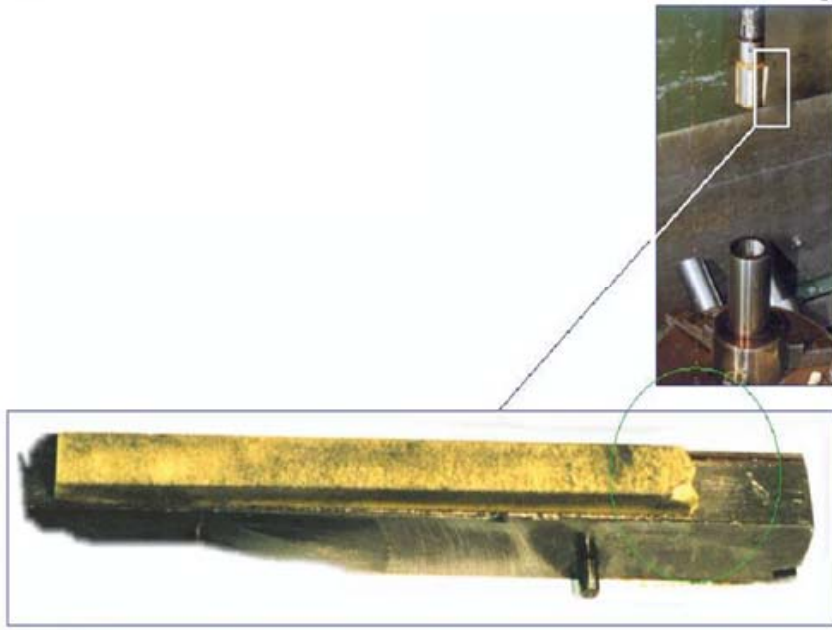
珩磨是一种优良的上浆、精加工工艺去除材料—通常小于20微米的极少量。珩磨去除表面粗糙度和相应的程度的圆度

- The work piece and tool are usually flooded with coolant – the main function of the lubricant is to remove the fine swarf particles to prevent the stone from clogging and to maintain a steady work piece temperature to avoid dimensional changes

工件和刀具通常充斥着冷却液—润滑液的主要功能是去除细屑颗粒以防止石头堵塞，维持一个稳定的工件温度以避免尺寸变化



Chipping: fracture damage caused by impact or fatigue 碎屑：由冲击或疲惫引起的破损



- Ceramic material is hard, but brittle and must be treated with care to avoid breakage by impact.
陶瓷材质非常坚硬，但是易碎，必须小心应对以防止冲击造成破损
- Sometimes the edges of honing stones and ceramic tools can flake during use.
有时珩磨块和陶瓷刀具边缘在使用中会剥落

High Performance Fluids for Honing Application 适用加工主体零件的高效产品



Operation 加工方式: Honing 珩磨

Material 材质:

Products 产品: Neat Cutting Oils & Water miscible Cutting fluids 切削油 & 切削液

High Performance Neat Cutting Oils 高效切削油

ECOCUT HFN 5LE
ECOCUT HFN 10 LE

Products have Following Properties 产品性能如下:

Approvals:

NAGEL Honing Machines Tools

Higher Flash Point
Low Odor
No residue
Excellent Tools Life
Non toxic
Not water Polluting

高闪点
低味
无残留
卓越的刀具寿命
无毒
无水污染

High Performance Fluids for Honing Application 适用加工主体零件的高效产品



Operation 加工方式: Honing 珩磨

Material 材质:

Products 产品 Water miscible Cutting fluids 切削液

High Performance Cutting Fluids 高效切削液

ECOCOOL S-HL
ECOCOOL RM 838
ECOCOOL 700 NBF C

Products have Following Properties 产品性能如下:

Excellent EP	卓越的极压性能
Low Odor	低味
No residue	无残留
No Stain	无腐蚀
Excellent Tools Life	卓越的刀具寿命
Longer Sump Life	长寿命
Easy Maintenance	易维护

Why Choose FUCHS Products 为什么福斯



These are the key
benefits of FUCHS water
miscible coolants
and neat cutting oils

福斯纯油性切削油和
水溶性切削液
的主要作用

Neat cutting oils

- Suitable for all operations
- Anti-mist with LE technology
- Multifunctional products
- Biodegradable
- Machine tool approvals
- Free of zinc, chlorine, heavy metals

Water-miscible Coolants

- Suitable for all materials
- Water quality adjusted
- Bio-resistant & Longer Sump Life
- Cleanliness & Safety
- Extended Tool Life
- Corrosion Protection
- Least Offensive to Operators (Odors, Irritation)
- Waste Treat-ability
- Free of zinc, chlorine, phenol , PTBBA & heavy metals
- No Foaming
- Surface Finish Requirements

纯油性切削油

应用广泛
抗雾，低挥发技术
产品多用途
可生物降解
刀具认证
不含锌，氯，重金属

水溶性切削液

适用于所有材料
调节水质量
生物稳
清洁度好,安全
刀具寿命长
防锈时间长
无味，无刺激
处理性好
不含锌，氯，苯酚
无 PTBBA 和重金属
无泡
符合光洁度要求



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