FILTRATION news
7
September 2003

Filtration in deep hole drilling operations

DEEP HOLE DRILLING

Deep hole drilling is used in:

- Engine block
- Crankshaft
- Valve guides
- Valve spindles
- Hydraulic distributors
- Diesel pumps and injectors
- Gearboxes
- Firearm guns etc.
- And certain others etc.

Deep hole drilling basically consists of the use of the so-called gun drill bits, which are made up of:

1. **A tube in the shape of a half stem**, which is the bit core. The high-pressure cutting oil circulates inside it towards the cutting head, and this same tube channels the cutting oil and any chips which are formed to the outside of the drill.

2. **A cutting head consisting of a hard metal core** which includes drill holes through which the high-pressure cutting oil exits, which cools the cutting operation and at the same time takes any chips which are formed away to the exterior.

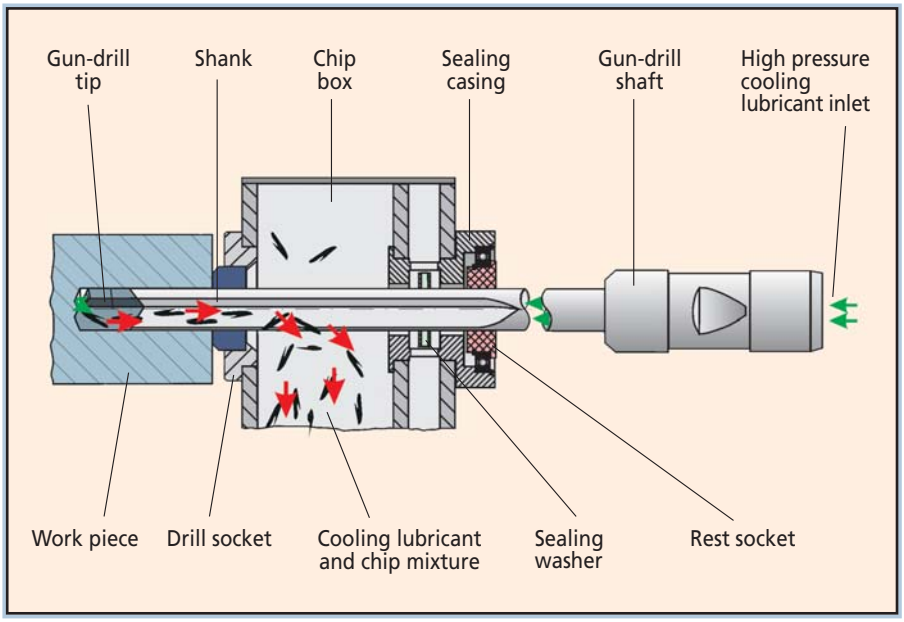
3. **Friction and guide skids** which are employed in certain cases and which not only guide the gun drill bit, but also mill the interior surface of the drill hole leaving it bright and smooth.

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Burgsmüller 1937 gun first drill bit

GUN DRILL BIT DIAGRAM



Picture released by: BERATENDE GESELLSCHAFT FÜR TIEFBOHR-UND ZERSPANUNGSTECHNIK - Dortmund (Germany).



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DEEP HOLE DRILLING ADVANTAGES

a) **Greater cutting speed.**
For example:
- Conventional drill bit, Ø 5 mm: Vc 10 - 15 meters/second.
- Gun drill bit Ø 5 mm: Vc 80 - 100 meters/second.

b) **Drastic reduction of drill bit consumption.**
- Conventional drill bit "life": 10 - 15 meters/sharpening
- Cannon drill bit "life": Approximate 50 meters/sharpening

c) **Greater drilling speed.** Performed in a single advance movement, without any need for non-productive dead time caused by tool reversal to facilitate extraction of chips and to carry out tool changes.

d) **In order to perform deeper drill holes**, in a single operation, without any need to carry the operation out in several stages.

e) **In order to obtain excellent internal surface finishes** without any need for reaming or super-finishing operations.

CONDITIONS REQUIRED TO OBTAIN THESE HIGH PERFORMANCES

The necessary conditions for obtaining these high performances are as follows:

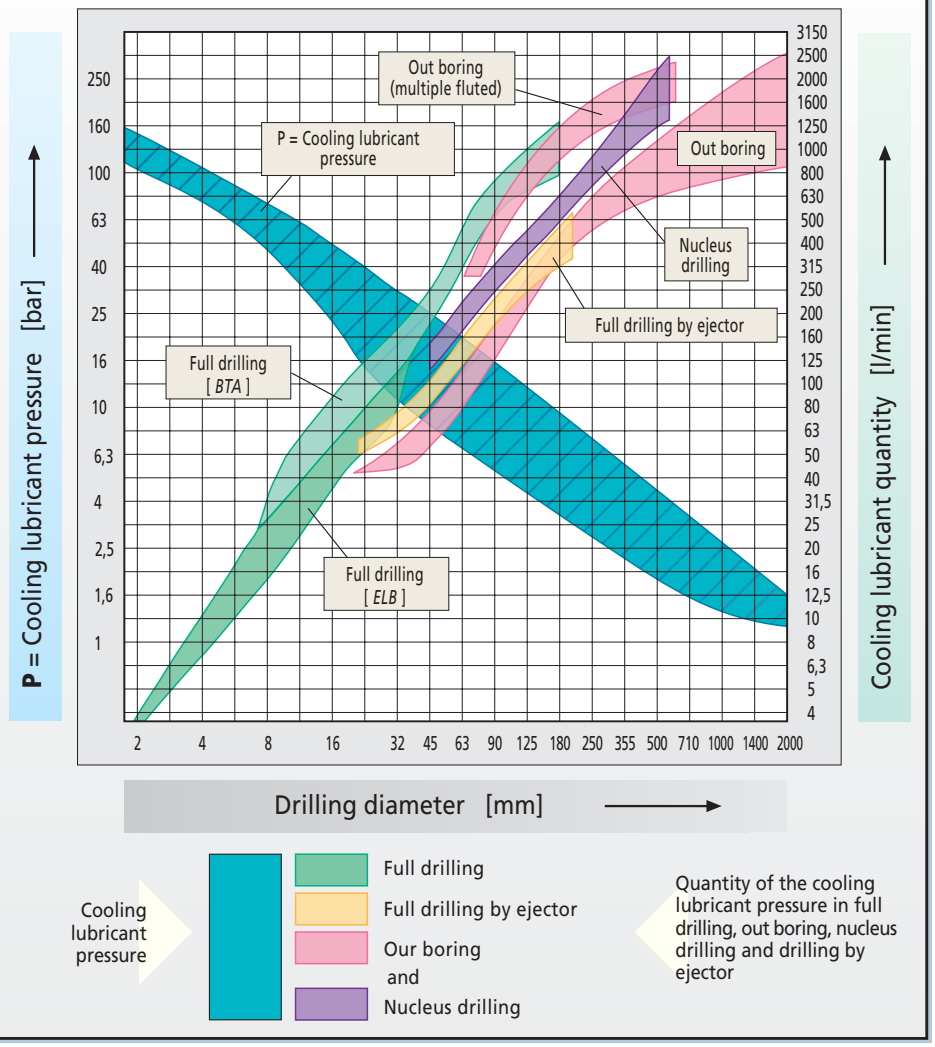
1. To have available a gun drill bit specially designed for the diameter, depth and material that is to be machined.

2. A high-pressure pump which enables the gun drill bit to be fed with the flow rate and pressure required for its diameter.

3. To have clean, transparent cutting oil available, which is also completely free from suspended metal particles.

GUN DRILL BIT PRESSURES AND FLOW RATE TABLES

Indicative cooling lubricant values for deep hole drilling



HOW IMPORTANT IS FILTRATION IN DEEP HOLE DRILLING OPERATIONS ?

In this type of cutting operation, having an optimum oil filtration system available is essential in order to achieve the following:

Lengthening the life of the gun drill bits.
When working with gun drill bits at pressures of 70 and 120 bar, if the oil is loaded with suspended solid particles, these will attack the tool's cutting edge as if being treated by a sand-blaster.

This phenomenon becomes particularly visible when machining cast parts, where the difference between working with a well-filtered oil or a poorly filtered oil contaminated with graphite crystals can result in the number of drill holes per gun drill bit resharpening being increased by up to ten times.

The lengthening of the lives of the high-pressure pumps.
In order to work at pressures above 30 bar, volumetric hydraulic pumps must be employed.

These pumps are especially sensitive to suspended particles in the oil, since these will deteriorate their components extremely quickly, causing them to lose their internal

sealing and consequently loosing both pressure and flow rate, which will directly affect the gun drill bit performance.

Improving finish quality

When the cutting oil is contaminated with suspended particles, these may scratch the machined surface or become embedded in it, both of which will reduce the drill hole surface quality.

HOW SHOULD A CUTTING OIL BE FILTERED DURING DEEP HOLE DRILLING OPERATIONS ?

In order to achieve good performance from deep hole drilling equipment, it is necessary to maintain the cutting oil with a cleanliness quality equivalent to conventional hydraulic oil (ISO 4406 Code 18/15).

This filtration quality may be achieved by:

A. Throw-away filter cartridges

- System with low initial investment.
- High maintenance labour costs.
- High filter cartridge replacement costs.

B. Precoat filters

- Significant initial investment, but with rapid amortisation
- Filtration quality equal to or better than cartridge filters
- Low maintenance costs
- Low filter-aid consumption costs *(See Filtration News n°3).*

PRACTICAL APPLICATIONS FOR PRECOAT FILTERS IN DEEP HOLE DRILLING OPERATIONS

Many companies are installing precoat filtration systems for the filtration of cutting oil used in deep hole drilling operations:

- Steel or cast iron crankshafts.
- Cast iron crankshafts.
- Cast iron, steel or aluminium engine blocks.
- Aluminium or magnesium gearboxes.
- Common rail diesel pumps.
- Diesel injectors.
- Parts turned on CNC, multi- or single-shaft lathes
- Etc.



Precoat filtration centre type FTD 9 AD TA + DL 15 for filtration of two T.B.T. transfer line cutting oil for deep hole drilling steel crankshafts.



Transfer machine ETXE-TAR for deep drilling of cast iron crankshafts

ADVANTAGES OBTAINED FROM THE USE OF PRECOAT FILTERS

- **Reduction of gun drill bit consumption.**
- **Reduction of maintenance operations for the bar or part retaining clips, together with the automatic loading systems.**
- **Reduction of wear to guides and shaft retainers on the machine heads.**
- **Increase in machine performance.**
- **Increase in the life of high-pressure pumps.**

Precoat filters for microemulsions

Quaker Chemical Quakeral 370 microemulsions in Delphi Diesel Systems

Introduction

The Delphi Diesel Systems plant in Sant Cugat, *Barcelona*, is one of the two in Europe which produces high-pressure diesel pumps for the Common Rail System.

Renault, Ford, Hyundai-Kia and Peugeot-Citroën all use the diesel pumps which are manufactured in Sant Cugat.

The Sant Cugat plant commenced machining the hydraulic head, the heart of the high-pressure diesel pump, with neat cutting oil from a well-known lubricant firm.

The machining operations are as follows:

- Milling, drilling, threading, gun drill bit drilling, boring and reaming.
- Material: steel alloy with magnesium.
- Machining cells: IMASFLEX, GROB 500, GROB 520.
- Maximum refrigerant pressure: 60 bar in the gun drill bits.
- Filtration: this is carried out at three precoat filtration stations - **KENFILT-novotecnic** type 2 FTD 60 AD TA employing cellulose as the filter aid.

  Each of the stations has a flow rate of 5,000 litres/minute, together with a capacity of 40 m^3.



Precoat filter, 2 FTD 60 AD TA, installed in Delphi—Sant Cugat (Barcelona).

Problems

In certain machines, it was very difficult to effectively eliminate the presence of cutting oil mist, which meant that there was a very high risk of fire, if this were to occur, it would involve danger to personnel and the plant, together with the consequent loss of production.

Within the DELPHI plants for the minimisation of risks, it was decided that these machining lines should operate with a water-based refrigerant.

The neat cutting oil supplier, when faced with the demand that the refrigerant had to be filtered using precoat filters below 3-5 microns, emulsions since these would break down and recommended the use of a synthetic solution.

Two weeks after commencing use, this synthetic product had to be urgently removed, due to the appearance of severe machining cell oxidation, together with a heavy increase in tool wear, and decided again the use of the neat cutting oil.

After this unfortunate experience, **KENFILT -novotecnic**, contacted the company QUAKER CHEMICAL, since they had already worked with Ford/Jaguar at Bridgend in the United Kingdom, where several **KENFILT-novotecnic** precoat filtration units have been in operation for nine years, and in which cellulose is used as a filter aid, together with the QUAKERAL 370 micro-emulsion from QUAKER CHEMICAL.

Solution

QUAKER CHEMICAL, proposed that DELPHI replaced the cutting oil by the QUAKERAL 370 micro-emulsion, since although it was still an emulsion, would permit filtration below 5 - 10 microns and **KENFILT-novotecnic** proposed new filtration station parameters in order to adapt to the new operating conditions.

The simultaneous application of both QUAKER CHEMICAL and **KENFILT-novotecnic** knowledge and technology proved to be highly significant to the final success of this interesting project.

Results

After nine months of operation, the results are highly satisfactory:

- Production objectives have been attained.
- Refrigerant costs have been reduced to 50% of those for the initial pure neat cutting oil.



Common Rail System Pump Body.

- Tool duration is the same as that previously obtained with the pure neat cutting oil.
- The required surface finish is obtained, thanks to the optimum 5 - 10 micron filtration achieved using the precoat filters **KENFILT-novotecnic** precoat filters.
- The **KENFILT-novotecnic** precoat filters are able to filter the micro-emulsion with 12-13% concentration , without any problems.
- The environment is both cleaner and healthier since there is no neat cutting oil mist.
- There is no fire risk.
- Since there is no fire risk, insurance premiums are cheaper and fire prevention equipment costs less.

For further information, please contact:

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SOLUTIONS

KENFILT novotecnic

Country:
SWITZERLAND

Equipment/Central **FIDE 10 E2**
Supplied 05.01.1999
NF-: 1895/5199

FILE
N° 1895

Manufacturer of:

HARDENED STEEL CUTTING TOOLS FOR WOOD-WORKING

Technical Data

Refrigerant Liquid:	**Semi-synthetic solution**
Flow Rate:	**4.500 l/min.**
Machined Material:	**Hardened steel**
Type of machining:	**Slot grinding**
Grinding Wheels:	**Corumdum**
Number of machines:	**12**

Problem to resolve:

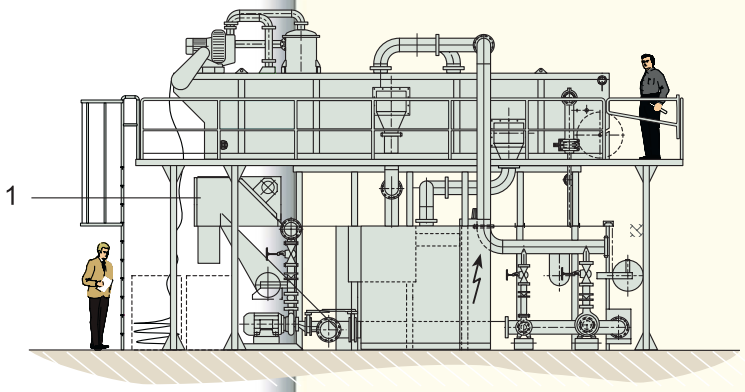
- Improve the performance of corumdum grinding wheels
- Prolong the life of the refrigerant liquid
- Improve grinding quality

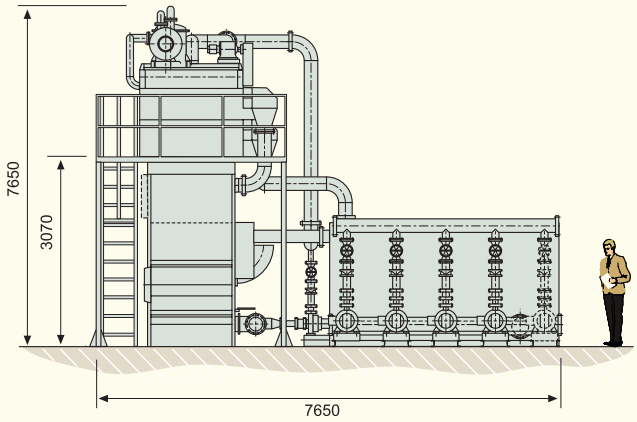
Adopted solution:

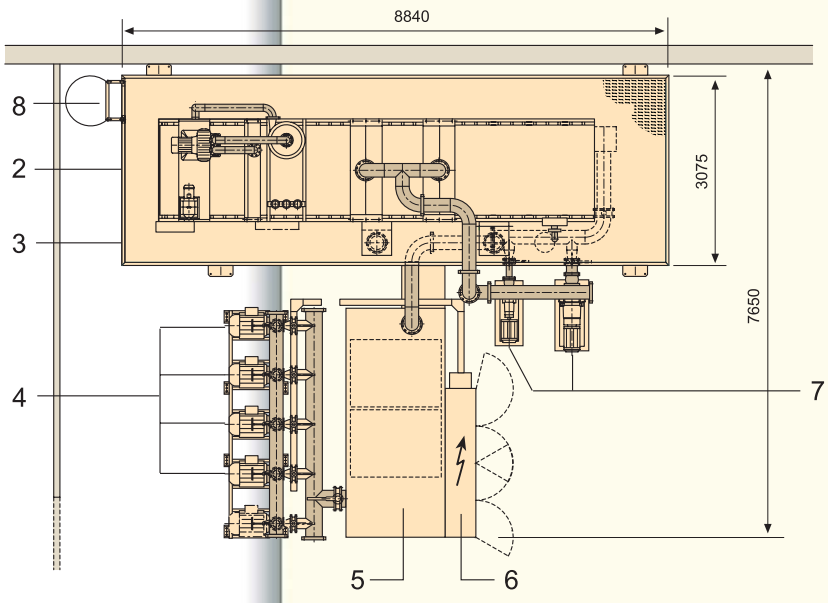
- **Installation of a paper Band Filtration facility with pneumatic depression with a rated quality of 20-30 microns ISO 4406 Code 20/17**

Obtained results:

- **Improvement of grinding wheel performance**
- **Reduction of machine maintenance costs**
- **Improvement of final product quality**







POS.	BESCHREIBUNG
1	Filter mit hydraulischem Unterdruck
2	Filter mit pneumatischen Unterdruck FIDE-10
3	Plattform
4	Versorgungspumpen
5	Sauberflüssigkeitsbecken
6	Elektroschaltschrank
7	Filtrierungspumpen
8	Zugangsleiter
	VERSORGUNGSDURCHFLUSS : 4.500 l/min

Drum Filter

It is well-known fact that one of the most widely employed filtration systems in the industrial and metallurgic sectors that does not use any consumables is the so-called drum filter.

MAIN CHARACTERISTICS

- Automatic self-contained operation.
- Does not use any filtering consumables.
- Simple installation and operation.
- Limited filtration flow rate.
- Limited filtration quality.
- Possibility of combining with complementary systems .



Drum filter, type TA-40.

Basic operation

The dirty liquid to be filtered, coming from the machine-tool, is made to pass through a filter element, in this case, a drum for which the surface filtration characteristics are known.

When the drum filter is silted up, a system of jets cleans the filter surface by means of a back-wash process. All the sludge which has been retained by the filter is removed via the dredged tank in which the drum filter is installed.

Types of drum filter

There are two basic types:

- **Gravity-operated drum filter, type TG:** the filtered liquid is removed from the drum by simple gravity.

- **Drum filter with suction, type TA:** in this case, the liquid is removed by means of pump which sucks from the drum centre, creating an internal depression and thus increasing the performance of the filter surface versus the flow rate.

Filtration quality

Depending on the application, rated filtration degrees of ISO 4406 Code 22/19 (30 μm) may be obtained.

Applications

A list of generic applications for this system is given below:

- General machining operations.
- Turning.
- Milling
- Deep boring
- Grinding

However, each specific case should be examined individually in order to correctly design and dimension the most suitable filtration system.

Liquids to be filtered

- Cutting oils.
- Emulsions.
- Synthetic solutions

Particles to be retained

- Steel.
- Cast iron.
- Aluminium, copper and brass etc.

Depending on the amount of particles or sludge, this system is usually combined with a prior system for the extraction of particles or sludge.

Our window

ITALY

ROSSI MOTOREDUTTORI, manufacturer of the world reknowned geared motors, has installed one filtration station at its Modena plant, with a cellulose precoat, **KENFILT- novotecnic** type FTD 12 AD TA, for the filtration of cutting oil for one gear grinding line of REISHAUER gear grinding machines.

- Filtered flow rate: 500 l/min.
- Average filtration quality: ISO 4406 Code 18/15.
- Cooling equipment with a power of 32,000 Kcal/h to maintain a temperature of 26ºC.



GREAT BRITAIN

We are continuing with the expansion of our network of representatives.

We have signed a representation agreement with the company CUTAHURST LTD of *IRCHESTER*, *Northants*, which is also the representative for the following prestigious firms, Ebay, Etxe-tar, Gaindu, Geinsa, Irurak and MHG.

BRAZIL

We have reached an agreement for representation in this country with the company FERROSTAAL in *São Paulo*, which also represents the firms Reishauer, Junker, Alfing and Starrag Heckert, among others.

KENFILT novotecnic

WE ARE ON THE WEB !

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