FILTRATION news
6
April 2003

Gear grinding



FTD 6 AD TA precoat filter with a cooling system for the cutting oil in a gear grinder.

THE IMPORTANCE OF FILTRATION IN THE FINISH OF HARDENED GEARS

To achieve the best geometric and surface finish for gearing, a finishing operation is needed after the hardening process, and it involves a grinding operation. Performing this grinding process was a slow and costly operation for a long time, since it was done tooth by tooth, with conventional grinders that had low cutting performance, and so it was only used for gears that were to be subjected to particularly demanding stresses, and only exceptionally for mass-production gears.

Back in the 1930s, the first generative gear grinder came in, bringing a geometric and surface quality that enabled gears to be ground in a much more rational, economical way.



Conical-helical tooth grinder.
Photo courtesy of ENGRANAJES ESPECIALES, S.A., Sant Joan de Vilatorrada, province of Barcelona. Where a central filter system for grinding oil, working with a flow of 600 l/min., is installed.

GRINDING IN THE MANUFACTURE OF MASS-PRODUCED GEARS

Mechanical-engineering industries, and the automotive industry in particular, requires "perfect" gears with the best geometric structure for the teeth and the best surface structure, in order to be able to heighten as far as possible their capacity to cope with the stresses on the sides of the teeth. This leads to a reduced gear size, and thus to smaller gear boxes, while also reducing the noise emissions and extending the service life of the gears.

The development of new machines and new CBN grinders over the last 15 years has enabled process time for gear grinding to be divided by 5 or even 10 as compared with conventional machining. Nowadays, large production runs of ground gears are produced with astonishing speed and economy.

Some grinding machines can even lap the gear teeth as well through a second operation in order to make a further improvement to the bearing surface of the teeth.

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WHY IS REFRIGERATION WITH CUTTING OILS NEEDED ?

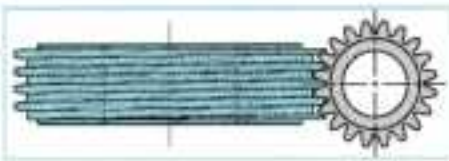
In grinding gears, cutting oil is needed, partly for cooling purposes during the grinding, and partly to lubricate the grinder during its work, **to prevent it seizing up on the gear teeth**. That is why water-based coolants are ruled out for this kind of grinding.

The use of CBN grinders has made the use of cutting oils compulsory, since water-based coolants lead to the chemical destruction of the CBN. *(See Filtration News, issue 1).*



Generative grinding

Photo courtesy of SAMPUTENSILI S.P.A., Bologna, Italy



HOW DOES DIRTY CUTTING OIL AFFECT THE FINISH AND SUPER-FINISH OF GEARS ?

The first thing a grinder does in a grinding operation, before removing any material, is to spread a film of cutting oil for cooling purposes between the piece to be ground and the grinder itself. Between these, a film is built up comprising the cutting oil and any solid particles contained in the oil.

It is very important to bear in mind that special circumstances arise in grinding gears, since a large part of the grinder profile goes into the teeth to be ground, **meaning that a large area of the grinder surface is active**. Consequently, the phenomenon of the lamination of dirty particulate matter held in suspension in the oil is much more evident than in cylindrical grinding.

Having very clean oil – i.e. oil free from particulate matter in suspension – has many advantages:

- The particles do not become embedded in the material being ground and cause scratching on the surface.
- The particles do not get into the cutting pore of the grinder, thereby causing clogging or diminished capacity. This is particularly serious when using CBN grinders made by electro-deposition, with non-renewable profiling.
- Clogging leads to the work piece heating up, which may in turn lead to the formation of micro-cracks in the tooth surface, thus diminishing the surface quality.
- Clogging causes deformation in the grinder profile, thereby diminishing dimensional and geometric quality in the ground teeth.
- When the gears are ground by 'packs', micro-cracks may arise on the surface of the teeth in the last gears of the 'pack', or deformations in the profile of the teeth. When the oil is properly filtered, more gears can be included in the 'packs' for grinding, leading to a considerable increase in output, since the grinders retain their cutting power for longer.





Grear grinding and super-finishing system

Photo courtesy of SAMPUTENSILI S.P.A., Bologna - Italy

HOW SHOULD CUTTING OILS BE FILTERED IN GEAR GRINDING AND BURNISHING OPERATIONS ?

Experience has shown that simple filtration equipment, such as paper band filters, endless bands, self-cleaning mesh filters, centrifuges, magnetic separators etc. do not produce the filtration quality required for achieving the high surface and geometric quality demanded, or the high performance and efficiency that can be attained with present-day machines.

The best manufacturers of machines for gear grinding and burnishing, and the gear makers that use those machines, have concluded that for such finishing and super-finishing operations, **PRECOAT** filtration units or central systems should preferably be used, since they have been shown in practice to be the kind that can really keep the cutting oil totally clean and transparent in an efficient and industrially economical way.



Precoat FTD 30 DA 25 central filtration system for feeding a line of 8 gear grinders with a flow rate of 1.200 l/min.



Photo courtesy of CASAGRANDE INGRANAGGI S.P.A., Cardano al Campo (VA), Italy, in whose factory an FTD 50 DA 35 filtration system was installed in 1990 for a flow rate of 2,000 l/min, to feed a line of 12 gear grinders.

THE ADVANTAGES OF USING A FULLY CLEAN, TRANSPARENT CUTTING OIL

On the basis of over 30 years' experience gained by KENFILT-NOVOTECNIC in making and installing PRECOAT filtration systems for customers all over the world and for various types of gear grinding and burnishing work, we have drawn up the following list of advantages achieved by using cutting oils that are completely clean and transparent:

1. **Reduction in grinder consumption.**
2. **Reduction the consumption of the grinder's crushers.**
3. **Increased output, through:**
   a) **The possibility of increasing cutting and feed speeds;**
   b) **The reduction in the number of grinder profiling and grinder replacements needed.**
4. **Reduction in maintenance costs.**
5. **Improvements in automated control systems.**
6. **The service life of the oil lasts indefinitely.**

Multi-circuit cooling systems

Most machine tools usually have the following two hydraulic circuits:

A **Cooling liquid for the work of tools or grinding wheels**

This is about cutting oils, emulsions, synthetic solutions, etc.

These liquids need to be filtered and cooled under certain conditions, in terms of each application *(see Filtration News No. 4 and 5)*.

B **Cooling liquid for motors, heads and shafts**

These are principally hydraulic oils, where it is absolutely necessary to maintain the temperature constant, especially when the shaft is cooled, because at the same time it serves for its correct centering, keeping also the viscosity of the oil constant.



Multi-circuit cooling system for cutting and hydraulic oil, type FS2-106-A (17.000 Kcal/h + 2.000 Kcal/h)

KENFILT-NOVOTECNIC designs and produces its own individual cooling and multi-circuit equipment meeting the needs of each client.



Direct cooling equipment for cutting oil, type FC-245-A, (216.000 Kcal/h)

During the productive process of the machine, both circuits require external cooling, in order to maintain an optimal and constant working temperature.

It is because of this double refrigeration of two independent circuits that there are two possibilities for cooling systems:

1 Individual cooling systems
Installation of one system for each of the circuits which are to be cooled.

2 Multi-circuit cooling system
Installation of one single cooling system, with double regulation and independent from each other.

The principal differential characteristics of these multi-circuit systems are:

- One single compressor for the two circuits (depending on the global cooling power).
- Independent expansion for each circuit.
- Individual evaporation system for each circuit.
- Independent control and adjustment of the temperature.



Cooling equipment for hydraulic oil type, FC-108-A 25.000 Kcal/h

The advantages of a multi-circuit system with regard to doubling individual systems are:

- Minimization of the occupied space.
- Unification of the point of control and maintenance.
- Reduction of the global cost.
- Optimization of the compressor power.

Vacfilt

Pneumatic filter-aid bag emptier used for the precoat

Kenfilt- Novotecnic is already equipping its filter-aid dosing devices with the **Vacfilt** device.

This device eases the handling of the filter-aid (cellulose, diatomaceous earth, perlite, wood flour, etc.) and protects furthermore the health of the workmen who must handle it.

The **Vacfilt** works with a pneumatic vacuum generated by compressed air. The vacuum generated transports the filter-aid to the discharging funnel of the dosing system. The circuit is totally closed, thus avoiding any possibility of ambient-air contamination.

The **Vacfilt** can be installed in the dosing device of any type of precoat filtration unit and allows the fast emptying of the filter-aid bags.

By its vacuum operation, the air current that is produced during the emptying of the bag always flows from the outside to the inside of the bag.

Vacfilt has self cleaning filters for the air that is evacuated.

IT DOES NOT CONTAMINATE THE AIR !!

The **Vacfilt** has a totally automated electronic control.

The **Vacfilt** is very easy to install requiring only:

- One 1/2" compressed air connection.
- One 24 V DC electric connection.
- Fitting its discharge socket into the upper part of the dosing device.

Its installation does NOT require:

- Fixed mechanical transport installations with rigid or flexible dosing screws operated by gear motors.
- Moving heavy bag-emptying carts and bag-supply carts around the factory.
- Fixed installations for the inter-connection between the mechanical transport devices and the bag-emptying wagon.



Please contact our technical-commercial department, to find out how you can adapt it to your dosing devices

SOLUTIONS KENFILT-NOVOTECNIC

Country:
GERMANY

Equipment/Central **FTD 20 DA 10**
Supplied 30.08.2002
NF-: 2068/3502

FILE Nº 2068

Manufacturer of:
DIESEL MOTORS

Technical Data

Refrigerating liquid	**Oil**
Flow:	**660 liters/minute**
Machined material:	**Steel and cast iron**
Type of machining:	**Grinding of steel and cast iron cam-shafts**
Grinding wheels:	**CBN**
Binder:	**Metallic and Resin**

Problem to resolve:

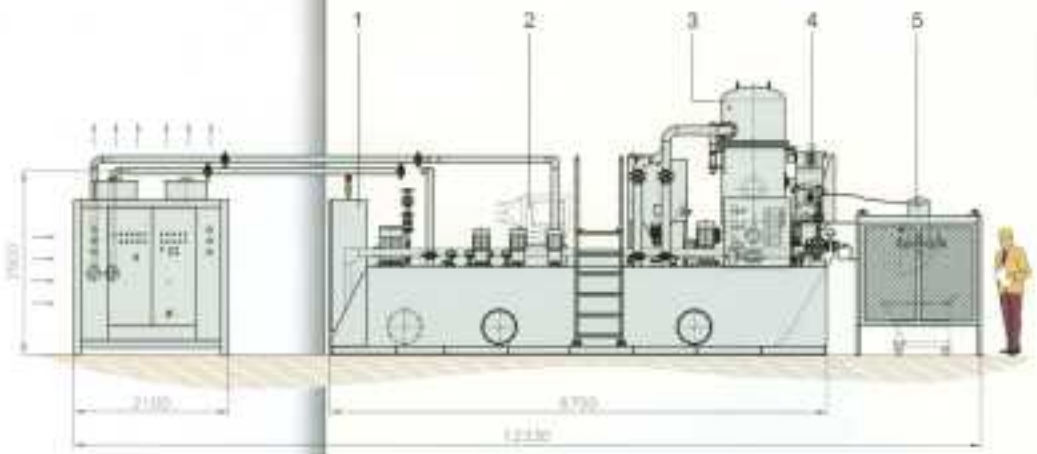
- Improve grinding wheel efficiency
- Prolong coolant life
- Improve the grinding quality
- Total elimination of the graphite dust when grinding cast iron

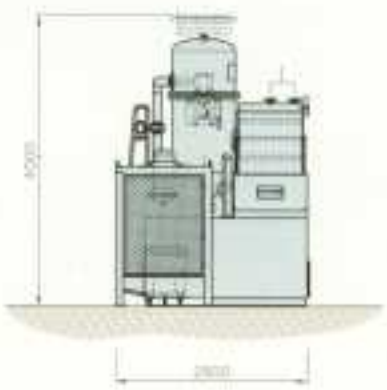
Adopted solution

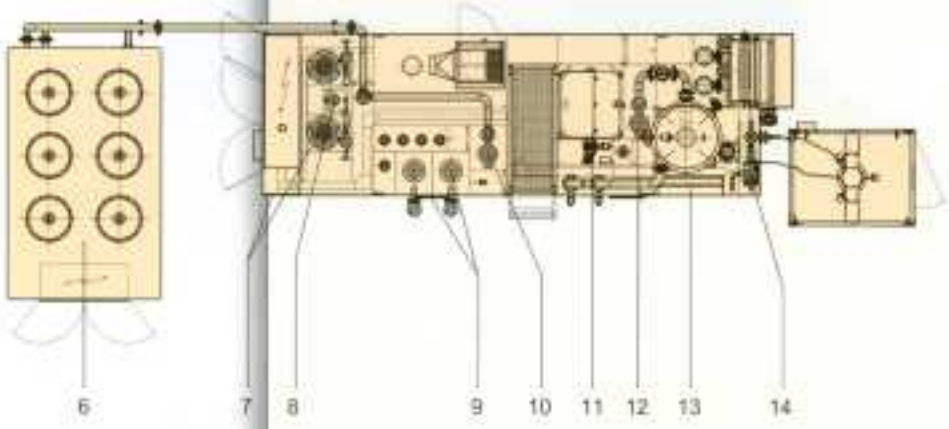
- **Assembly of a precoat filtration system FTD - 20 DA 10 with a quality of filtration ISO 4406 Code 18/15, with dredge tank, sludge dryer by compressed air and coolant system**

Results obtained:

- **Improvement in grinding wheel efficiency**
- **Keeping the oil clean and transparent for years, even when grinding cast iron**
- **Improving the surface and geometrical quality of the cam-shafts**
- **Elimination of dermatitis problems**
- **Maintaining the oil within ISO 4406, code 18/15** *(See Filtration News nº 2)*
- **Considerably reduction in maintenance and accessories costs. All of them increase their "life"**







POS.	BEZEICHNUNG
1	Elektroschaltschrank 60 kw
2	Elektrostatischer Luftfilter
II	Filter FTD-20
4	Magnetwalzenabscheider
5	Schlammtrocknungseinrichtung
6	Kühlaggregat 100 kw
7	Versorgungspumpe 210 l/min 20 bar
8	Versorgungspumpe 20 l/min 3 bar
9	Versorgungspumpen 28 l/min 60 bar
10	Umlaufpumpe
11	Filtermitteldosierung
12	Beschichtungs-Filtrierungspumpe
13	Pneumatikschalschrank 20 m/s 6 bar
14	Schlammtrocknungspumpe
	FASSUNGSVERMÖGENBECKEN : ~10.500 L

12th anniversary of the start-up of a filtration-unit system

Back in 1991, **KENFILT-NOVOTECNIC** designed, manufactured and installed a centralised filtering system for coolant oil for all the grinding operations for the threading taps made by the **Japanese Yana** - based company **OSG**.

It could be one of the biggest in the world.

The installation comprises eight type 2 FTD 75 DA 70 Precoat systems with a total flow capacity of **36,000 l/min** filtered by 16 FTD 75 filters.

Total capacity amounts to **560 m³**, spread over eight 70 m³ tanks.



Overview of the eight 2 FTD 75 DA 70 systems at OSG - Yana, Japan.

During the latest **JIMTOF 2002** Machine-Tool Fair held in late October in Tokyo, Mr. Sugihara, who was CEO of **OSG** when the project was arranged, voiced his satisfaction at how the filtering systems were working, since the oil is as clean now, after 12 years' operation, as it was on the first day, and the premises are working to the full with no problems.

Mr. Sugihara told Mr. Lleal that the olive tree that was taken by air from Barcelona to Japan and planted at the OSG factory in Yana has been producing olives for years. The company's employees pick them and enjoy eating them.



15 may 1991. Our CEO Mr. Jaume Lleal presenting an olive plant to OSG CEO, Mr. Hikosaburo Sugihara.

KENFILT-NOVOTECNIC reports

CHINA

One of the latest sales missions in late October and early November was in China.

Valuable contacts were made during the course of the trip for the purpose of appointing agents in Peking and Shanghai, and it is hoped that the "Gentlemen's Agreement" will soon be signed.

JAPAN

Our CEO entered an agency agreement for Japan with YKT Corporation on the occasion of the JIMTOF '02 fair held in Tokyo in October-November last year.

Many visitors there showed interest in our products over the 7 days of the event. They were mostly Japanese and German companies, though with Switzerland, Israel and India figuring prominently as well.

During the course of the fair, our engineer Mr. Ribatallada acted as our technical-support consultant for Mr. Ryoichi Aihara from YKT Corporation.



Mr. Takashi Watanabe, CEO of YKT Corporation, and our own CEO Mr. Jaume Lleal

ITALY

Continuing with progress in consolidating our sales network, we signed an agency agreement for Italy last October with the Turin-based company IPR Macchine, S.R.L., that company being agents for highly regarded machinery makers such as Reishauer, Maegerle, Grob, Winterthur Schleiftechnick, Dr. Müller and Schnyder among others.

IPR's owner-manager Mr. Pierluigi Zappa is convinced that they will be successful in selling KENFILT-NOVOTECNIC filters, furthering the work our company started in that country over 20 years ago.

THE BASQUE COUNTRY

An agency agreement was signed by KENFILT-NOVOTECNIC and the company IZEKA S.L., based in Iurreta in the province of Biscay.

We are sure that Mr. Javier Canales and his sons Javier and Alberto will do fine work in this important market, in which we have had many significant customers for over 25 years.

KENFILT
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WE ARE ON THE WEB !

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