

Maintain Clean Oil Cement Mill Gears - and save money!

*by Area Sales Manager
Christian Juhl Thomsen, C.C.Jensen A/S*

Filtration is a very important, but unfortunately often neglected tool for the effective maintenance of cement mill gears. In Europe the problems with break downs on wind turbine gears has put a renewed focus on the importance of maintaining gear system oils clean.

The majority of all problems with gear systems are caused by contamination particles in the oil. Overheating and water in the oil should also be avoided in order not to damage components and oil.

Maintaining the oil free of particles, water and oxidation residuals means considerable savings on the maintenance budgets.

A very contaminated gear oil may contain up to five million particles per 100 ml; particles which wear, grind and eventually may destroy the expensive components inside an industrial gear box.

The contamination in the gear oil originates from various sources - in fact, the oil is often contaminated before it is filled on the gear box. The Danish Institute of Technology states: "During long time storage oils may form crystals, and particles may ingress through untight barrel and tank covers during decanting and transportation". It is important to note, however, that the majority of the contamination intrudes/is produced by the gear system during operation or, very often, during repair and maintenance work.

Particularly in industries where dusty environments seems unavoidable, like the cement and mining industries, it is very important to maintain focus on enhanced oil filtration.

Particulate Contamination

A very contaminated gear oil may look very clean to the eye. The naked eye can only see particles larger than four hundredths of a millimetre ($40\mu\text{m}$), but the majority of the particles in a contaminated gear oil are around five thousandths of a millimetre ($5\mu\text{m}$). The particle size distribution in a gear oil system is illustrated in fig. 1.

The particles smaller than 5 micron act as catalysts to the oxidation and, consequently to the decomposition of the oil and, eventually, it will be necessary to change the oil.

Furthermore, metal and other particulate contamination (like cement dust) will continuously flow to the bearings and the gear wheels where the particles may create massive damage to the components. In turn, this damage may cause unplanned production stops which, on top of lost production time, may imply costly repairs or even renovation.

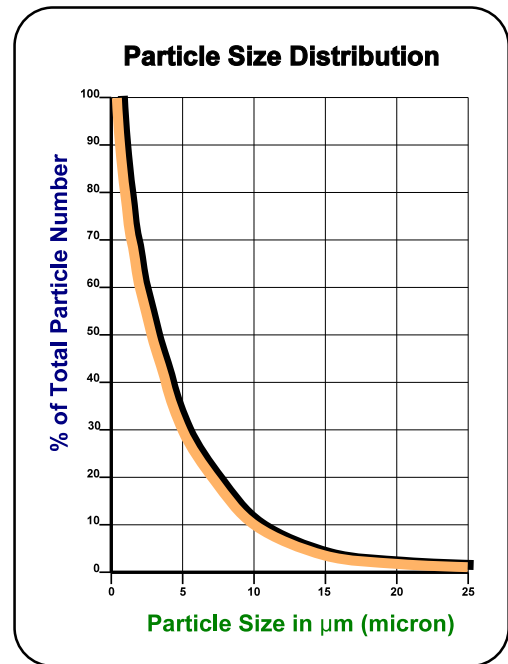


Fig. 1 Average contaminant particle sizes in gear oil system

The Importance of Small Particles

Mr. MacPherson, a specialist in oil maintenance, made a test demonstrating the importance of removing the very small particles from gear oil systems.

The well-known MacPherson graph is based on an accelerated test of 10 roller bearings with a lubricant contaminated with dirt from gear boxes. When looking at the degree of filtration it is obvious that removal of the very small particles will prolong the life time of the components - the main purpose of filtration. It also extends the oil life time and it is a well proven fact that a clean oil last longer than an oil operating in a contaminated gear oil system.

During normal operation the surface of the gear teeth must sustain very high load pressures, which is why a good lubricant is necessary. However, if the lubricant is contaminated and particles are introduced between the gear teeth when the gear is in operation, the particles can seriously damage the surfaces of the gear wheel.

If this wear and tear process is allowed to continue the creation of particles in the oil will accelerate, thus increasing the risk of the very vital gear components breaking down. On top of this the accumulation of particles will also accelerate the oxidation process of the oil (the che-

mical decomposition and the breaking down of additives) which will negatively affect the oils lubricating efficiency and properties.

The economical aspects of good oil maintenance are equally obvious. An example: cement mill often use excellent and expensive syntethic oils. The potential lifetime of such oil is at least 60,000 operation hours, but contamination can make it necessary to change the oil after just one year - which, of course,

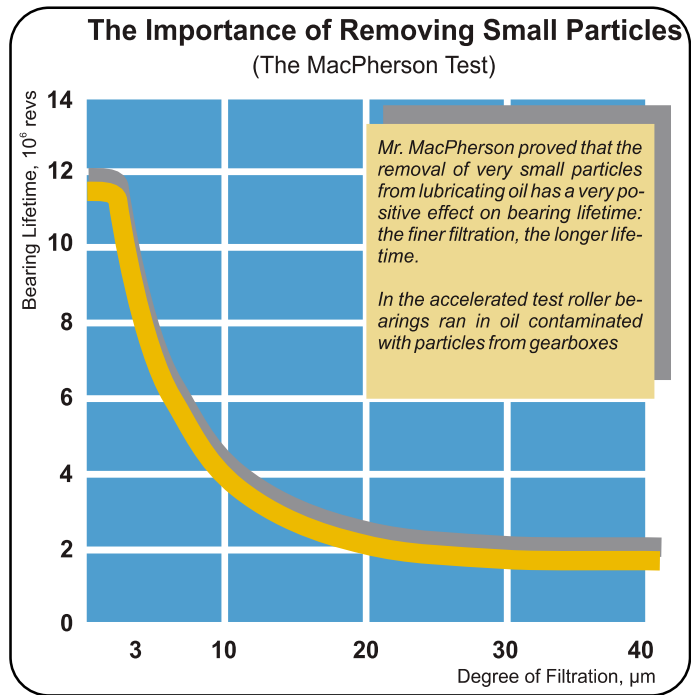


Fig. 2 The MacPherson graph

was not the intention. Yet another aspect is that changing the oil does not remove all the particles sticking inside the system components and piping - and as soon as new oil is poured into the system the oil gets contaminated - filtration is a necessity.

The above actually describes the very evil contamination circle of an oil system, and it is a fact that the number of particles and the oxidation ration will continue to increase if the oil is not cleaned effectively and continuously.

Some manufactures of cement mill gears like FLS/MAAG in Valby, Denmark, has been offering their customers CJC™ Offline Fine Filters for many years. The reason is that FLS/MAAG recognize the importance of a good and oil fine filtration in order to maintain a good level of oil cleanliness for the benefit of both components and oil in their gear boxes.

Filtration Principles

There are many ways of cleaning oil, but the most effective method is offline filtration by means of a filter unit with a separate pump, working independently of the existing gear oil system. First, however, we will go through the principle of inline filtration in order to make the somewhat different philosophy of offline filtration more comprehensible.

In-line filters

Cement mill gears are very often equipped with a factory-fitted filter - typically an inline filter integrated in the cooling and lubricating circuit of the gear. The filtration degree will often not be better than 20 µm.

A filter of this type will obviously assist in retaining a part of the large particles from the oil system. However, the important small particles, oxidation residuals and water will not be removed by this type of inline filter. Consequently, the oil maintenance on such a system is relatively poor and will have a very low effect on reducing overall maintenance costs.

Off-line filters

On the long term an investment in a true offline filter will be the wiser solution, provided that the filter inserts used has a large dirt holding capacity and ability to absorb oxidation products and water from the oil.

With its separate pump the offline filter acts as a “vacuum cleaner” removing dirt from the oil sump. The principle is that the filter pump draws the oil from the bottom of the tank where the concentration of settling impurities is biggest. The oil is pumped through the filter insert and returned to the gear box, either below the oil surface or, if adequate, on top of the gear wheels. The flow capacity per hour of an offline filter must be 10 to 15% of the total system oil volume.

It is important to note that a high filter flow does not automatically lead to cleaner oil. A high flow through a fine filter (3-6 µm abs.) implies sturdy and costly filter inserts, energy loss (high pressure drop), low dirt holding capacity and increased risk of particle blow-throughs. An offline filter in continuous operation and working with a stable and low oil flow gives the perfect conditions for fine filtration. In combination with a true depth-filter element the offline filter will effectively remove particles, water and oxidation deposits from the oil. The installation of an offline filter unit is uncomplicated and uncostly as it does not directly interfere with any other system oil circuits.

To summarize, the advantages of installing a high quality offline fine filter are:

- Increased component life time
- Longer intervals between oil changes
- Reduced expenses to maintenance work and spare parts
- Less unplanned production stops
- Extended main overhaul intervals

Test of CJC™ Offline Fine Filters

The large and well-known Danish manufacturer of cement, Aalborg Portland, have equipped their Symetro Gears with CJC™ Offline Fine Filters from C.C. JENSEN in Denmark. The company have also decided to utilize this type of filtration on the gear of their big rotating ovens - and with great success as you can see from the following application study.

The Company of C.C. JENSEN A/S has specialized in manufacturing oil filtration units, not only for gear oil systems, but also for hydraulic and lubrication oil systems.

For further information, please contact

C.C. JENSEN A/S

Att.: Mr. Christian Juhl Thomsen

Lovholmen 13

5700 Svendborg

Denmark

Phone: +45 63 21 20 14

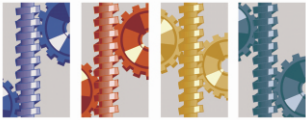
Fax: +45 62 22 46 15

E-mail: cjt@cjc.dk

Web: www.cjc.dk



C.C.JENSEN
OIL FILTRATION SYSTEMS



INDUSTRY

Application Study written by
Christian Juhl Thomsen,
C.C. Jensen A/S (DK)

CJC™ Application Study

Cement Mill - Gear Filtration

CUSTOMER

Aalborg Portland A/S, Denmark
Contact person: Per Munk
Bertelsen, Maintenance Manager

THE SYSTEM

FLS Gear-TD1500, gear with torsion shaft for rotating cement oven. Oil 370 litres of MOBIL GEAR SHC 632.

THE PROBLEM

Oil samples had shown an extremely high particle content, leading to increased wear and tear on the gear teeth. It was decided to improve oil cleanliness during the forthcoming overhaul of the transmission.

THE SOLUTION

A CJC™ **Fine Filter** type HDU 27/27 PM-DY with pump flow rate = 90 l/h and with CJC™ **Filter Insert** type B 27/27 (3 µm abs) with a dirt holding capacity of 4 litres.

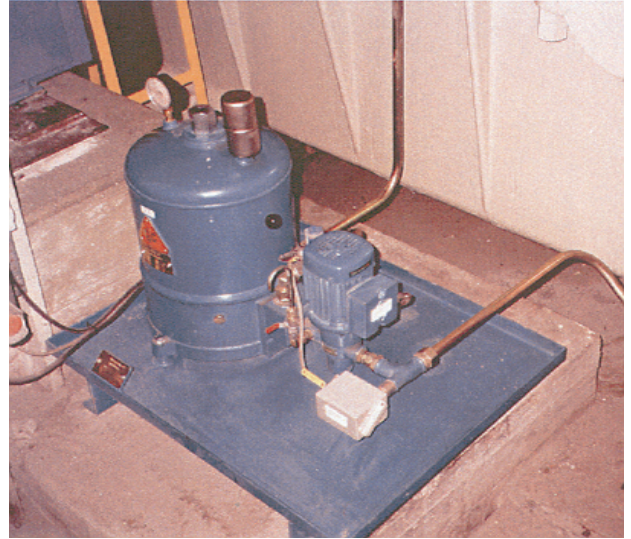
The CJC™ filter unit is installed on the gear system platform next to the gear housing drawing the oil from the bottom (sump) of the gear box and returning it to the top of the gear wheels.

THE TEST

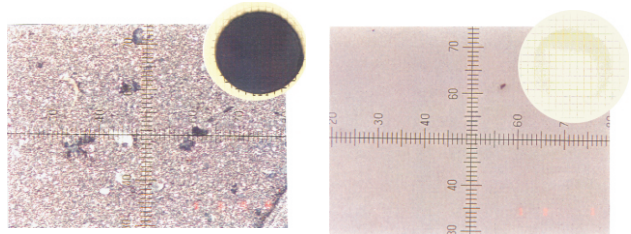
Oil sample no. 1 was taken out before the overhaul of the system. The sample no. 2 was taken at filter start up after overhaul and with new oil. Samples nos. 3, 4 and 5 were during the test.

THE RESULT

The achieved reduction from 3,257,000 particles >5µm to 6,969 will increase the gear bearings life by a factor five.



The Portland Rotating Oven is driven by FLS Gear equipped with a CJC™ Filter for retaining particle, oxidation and water from the gear oil.



Before

After

Date	01-11	17-12	20-12	07-01	12-02	15-05
Particles >2 µm	>500,000	>8,000,000	215,884	19,240	15,489	7,242
Particles >5 µm	>500,000	3,257,230	65,185	10,004	6,969	5,219
Particles >15 µm	>130,000	80,250	7,080	762	549	227
ISO CLASS	20/20/18	24/22/17	18/17/13	15/14/10	14/13/9	13/12/8

The customer is very satisfied with the achieved ISO code of 13/12/8.

COMMENTS

Per Munk Bertelsen, Maintenance Manager at Aalborg Portland A/S, Cement Mill.

"I can only recommend the use of CJC™ Oil Filters - as it helps us saving money on our maintenance budgets".



C.C.JENSEN

C.C.Jensen A/S * Løvholmen 13 * DK-5700 Svendborg * Denmark
Phone: +45 63 21 20 14 * Fax: +45 62 22 46 15
E-mail: filter@cjc.dk * Web: www.cjc.dk