Magnom® Filtering Lubrication System

Petri Korhonen – Condition Monitoring Specialist
Cold Reduction Department
Western Port Works

Magnom® Magnetic Filtering – Lubrication System

The Condition Monitoring Department at Cold Reduction conducted a filtration trial on the Five Stand Mill (FSM) Motor Generator Set lubrication system.

A filter cart was used to polish the oil in a kidney loop arrangement, installed with a 3 micron $\beta_3 \geq 100$ Filter.

A Magnom® filter (Magnetic Core) was also connected as a pre-filter to the filter cart.

Magnom® Magnetic Filtering – Lubrication System

MG set white metal journal bearings with running clearance of 125 microns.
MG Set lubrication system contains several filters at different stages.
Ranging from 10 micron to 250 Mesh.

Magnom® Magnetic Filtering – Lubrication System

The filter cart flow rate is:

30 litres per minute.

System Capacity is 3000 litres

The full system was filtered for 1 week.

System turned over approx 100 times.

Magnom® Magnetic Filtering – Lubrication System

The clear bowl of the Magnom® filter allows ease of inspection (depending on fluid clarity). Here the lubricating oil BP Bartran 46 can be seen passing the magnetic core.

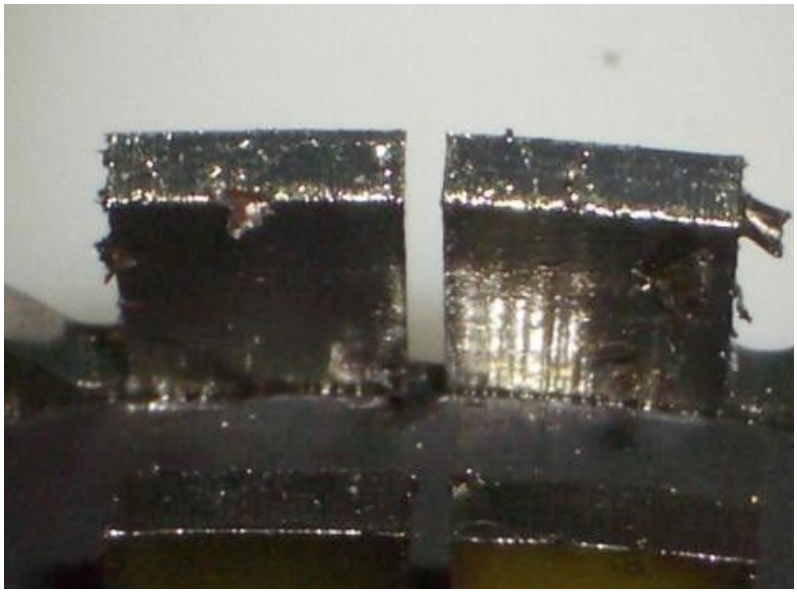
The fluid looks heavily air entrained !

BLUESCOPE

Magnom® Magnetic Filtering – Lubrication System

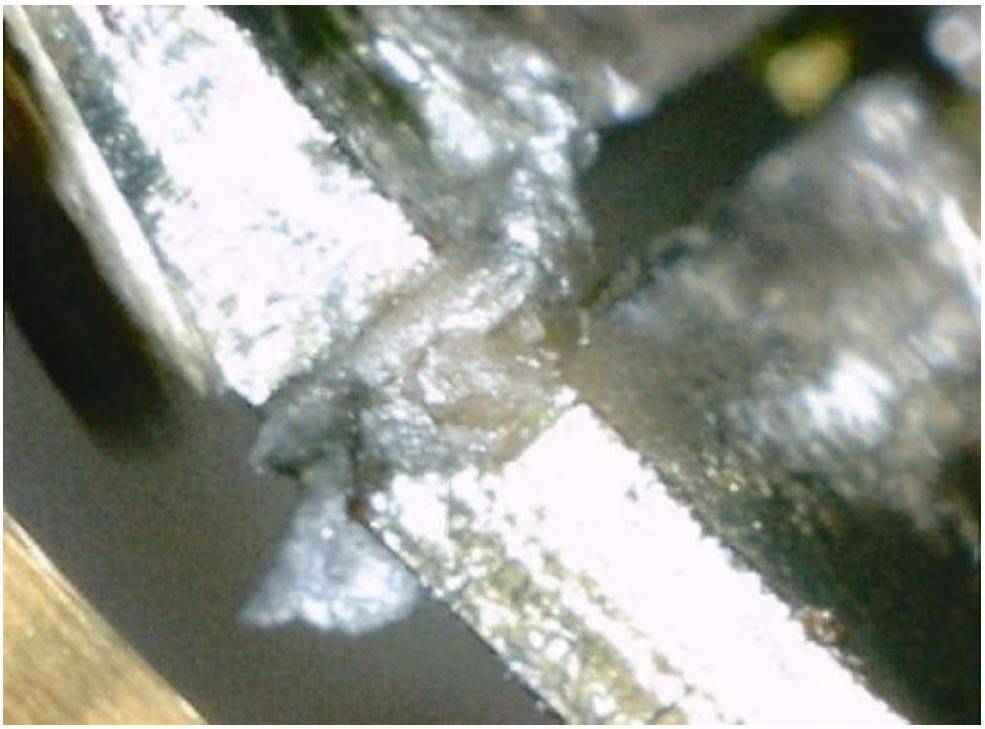
Magnom® Magnetic Filtering – Lubrication System

Disassembly of the Filter allows recovery and inspection of collected contaminants. Large particles captured by the Magnetic Core of the Magnom® filter are clearly seen in the first few stages of the filter. The particles are approximately 1-3 mm in length.



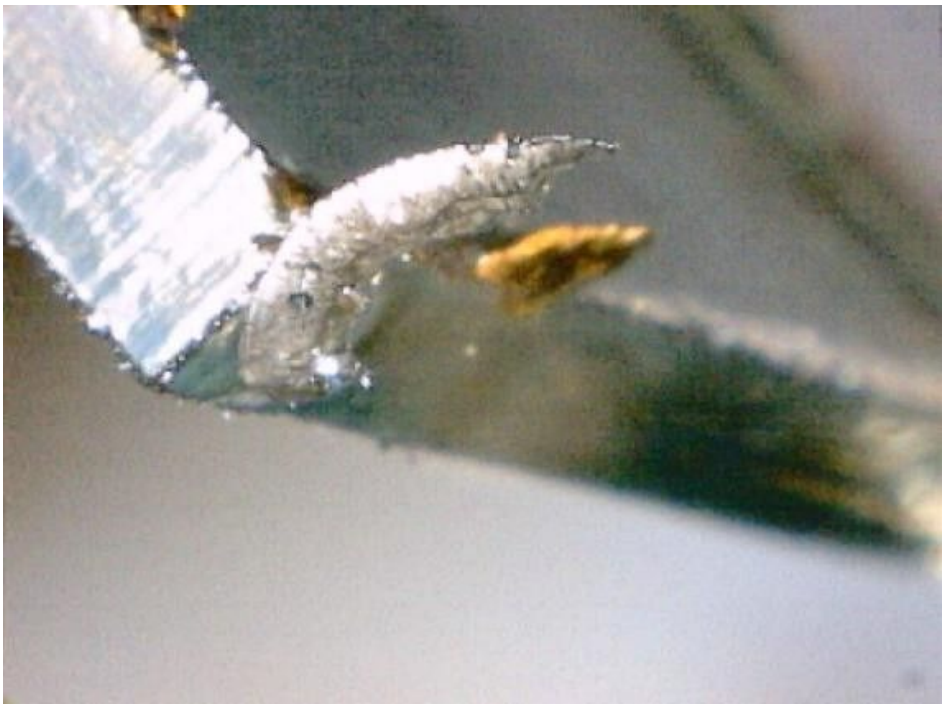
Magnom® Magnetic Filtering – Lubrication System

The Magnetic Core of the Magnom® filter also captured very fine ferrous particles.



Magnom® Magnetic Filtering – Lubrication System

Close-up of large cutting particle attached to magnetic core of Magnom® filter – also unknown particle captured (yellow color).

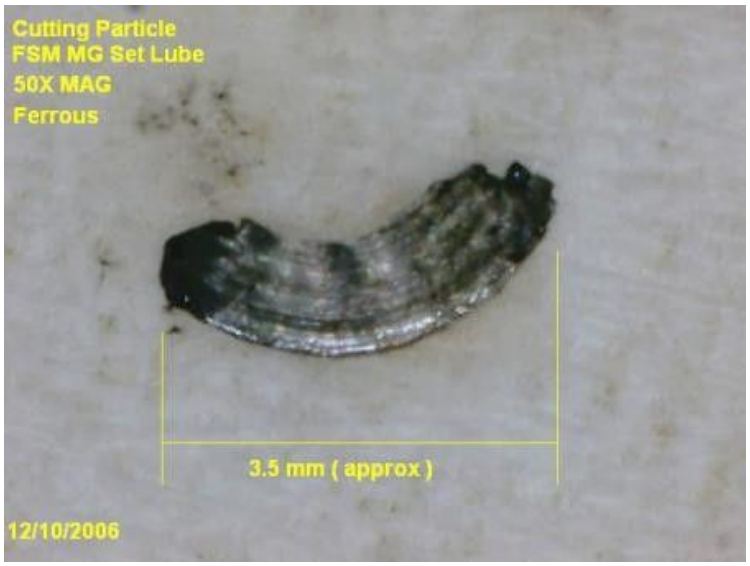


Magnom® Magnetic Filtering – Lubrication System

The microscope view of this particle shows defined cutting lines, tempering color and curling.

A large particle of 3.5 mm size found in the MG Set lubrication system is of serious concern.

The origin of the particle is unknown, but there had been some maintenance activity about 2 years prior, which involved hatch installation because the system was not sealed sufficiently to prevent contamination. This could be drill swarf from the hatch installation.



LEARNINGS :

Lubrication System Deficiencies highlighted.

Poor design of lubrication reservoir.
Baffles ??
Suction line too close to return line.
Pump relief valve return above fluid level.

Short lubricant residence time in tank.

Magnom® Filtering Hydraulic System

Petri Korhonen – Condition Monitoring Specialist
Cold Reduction Department
Western Port Works

Magnom® Magnetic Filtering – Hydraulic System

The FSM Entry Hydraulic system contains approximately 12000 litres of hydraulic oil.

Hydraulic cylinder **failure** had occurred in the system resulting in ferrous particle contamination.

The FSM Entry Hydraulic system contains several filters at different stages.

Ranging from a 7 micron Recirculation system filter

10 micron Pressure Filters
and

150 micron (100 Mesh) Suction Filters.

Magnom® Magnetic Filtering – Hydraulic System

The filter cart flow rate is:

30 litres per minute.

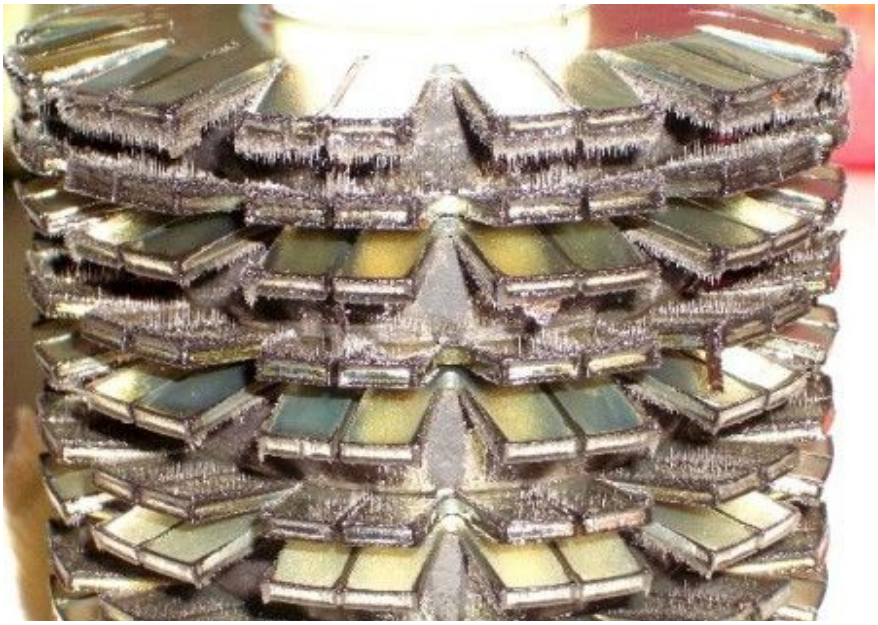
System Capacity is 12000 litres

The full system was filtered for 5 weeks.

System turned over approx 100 times.

Magnom® Magnetic Filtering – Hydraulic System

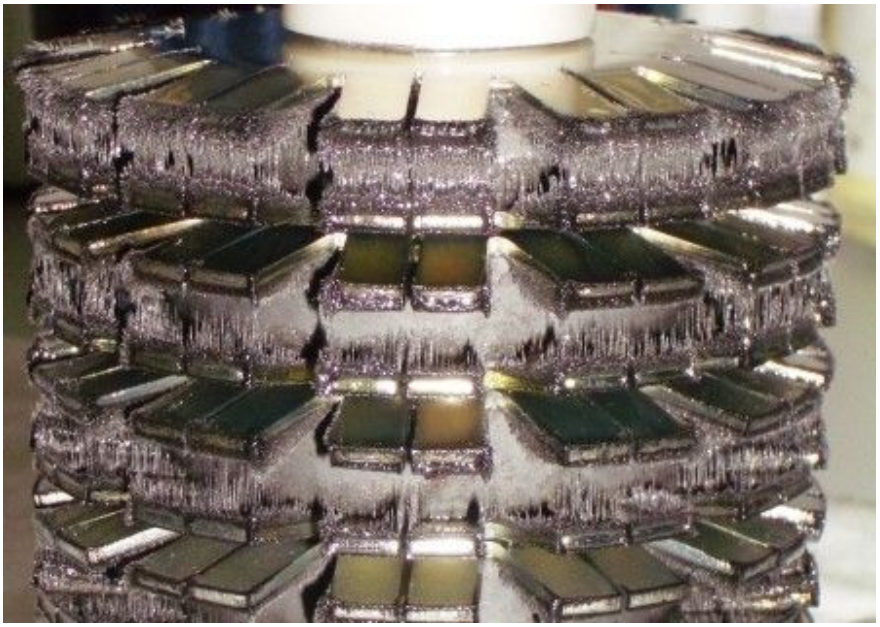
Inspection of the Magnom® filter magnetic core at week 1 of operation.



Filter was cleaned and put back in operation.

Magnom® Magnetic Filtering – Hydraulic System

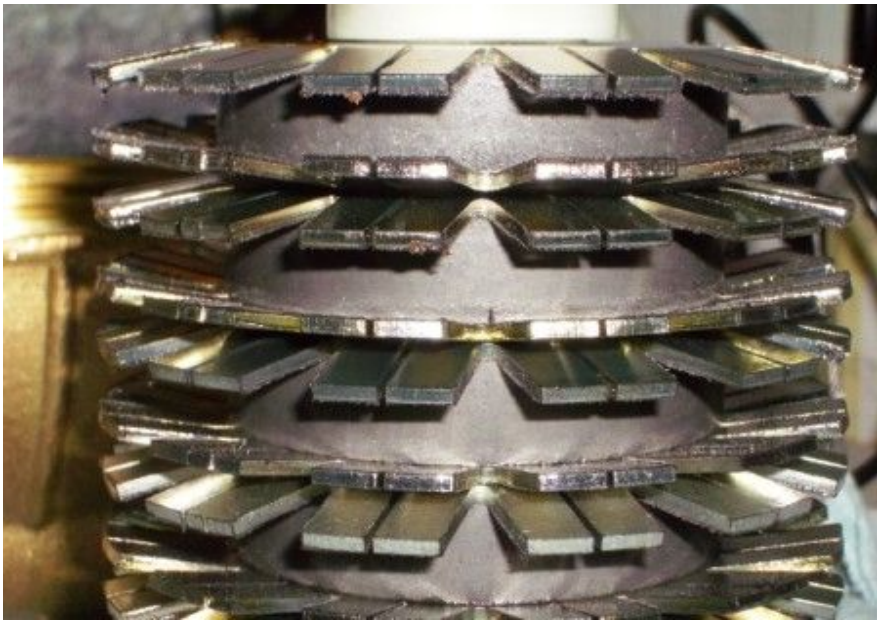
Inspection of the Magnom® filter magnetic core at week 4 of operation.



Filter was cleaned and put back in operation.

Magnom® Magnetic Filtering – Hydraulic System

Inspection of the Magnom® filter magnetic core at week 5 of operation.



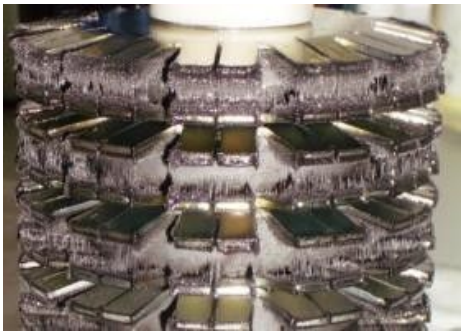
Magnom® Magnetic Filtering – Hydraulic System

Inspection of the Magnom® filter magnetic core during 5 week operation

Week 1 Initial operation

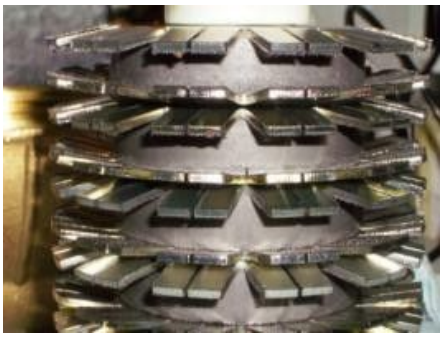
Filter cleaned

Week 4 in operation



Filter cleaned

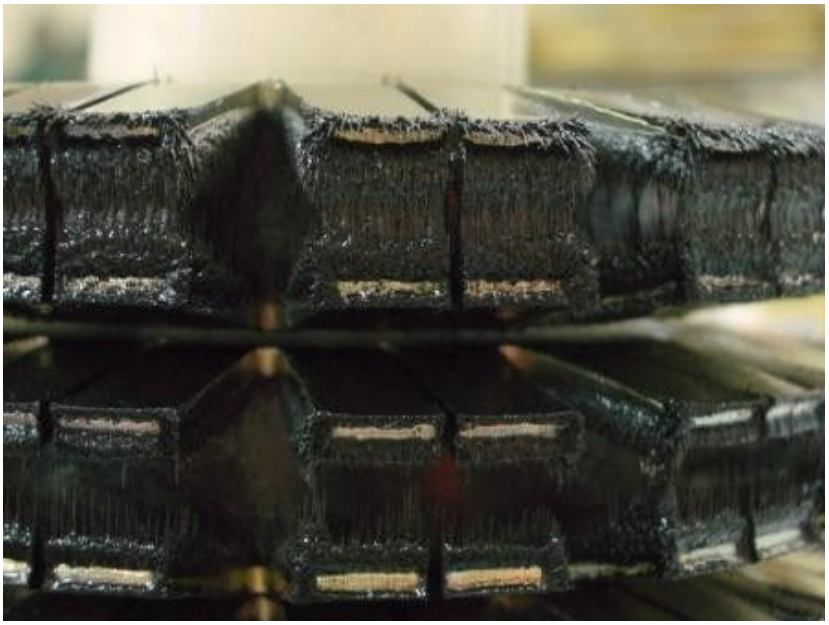
Week 1 after clean



No further debris collected !

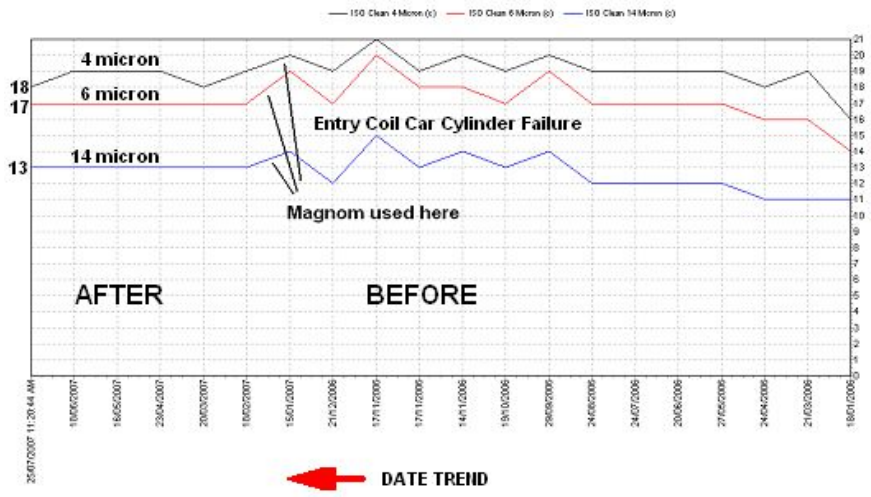
Magnom® Magnetic Filtering – Hydraulic System

Disassembly of the Magnetic Filter allows for recovery and inspection of collected contaminants. Very fine particles captured by the Magnetic Core of the Magnom® filter are clearly seen in every stage of the filter.



Magnom® Magnetic Filtering – Hydraulic System

BP Detecta system ISO Cleanliness Trend.
Target 17/15/12



Hydraulic System should be cleaner – Recirculation filter requires review.

Magnom® Magnetic Filtering – Hydraulic System

LEARNINGS :

Recirculation Filtering System not cleaning effectively.

Targeting ferrous particulate is effective with magnetic filtration.

Magnom® Filtering Industrial Gearbox

Petri Korhonen – Condition Monitoring Specialist
Cold Reduction Department
Western Port Works

Magnom® Magnetic Filtering – Industrial Gearbox

The Pickle Line (PKL) Exit Looper Gearbox contains approximately 414 litres of BP Energear GR-XP 320 cSt. oil.

Simple splash lubricated gearbox operates through an varying speed range. (0 – 400 rpm)

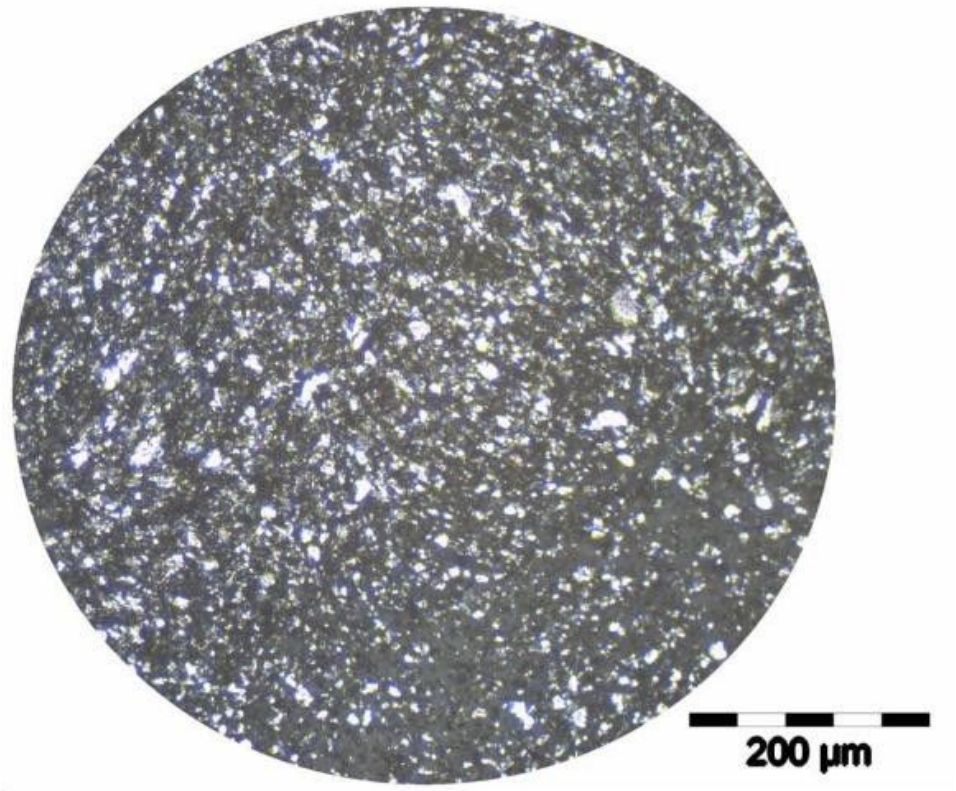
The gearbox spends long period of it's operating time in a holding position. (zero speed – high load)

Lubrication is critical, Lubricant cleanliness is vital.

Magnom® Magnetic Filtering – Industrial Gearbox

Microscopic filter patch of gearbox oil 07-09-2011….GEARBOX INSPECTION REQUIRED

Cleanliness Count >26 >25 >22



Magnom® Magnetic Filtering – Industrial Gearbox

Gearbox internal inspection..

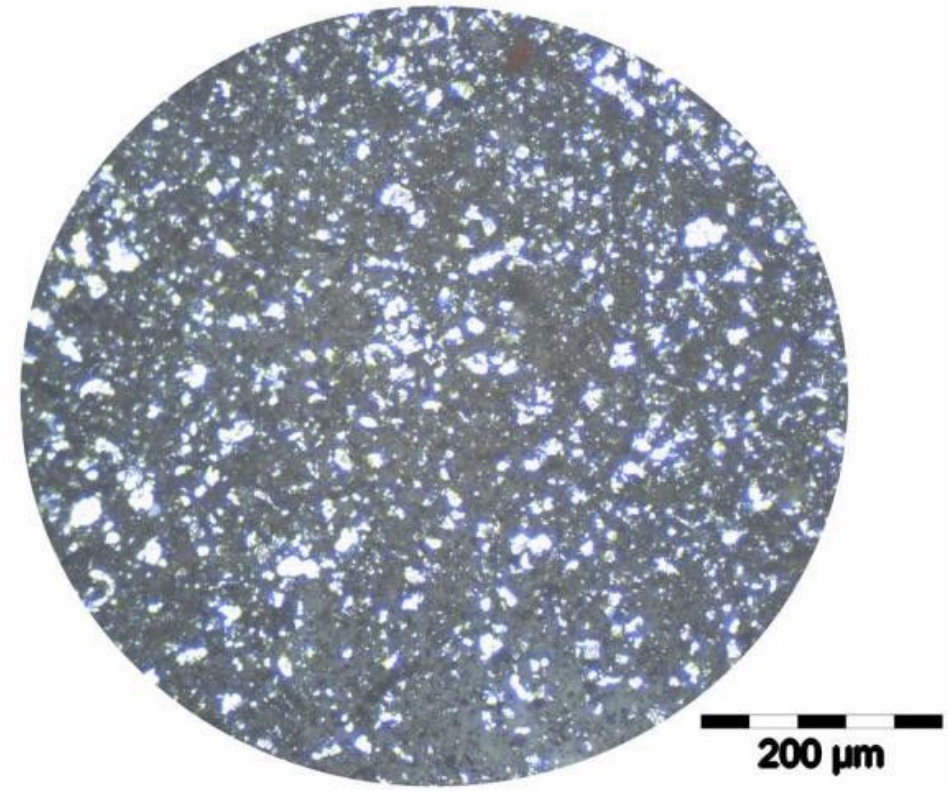
HEAVY PITTING ON INTERMEDIATE GEARSET FOUND

OIL DUMPED…..

Magnom® Magnetic Filtering – Industrial Gearbox

Microscopic filter patch of gearbox oil 15-02-2012….AFTER OIL DUMP

Cleanliness Count >26 >25 >22



Magnom® Magnetic Filtering – Industrial Gearbox

A filter cart was connected to the PKL Exit Looper Gearbox on the PKL down day, 04/07/2012, in readiness for cleaning as per the connection arrangement below.

Magnetic Filter (large capacity) installed.

The filter cart was also fitted with a 12 micron Pall SRT filter to remove non ferrous (silica / dirt etc.).

Pump is a diaphragm type that has flow adjustment and driven by pneumatics.

Magnom® Magnetic Filtering – Industrial Gearbox

Filter operation.

OIL FROM GEARBOX INTO FILTER CART.

OIL OUT OF FILTER CART AND RETURNED TO GEARBOX.

BLUESCOPE

Magnom® Magnetic Filtering – Industrial Gearbox

Filter CLEANING AFTER ONLY 8 HOURS OF OPERATION…..

Magnom® Magnetic Filtering – Industrial Gearbox

HIGH STRENGTH MAGNET ON FILTER CART SUCTION LINE….

Magnom® Magnetic Filtering – Industrial Gearbox

Magnetic Filter inspection

High level of ferrous particles collected.

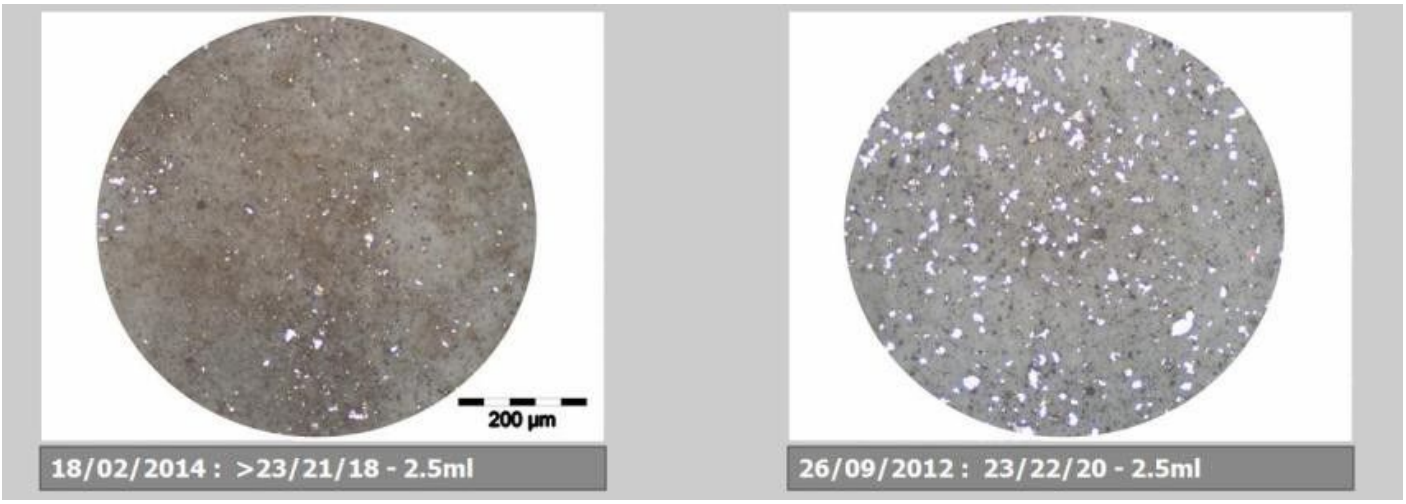
FILTER UNIT LEFT ON GEARBOX FOR SEVERAL WEEKS.

Magnom® Magnetic Filtering – Industrial Gearbox

Microscopic filter patch of gearbox oil ….AFTER OIL FILTRATION

Cleanliness Count >23 / 21 / 18

TARGET 22 / 19 / 16



Magnom® Magnetic Filtering – Industrial Gearbox

LEARNINGS :

Splash lubricated gearboxes will accumulate a lot of wear debris. This produces the wear chain that builds up and destroys gear teeth and bearings over time.

Break the wear chain with filtration and extend the life of your equipment.

THANK YOU .