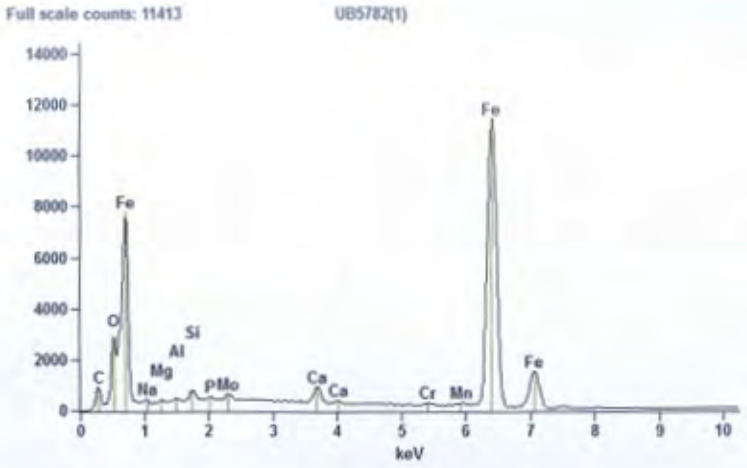
REDUCING OPERATIONAL DOWNTIME

ROGER SIMONSON, ONE EYE INDUSTRIES, CANADA, EXPLAINS HOW CANADIAN TECHNOLOGY CAN EXTEND THE LIFE OF ENGINE LUBE OIL AND ENGINE COMPONENTS.

With the global downturn in the mining industry, everyone is ready for a way to save on maintenance costs and downtime.

Contamination is responsible for up to 80% of equipment failure. Maintenance and downtime are costly and can range anywhere from 20 – 50% of the cost of production. Unplanned downtime can cost three times as much as scheduled downtime. The most damaging and constant contaminant in hydraulic and lubrication systems that causes the majority of premature wear and equipment failure is ferrous metal under 10 μm in size. The sources of



Quantitative Results for: UB5782(1)

Element Line	Net Counts	Weight %	Atom %
C K	6248	3.57	13.46
O K	17940	3.26	9.23
Na K	679	0.17	0.34
Mg K	1048	0.25	0.47
Al K	1274	0.31	0.51
Si K	4428	1.05	1.69
P K	1307	0.32	0.47
Ca K	8065	2.19	2.47
Cr K	1661	0.63	0.55
Mn K	1522	0.64	0.52
Fe K	190291	85.39	69.24
Mo L	4279	2.23	1.05
Total		100.00	100.00

Analysis of trapped contamination after 3 hr.

Contamination removed from shovels using OEI kidney loop after only 3 hr.

this metal contamination are the component manufacturing process, break-in wear and new hydraulic fluid, glycol and lubrication oils. This contamination is the main cause of premature wear of pumps, motors, seals and valves.

Proactive preventative maintenance programmes are key to reducing unscheduled downtime. They can extend component life and reduce maintenance costs. By reducing these costs and downtime, a mining company will improve its profitability, allowing for growth and a stronger market position.

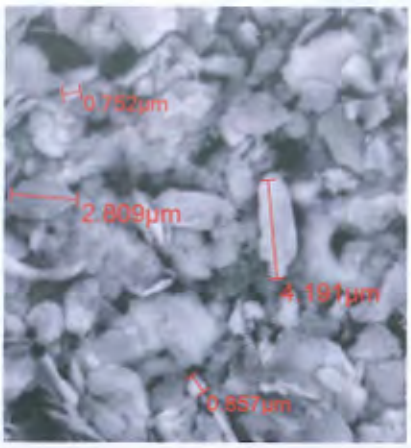
A new Canadian technology offers a cleanable, reusable filtration technology able to extend the life of oils, coolant, fuel and engine components. New rare earth magnetic filtration technology developed by One Eye Industries (OEI) offers the ability to remove ferrous and non-ferrous contaminants and protect systems from particles down to sub-micron levels. Traditionally, ceramic magnets have been used to filter hydraulic fluid and gear oil, but the strength of these magnets is low, resulting in an inability to remove contamination below 10 µm. Another problem ceramic magnets pose is that they need to be in direct contact with the fluid to ensure the strength is not limited. This poses a contamination issue, as the magnet is susceptible to vibration and temperature and can crack, resulting in magnetic particles travelling through the system and attaching to metal components, such as bearings. These in turn cause wear to the bearings and shafts.

Engines

Coolant contamination is the cause of over 70% of engine failures, yet most OEMs still do not install any filtration on their coolant lines. Those who do often install filtration that is efficient to 30 µm, while the majority of contamination is below 10 µm to sub-micron levels. This contamination wears through the walls of the coolant jacket, contaminating the oil and causing hydraulic lock, acid formation, bearing damage, oil balls, oxidation and filter plugging – all of which lead to engine seizure.

Preventing and removing oil contamination is also essential in reducing premature wear on engine components and reducing maintenance intervals.

In May 2014, Pioneer Natural Resources needed to remove a large amount of contamination in the lubrication oil on start-up of their 3512C CAT Engine. Daniel Stoye, maintenance manager for Pioneer, tested and chose to employ OEI magnetic filtration on all possible applications of his rotating equipment. This meant that, when the installation of the ADD-Vantage 9000 was suggested as the final engine oil filter, it was installed. Upon start-up, the system ran for 30 hr and a large amount of contamination was removed from the system after the two traditional CAT filters. 86% of the trapped contamination was non-ferrous (69.6% calcium) and the other 14% was ferrous.



Contamination ranging from 20 µm to sub-micron levels.

Kidney loop designed for a diamond mine.

Contamination removed from engine oil on start-up of new pioneer unit after 30 hr.

BHP kidney loop installed on gearbox.

"Clearly the OEI magnetic filters pick up ferrous and non-ferrous contamination below 20 µm that traditional filters are unable to. Removal of this contamination during the break in stage will extend the engine components life, reducing operational costs and increasing uptime," Stoye said.

Hydraulics

Hydraulic systems operate at tolerances below 1 µm. However, most traditional filtration is nominally rated to 3 µm. These ratings can be misleading, as nominal indicates that throughout a number of passes at one time a particle of 3 µm will be trapped by the filter. Patented rare earth magnetic filtration systems trap contamination to sub-micron levels at 97% efficiency.

In February 2014, a diamond mine in Northern Canada reported problems with dirty hydraulic fluid (ISO 25/24/16). Traditional filtration was unable to meet a minimum ISO standard of 18/16/13 with a limited kidney loop filtration interval of 3 hr. The company offered a project to all their filtration suppliers, asking them to design and install a kidney loop with the guarantee that they would achieve this minimum ISO standard on their hydraulic systems. OEI agreed to meet their requirements.

Commissioning of the High Flow Mobile Kidney Loop was performed on a 5500 Komatsu shovel operating with a 4500 psi hydraulic system. On its trial run, fluid samples were taken before and after, then sent to three independent labs. Common results showed that not only had OEI met the anticipated standards but had exceeded them, retaining a cleanliness level of 17/14/10. The analysed contamination on the magnetic filter rods identified ferrous (88%) and non-ferrous (12% mainly consisting of carbon and calcium) contaminants ranging from over 100 µm to sub-micron in size.

The diamond mine maintenance manager was pleased with the results and ordered another kidney loop filtration system, as well as a wide variety of OEI mobile equipment filters for haul trucks, shovels and drill rigs.

Gearbox

There is a link between failures of lubricants and failures of equipment. Oil analysis data will detect particles of contamination and degradation and the proper use of this

information can detect the chance of a failure.

In June 2014, BHP Billiton in Australia discovered high levels of contamination in its lubrication oils on a number of gearboxes. This contamination was causing premature wear of the gears, seals and other system components. Because BHP had been using OEI filtration technology in a variety of other applications, it asked OEI to fabricate two kidney loop systems to remove the contamination to sub-micron levels, protecting the components. Each kidney loop is currently installed on separate gearboxes and is extracting a large amount of contamination. Even without a lot of run time, Douglas Ridsdale, condition monitor for BHP Billiton, believes that they have yet to see all that these filtration systems can achieve. He explained: "All in all we are very happy with the product we have".

BMA Peak Downs also found the same high level of ferrous debris on its dragline swing case gearboxes. Josh Price, technical engineer at CBC Australia, suggested the use of an OEI magnetic filtration kidney loop in order to remove the inherent contamination. BMA is happy with the results found so far. It may see an extension of the life of the oil, as well as the gearbox system components.

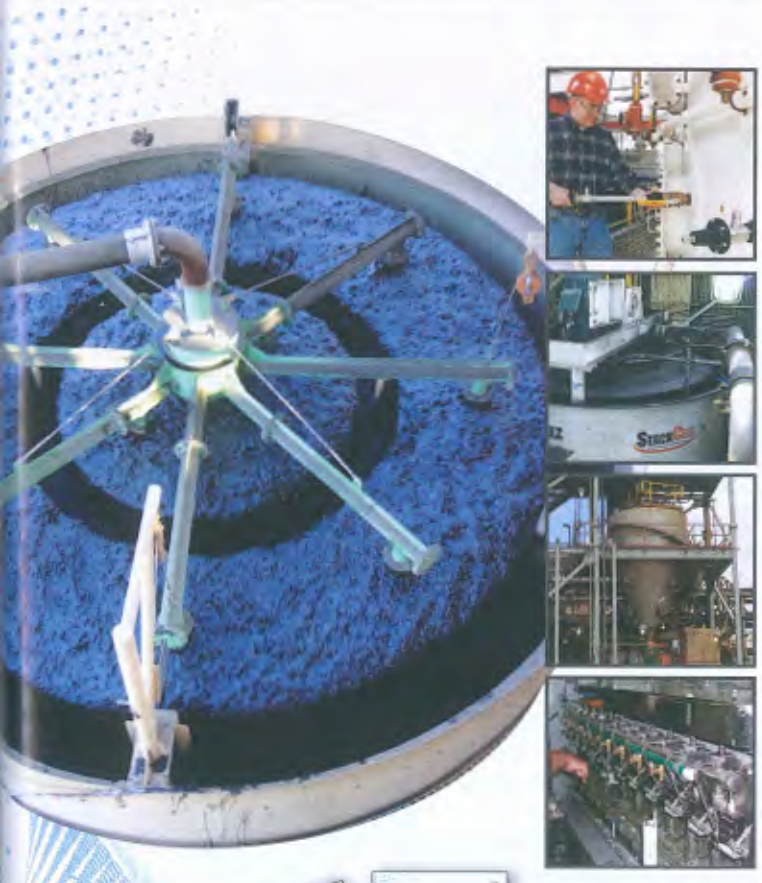
Fuel and emissions

Removing contaminants from fuel down to sub-micron levels using a reusable, cleanable magnetic filter will reduce wear on the fuel system components, deliver a cleaner burn, resulting in increased efficiency and reduced emissions.

PT Terminal Petikemas Surabaya Ocean Port in Indonesia found high levels of ferrous metal contamination (>10 μm to sub-micron in size), flowing through the traditional spin on disposable filters, resulting in reduced operational life of injectors, actuators, camshafts and reduced fuel efficiency, increased emissions and fuel consumption. Beny Hermawan, head engineer for PT Sinarmentari, suggested installing a magnetic filter (scrubber) as the primary fuel filter on the four Cummins engines. By removing this ferrous contamination after 18 months of testing the OEI scrubbers improved the cleanliness of the fuel and reduced premature wear of the fuel actuators, injectors and camshafts. Between January 2010 and July 2011 the fuel actuator and injectors life was extended by 6000 hr and the camshaft life by 12 000 hr. This is a significant cost saving.

Conclusion

With the significant reduction in downtime offered across a range of applications, it is clear that mining operations can benefit from investing in the appropriate filtration technology. Doing nothing to fight contamination can result in prolonged periods of unplanned downtime. In depressed market conditions, such expensive periods of downtime must be avoided at all costs. WC



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