

2019

OEI EQUIPMENT REPORT

HAUL TRUCKS



OEI's Patented Radial Magnetic Field
Technology Defies the Force of Gravity



SOLVING TOMORROW'S CHALLENGES TODAY.

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ONE EYE INDUSTRIES

GLOBAL SUCCESS ACROSS DIVERSE INDUSTRIES

OEI magnetic filtration is employed internationally by leaders in the oil and gas, mining, commercial and residential building, manufacturing, transportation, food, pharmaceutical, defense, petrochemical, and marine industries. OEI magnetic filtration systems apply to engines, gearboxes, hydraulics and pneumatics, processed products, cooling systems, and water systems. Each filter employs a magnetic filter element with a patented radial field configuration for high holding strength. These systems operate with minimal flow restriction and are proven to capture both ferrous and non-ferrous contamination in rotating equipment applications. The first OEI filtration system was installed in 2001, and has been proven successful in over 40 countries.



HAUL TRUCK APPLICATIONS

OEI is presently working with Komatsu on a test project on extending planned maintenance intervals for final drives. Komatsu had originally been employing Donaldson kidney loops, unable to meet the required ISO Standard 18-16-13; they've since employed OEI Kidney Loops and have Currently Komatsu is employing an OEI Kidney Loop and are successfully exceeding their target cleanliness level.

OEI supplies magnetic filter plugs for haul truck wheel motors as a predictive maintenance tool. On average, the OEI proactive approach to identifying premature wear of wheel motor components has saved haul trucks upwards of \$70,000 USD in repair costs, labour, component replacements and downtime. The alternative? Catastrophic failure at a cost of \$500,000 USD.

OEI manufactures standard magnetic filters for fuel, coolant, engine lube, transmission and sump applications on haul trucks.

Presently, Anglo American has an ongoing case study on the cost savings associated with employing front wheel hub magnetic filter plugs on one of their Komatsu haul truck fleets.



ALL PRODUCTS: OVERVIEW

One Eye Industries offers a series of products designed to help organizations achieve rapid payback with the lowest risk by extending the life of rotating equipment:

- 1 ADD-VANTAGE 9000 SERIES**
 The ADD-Vantage 9000 magnetic filtration system employs a magnetic element and a stainless steel cloth element in its design for high efficiency filtration and replaces conventional spin-on cartridge filters.
- 2 SCRUBBER SERIES**
 OEI Magnetic Filter Scrubbers employ an OEI Magnetic Filter Element in a special housing that ensures maximum dwell time for high efficiency filtration. These systems install on both suction and return lines of low and high pressure applications.
- 3 Y-STRAINER SERIES**
 OEI Magnetic Y-Strainers employ a magnetic filter element as a replacement of conventional Y-strainers. Designs with and without a screen are available.
- 4 FILTER PLUGS**
 OEI Magnetic Filter Plugs employ rare-earth magnets and are the high quality replacement for OEM magnetic drain plugs. These filters are effective predictive maintenance tools when contamination is analyzed to determine component wear.
- 5 BEAR TRAP MAGNETIC FILTER PADS**
 OEI Magnetic Filter Pads enhance all spin-on filters by capturing the wear contamination (sludge) < 10 microns that disposable filters fail to remove. These filters extend fluid life by 2 - 3.
- 6 EMERGENCY MAGNETIC PATCH**
 The OEI Emergency Magnetic Patch provides an immediate, temporary solution to pipe wear or rupture by magnetically adhering to surfaces and preventing leakage. This patch helps to prevent unscheduled production.



- 7 SPECIALTY EQUIPMENT DESIGNS**
 OEI offers custom filters for OEM equipment applications such as chain cases, sump filters, transmission plates, pump jacks, and mud tanks. Other OEI specialty designs replace or enhance OEM conventional filters such as CAT, Komatsu, Parker, Schroeder or PALL.
- 8 KIDNEY LOOP SYSTEMS**
 OEI Kidney Loop Systems are self-contained filtration units for offline filtration, fluid transfer of mobile or stationary equipment, and flushing of storage reservoirs. These systems employ multiple magnetic filters for filtration of wear contamination down to 4 microns and below.



CORE TECHNOLOGY

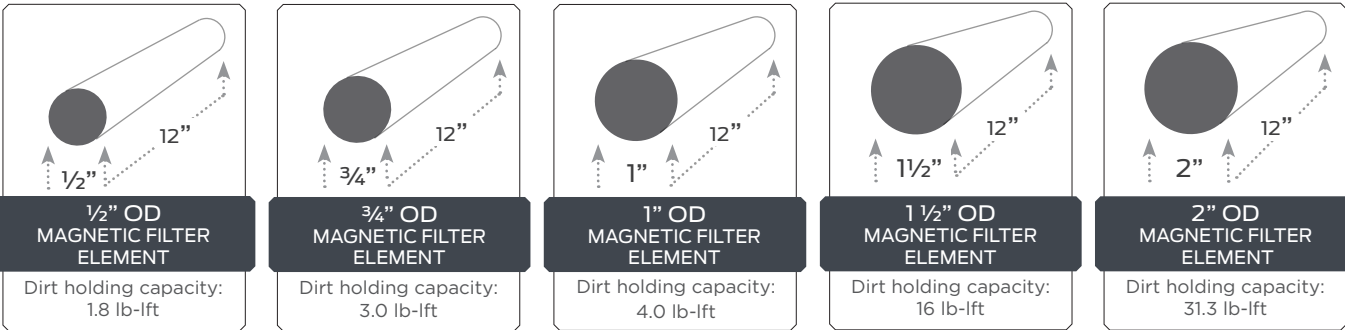
DESCRIPTION

The patented magnetic filter element attracts ferrous wear particles down to 4 microns and below with up to 95+% efficiency. The magnetic filter element attracts both ferrous and non-ferrous particles. The radial magnetic field design offers incredible holding strength and a high dirt holding capacity.

OEI magnetic filter elements are employed in various housings designed with calculated dwell times for optimal filtration. Magnetic filter elements come in five sizes from 1/2" to 2" outer diameter (OD) (shown below).



1" magnetic filter elements with varying loads of contamination. Dirt holding capacity*: 3.97 lb-ft.



*Dirt holding capacity is the quantity of contaminant mass a filter element can trap and hold before the maximum allowable back pressure, or delta P level, is reached.

CORE TECHNOLOGY BENEFITS

CLEAN AND REUSE

OEI products are reusable for 18+ years, and require minimal consumables. Conventional filters require frequent, costly changeouts, and disposal.

PREDICTIVE MAINTENANCE

OEI Magnetic Filter Elements are effective predictive maintenance tools when used for condition monitoring. When removed for inspection, magnetic filter elements will have varying quantities of contamination. Abnormally high quantities of contamination indicate component failure. The composition of contamination will identify which components are stressed, worn, or failing.

Visual analysis of the quantities of wear contamination collected on magnetic filter plugs can determine component failure. Analysis of wear particle compositions and sizes will determine early component wear.

GOES WHERE NO CONVENTIONAL FILTER HAS GONE BEFORE

OEI magnetic filters can be installed on suction lines to protect pumps without risk of cavitation. Unlike conventional filters, they accommodate space restrictions and unique applications such as splash oil gearboxes, reservoirs, and small coolant lines.

CAPTURES NON-FERROUS CONTAMINATION

Non-ferrous particles are magnetically captured because of cross-contamination. Particles become statically charged from flow velocity. This charge is a principal force of particle adhesion; iron particles contaminate non-ferrous particles by adhering to their statically charged surface. Another form of cross-contamination occurs when sub-micron iron particles embed in softer non-ferrous particles after abrasive impact.

PREVENT OXIDIZATION AND VARNISH

OEI effectively removes iron and steel particles under 10 microns that are known to promote oil oxidation because of their catalytic properties. Oxidation can deplete additives that protect against wear, corrosion, sludge, varnish, and viscosity changes that affect the thickness of films between bearing surfaces, friction, control of temperature, and energy consumption.

NO WORMHOLING OR CHANNELING

OEI filters eliminate the opportunity for wormholing and channeling that conventional paper, fiberglass, and polymer media filter elements are subject to.

Wormholing: when wear contamination punctures the filter media.

Channeling: when fluid flows through punctured holes because it takes the path of least resistance.



MOBILE KIDNEY LOOP SYSTEMS

PRODUCT NUMBER	DESCRIPTION			
8KLM-51-91-##	Operating Parameters	Viscosity	500 cSt	
		Flow Rate	5 gpm	
		Motor	1	3 Phase Electric
	Features	Magnetic Filter Scrubber	1	» Dual Magnetic Filter Element » Suction installation for pump protection.
		ADD-Vantage 9000	1	» Dual Magnetic Filter Element » Stainless Steel Cloth Element
8KLM-51-91-##	Operating	Viscosity	500 cSt	
		Flow Rate	5 gpm	
		Motor	1	3 Phase Electric
	Features	Magnetic Filter Scrubber	2	» Dual Magnetic Filter Element » Suction installation for pump protection.
		ADD-Vantage 9000	2	» Dual Magnetic Filter Element » Stainless Steel Cloth Element

KOMATSU 930E, OSK60 ENGINE KIT # 8K930E-QSK60

APPLICATION	PRODUCT	PRODUCT NUMBER	CROSS OVER
Engine Lube	ADD-Vantage 9000	9ADV9-9024	LF-9024
Fuel	ADD-Vantage 9000	9ADV9-0958	» K2000 » Detroit 16V-4000, LF-1006
Fuel	Magnetic Scrubber	5SCF9RCLORB16	
Front Wheel Hub	Magnetic Filter Element (ORB)	2RORB10M50EH	
Front Spindle Hub	Magnetic Filter Plug	7PKOM-1199	Komatsu WB1199
Front Brake Assbly	Magnetic Filter Plug	7PKOM-0317	Komatsu VM0317
Back Brake Assbly	Magnetic Filter Plug	7PKOM-0317	Komatsu VM0317
Trans Motor Wheel	Magnetic Filter Plug	7PKOM-0086	Komatsu GE0086
Engine Drain Pan	Magnetic Filter Plug	7PM2720IH	367-8605, 367-8611

CAT 793D, 3516N ENGINE KITS

KIT # 8K793D-3516B

APPLICATION	PRODUCT	PRODUCT NUMBER	CROSS OVER
Hydraulic	ADD-Vantage 9000	9ADV9-8878	» CAT 102-2828, » 1G-8879 » 156-0214
Hydraulic	Stainless Steel Cloth Element Replacement	9EL3040201X25	CAT 1R0778
Hydraulic	Stainless Steel Cloth Element w/ Magnetic Filter Element	9ELSS77840	CAT 1R0778
Transmission	Magnetic Filter Element w/ Plate	25RCAT-7160	CAT 8M-7160
Transmission	Magnetic Filter Plug	7PCAT-4181	CAT 9S-4181
Front Wheel Drive	Magnetic Filter Plug	7PCAT-3837	CAT 8M-3837 and 2A-3852
Front Wheel Drain	Magnetic Filter Plug	7PCAT-7031	CAT 6B-5262
Rear Final Drive	Magnetic Filter Element with a Plate	3RCAT-3963	CAT 6V-3963
Rear Final Drain	Magnetic Filter Plug	7PCAT-7031	CAT 6B-5262
Rear Axle Housing	Magnetic Filter Element	3RCAT-8334	CAT 175-6689
Rear Axle Housing	Magnetic Filter Plug	7PCAT-5576	CAT 8M-5576
Rear Axle Lube	Magnetic Filter Element	25RCAT-7160	CAT 8M-7160
Gear GP Transfer Input	Magnetic Filter Element	25RCAT-3251	
Engine Sump	Magnetic Filter Element	25RCAT-1W1564	CAT 1W-1564



CASE STUDIES

FLEET: ENGINES

PAPA NEW GUINEA

Application	Engines
Fluid	Engine Oil
Challenge	Extend PM periods of multiple haul trucks.
Solution	Run a 2 year trial deploying ADD-Vantage 9000 magnetic filters on 6 haul truck engines.
Results	Expanded trial from 6 haul trucks to outfitting all haul trucks after the first year. Saved Between \$1.3 – \$1.6 million by extending rebuild time and extending oil intervals. A complete outfitting of the CAT-785D Fleet, for a total of 50 haul trucks this year.



793B TRANSMISSION

SYNCRUDE OIL SANDS OPEN PIT MINE AB, CANADA

Application	793B Transmission
Fluid	Transmission Fluid
Problem	High levels of ferrous contamination.
Solution	Replace the OEM magnetic filters with OEI Magnetic Filter Elements (2RNC5169).
Results	Contamination captured after 500 hours.



MARION SWING CASE

BMA OPEN CUT COAL MINE AUSTRALIA

Application	No. 2 Gearbox, DRE Dragline
Fluid	Lube Oil
Challenge	High levels of ferrous contamination.
Solution	12" Magnetic Filter Scrubber (5SC12SCL) added to the existing kidney loop system.
Results	Contamination captured after 3 days. » Lab report showed a PQ reduction from 3904 to 723.



OEM Magnetic Filter Plug



OEI Magnetic Filter Plug



FLEET: STEERING SYSTEMS

IRON ORE MINE SOUTH AFRICA

Application	Steering system gearboxes of 96 haul trucks
Fluid	Lube Oil
Problem	The mine was losing 2-3 gearboxes at estimated \$70,000 USD/gearbox.
Solution	Employ OEI Magnetic Filter Elements on 96 haul trucks for 14 months to measure extended maintenance intervals and reduced gearbox failures.
Results	Since installing the OEI filters, there have been no gearbox failures saving the mine upwards of 1 million dollars in 1 year.



CASE STUDIES

CAT 3508 ENGINE

BMA BLACKWATER MINE AUSTRALIA

Application	3508 Cat Engine
Fluid	Engine Oil
Challenge	Extend the life of a Kress Coal Haul Truck's 3508 CAT Engine that was diagnosed for rebuild at 13,000 hours because an oil analysis showed high levels of contamination: particle quantifier (PQ) 12.
Solution	Install an OEI ADD-Vantage 9000 magnetic filter (200 Beta efficiency rating) alongside two conventional CAT filters.
Results	<p>The oil analysis on the next planned maintenance (PM) interval identified the PQ of < 1.</p> <p>With OEI filtration, the haul truck remained in service, and the CAT 3508 engine lasted an additional 17,200 hours before a glycol leak contaminated the oil and seized the engine.</p> <p>The maintenance intervals extended first to 350 hours, then to 500 hours.</p> <p>The extended maintenance intervals recovered the cost of the ADD-Vantage 9000 filter within 250 hours of operation.</p>



ROI

ENGINE REBUILD PREVENTION:

\$251,760 USD

ACTIONED BY Robert Jambor ON 24/01/2008
RESOLVED BY Robert Jambor ON 24/01/2008

Hastings Deering



**S-O-SSM Fluid
Analysis
Laboratory**

Condition Monitoring Centre

Hastings Deering (Australia) Ltd. - A.B.N. 48 054 084 647

Call 131 228

BRISBANE (Head Office)

Kerry Road, Archerfield, Qld. 4108

P.O. Box 46, Archerfield, Qld. 4108

Fax: (07) 3365 9228

Web: www.hastingsdeering.cat.com

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• TOWNSVILLE
• DARWIN
• ALICE SPRINGS
• GOVE

BMA BLACKWATER MINE MOBILE
ATT: Mobile Planners

Unit Number **TKD6498**
Location **BLACKWATER MINE**
Make **KRESS**
Model **CH200C**
Serial Number **HBB-M079**
Compartment **engine-primary**
Oil Brand/Type **BP MINE MULTI 15W40**
Oil Changed **Y**

Lab Control Number **02925708**

Current Evaluation **A**

CURRENT					EVAL: A	Wear Levels in the 5 Micron Range appear OK. Viscosity Normal for Oil Type Indicated. Infra-red analysis INVALID with oil on record at laboratory. Please supply sample of new oil to update our records. Continue Sampling at the Recommended Interval.																		
DAYS TAKEN TO REACH LABORATORY: 3																								
DATE	DATE	OIL	METER	HRS/KM																				
TAKEN	REC'D	ADDED	HRS/KM	ON OIL																				
21-01-08	23-01-08		13980	534																				
PREVIOUS #1					EVAL: A	Wear Levels in the 5 Micron Range appear OK. InfraRed Analysis appears acceptable for Hrs/Kms. Viscosity Normal for Oil Type Indicated. All other Test Results appear Acceptable. Continue Sampling at the Recommended Interval.																		
DATE	DATE	OIL	METER	HRS/KM																				
TAKEN	REC'D	ADDED	HRS/KM	ON OIL																				
10-12-07	12-12-07		13446	508																				
PREVIOUS #2					EVAL: B	Iron is HIGH for the Hrs/Kms on the Oil, Lead is Increasing, Oxidation is HIGH, Oxidation result can be from Overheating/Blow By. Viscosity Normal for Oil Type Indicated. Investigate and Evaluate Compartment Condition. These results may be due to an Extended Oil Change period. REDUCE the Oil Change Interval. Resample at 250 hours.																		
DATE	DATE	OIL	METER	HRS/KM																				
TAKEN	REC'D	ADDED	HRS/KM	ON OIL																				
27-11-07	29-11-07			350																				
PREVIOUS #3					EVAL: A	Wear Levels in the 5 Micron Range appear OK. InfraRed Analysis appears acceptable for Hrs/Kms. Viscosity Normal for Oil Type Indicated. All other Test Results appear Acceptable. Continue Sampling at the Recommended Interval.																		
DATE	DATE	OIL	METER	HRS/KM																				
TAKEN	REC'D	ADDED	HRS/KM	ON OIL																				
23-11-07	26-11-07		13186	248																				
ELEMENTS:- Concentration in ppm (weight/weight)																								
	Wear metals										Additives													
DATE	Cu	Fe	Cr	Pb	Al	Si	Sn	Ni	Na	K	Ca	Mg	Zn	P	W	F	ST	OXI	SUL	PQ	VSC	DEP	V100	Mo
TAKEN																								
210108	2	19	<1	2	1	3	<1	<1	3	3	2486	8	1188	1076	0.1	<3.0	41			<1	111	OK	14	<1
101207	2	19	<1	2	2	4	<1	<1	3	4	2214	7	1077	933	0.1	<3.0	35	27	34	1	110	OK	13	1
271107	9	46	<1	5	7	15	<1	<1	4	2	2611	9	1233	1091	0.1	<3.0	59	41	49	2	110	OK	15	2
231107	6	32	<1	3	6	12	<1	<1	3	2	2930	8	1116	958	<0.1	<3.0	40	23	37	<1	111	OK	15	2
081107	3	21	<1	<1	3	7	<1	<1	3	1	2933	8	1088	988	0.1	<3.0	20	17	26	<1	106	OK	14	1
031107	12	90	2	4	8	19	<1	<1	5	2	2650	9	1155	1000	0.1	<3.0	64			12	106	OK	14	3

Cu - Copper

Sn - Tin

Zn - Zinc

SUL - Sulphur product

Fe - Iron

Ni - Nickel

P - Phosphorus

PQ - PQ Index

Cr - Chromium

Na - Sodium

W - % Water

VSC - Viscosity

Pb - Lead

K - Potassium

F - %Fuel Dilution

DEP - Visible Dep.

Al - Aluminium

Ca - Calcium

ST - Soot

V100 - Viscosity 100C

Si - Silicon

Mg - Magnesium

OXI - Oxidation

Mo - Molybdenum

Prior to OEI

Prior to OEI

OVERALL SAMPLE EVALUATION: "A" - normal wear is occurring; no action required.
"B" - increased wear is occurring; corrective action may be required.
"C" - abnormal wear is occurring; corrective action is required.
"X" - extreme or critical wear is occurring; immediate corrective action is required

(em SUS011 AUG 06/06)





SOLVING TOMORROW'S CHALLENGES, TODAY.

OneEyeIndustries.com
4344 12 Street SE
Calgary, AB T2G 3H9
Canada