CASE STUDY

APPLIED Industrial Technologies®

CUSTOMER
WEST FRASER

LOCATION
SMITHERS, BRITISH COLUMBIA, CANADA

EQUIPMENT
VOLVO PENTA ENGINE MADILL 4000

APPLICATION
ENGINE OIL

ROI: PAYBACK IN 4 MONTHS

ENGINE SERVICING SAVINGS:

$8,138
PER YEAR

> "We were able to ***more than double*** the time between service intervals by reducing the chain reaction of wear"
>
> — Glen Cullen
> Shop Manager, West Fraser

CHALLENGE

With serious cost saving realized from employment of magnetic filtration on other mobile equipment applications West Fraser decided to conduct a test to improve engine oil and component life on their Volvo TAD1371VE engines.

Figure 1: OEI Magnetic Scrubber attached to engine oil circuit.

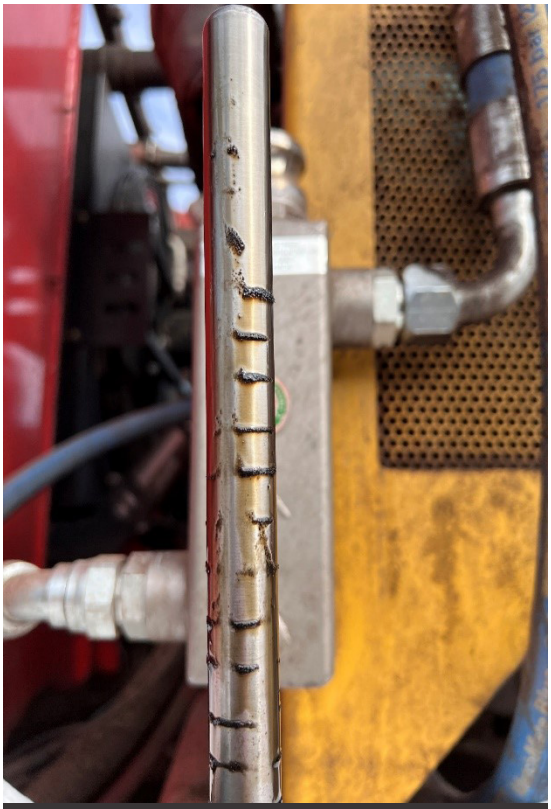

Figure 2: Wear contamination captured by the Magnetic Filter y-strainer over 500 hours, post traditional filtration.

SOLUTION

Install OEI magnetic filtration on the engine lube circuit (filter operational life 22+ years) Clean and return to service. To document and support the efficacy of OEI magnetic filtration a comprehensive analysis by a third-party lab was conducted. X-ray Diffraction (XRD), Elemental Dispersive Spectroscopy (EDS), Particle Size Distribution (PSD), and Scanning Electron Microscopy (SEM) was performed on the solid sample captured by the OEI Magnetic Filter Element.

RESULTS

The magnetic filters ability to clean wear contamination was impressive and the contamination composition exhibited significant removal of steel and various iron compounds from the system, accounting for more than 50% of the contamination. The remaining contamination was non-ferrous of which 40% was silica sand, a serious wear contaminant with a hardness of 6 on the Mohs scale. Refer to figure 3 for a detailed summary of the wear contamination effectively removed by OEI Magnetic Filtration technology.

XRD Quantitative Results

Ref.Code	Mineral Name	Compound Name	Chem. Formula	Weight %
01-075-8322	Quartz	Silicon Oxide	SiO_2	17.2
01-076-1849	Magnetite	Iron Oxide	Fe_3O_4	9.0
04-017-1022	Plagioclase	Sodium Calcium Aluminum Silicon Oxide	$Na_{0.98}Ca_{0.02}Al_{1.02}Si_{2.98}O_8$	17.5
04-014-1813	Illite/Mica	Potassium Sodium Calcium Magnesium Aluminum Iron Silicon Titanium Oxide Hydroxide	$K_{0.74}Na_{0.17}Ca_{0.01}Mg_{0.02}Ti_{0.02}Fe_{0.03}Al_{2.83}Si_{3.10}O_{10}(OH)_2$	3.2
04-016-6734		Iron	Fe	37.6
01-083-3288	Calcite	Calcium Carbonate	$Ca(CO_3)$	0.8
04-002-9527	Mackinawite	Iron Sulfide	FeS	3.2
04-023-7859	Alabandite	Manganese Sulfide	MnS	0.4
01-074-2421	Anhydrite	Calcium Sulfate	$Ca(SO_4)$	0.4
04-015-7822	Melanterite	Copper Zinc Iron Sulfate Hydrate	$Cu_{0.086}Zn_{0.262}Fe_{0.652}(SO_4)(H_2O)_7$	3.2
01-078-7032		Zinc	Zn	1.5
00-032-0626		Magnesium Phosphate	$Mg_2P_2O_7$	0.8
01-075-1593	Kaolin	Aluminum Silicate Hydroxide	$Al_2Si_2O_5(OH)_4$	2.5
01-072-1616	Vaterite	Calcium Carbonate	$Ca(CO_3)$	0.3
04-014-3871		Chromium Chloride	$CrCl_2$	0.2
04-002-8941		Iron Nickel	$Fe_{0.65}Ni_{0.35}$	0.9
04-006-6518	Periclase	Magnesium Oxide	MgO	1.1

Figure 3: XRD Analysis Results on the wear contamination by the magnetic filter.

The PSD analysis provides insights into the sizes of particles within the wear contamination. Figure 4 visually present the particle size distribution found within the captured wear contamination. The analysis revealed that the cutting and rolling wear contaminants in the sample ranged from 0.11µm to 159.42µm. The most frequently occurring particles fell within the size range of 1.594µm to 2.033µm.

	Size (um)								
Statistical Value	**D10**	**D25**	**D50**	**D75**	**D90**	**Maximum**	**Minimum**	**Mean**	**Mode**
Solids Contamination from Volvo Penta Engine MF April 2023	0.50	0.89	2.13	6.57	19	159.42	0.11	6.79	1.594 – 2.033

Figure 4: Statistical Values for Particle Size Distribution

Wear particles below 4-microns, especially below 1-micron, pose a significant risk of causing severe damage to close tolerance engine components. The analysis identified 65.5% of the particles were below 4 microns in size, and 28.0% of the particles were less than one micron, underscoring the effectiveness and necessity for installing OEI magnetic filtration.

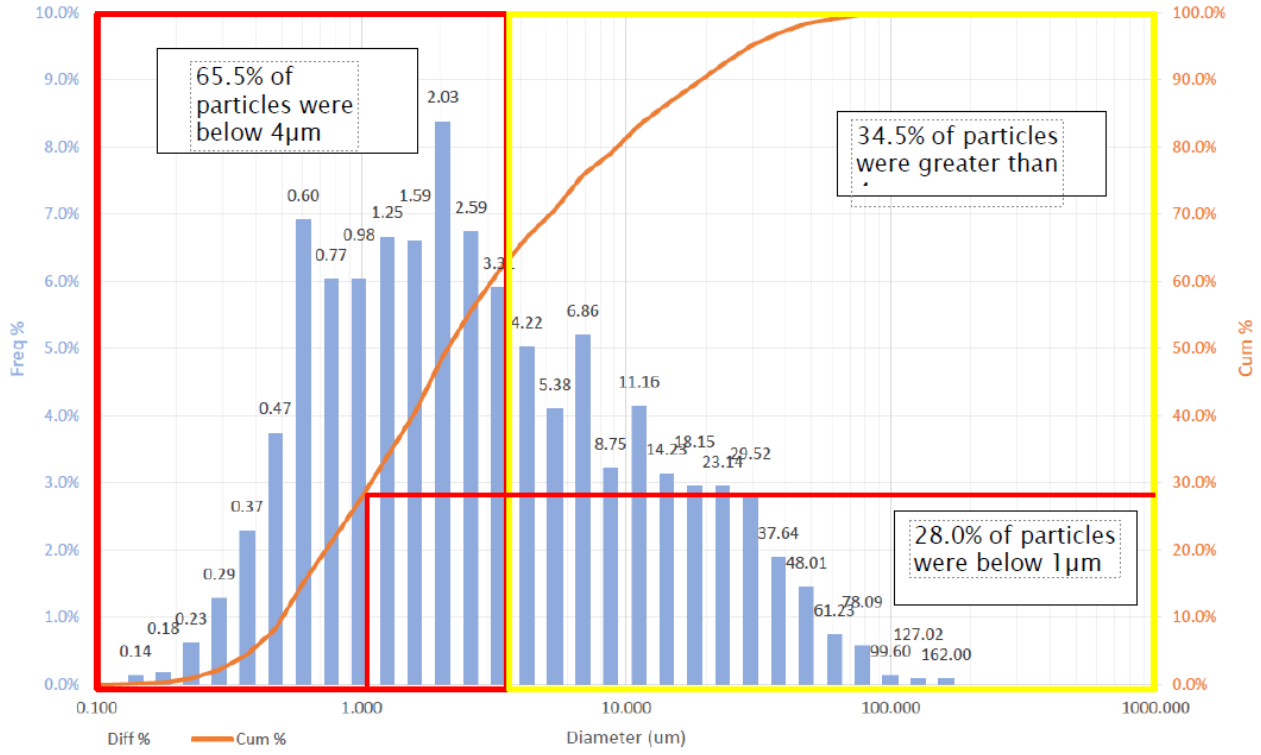

Figure 5: Particle Size Distribution for Solids Sample 1

With OEI upgrades West Fraser extended service intervals from 250 hours to 750 hours. If we extrapolate this finding across a year of equipment usage at 4,500 machine hours per year, savings can be up to $8138 per year in engine servicing costs (oil, filter, labour).

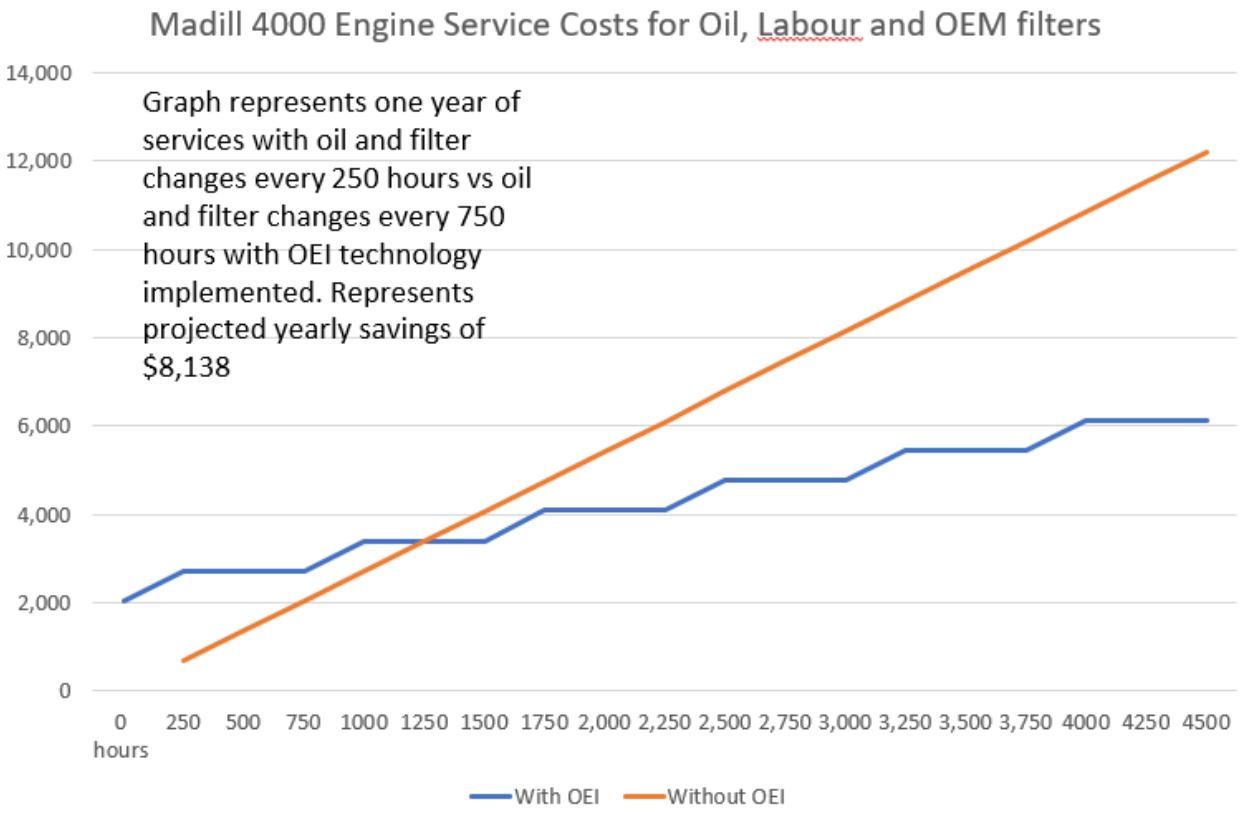

Figure 7: Graph comparing costs of oil and OEM filters replacement with and without OEI magnetic filtration Installed

CONCLUSION

The quantity of contamination cleaned from the oil along with the results of the XRD/EDS and PSD/SEM demonstrate the effectiveness of OEI Magnetic Filtration Technology in capturing wear contamination down to the sub-micron level. In return, the benefits are extended oil and engine component life, reduced fuel consumption and emissions. The added benefit of OEI magnetic filtration technology is the 22+ year service life, further reducing operational costs thereby improving profitability year after year!