



INNOVATIVE PRODUCTS FOR SAVING OIL & FUEL

It's time to go green!



International patent pending

PROQUIP
VALUE ADDED PRODUCTS

micfil Ultra Fine Filter for Oil and Diesel



The Micfil Ultra Fine Filter housing is produced in both saltwater-resistant aluminium as well as in stainless steel.

Our stainless steel housing fulfils the shipping regulations of the IACS (International Association of Classification Societies), whereby the material of any additionally installed filter in a commercial ship must have a higher melting point than 925°C.

The Micfil Ultra Fine Filter housing and inserts can be supplied in three sizes: 150mm, 300mm and 600mm.

The patented Micfil Ultra Fine Filter insert consists of a tear-resistant fibre mesh with woven-in cellulose fibres of the highest quality. The filtration performance is down to 0.5µm (microns). The Micfil Ultra Fine Filter inserts possess a very high contamination absorption capacity, long life span, lower differential pressure and are water absorbent.

Micfil Ultra Fine Filters are suited for the filtration of engine oil, gearbox oil, and hydraulic oil, as well as for fuel. With engine and gearbox oil, the filter is placed in a bypass. For fuel it is in the main stream, and for hydraulic oil it is in the return. The units can be installed in all engines and all machinery, either as main filters or as after-market filters. They will reduce frictional wear, lengthen machinery life spans, and lower maintenance costs.

micfil Ultra Fine Filters are suited for all Engines and Machinery:

- Engines and gear boxes of buses and trucks
- Main engines, bow thrusters, generators and hydraulic systems, fishing boats, sail and motor boats
- Wind generator gear boxes
- Engines from combined heat and power units and Biogas plants
- Engines, gear boxes and hydraulic systems of heavy machinery and tractors etc.
- Hydraulic systems in factories and assembly plants
- Transformers, and much more

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micfil Ultra Fine Filter for Engine Oil



BETTER LUBRICATION AND LESS WEAR WITHOUT OIL CHANGES

- Up to 20 Times better filter performance than standard filters
- Improved lubrication capability
- Prolonged life span by reducing wear
- Additives are not removed from Engine Oil
- Conventional oil changes are no longer required
- Lower maintenance and repair costs
- Active environmental protection by reducing oil consumption and elimination of waste oil disposal
- No restriction of engine manufacturer's warranty by law

Regular oil analyses have shown that with **micfil** Ultra Fine Filtration, Oil change intervals of 20,000 hours or more are common.

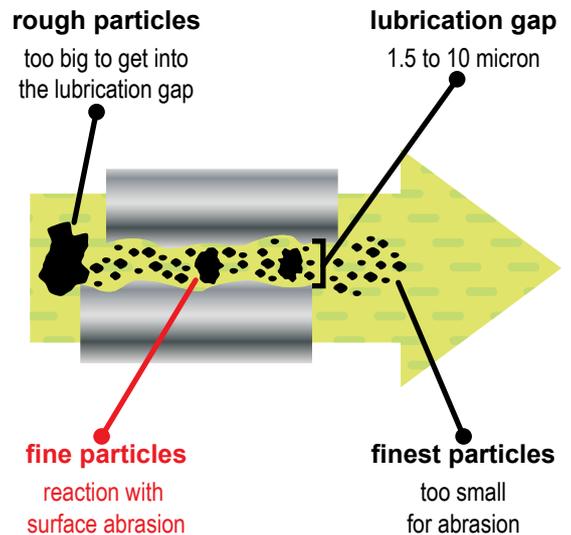
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Up to 20 Times Higher filter performance than standard filters

Although the lubrication gaps in engines are between approximately 1.5 to 10 μm , the standard oil filter cannot filter out particles smaller than approximately 10 μm . As international studies show, abrasion caused by particles in lubrication gap size (between 1.5 and 10 μm) is three times higher than caused by particles bigger than 10 μm . Therefore, standard filtration is not sufficient.

On average, about 15% of the contaminated used oil remains in the engine after an oil change, and the number of dirt and abrasion particles increase permanently during engine operation. As a result, the engine operates continuously in contaminated oil, and solid particles cause further abrasion. Moreover, standard filters cannot absorb water which may cause acid formation.

The Micfil Ultra Fine Filter possesses approximately 20 times higher filtration performance than a standard filter. Dirt, combustion, oxidation, and abrasion particles of up to approximately 0.5 μm in size are continuously filtered out from the oil, thereby minimising abrasion. The remaining smaller particles in the oil do not cause damage, but increase the load bearing capacity (lubricity) and thermal resistance of the oil. The Micfil Ultra Fine Filter insert manufactured from high quality materials absorbs water and prevents formation of acid in the oil.



Improvement of the lubrication properties of Ultra Fine Filtered Oil



REICHERT FRICTION WEAR TEST

Left:
Friction with
unused oil

Right:
Friction after
350,000km with
Micfil filtered
used oil

The load bearing capacity (lubricity) and thermal resistance of the Micfil ultra fine filtered and unchanged oil are markedly increased in comparison to fresh oil by enriching the oil during operation with carbon and other particles of a size that do not cause abrasion.

The particles of less than approximately 1 μm remaining in the oil during Micfil ultra fine filtration do not cause any damage, but instead improve the load bearing capacity (lubricity) and thermal resistance of the oil.

These properties continue to improve the longer the oil is used.

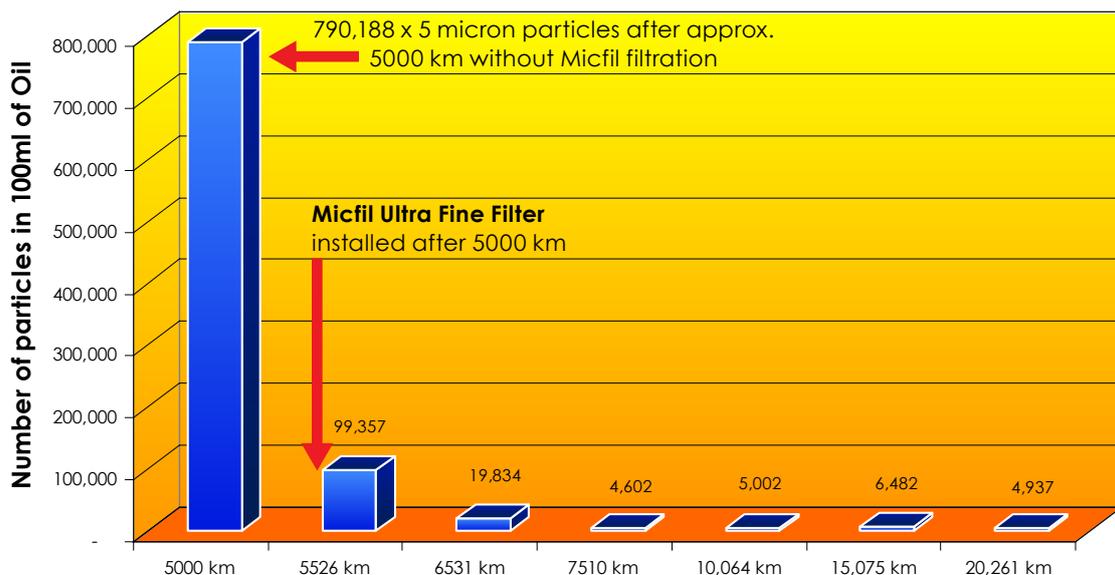
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Conventional Oil Change is Eliminated

Oil is a mineral and a mineral does not age. It does not wear out, break down or deteriorate. During its use oil becomes contaminated with water, acids, carbon, dirt, metal particles and sludge. The oil filter of a standard engine only removes solid particles above a certain size (approximately $> 10 \mu\text{m}$). In contrast, the Micfil Ultra Fine Filter absorbs water and continuously filters out particles $> 0.5 \mu\text{m}$. This prevents the formation of acids. Solid particles of less than approximately $0.5 \mu\text{m}$ remaining in the oil actually improve the lubrication properties and thermal stability of the oil.

The effects of the process become even more apparent the longer the oil is in use. An oil change is therefore not necessary in engines which are technically sound. In fact, oil changes reduce the positive effect of Micfil filtration. REICHERT abrasion wear tests show improvement in the lubricating properties of the used oil in comparison to fresh oil. We recommend monitoring the technical condition of the engines at regular intervals by means of comparative oil analysis.

Reduction of solid particles of 5 microns in size After installation of Micfil Ultra Fine Filter



Hand Held Oil Tester



The quality of the oil can be checked at any time directly at the engine with this mobile oil testing device. Through the use of this device it can be shown that, in a technically sound engine, no oil change is necessary after the installation of the Micfil Ultra Fine Oil Filter.

The Oil Tester also detects any sudden increase in mechanical wear and loss of the oils lubricating properties in the case of a defect in the engine. This early detection of a defect can prevent a complete mechanical failure of the engine and save high repair costs.

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micfil Ultra Fine Filter for Gearbox Oil



Clean and water-free gearbox oil reduces wear and damage

Gear boxes are exposed to intense stress and the standard filtration is, in many cases, insufficient. An additional Micfil Ultra Fine Filter, with its filter capability of down to 0.5 microns (μm) continually cleans the oil like a recycling process and keeps it largely water free, thereby minimising frictional wear and damage. This works particularly well in difficult and extreme conditions. For example, Micfil Ultra Fine Filters have been proven to be very helpful in wind generator gear boxes and mining equipment.

Size of particles ISO 4406	Without Micfil filters per 100 ml	With Micfil filters per 100 ml
> 4 μm	177,305	13,925
> 6 μm	48,601	3,246
> 10 μm	6,557	1,547
> 14 μm	4,128	367
water ppm	281	54
ISO 4406	21/19/16	18/16/12

When using auxillary Micfil Ultra Fine Filters on gear box oil, up to 92% of the abrasive particles and 90% of water are filtered out when compared to standard filtration alone.

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micfil Ultra Fine Filter for Hydraulic Oil



90% of breakdowns on hydraulic systems are shown to be caused by contamination in the oil

Maintenance of hydraulic oil is often neglected. Regular maintenance of oil is a crucial factor for faultless operation. The components in a modern hydraulic unit glide on an oil film of less than 10 μm . This fine oil film guarantees the smooth operation of the system, however it requires clean oil. In practice, fluids in hydraulic systems are often highly contaminated. This is not always apparent as the visibility threshold for the human eye is approximately 40 μm .

The Micfil Ultra Fine Filter in the bypass flow has a filter performance of 0.5 μm and provides a continuous cleaning process of hydraulic oils and absorption of water. The filter reduces wear on valves, cylinders and pistons and minimises the risk of breakdowns.

Size of particles	Without Micfil filters per 100 ml	With Micfil filters per 100 ml
> 2 μm	1,845,320	52,475
> 5 μm	1,583,675	2,450
> 10 μm	1,415,367	341
> 15 μm	1,256,380	45
water ppm	5,450	175
ISO 4406	21/21	11/6

When using auxillary Micfil Ultra Fine Filters on hydraulic oil, up to 99% of the abrasive particles and 96% of water are filtered out when compared to standard filtration alone.

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micfil Ultra Fine Filters for Fuel



CLEAN FUEL PROTECTS INJECTION NOZZLES AND INJECTION PUMPS

The high pressure injection of modern diesel engines needs clean and water-free diesel, which is not always available. Standard filtration is not always adequate. With the high filter performance of Micfil filters down to $0.5 \mu\text{m}$ and with the ability to absorb water, the Micfil Ultra Fine Filter offers much higher filtration than standard fuel filters. Damage to injection pumps and nozzles can be avoided, and service life can be considerably lengthened.

A fuel analysis with a particle count shows the following results:

Size of particles	Without Micfil filters per 100 ml	With Micfil filters per 100 ml
> $2 \mu\text{m}$	2,817,700	143,500
> $5 \mu\text{m}$	1,523,500	20,400
> $15 \mu\text{m}$	11,040	2,270
> $25 \mu\text{m}$	2,270	530
ISO 4406	22/21/14	18/15/12

Even with heavily contaminated diesel fuel, when using auxiliary Micfil Ultra Fine Filters, up to 98% more of the abrasive particles and water are filtered out than when compared to standard filtration alone.

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WS Water Separator and Pre-Filter



Water in a diesel tank can lead to bacterial growth and cause blockages of the entire fuel system, then engine breakdown

Water in the tank (mainly condensation caused by temperature differences), creates the ideal breeding ground for bacteria, fungus, yeast and algae on the barrier layer between water and fuel. These micro-organisms and their excrements become a dark slimy deposit and cause acidification. Bacteria can form quickly. In perfect conditions, they multiply every 20 minutes. Micro-organisms and their excrements clog filters and fuel lines. In extreme cases, this will cause blockages of the entire fuel system, leading to engine breakdown.

The **WS** Water Separator in practice together with the Micfil Ultra Fine Filter has proven to be a successful combination.

The advantages of the purifier are:

- Removes 100% of the free water from the fuel
- Filters out particles down to approximately 10 µm
- No maintenance – no filter inserts need to be changed
- Water and particles are drained off at the bottom

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micfil Fuel Optimising System

1. micfil FUEL OPTIMISER



Diesel fuel is composed of long chained hydrocarbon molecules and is, due to its nature as a fluid, prone to changes. Chemical reactions cause the hydrocarbon molecules to cluster and grow in size. The fuel becomes cloudy. This results in bad combustion because the individual molecules don't get enough oxygen during combustion. Most of the tank sludge is caused by this clogging.

When fuel flows through the Micfil Fuel Optimiser the hydrocarbon molecules are electrostatically charged, which causes the dissolving of clusters in the fuel. The fuel molecules repel each other. This improves the atomisation upon injection. The individual fuel molecules receive more oxygen during the ignition process.

The **micfil** fuel optimiser disperses the clumping of the hydrocarbon molecules and improves combustion.



Combustion residues without Micfil Fuel Optimiser System



No Combustion residues using the Micfil Fuel Optimiser System

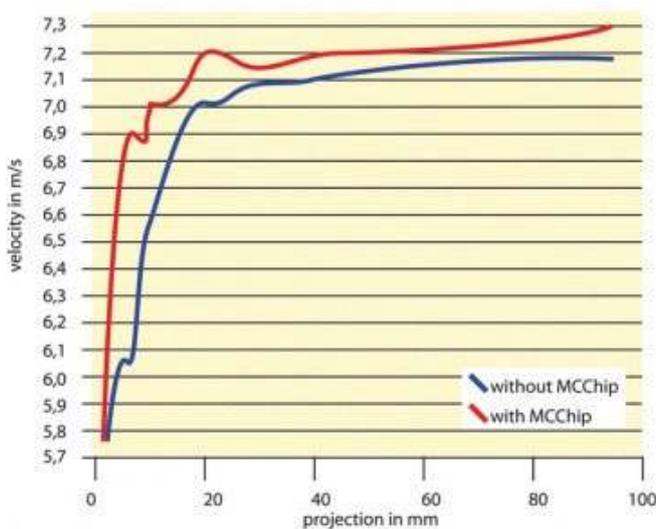
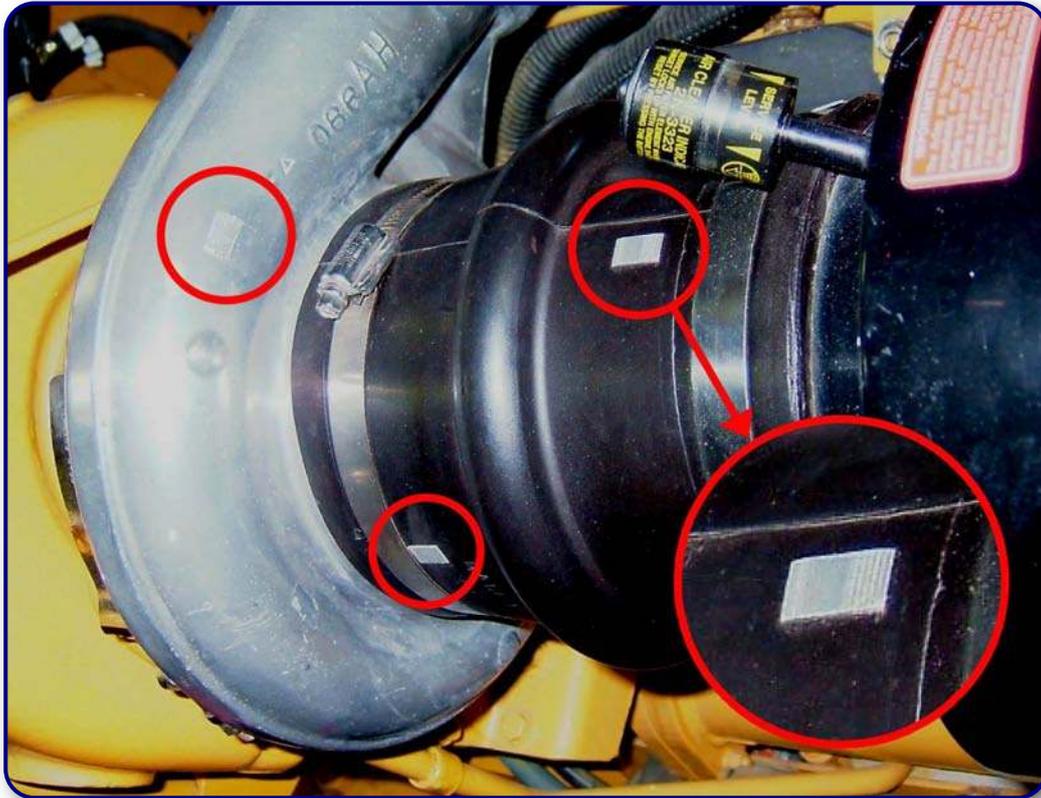
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micfil Fuel Optimising System

2. VR CHIPS



Improvement of Combustion due to Finer Atomisation and Increase Of The Charge Air Flow Speed



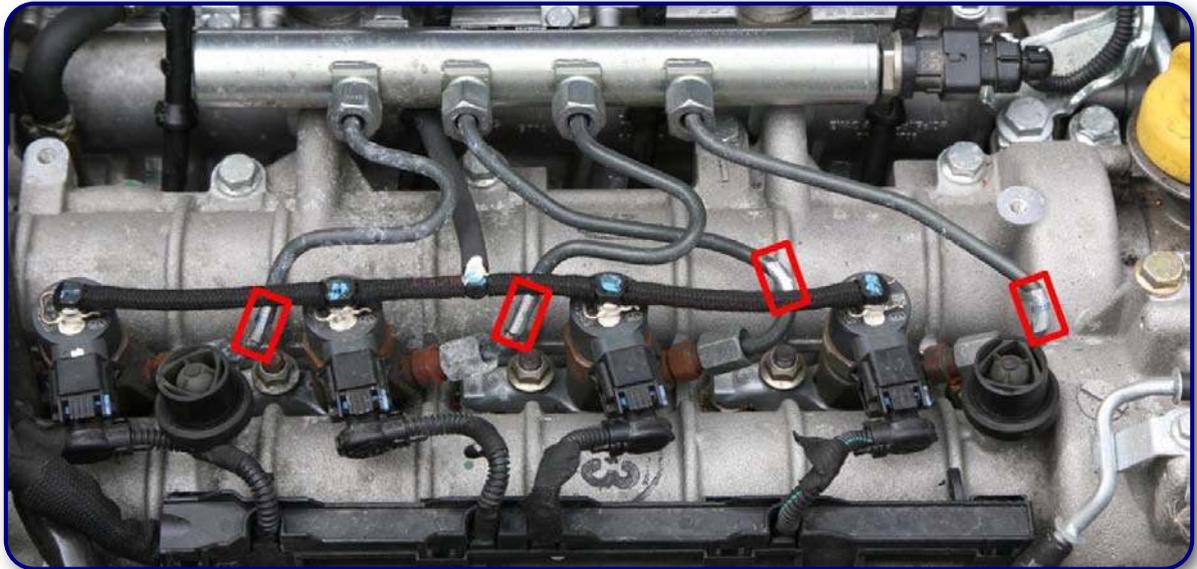
The aerodynamic resistance in the long, twisted air-intake channels can be so great as to impede optimum charging of the combustion chamber.

Through the use of VR Chips, the air speed in the peripheral zone is increased, which creates a more even airflow. This reduces turbulences, thereby supplying more air to the combustion chamber and improving the combustion and performance of the engine.

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micfil Fuel Optimising System

3. Improvement of Combustion due to Finer Atomisation



Through the application of VR Chips on high pressure injection lines, or injection valves at a pump nozzle element (PDE), electromagnetic radiation is reduced. This causes the droplets of atomised fuel to decrease in size and increase in quantity. Individual fuel molecules receive more oxygen during the ignition process. This results in better combustion, which produces smoother and quieter engine performance.

Advantages of the micfil Fuel Optimising System

- Noticeably improves engine output
- Reduces fuel consumption by as much as 5%
- Engine runs more smoothly and quietly
- Improved air flow capability
- Reduces soot and smoke formation
- Residue prevention in the combustion cavity
- Prevents tank sludge

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Choosing the right Filter Size and Quantity for your application

Diesel fuel / Heating oil

Flow rate	Filter Requirement
350 l/h	1 x AL/ST 150
700 l/h	1 x AL/ST 300
1,400 l/h	2 x AL/ST 300
2,100 l/h	3 x AL/ST 300

* custom fabrication by arrangement

Engine oil

Volume in Litres	Filter Requirement
50 l	1 x AL/ST 150
100 l	1 x AL/ST 300
300 l	2 x AL/ST 300
600 l	3 x AL/ST 300

* custom fabrication by arrangement

Gearbox oil

Volume in Litres	Filter Requirement
125 l	1 X AL/ST150
250 l	1 X AL/ST300
750 l	2 X AL/ST300
1500 l	3 X AL/ST300

* custom fabrication by arrangement

Hydraulic oil

Volume in Litres	Filter Requirement
250 l	1 x AL/ST 150
500 l	1 x AL/ST 300
1,000 l	2 x AL/ST 300
2,000 l	3 x AL/ST 300

* custom fabrication by arrangement

(Achieve Higher flow rates / oil volume by adding more filters)

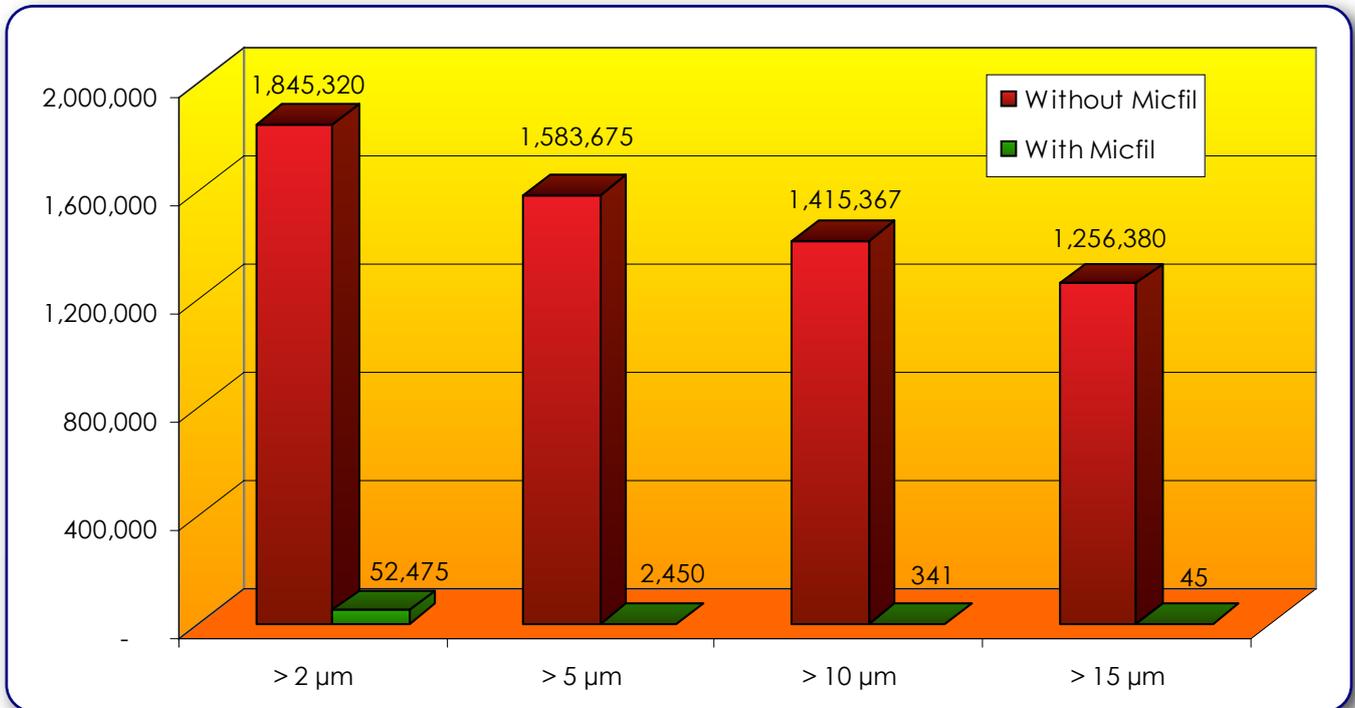


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Reduction of Abrasive Particles through micfil Ultra Fine Filters compared to Standard Filters

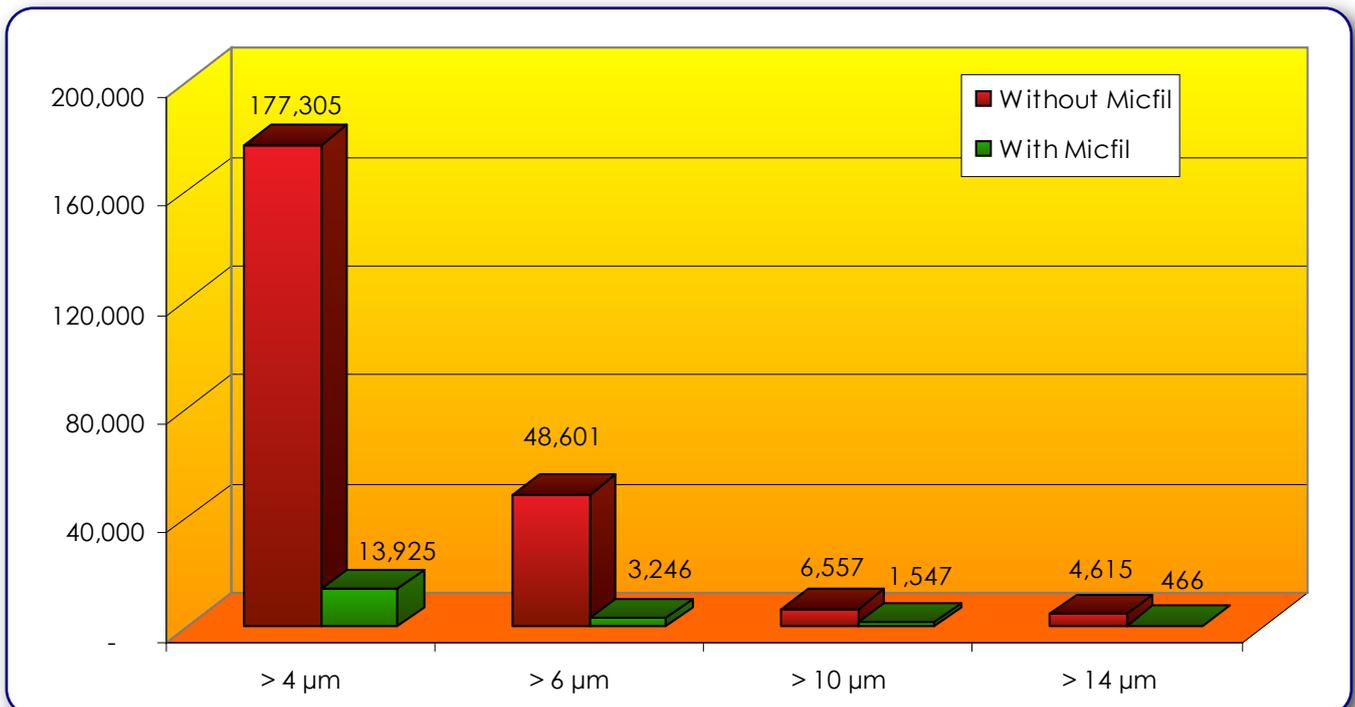
1. Hydraulic oil

Number of particles in 100ml of Hydraulic Oil in accordance with ISO 4406



2. Gear box oil

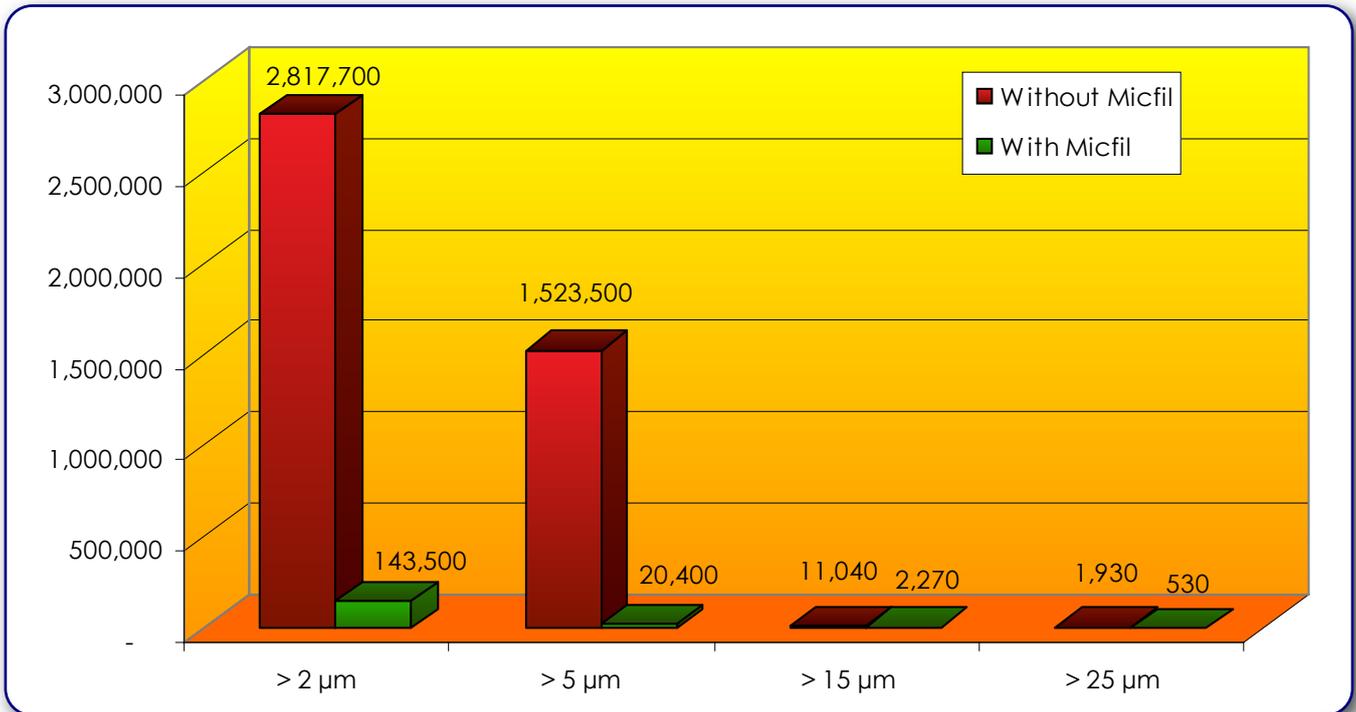
Number of particles in 100ml of Gear Box Oil in accordance with ISO 4406



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3. Diesel/Fuel

Number of particles in 100ml of Diesel in accordance with ISO 4406



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