FILTERMAG®

Simple Easy Obvious

+ Reduce Wear

+ Increase Reliability

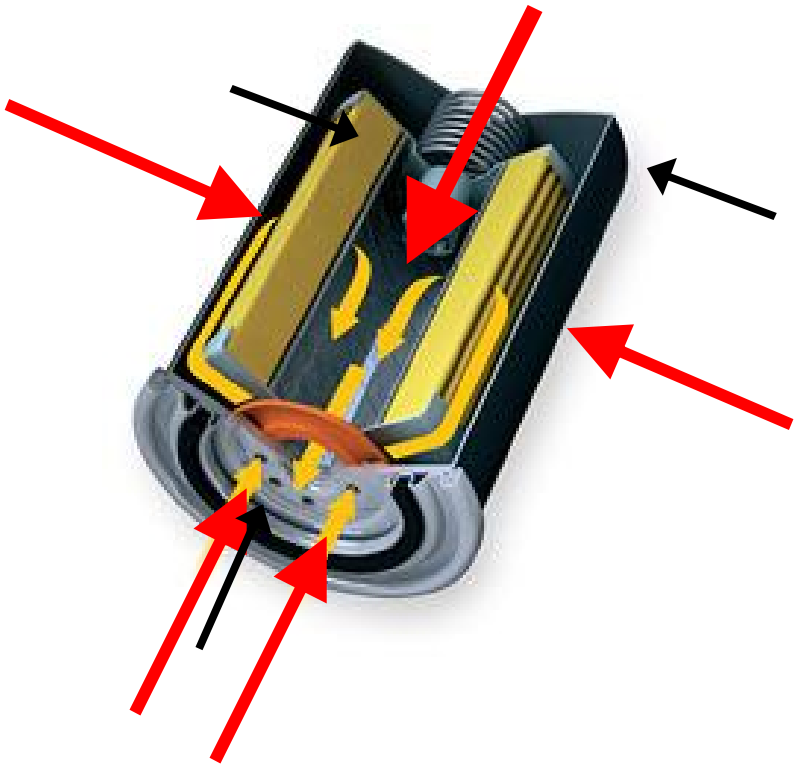
+ Extend Equipment Life

= REDUCED COST OF OWNERSHIP

A Lifetime of Protection from a One Time Investment

Contamination Control Systems

Traditional Oil Filtration



Standard oil filters are comprised of:

- **Metal canister**
- **Pleated paper filter element**
- **Holes for the oil to enter and exit**

Oil circulates through the filter:

- **Enters along the walls of the canister**
- **Flows through the paper filter element**
- **Exits out the center**

FILTERMAG®
Contamination Control Systems

Traditional Oil Filtration

Lubricating oil is very viscous

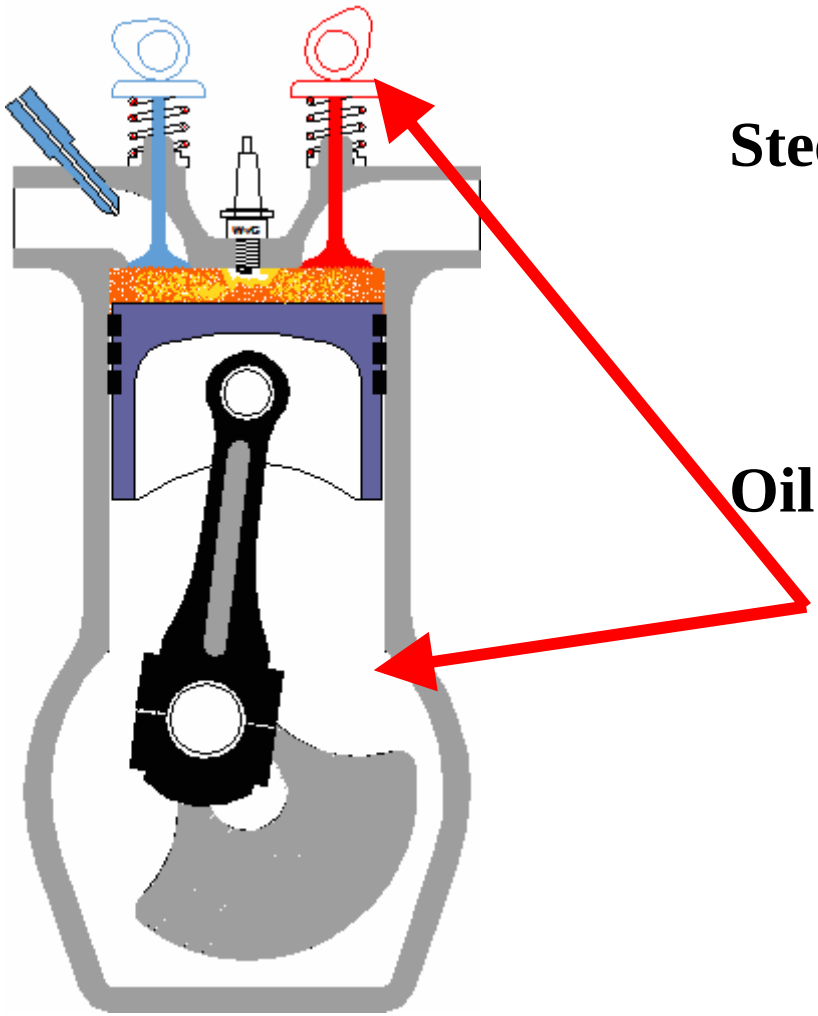
- **The paper filter element must be very porous in order to provide high oil flow rates**
- **Standard filters have a porosity of 20-25 microns (µm)**

Particles smaller than 20-25 µm

- **Pass through the paper filter**
- **Flow back into the engine**
- **Continue to circulate in the oil**

FILTERMAG®
Contamination Control Systems

Traditional Oil Filtration



Steel particles

- **Principle particles created in an engine during normal wear**
- **Most are smaller than 20 µm**

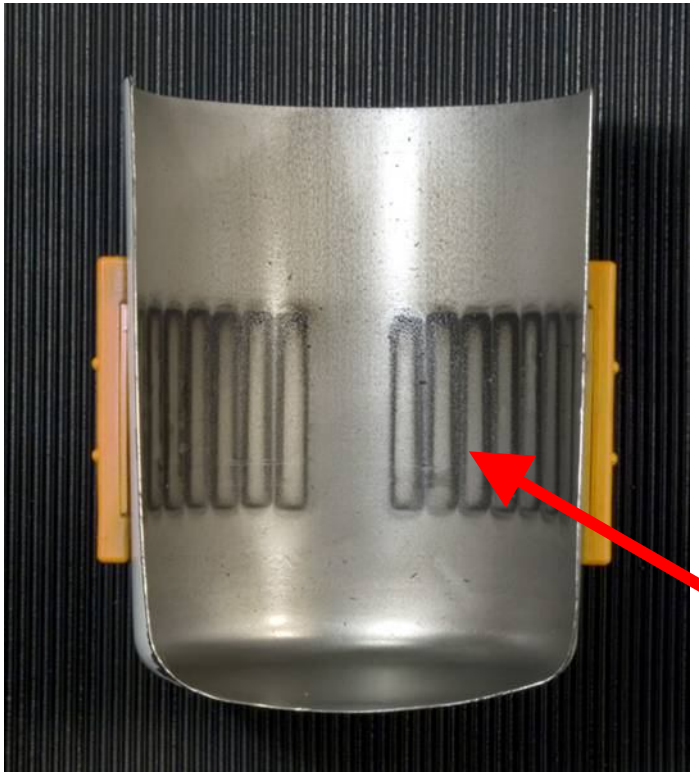
Oil lubricates the moving parts

- **Steel particles in the oil are trapped between the lubricated surfaces**
- **Particles cause grinding wear**
- **More wear creates more particles**
- **Cycle continues and wear increases**

FILTERMAG®
Contamination Control Systems

FilterMag® Breaks the Wear Cycle

Simply snap a FilterMag® on the outside of a standard oil filter

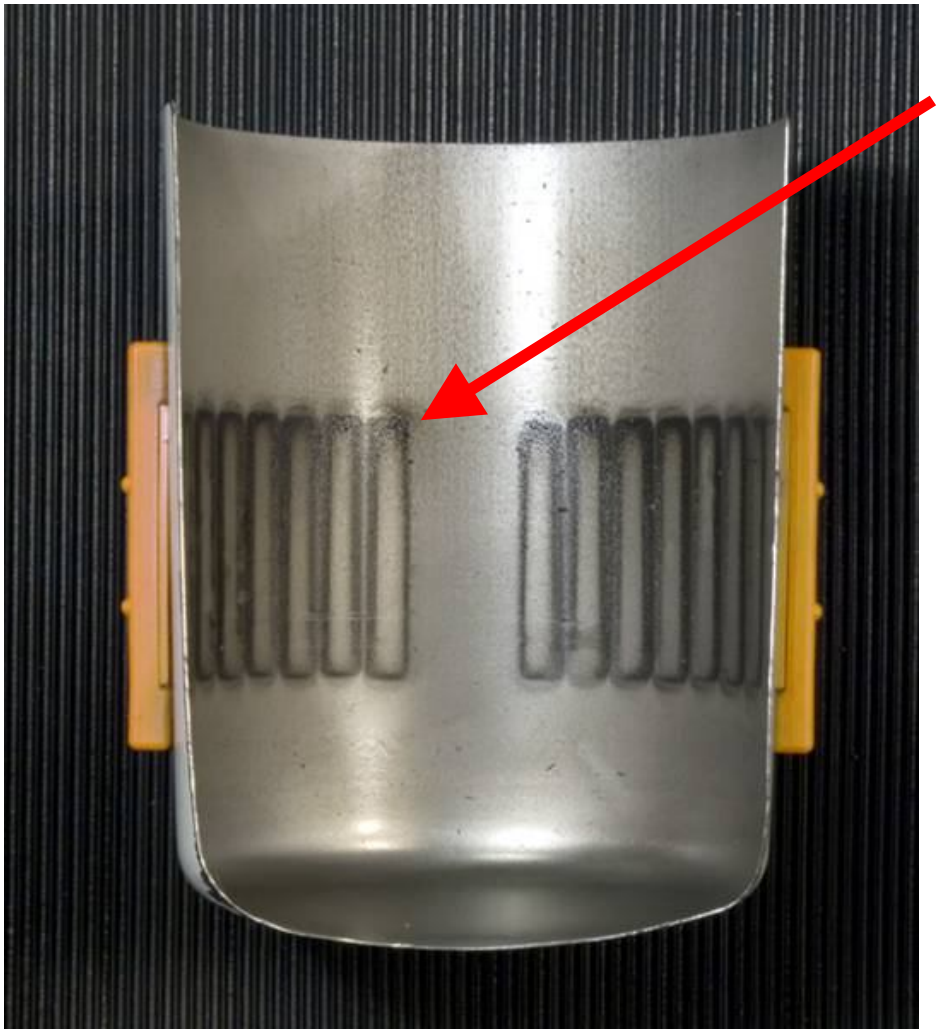


FilterMag's powerful rare earth magnets attract and hold particles that would normally pass through the paper filter

The RESULTS are obvious

FILTERMAG®
Contamination Control Systems

FilterMag® Breaks the Wear Cycle



The black rectangles on the inside of this oil filter are particles captured by a FilterMag after only 100 hours of operation on an Isuzu 4800 truck.

Most are less than 25µm

Too small to be seen individually

Millions of these wear causing particles align to form the outline of FilterMag's powerful rare earth magnets

FILTERMAG®

Contamination Control Systems

FilterMag® Breaks the Wear Cycle

Removing most of the small wear causing particles can:

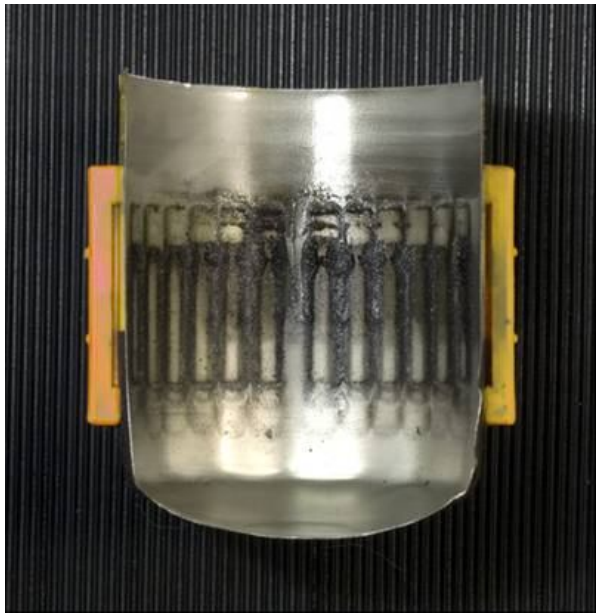
- Reduce engine wear up to 80%[1]
- Increase reliability by 2 to 3 times[2]
- Extend the life of lubricated parts up to 100%[2]

Non-invasive patented technology means:

- No loss of oil flow
- No loss of oil pressure
- Completely re-usable

  Slide off of the old filter

  Snap onto the new filter



Inside of an oil filter from a John Deere farm tractor

1 - David R. Staley, General Motors Corp.
"Correlating Lube Oil Filtration Efficiencies With Engine Wear"
Society Of Automotive Engineers
Paper Number 881825, November 7, 1988

2 - Sayles, R.S. And Macpherson, P.B.,
"Influence of Wear Debris on Rolling Contact Fatigue"
Rolling Contact Fatigue of Bearing Steels, J.J.C. Hoo, editor
ASTM STP 771, ASTM 1982, pp. 255-274

FILTERMAG®
Contamination Control Systems

Easy Installation...

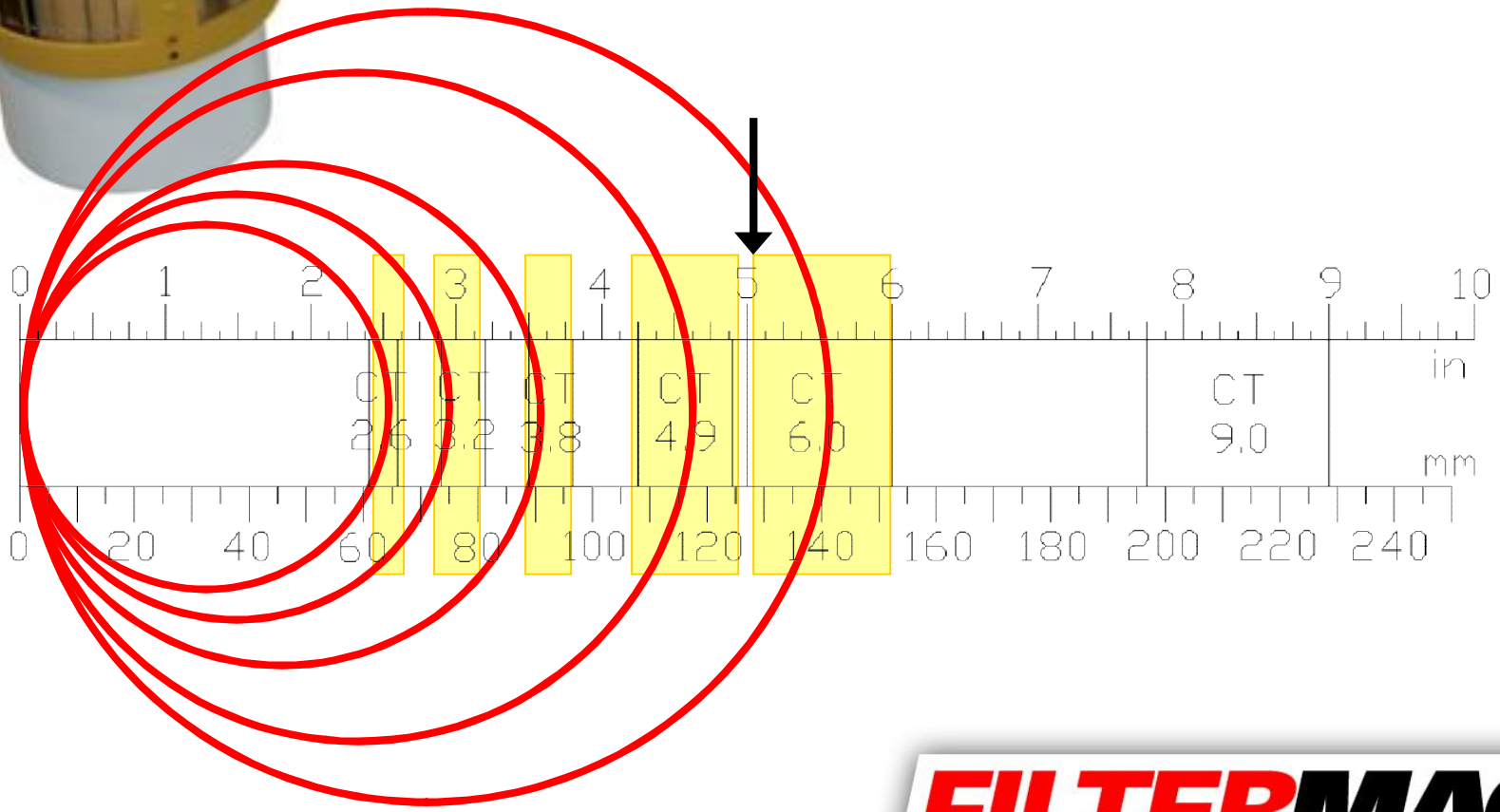
- **No tools needed**
- **No training required**
- **No effect on equipment warranty**

FILTERMAG®

Contamination Control Systems

Simple Size Selection

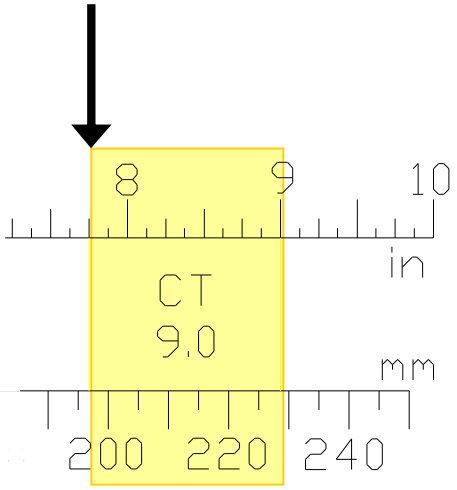
- **5 CT products for spin-on filters**
- **Select by the diameter of the filter**



FILTERMAG®
Contamination Control Systems

Simple Size Selection

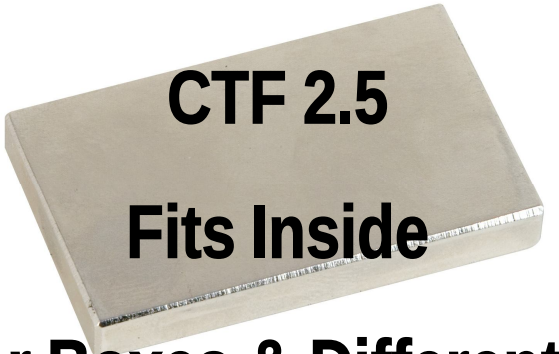
- 5 CT products for spin-on filters
- Select by the diameter of the filter
- **CT 9.0 for large fixed canister filters**



FILTERMAG®
Contamination Control Systems

Simple Size Selection

- 5 CT products for spin-on filters
- Select by the diameter of the filter
- CT9.0 for large fixed canister filters
- **Specialty products**



Gear Boxes & Differentials

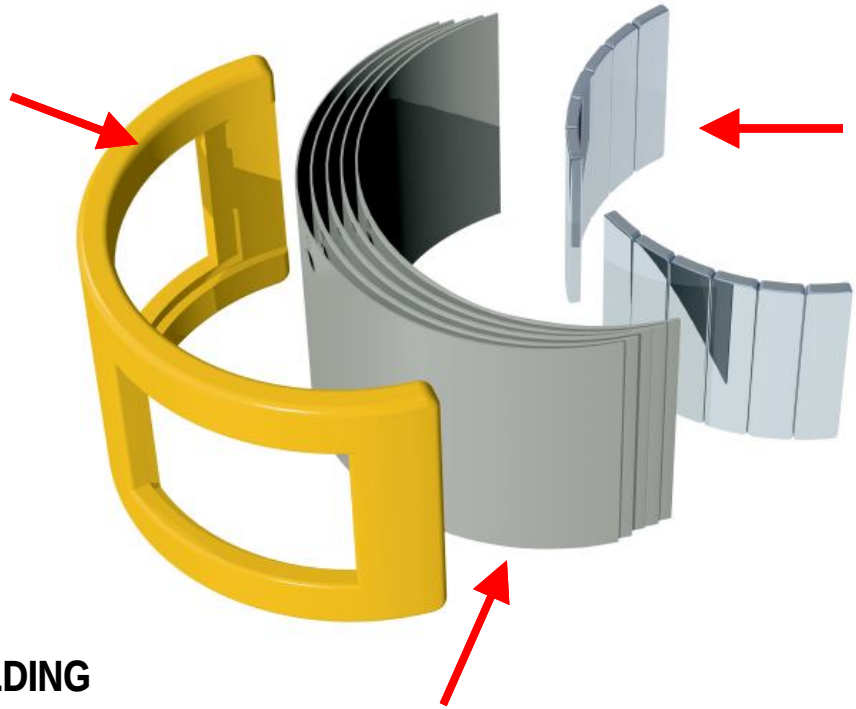
FILTERMAG®
Contamination Control Systems

Contamination Control System

Our Patented Fundamentals

PARABOLIC FLUX FOCUS

- Orients magnetic flux into center of filter
- Housing made of DuPont™ Zytel®
- High temperature tolerance -100ºF to +300ºF.



EXTREME RARE EARTH MAGNETS

- Provides tractive force to remove particles from fluids under very harsh conditions:
- Fluid temperatures to 300 ° F
- Fluid pressures commonly 80 to 120psi. Up to 20,000psi for hydraulics
- Flow rates up to 2,000 gallons/minute

FLUX AMPLIFIER & SHIELDING

- Redirects flux from exiting back of system to supplementing filter side of system
- Shielding STOPS ALL FLUX from exiting back of system and into engine compartment
- So effective a paperclip won't stick to the exterior for the system
- Vehicle electronics stay safe

FILTERMAG®

Contamination Control Systems

FilterMag Works On Practically All Vehicles & Equipment

Off-road heavy equipment

All sizes & types of trucks

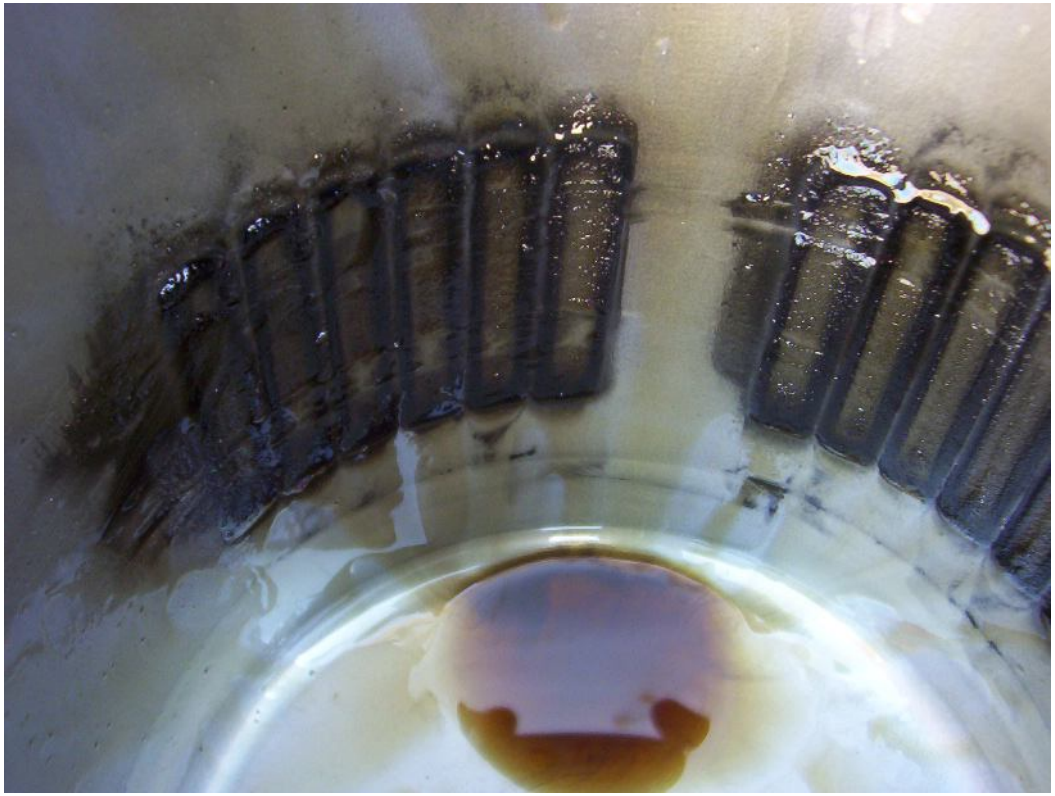
Engines, pumps, and compressors

Generators, & marine vessels.

FILTERMAG®

Contamination Control Systems

Completely Non-invasive Contamination Control



– **Cut open filter from a diesel engine after 800 hours operation**

- **Contamination Control without ANY changes in:**
  - Fluid flow paths
  - Fluid pressures
  - Fluid flow rates
- **No re-plumbing of manufacturer's:**
  - Engine oil systems
  - Hydraulic systems
- **NO warranty impact**

FILTERMAG®
Contamination Control Systems

Diesel Fuel Filtration

Customer's photo of a *secondary* diesel fuel filter after just 5,000 miles

Note the iron oxide particles missed by the primary fuel filter and trapped on the canister wall by the attached FilterMag®

Diesel fuel is often contaminated with water

Water can create rust in the fuel system

Rust particles (iron oxide) may pass through a fuel filter

Rust particles cause unnecessary wear to the fuel pump and fuel injectors

FilterMag® can capture the rust particles that ordinary filters miss

FILTERMAG®
Contamination Control Systems

Diesel Fuel Filtration

Extending the life of a fuel injection system will pay for the investment in FilterMag

Fuel only passes through the filter one time

Using 2 FilterMags in tandem is recommended for optimum results

Diesel fuel is often contaminated with water

Water can create rust in the fuel system

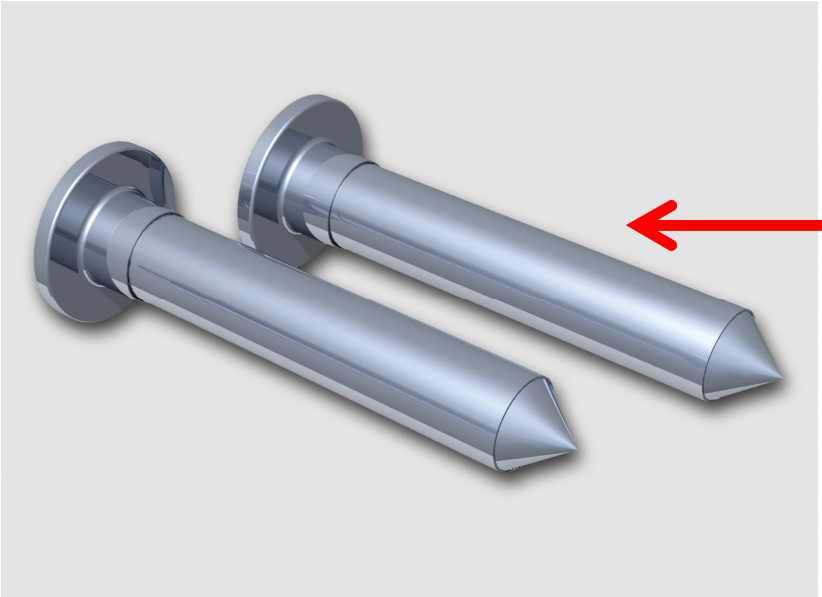
Rust particles (iron oxide) may pass through a fuel filter

Rust particles cause unnecessary wear to the fuel pump and fuel injectors

FilterMag® can capture the rust particles that ordinary filters miss

FILTERMAG®
Contamination Control Systems

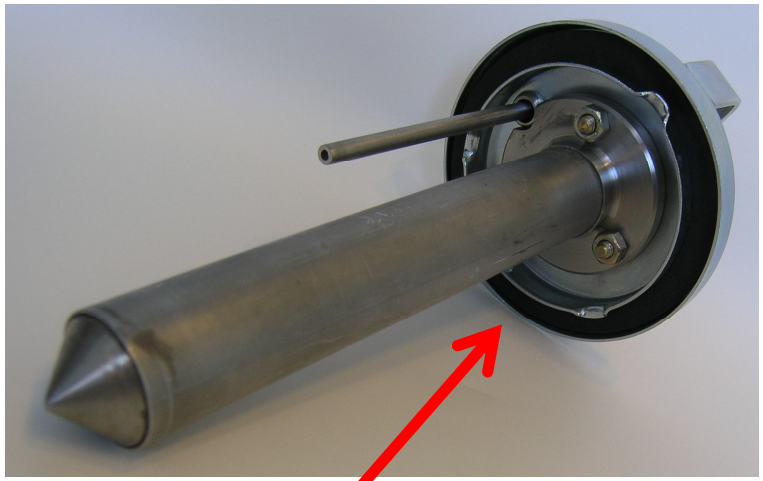
Hydraulic Fluid Filtration



A pair of CTR 8.0 magnets will fit many heavy equipment hydraulic tanks

Other sizes are available

Custom sizes upon request



Normal wear in hydraulic systems creates microscopic steel particles in the hydraulic fluid

When recirculated, these particles shorten the life of seals, valves and pumps thus reducing reliability

FilterMag® CTR products insert into hydraulic fluid reservoir tanks to capture the particles

Typically mounted to filler caps for ease of removal and cleaning

FILTERMAG®
Contamination Control Systems

Hydraulic Fluid Filtration

40 ton forklift at the Port of Los Angeles

CTR used in the hydraulic reservoir tank

Millions of microscopic steel particles captured by the magnets of the CTR

Simply wipe off and place back into the tank (< 5 min) No tools required

FilterMag® CT magnets may also be used with spin-on hydraulic filters

Cheap insurance for very expensive hydraulic systems

FILTERMAG®

Contamination Control Systems

Kidney Loop Application

FILTERMAG®

Contamination Control Systems

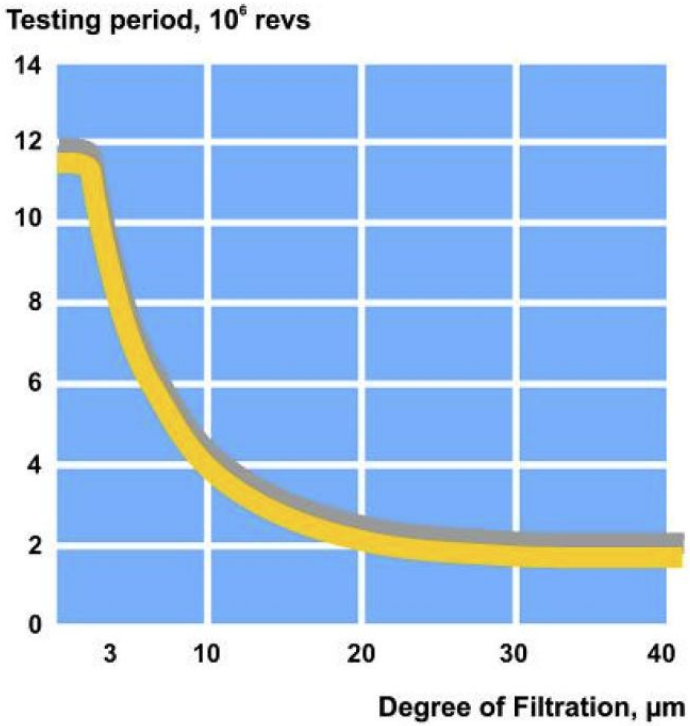
Reduce Wear, Increase Reliability & Extend Equipment Life

- **FilterMag works with full flow oil, hydraulic & fuel filtration**
  - Value based filtration removes particles ≥40 microns
  - Premium filtration removes particles ≥ 25 microns
  - FilterMag assisted filtration removes ferrous particle ≥ 1 micron
- **Preserve higher quality (TBN) of oil during operation**
- **Reduce risk of failure**
  - Engine
  - Fuel systems
  - Hydraulic systems

FILTERMAG®
Contamination Control Systems

MacPherson Graph

Clean Oil is Essential to Life Extension & Improved Reliability



MacPherson Graph

MacPherson proved that removal of very small particles (<10 micron) from lubricating oil has a very useful effect on the life of bearings: **The finer the filtration, the longer the life.**

The MacPherson Graph is based upon an accelerated test of 10 rolling element bearings. The oil was contaminated with particles from gearboxes.

Sayles, R.S., and Macpherson, P.B., "Influence of Wear Debris on Rolling Contact Fatigue," Rolling Contact Fatigue of Bearing Steels, J.J.C. Hoo, editor, ASTM STP 771, ASTM 1982, pp. 255-274.

Noria Chart

New Cleanliness Level (ISO Code)

Current Machine Cleanliness (ISO Code)

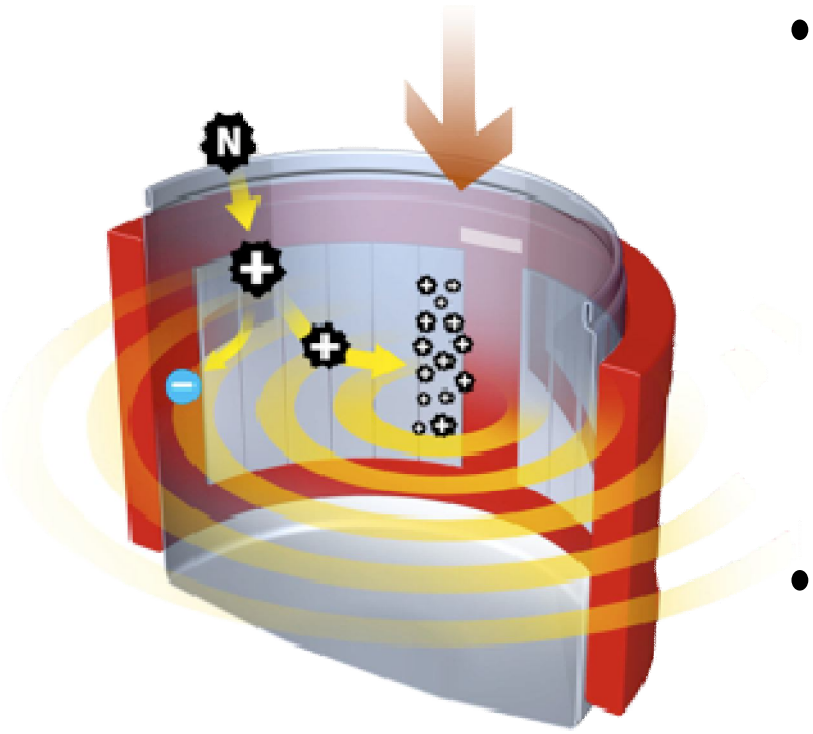
	20/17		19/16		18/15		17/14		16/13		15/12		14/11		13/10		12/9		11/8		10/7	
26/23	5	3	7	3.5	9	4	>10	5	>10	6	>10	7.5	>10	9	>10	>10	>10	>10	>10	>10	>10	>10
	4	2.5	4.5	3	6	3.5	6.5	4	7.5	5	8.5	6.5	10	7	>10	9	>10	10	>10	>10	>10	>10
25/22	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	7	>10	9	>10	>10	>10	>10	>10	>10
	3	2	3.5	2.5	4.5	3	5	3.5	6.5	4	8	5	9	6	10	7.5	>10	9	>10	>10	>10	>10
24/21	3	2	4	2.5	6	3	7	4	9	5	>10	6	>10	7	>10	8	>10	10	>10	>10	>10	>10
	2.5	1.5	3	2	4	2.5	5	3	6.5	4	7.5	5	8.5	6	9.5	7	>10	8	>10	10	>10	>10
23/20	2	1.5	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	8	>10	9	>10	>10
	1.7	1.3	2.3	1.5	3	2	3.7	2.5	5	3	6	3.5	7	4	8	5	10	6.5	>10	8.5	>10	10
22/19	1.6	1.3	2	1.6	3	2	4	2.5	5	3	7	3.5	8	4	>10	5	>10	6	>10	7	>10	>10
	1.4	1.1	1.8	1.3	2.3	1.7	3	2	3.5	2.5	4.5	3	5.5	3.5	7	4	8	5	10	5.5	>10	8.5
21/18	1.3	1.2	1.5	1.5	2	1.7	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	7	>10	10
	1.2	1.1	1.5	1.3	1.8	1.4	2.2	1.6	3	2	3.5	2.5	4.5	3	5	3.5	7	4	9	5.5	10	8
20/17			1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	5	>10	7	>10	9
			1.2	1.05	1.5	1.3	1.8	1.4	2.3	1.7	3	2	3.5	2.5	5	3	6	4	8	5.5	10	7
19/16					1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	6	>10	8
					1.2	1.1	1.5	1.3	1.8	1.5	2.2	1.7	3	2	3.5	2.5	5	3.5	7	4.5	9	6
18/15							1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4.5	>10	6
							1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5	2.5	5.5	3.7	8	5
17/14									1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	6	3	8	5
									1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	4	2.5	6	3.5
16/13											1.3	1.2	1.6	1.5	2	1.7	3	2	4	3.5	6	4
											1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.8	3.7	3	4.5	3.5
15/12													1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5
													1.2	1.1	1.5	1.4	1.8	1.5	2.3	1.8	3	2.2
14/11															1.3	1.3	1.6	1.6	2	1.8	3	2
															1.3	1.2	1.6	1.4	1.9	1.5	2.3	1.8
13/10																	1.4	1.2	1.8	1.5	2.5	1.8
																	1.2	1.1	1.6	1.3	2	1.6

Hydraulics and Diesel Engines	Rolling Element Bearings
Journal Bearings and Turbo Machinery	Gear Boxes and Other

–Machinery Lubrication “The Importance of ISO Cleanliness Codes”

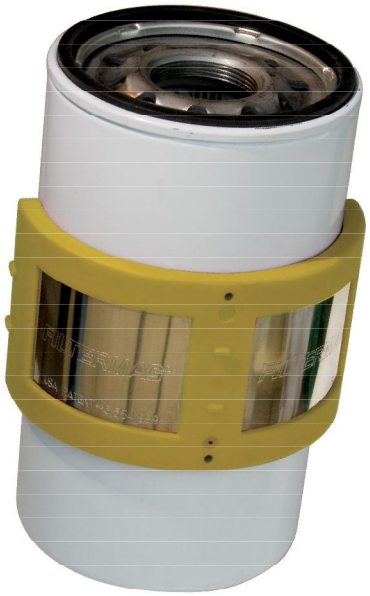
FILTERMAG®
Contamination Control Systems

What about particles that aren't magnetic?

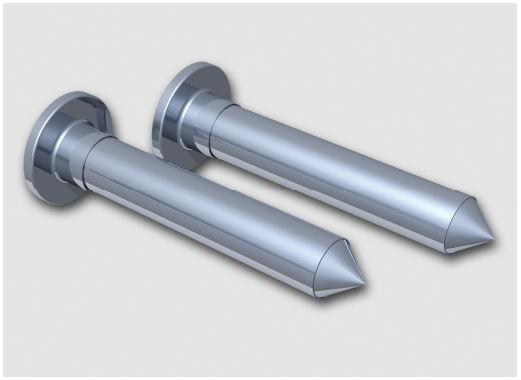


- **Non-ferrous particles become positively charged while in magnetic field**
  - Metals: Copper, Aluminum, Chromium, Sodium
  - Others: soot, silicates, Boron, Calcium
- **Positively charged particles attracted & held to negatively charged inner wall of oil filter**

FILTERMAG®
Contamination Control Systems



The FilterMag® Promise



Reduce Wear

Increase Reliability

Extend Equipment Life

in

Most equipment with an oil filter

Diesel fuel systems

Hydraulic systems

Transmissions, Differentials & Gear Boxes

FILTERMAG®

Contamination Control Systems

For further information please contact:

Merlin Equipment Pte Ltd
Tel: +65 6836 1743
filtermag@merlinequip.com

FILTERMAG®
Contamination Control Systems