RECONDOIL BOX

For a circular use of oil

Mats Norling

Technical Sales & Business Development Manager

Oil as a consumable

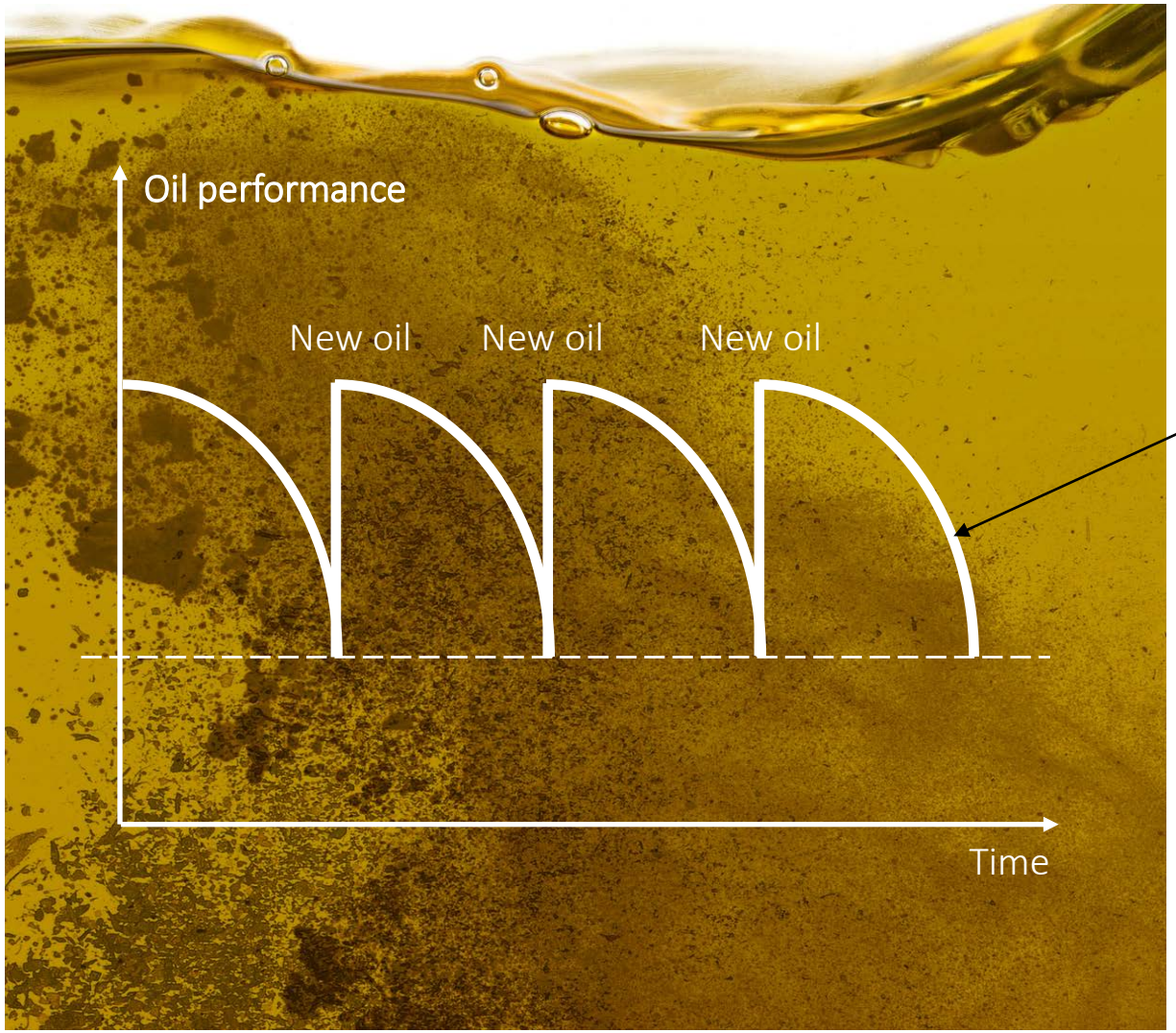
- Oil is used, discarded and replaced
- Costly and unsustainable approach
- Direct and indirect costs
- Impacts machines and processes

RecondOil®

SKF®

Double Separation Technology

Why we change oil



Contamination

Oxidation

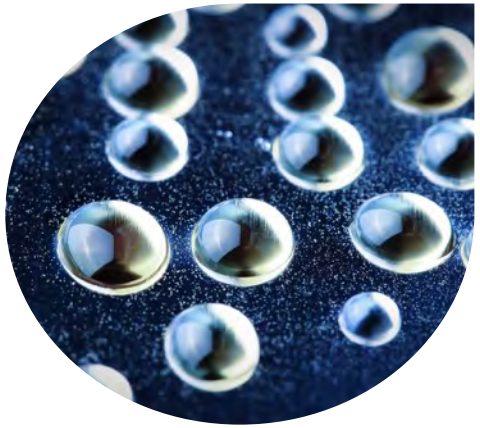
Additive consumption

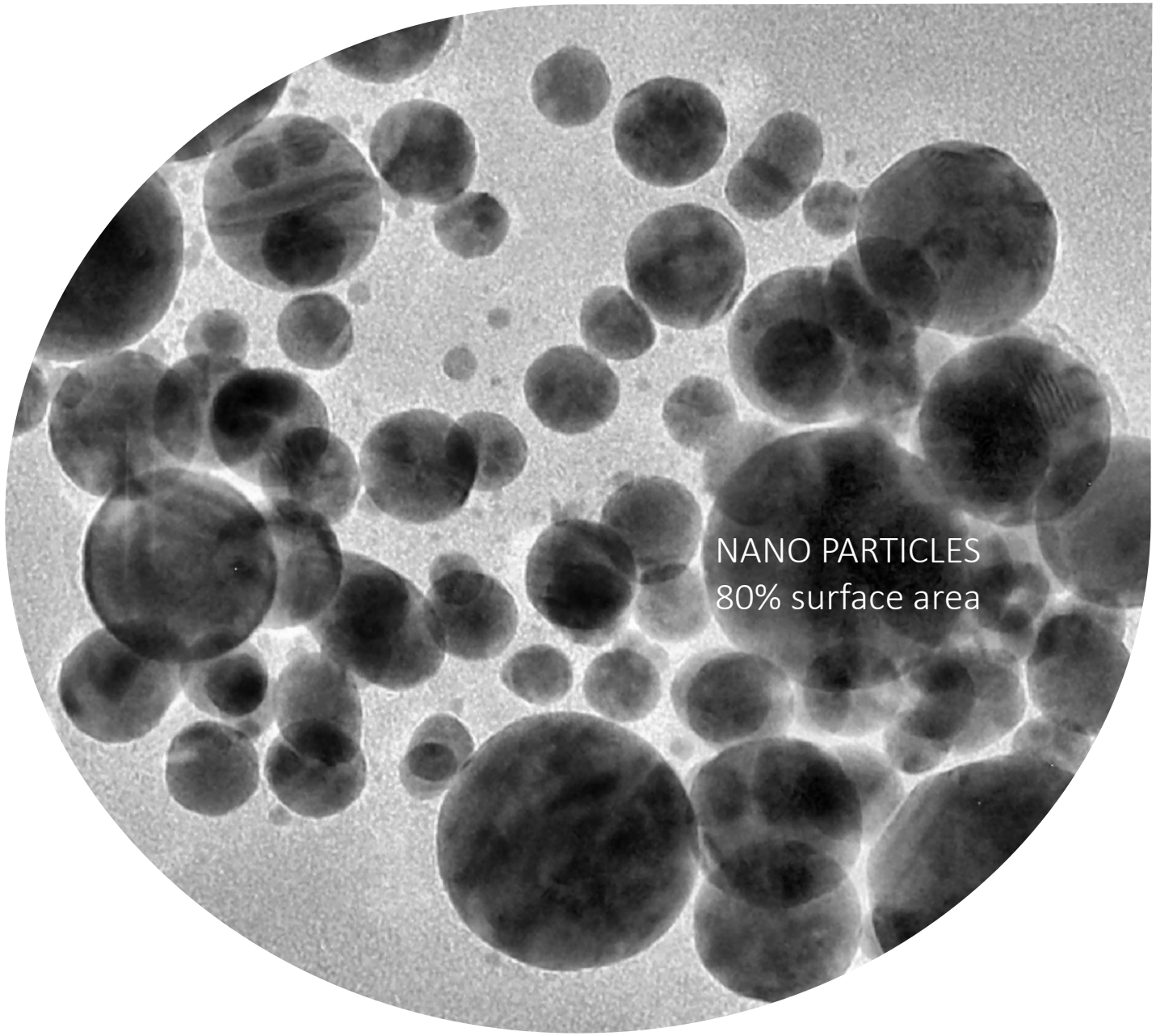
RecondOil®

SKF®

From micron range to nano scale

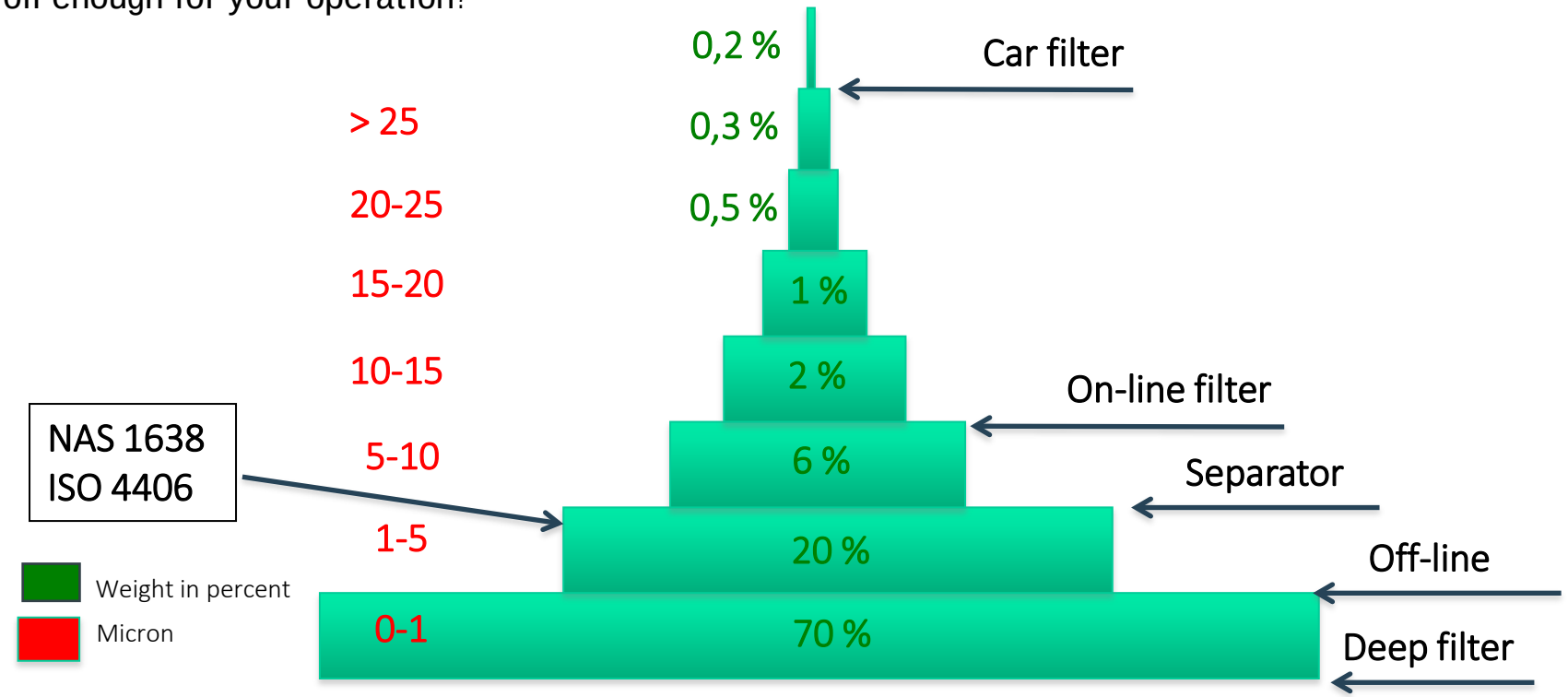
MICRO PARTICLES
20% surface area





What is clean oil?

- Particle surface + water + oxygen = Oxidation
- 90% of all particles in oil are below 5 micron
- Is clean oil enough for your operation?

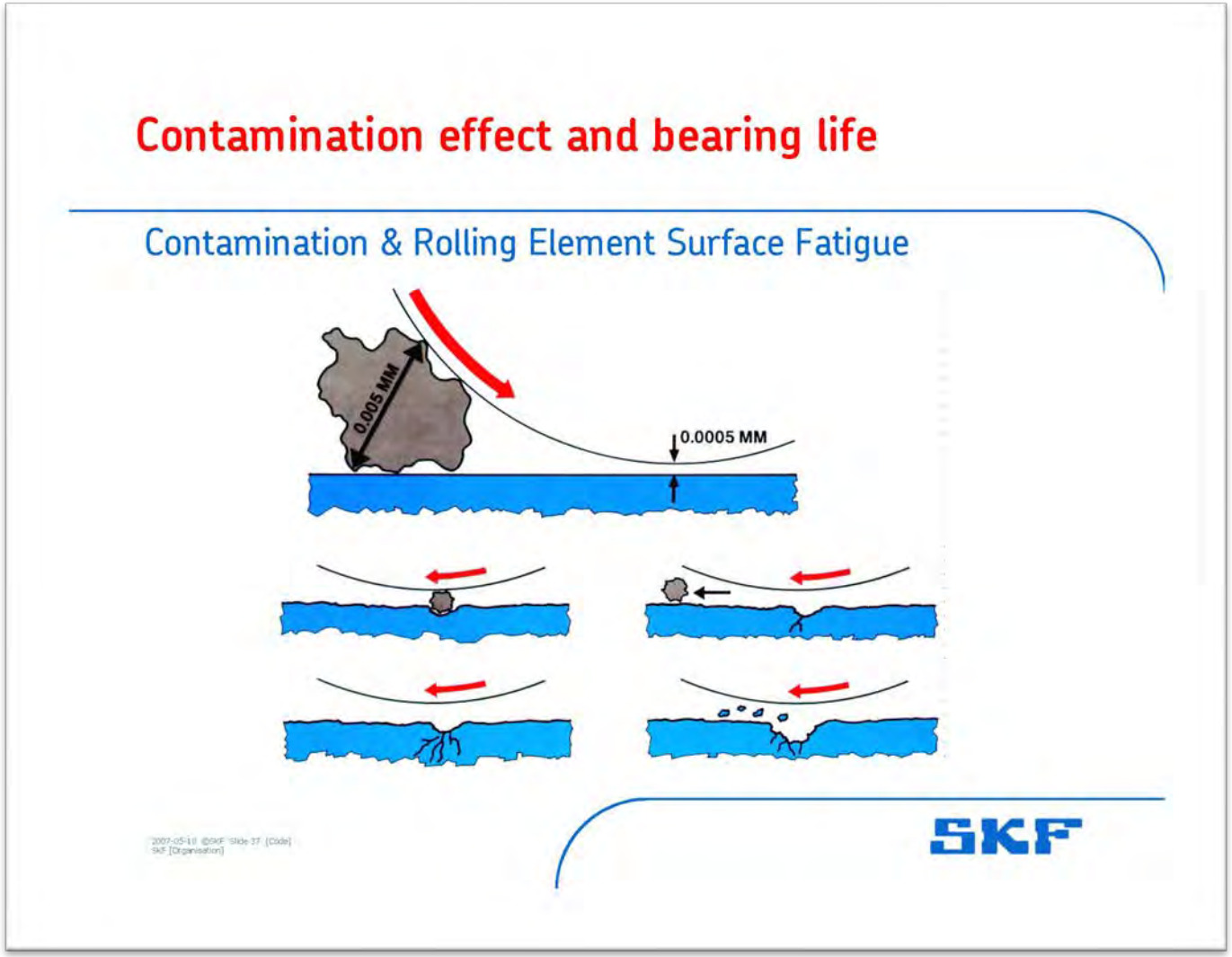


Source: Thompson, B. and Livingstone, G. "Using Quantitative Spectrophotometric Analysis (QSA) as a Predictive Tool to Measure Varnish Potential." *2004 International Maintenance Conference Proceedings*, December 2004.

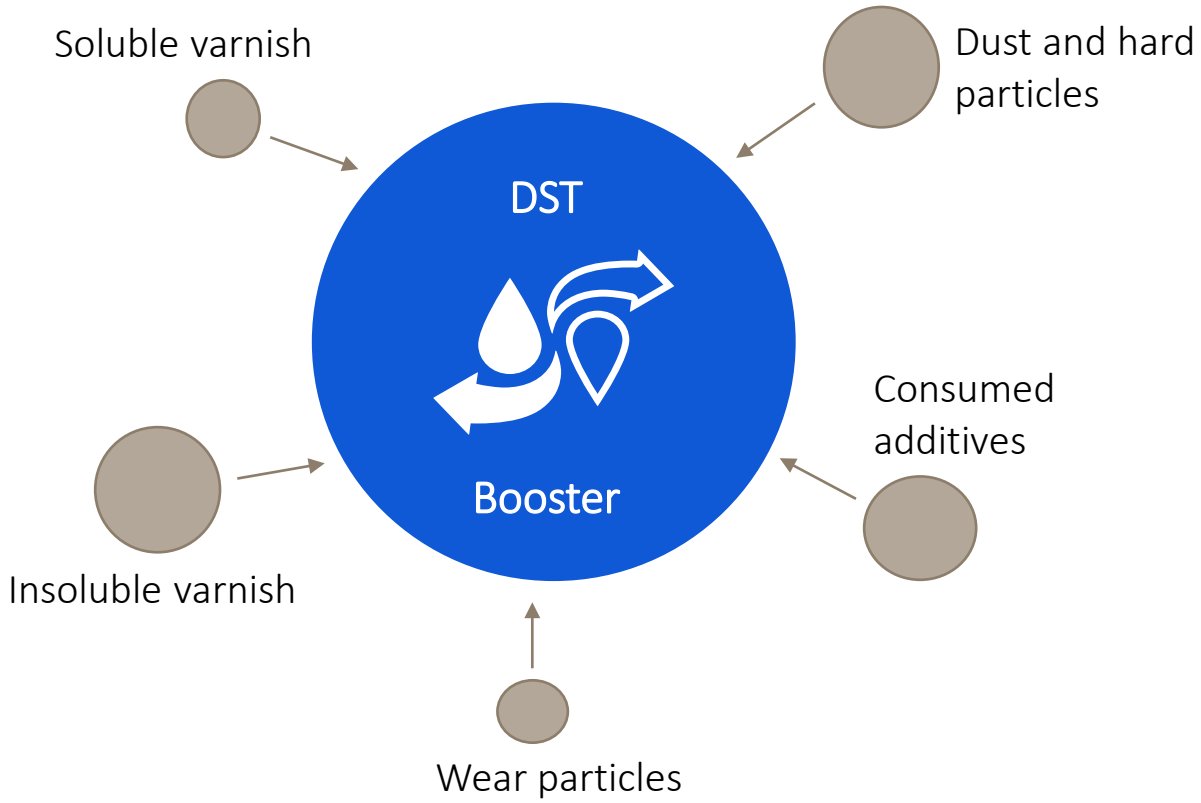
How far down should you clean?

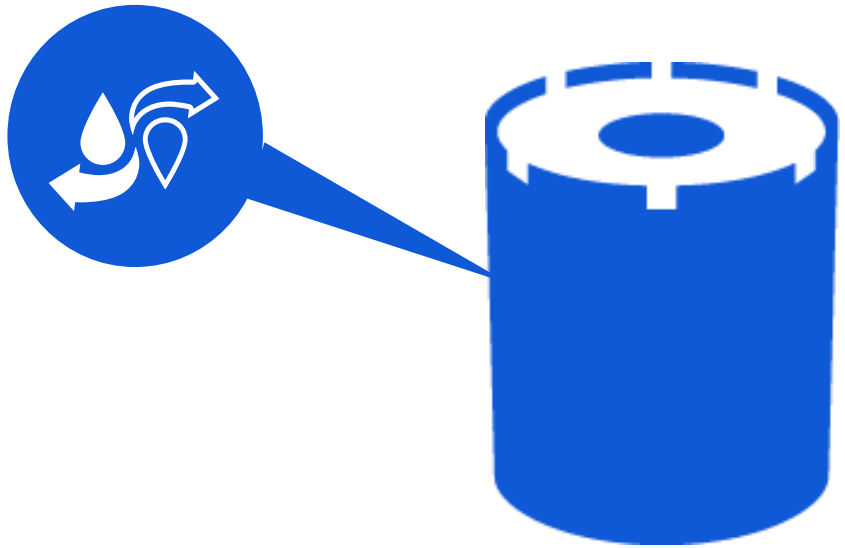
- What does SKF say?

0,5 micron



The DST booster attracts all particles, of all sizes





RecondOil®

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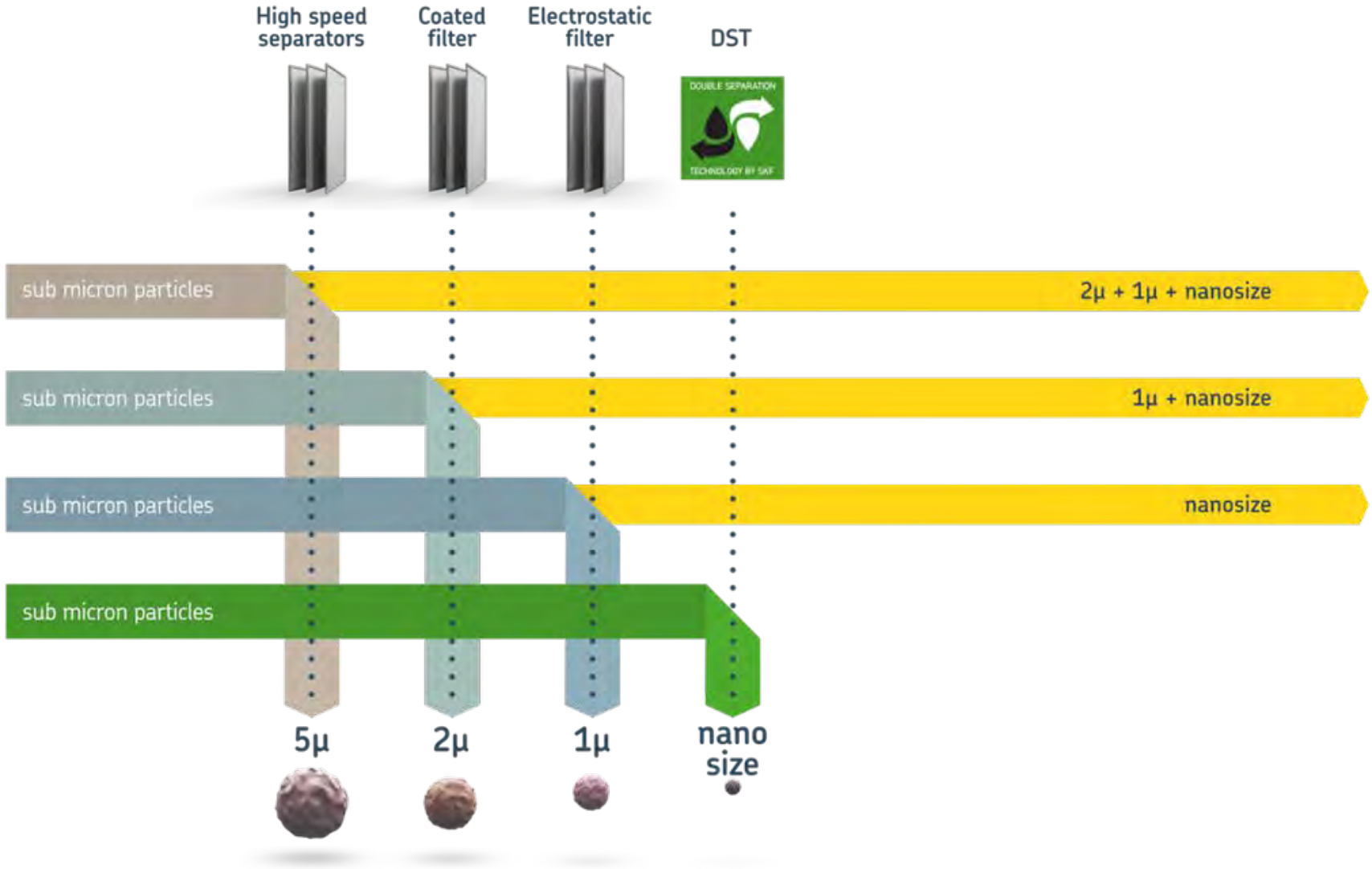
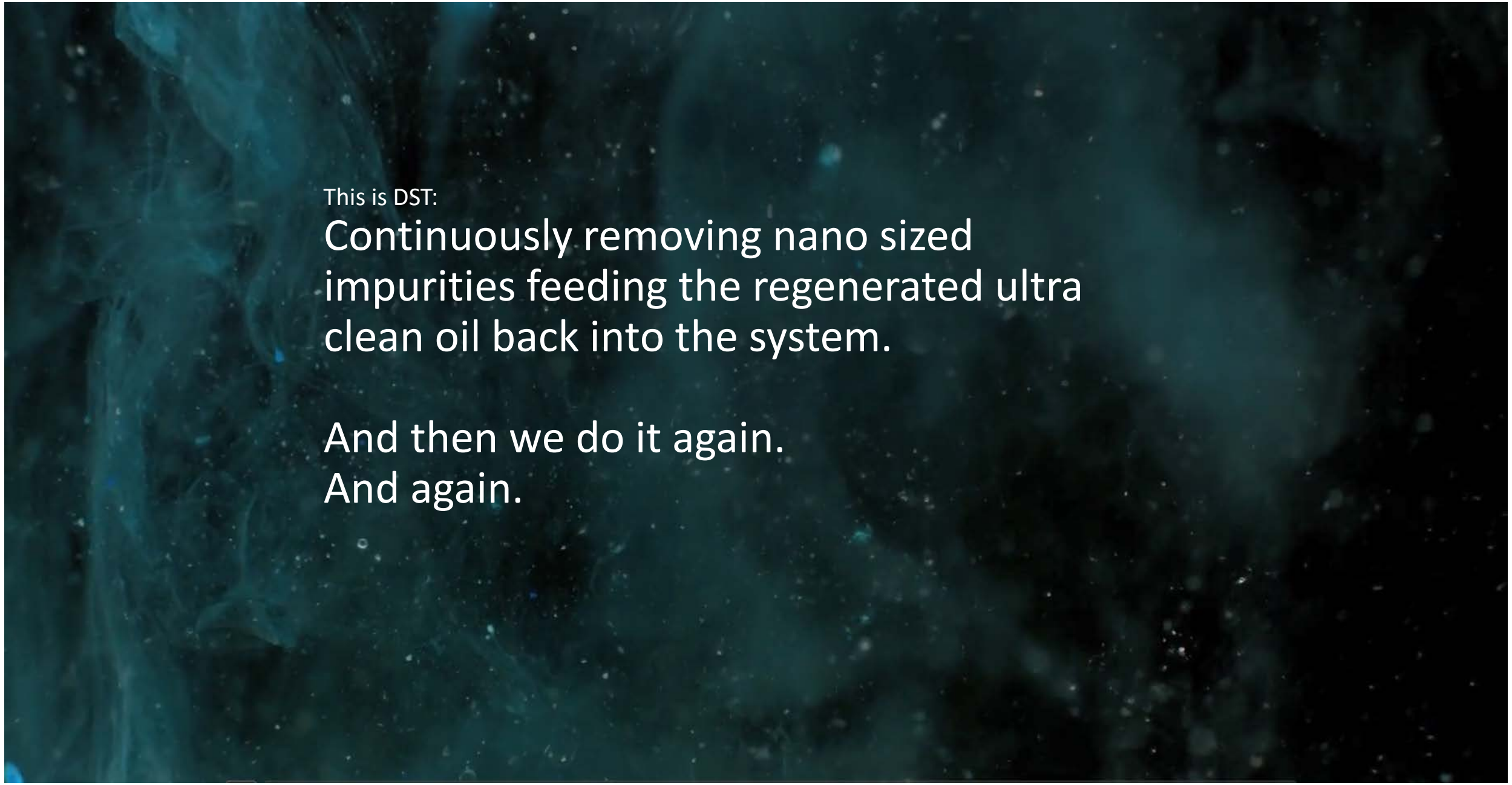
Removing the smallest nano-particles – the catalyst for oxidation




This is DST:
Continuously removing nano sized impurities feeding the regenerated ultra clean oil back into the system.
And then we do it again.
And again.

Circular use of oil – value creation across operations

Sustainability improvement

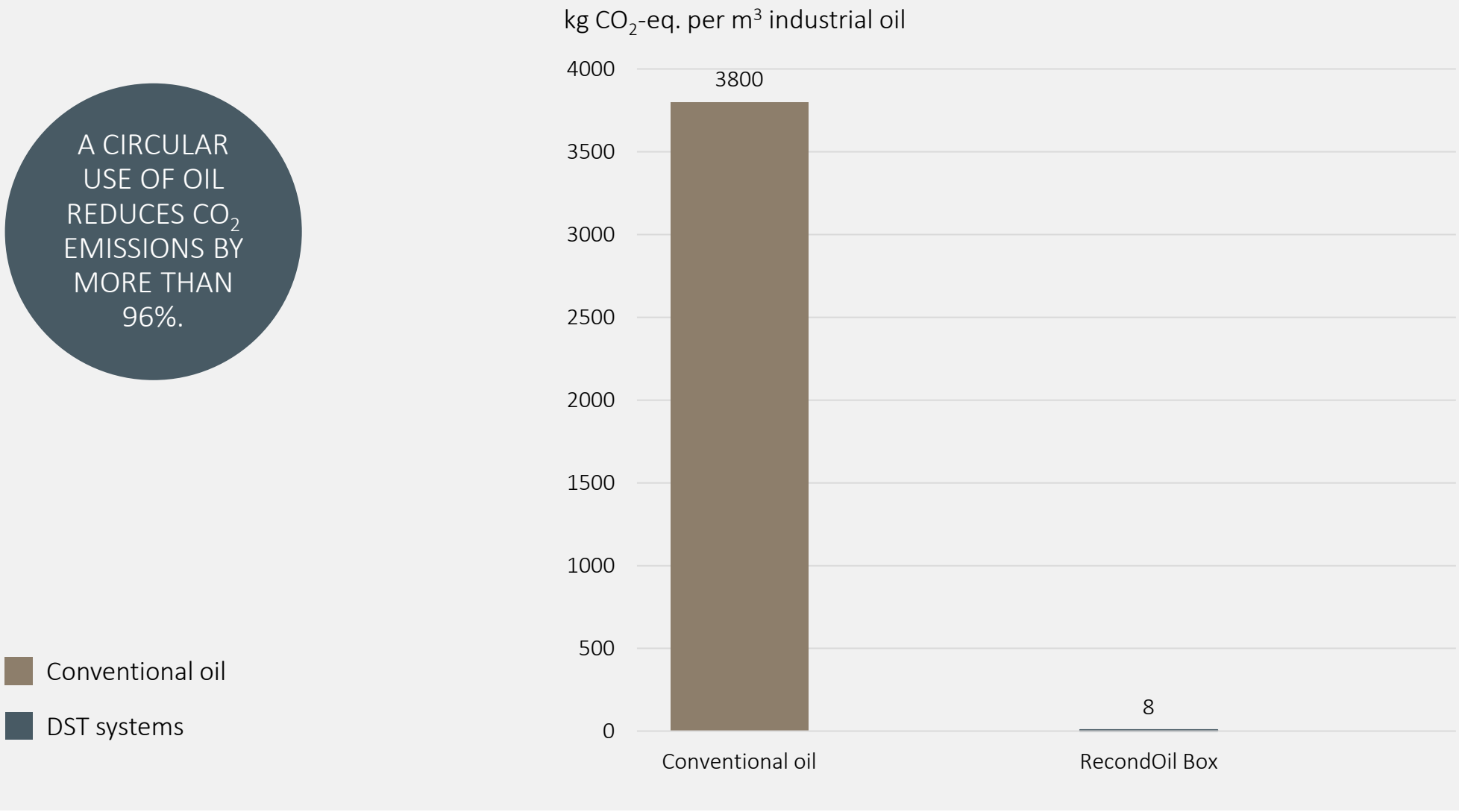
Total oil cost reduction

Performance improvement

#circularuseofoil

Life cycle analysis: CO_2 footprint with a circular use of oil

A CIRCULAR USE OF OIL REDUCES CO_2 EMISSIONS BY MORE THAN 96%.



Total cost of industrial oil

Direct costs:

- Oil purchases
- Transport and logistics
- Disposal of used oil

Indirect costs:

- Maintenance costs
- Component repair and purchasing
- Machine failure
- Production stops
- Energy consumption

Improved performance

- Improved system performance
- Higher machine reliability
- Higher availability of the machine
- More energy efficient system
- Higher productivity

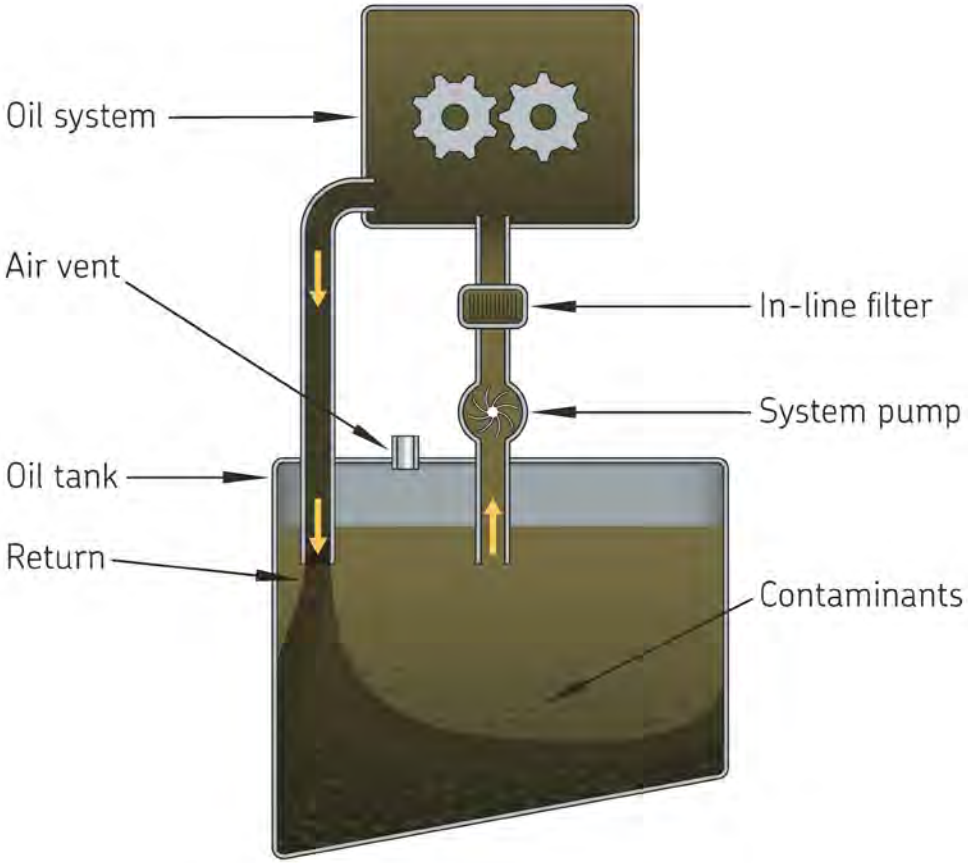
One system

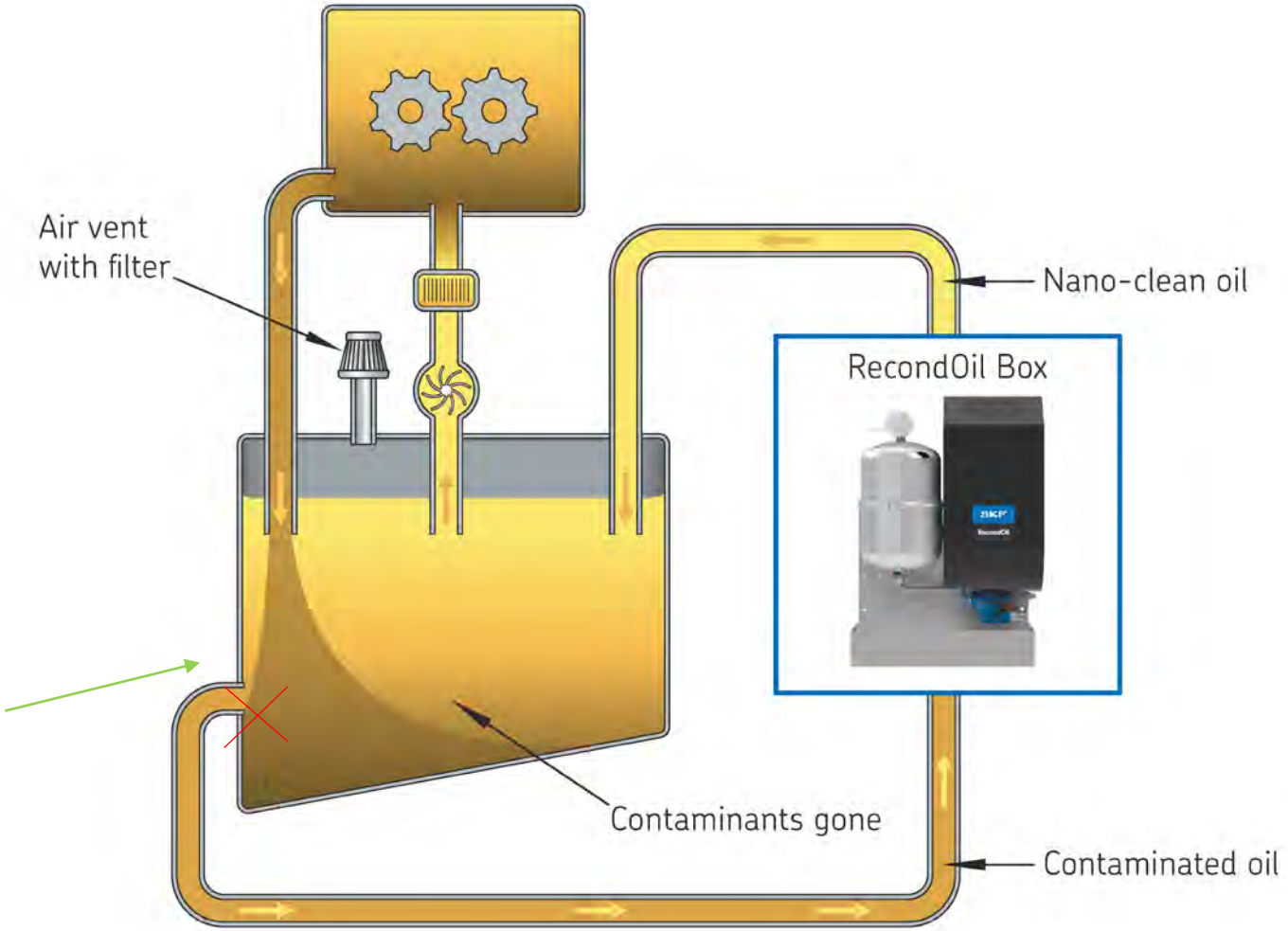
Three functions

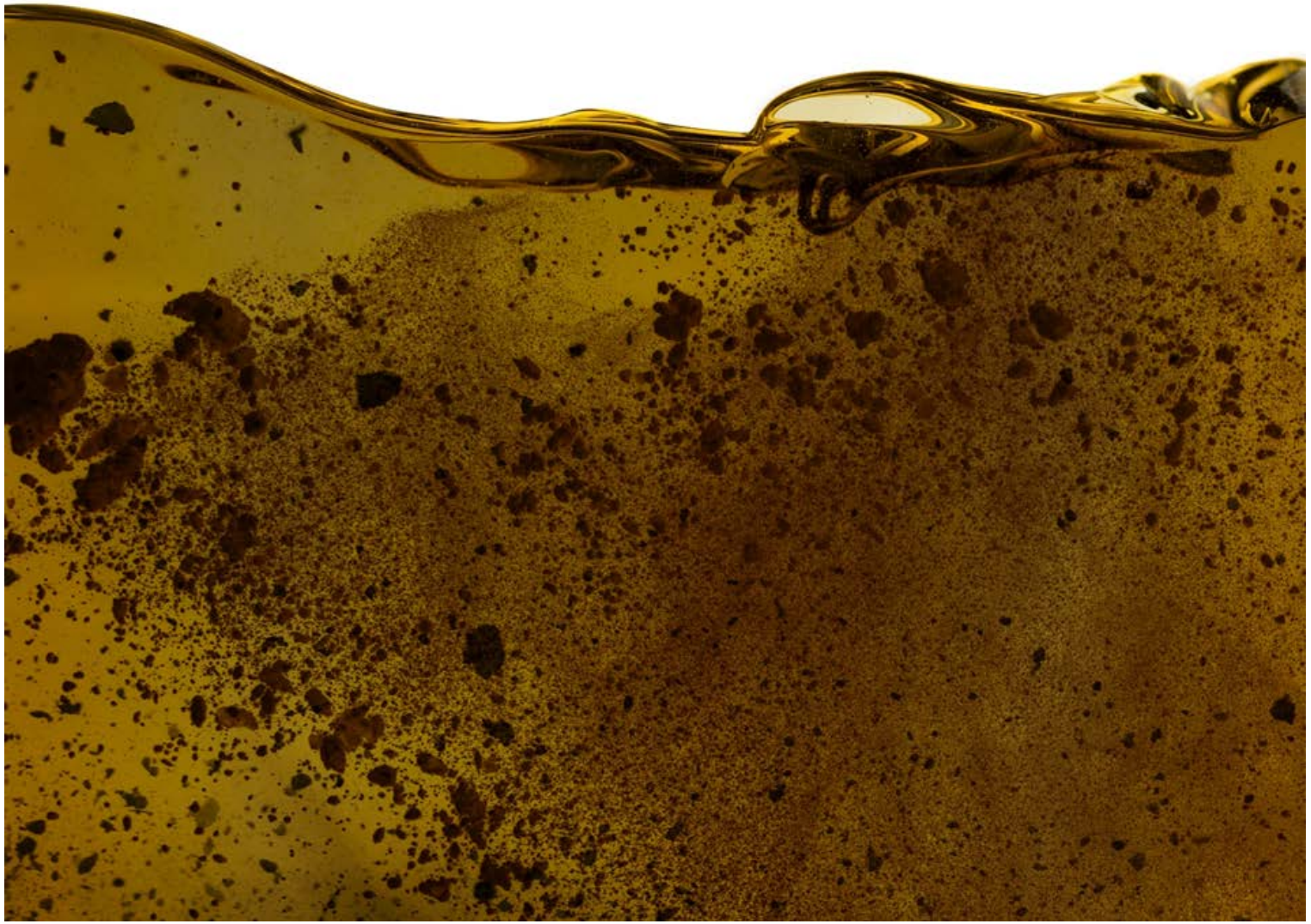
- Nanofiltration
- Varnish removal
- Water removal

RECONDOIL BOX

RecondOil Box is an offline kidney loop solution

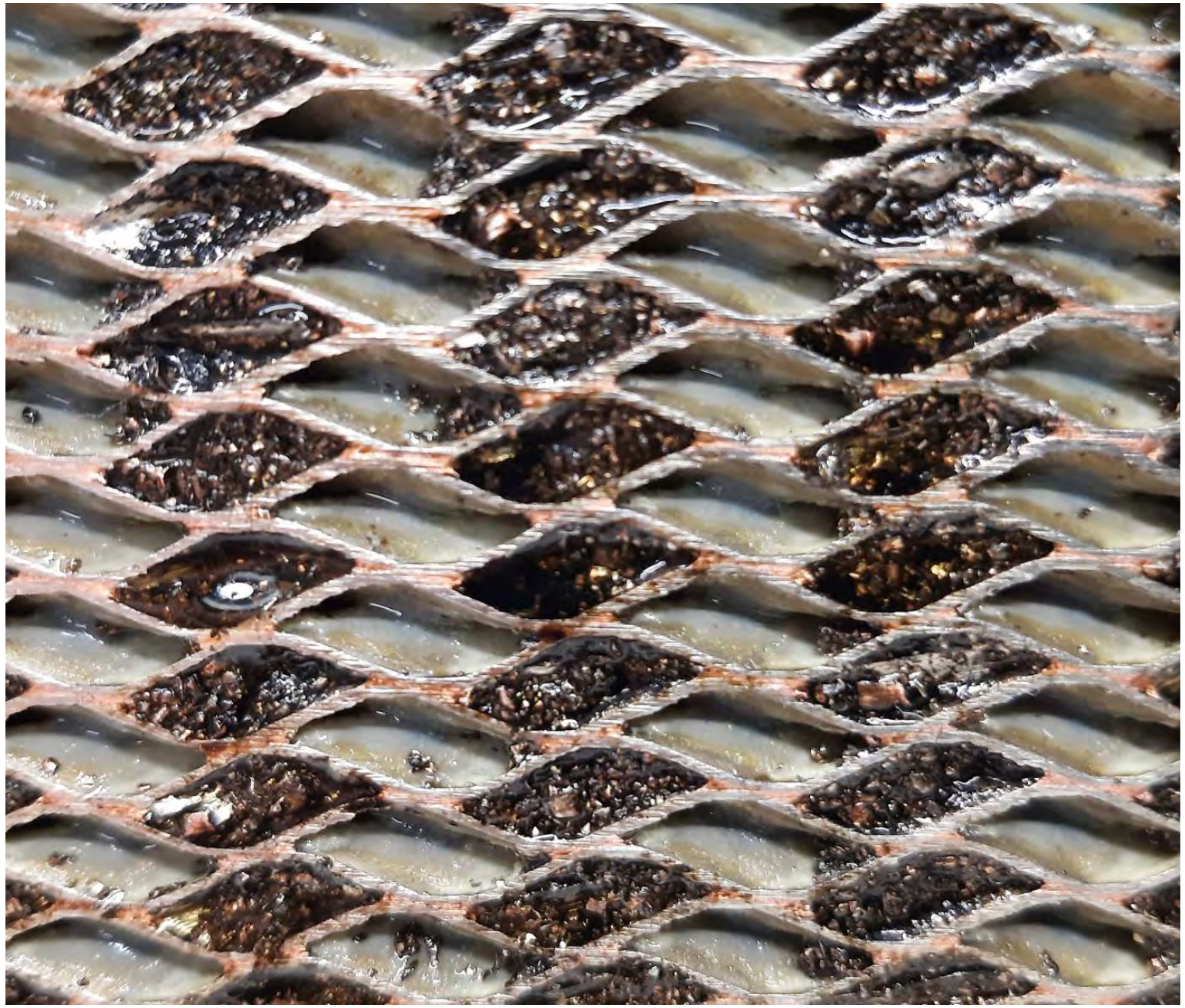






Nano filtration

- Prevents the oxidation process
- Reduces risk of varnish formation
- Reduces wear of mechanical components
- Prolongs service life of system



Varnish removal

- Removes soluble and insoluble varnish
- Prevents filter plugging and valve sticking
- Enables cooler operational oil temperature
- Improves equipment performance and reliability

Water removal

- Removes free, bound, and emulsified water
- Controls viscosity
- Protects components from corrosion
- Mitigates risk of foaming

Flexible configurations

Up to 8 filter housings

depending on tank volume and viscosity

RecondOil Box standard offers

Your current situation determines the solution:

- ☐ DST compatible oil
- ☐ DST certified oil
- ☐ Not compatible oil

We combine a **product solution**:

- ☐ RecondOil Box
- ☐ DST-activated filter
- ☐ Depth filter
- ☐ Additive package
- ☐ SKF oil

We agree on a **service level**:

- ☐ Light service
- ☐ Premium service

We agree on a **payment model**:

- ☐ Subscription fee
- ☐ Fixed service fee

Standard	DST	DST+
	☑ *DST compatible oil*	
		☑ *DST certified oil*
☑ *Not compatible oil*		
☑ *RecondOil Box*	☑ *RecondOil Box*	☑ *RecondOil Box*
☑ *Depth filter*	☑ *DST-activated filter*	☑ *DST-activated filter*
		☑ *Additive package*
☑ *Light service*	☑ *Light service*	
		☑ *Premium service*
☑ *Subscription fee*	☑ *Subscription fee*	☑ *Subscription fee*

RecondOil®

SKF®

Begin the journey towards
a circular use of oil.

Install a RecondOil Box

What is clean oil?

Clean oil can only be determined by analysis.

Methods for analyses

Acid number

Anti oxidation

Foaming

Emulsification

Water

Viscosity

MPC

Wear metals

Additives

Particle counting

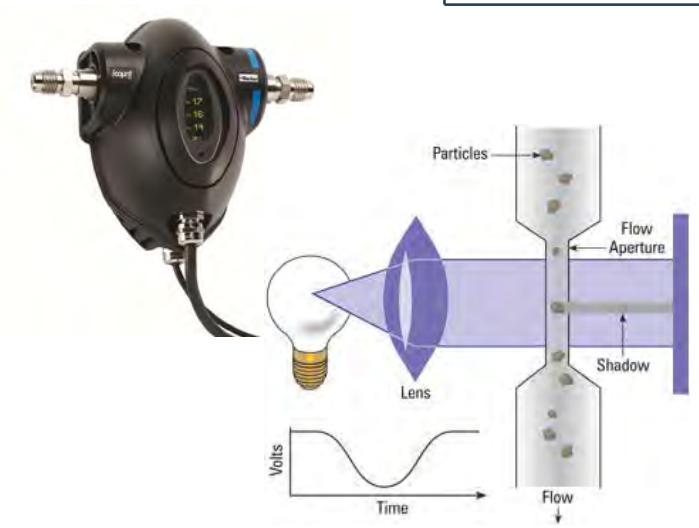
Gravimetrical cleanliness

New oil!!

Particle count ISO 4406

ISO 4406 count particles from sizes 4, 6 & 14 microns.

Example: 18/14/10



Qty from 4 micron

Qty from 6 micron

Qty from 14 micron

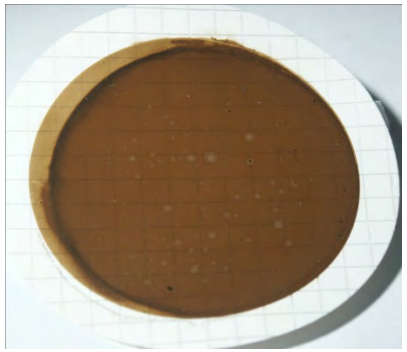
ISO class	Particles / 100mL	
23	4 000 000	8 000 000
22	2 000 000	4 000 000
21	1 000 000	2 000 000
20	500 000	1 000 000
19	250 000	500 000
18	130 000	250 000
17	64 000	130 000
16	32 000	64 000
15	16 000	32 000
14	8 000	16 000
13	4 000	8 000
12	2 000	4 000
11	1 000	2 000
10	500	1 000
9	250	500
8	130	250
7	64	130
6	32	64
5	16	32
4	8	16
3	4	8
2	2	4
1	1	2
0	0	1

What do SKF say? 0,5 micron

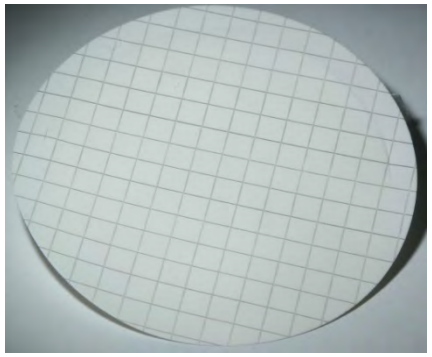
Gravimetrical test ISO 4405

Particle weight in oil
Picture of a sample (0.8 micron)
Unit is mg/100ml
Sample shows particles of mechanical and chemical composition. The chemicals are diluted with a solvent and each part is weighed to determine the levels.

Before cleaning



After cleaning



Varnish Potential Test (MPC) ASTM 7843-21

Standard Test Method for Measurement of Lubricant Generated Insoluble Color Bodies in In-Service Oils using Membrane Patch Colorimetry

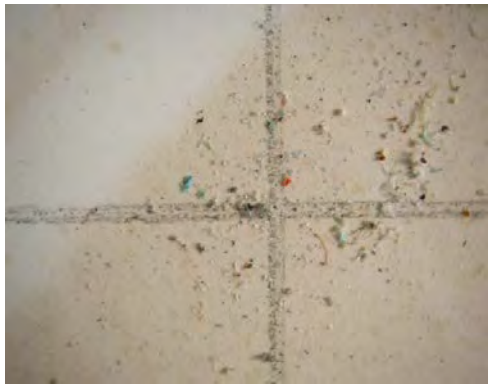
This test method extracts insoluble contaminants from a sample of in-service oil onto a patch and the color of the membrane patch is analyzed by a spectrophotometer. The results are reported as a ΔE value, from 0 (white) to 100 (black).

Rule of thumbs;
<15 = Good
15-25 = Monitor
25-35 = Abnormal
>35 = Critical

<10 | 10-20 | 25-35 | >35

What is clean oil?

New oil!!



ISO 4406 18/16 (5&15 micron)

Client sample of ”clean oil”

ISO 4406 12/8 (5&15 micron)

Definition of clean oil depends on method of analysis !

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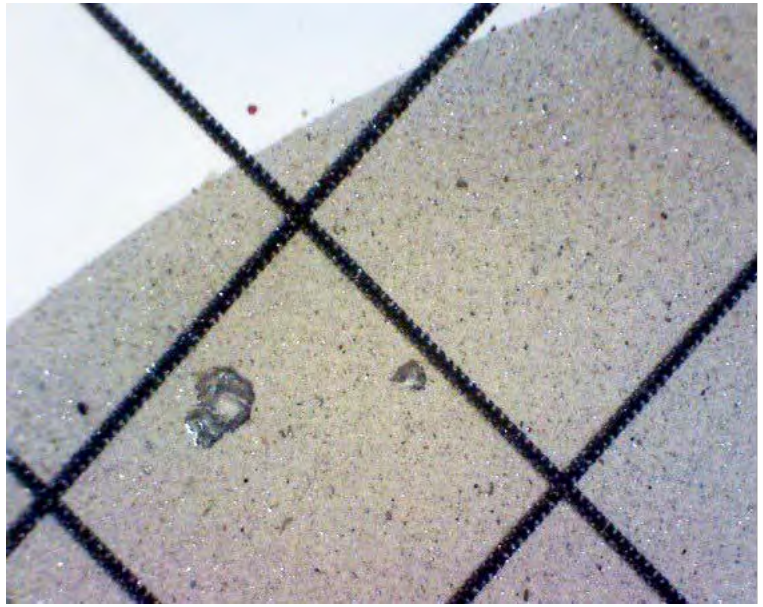
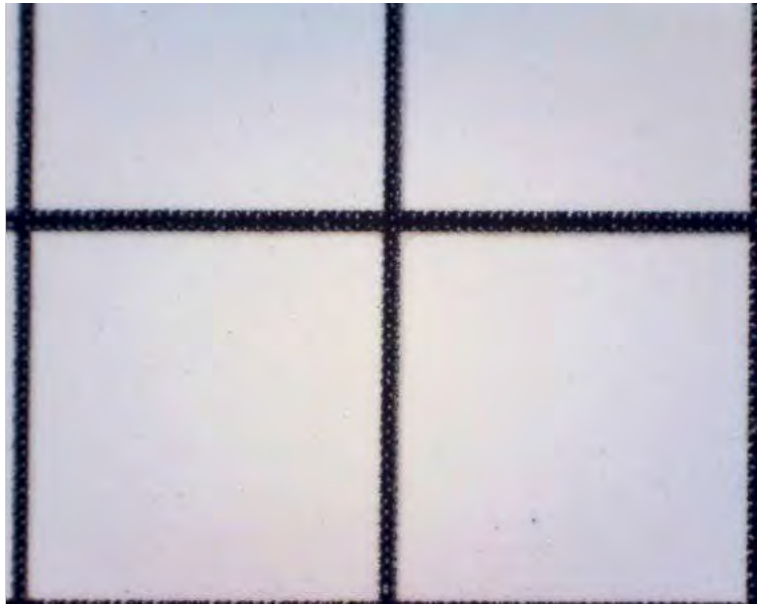
Typical result with off-line oil cleaning.



New oil (in use 30 min)



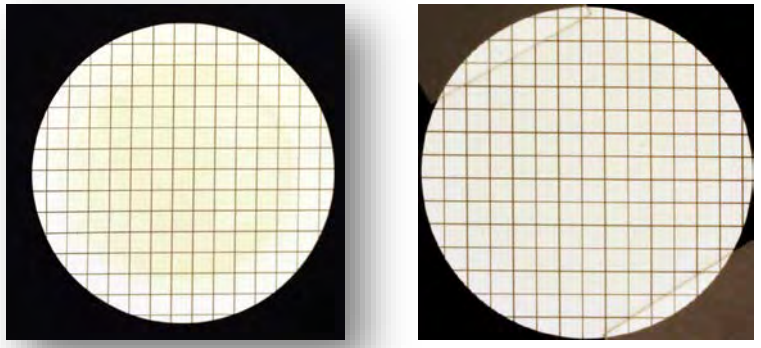
After 3 days cleaning

Power plant, Swe, Port pellet crane, Gearbox 200L

Importance of conditions during sampling and analysis!

Client: Holmen Paper AB
Bråvikens Paper mill
Object: Nipco F
Oil volume: 3 m3 with
Mobilgear 600 XP 100
Filter: In-line 3 µm full
flow filter

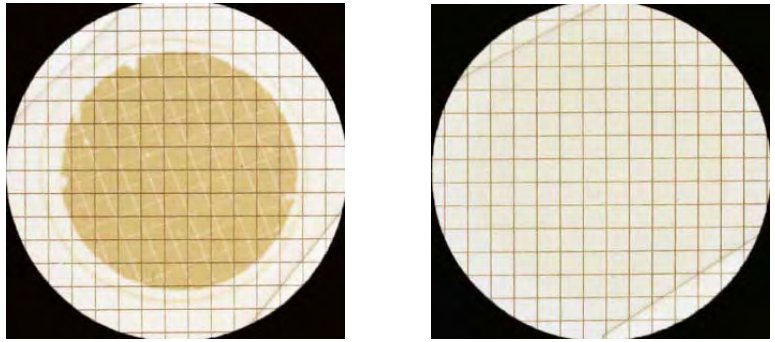
Filter patch 0,8 micron



At start

After 1 months cleaning

Filter patch 0,45 micron



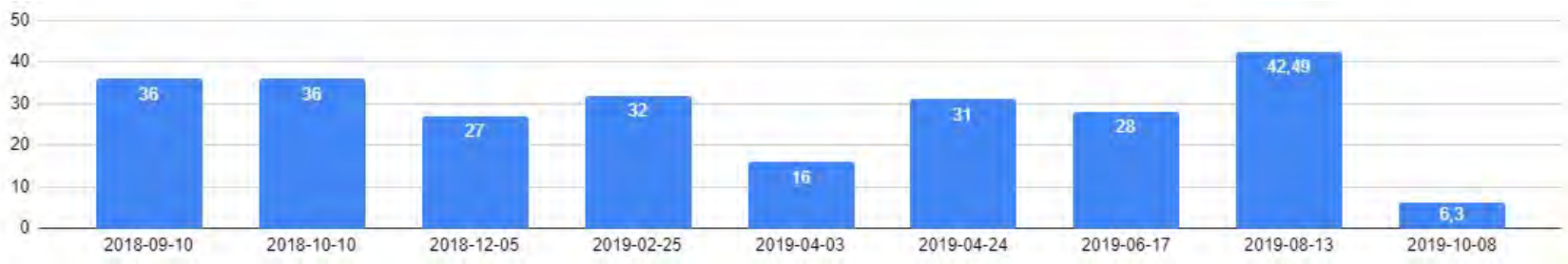
At start

After 1 months cleaning

Understanding the “Washing Effect”!

During start of a deep filtration cleaning process, a curve presenting values up and down for both particles and oxidation/varnish is often revealed.

Table below is from a analysis programme with MPC as target to reach below 25.



Oil cleaning is not a “Quick Fix”, it should be looked at as a maintenance solution.
Asset Management System

Table above from a reference case with 7000L in a paper mill, see our booth No 117 for more information.

Oil as a service for green energy producer

The Problem

- Short oil life, approximately 4 years
- Oil contaminated by particle ingression
- Contamination causes leaks and component failures

The Solution

- Oil cleaning with RecondOil Box with depth filter
- Oil condition monitoring and analysis
- Oil as a service contract (2 years)

Expected results in first 2 years

- CO2 emissions reduced by 5,2 tonnes
- Maintenance cost reduction by €17 900
- Increased machine availability, value of €5000

Customer:
Westenergy Finland

Industry:
Energy production

Application:
Critical hydraulic system

Two filter possibilities

		Depth filter	DST-activated depth filter
Remove particles	*Deep filtration* *Particles > 0.1µm*	✓	✓
	Nano polishing *Particles < 0.1µm*		✓
Remove varnish	*Insoluble varnish*	✓	✓
	Soluble varnish		✓
Remove water	*Water removal* *Water content <1000ppm (DST)* *Bound, emulsified & free*	✓	

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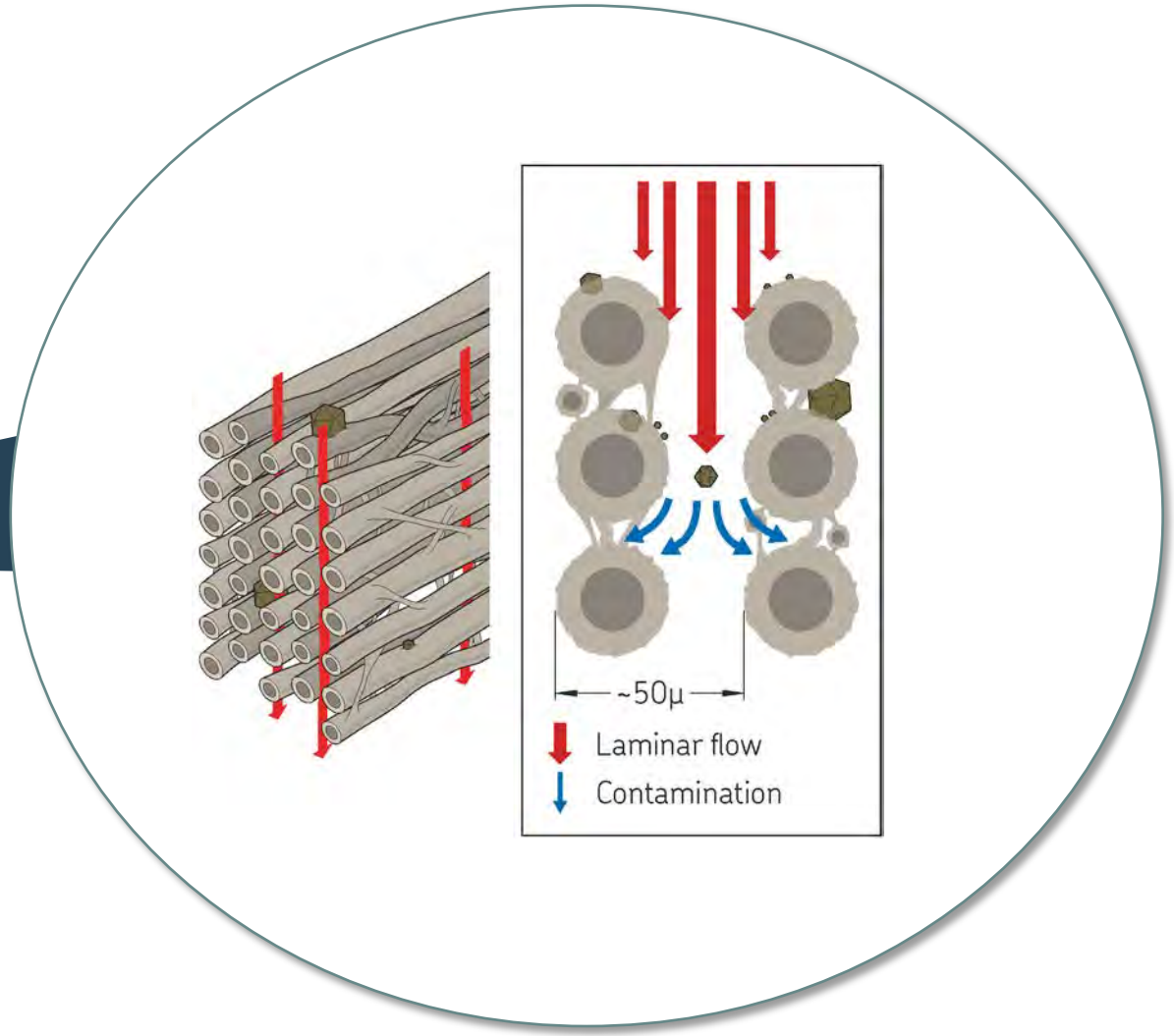
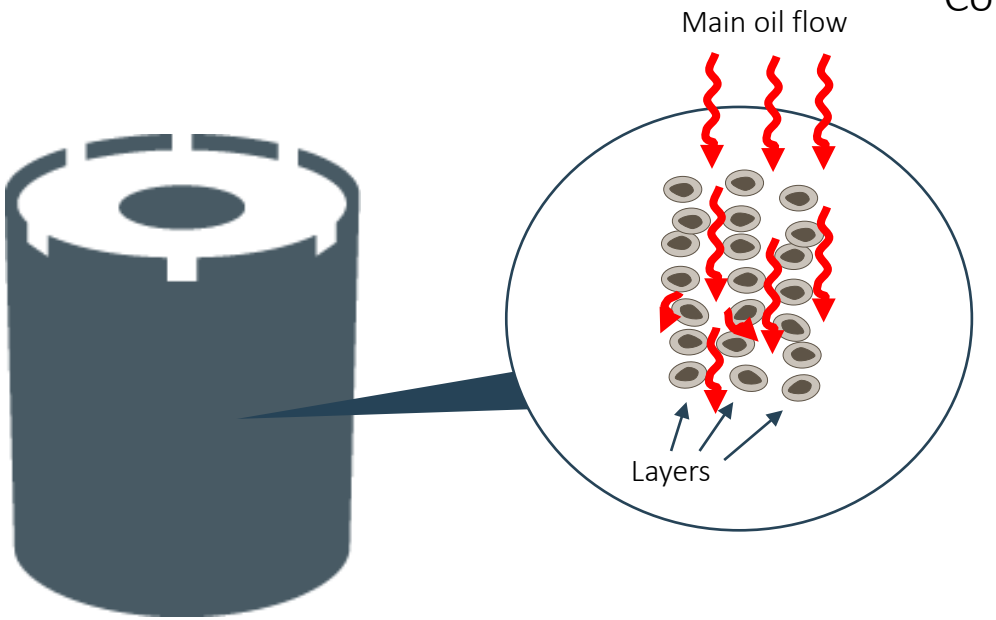
Depth filtration



Type #1: Depth filter



Adsorption

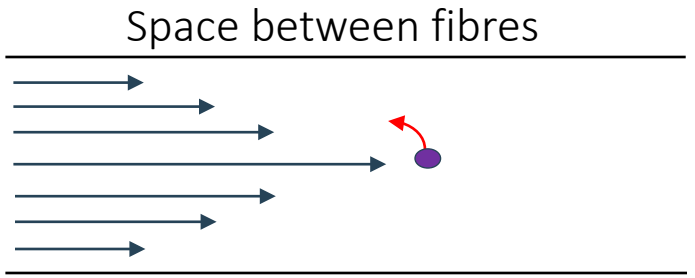
Contaminants stick to the fibres.

Absorption

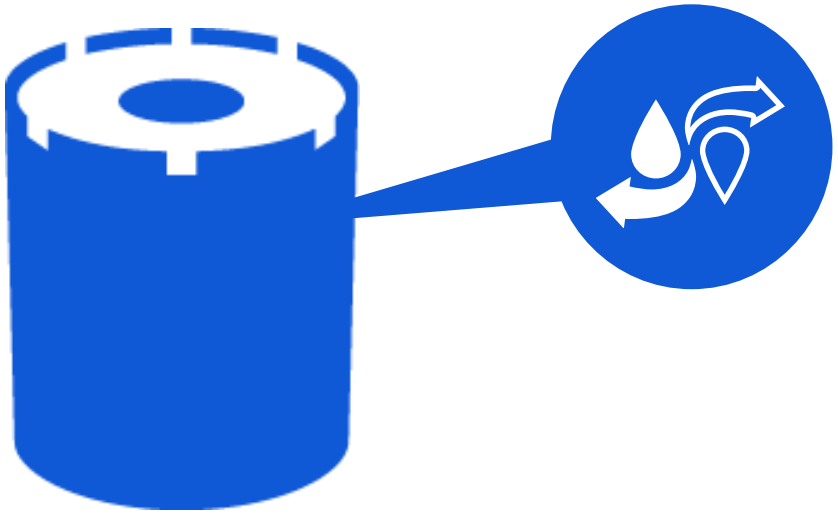
Water is absorbed into the fibres.

Laminar flow effect

Laminar flow effect moves particles to fibre walls



Type #2: DST-activated depth filter

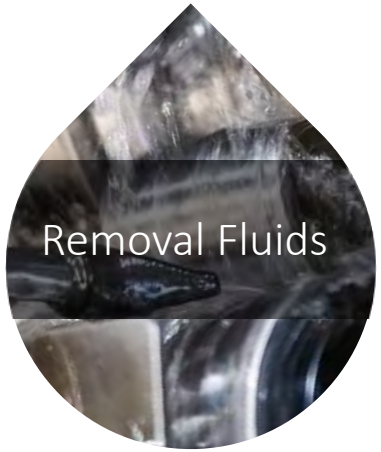


Enhanced adsorption

DST activation bonds a chemical booster to the cellulose fibres – increasing their adsorption properties and intensifying surface activity.

As a result, even the tiniest particles can be captured within the filter – including particles <0.1µm and soluble varnish.

SKF RecondOil Systems & Applicati



Honing, grinding, cutting

Cold rolling, cold forming: stamping, drawing, forging

Quenching

RecondOil DST Integ

RecondOil DST Stand-Alone

RecondOil Box

RecondOil®

SKF®

Integrated DST system

RecondOil®

SKF®

Stand-alone DST system

SKF tests show DST reducing wear of seals in hydraulic system

Accelerated lifetime tests for hydraulic systems

Performed by the SKF European product testing team in Judenburg (Austria)

Purpose of test:

- Evaluate the performance of SKF RecondOil's Double Separation Technology (DST) process on hydraulic oil and hydraulic seals

Results

- Significantly extended the lifetime of the original hydraulic oil (at least doubled)
- Improved lubrication performance
- Improved friction performance of seals

Oil analysis results from a customer installation

Mobil DTE 26

	Virgin oil	Used oil	ROBOX (week 2)	ROBOX (week 4)	ROBOX (week 8)
ISO 4406	21/20/18	28/28/28	14/13/10	15/14/11	14/13/11
MPC rating (dE value)	28/28/28	52.8	12.1	- - -	5.4
Total Acid Number (mg KOH/g)	0.56	0.62	0.56	0.50	0.50

Stena Forth

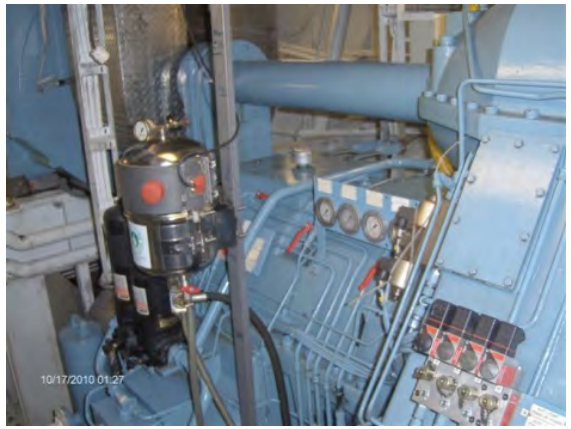
120,000 litre system pumping 22,000 L/min full uptime 24 hours a day

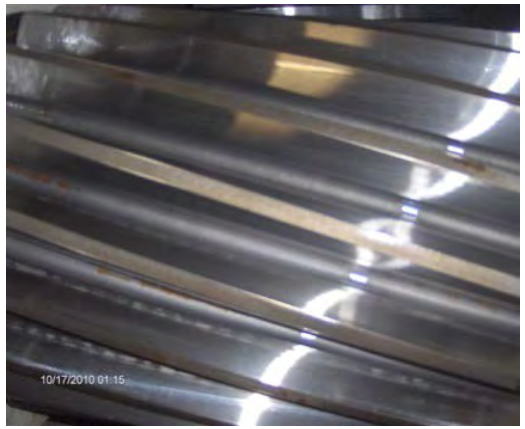
Result in less than 3 months: Reduction from 19/17/14 to 14/12/09

	Particle Count (particles/mL)										Ad		
Sample #	ISO Code Based On 4/6/14	> 4 µm	> 6 µm	> 10 µm	> 14 µm	> 21 µm	> 38 µm	> 70 µm	> 100 µm	Test Method	Water by Karl Fischer - 6304C ppm	MPC	MPC Weight g
1	19/17/14	2955	780	245	115	41	5	1	1	Laser	63	[illegible]	0.0047
2	17/14/11	677	134	27	12	5	2	0	0	Laser	48	[illegible]	0.0125
3	14/12/09	141	23	5	3	1	0	0	0	Laser	44	[illegible]	0.0148

Comments are advisory only and are based on the assumption that the sample and data submitted are valid. Missing fluid or component infc
expressed or implied.

Ship Gear box (in operation 34000 h with Europafilter oil cleaner)





Machine: Scana Volda, 2000Kva, 1800 Kw

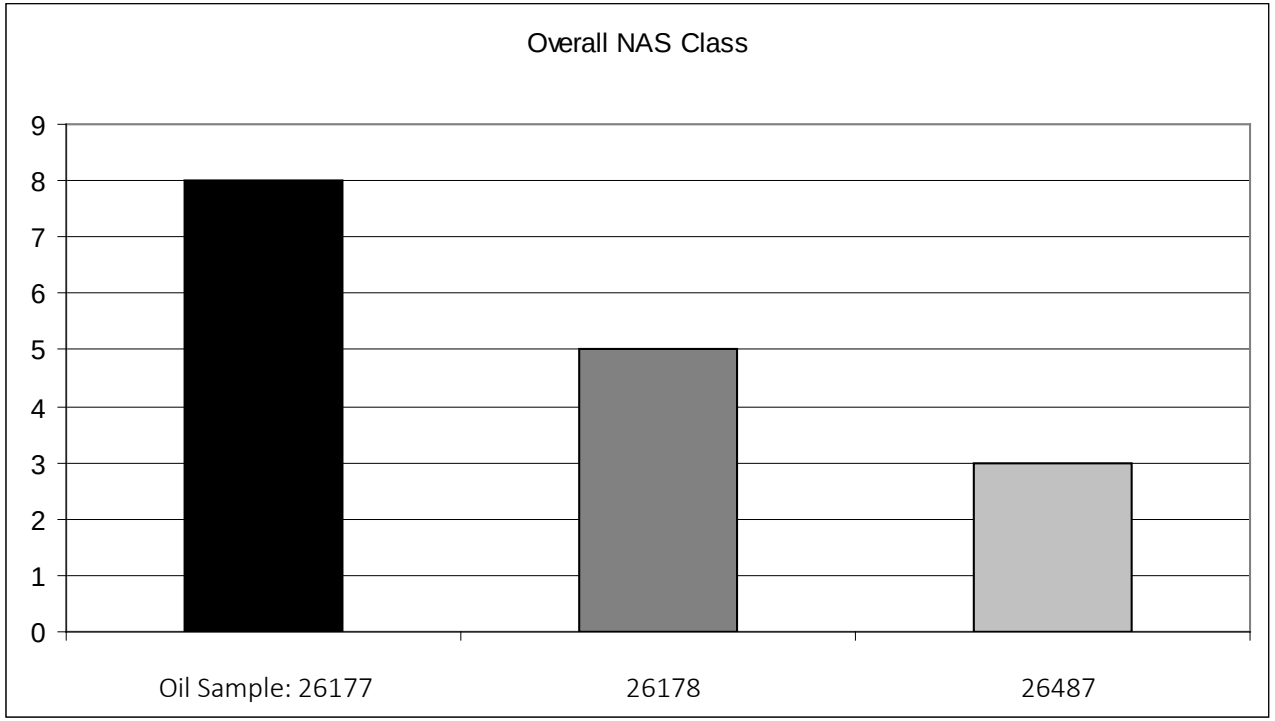
Lubricant: Mobilgear XP 600 100

Company:
Drønen Havfiske AS

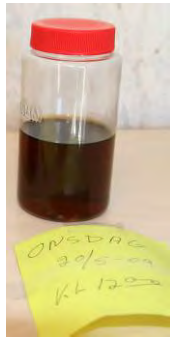
Vessel: MS Storeknut

Bow port hydraulics on Car Ferry

Bow port hydraulics on Car Ferry

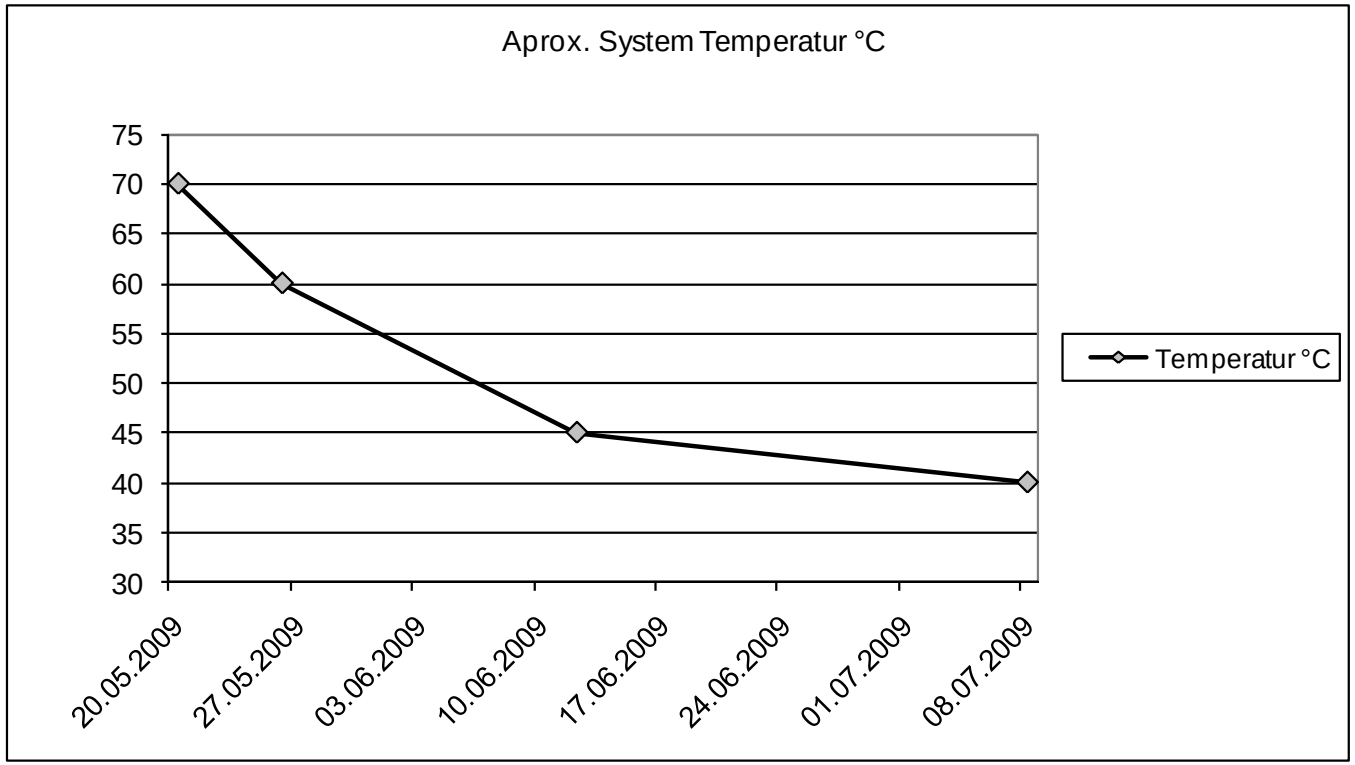


Excelent result of particle decrease level



Bow port hydraulics on Car Ferry

Approximate temperature of the oil reservoir



The Viscosity has due to the temperature decrease increased from 13 cSt to 34 cSt. This is accomplished without any increase of the oil's traction properties. This is very positive for the energy consumption and lubrication of all the machine internal components as well as oxidation speed.

RecondOil®

REFERENCE

CUSTOMER

Undisclosed RoPax ferry operator

Contact: Europafilter

SYSTEM

System name: Port CPP system
Oil type: Texaco Meropa
Oil volume: 1800 L

PROBLEM: Contamination including water

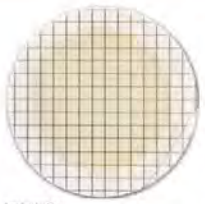
Client had high contamination levels of particles and water. 18,2 mg/100mL (0,45micron patch) (ISO-4405) and 2010ppm water (KF).

RESULT BEFORE CLEANING

Client decided to install a EF2125D system to restore a good quality and maintain the properties of the oil in use.

RESULT AFTER 90 DAYS

After 90 days, the water content was reduced to 1185 ppm, particulates lowered. After 180 days from start, water was at 95ppm and particulates 4,1mg/100mL (0,45micron patch)



EUROPAFILTER
KEEP IT CLEAN

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www.europafilter.com

REFERENCE STUDY
MARINE

SKF®

tide

CLIENT

Tide sjø in Norway is a subsidiary company
of Tide ASA with a fleet of 80 vessels.
MF Fedjefjord is a ferry transporting cars between Fedje and Sævrøy

Contact: Chief Engineer Einar Støldal

SYSTEM

Gear box 1 - Schottel STP1010RL
Oil volume 1700 liters
Mobil gear 150 cSt oil

CHALLENGE

ABNORMAL WEAR AND PROBLEMS WITH OVERHEATING

Tide sjø experienced a number of problems with their thruster gear box on the MF Fedjefjord ferry. There were signs of abnormal wear and problems with overheating, and valve failures
occurred. The oil analysis showed that the lubrication oil in the gear box was very contaminated.

SOLUTION

EUROPAFILTER'S KIDNEY LOOP OIL FILTRATION

Europafilters EF2115 kidney loop oil filtration unit was assembled in an offline circuit, treating the lubricant continuously while the ferry was still in operation.

RESULT

ELIMINATED PROBLEMS AND ECONOMICAL SAVINGS

The results gave large savings for Tide sjø, both economical and environmental.
The wear on parts decreased considerably, the problems with overheating were eliminated and the valve function was restored again. The NAS 1638 went from class 8 to class 5; the iron content went from 58mg/kg to 10mg/kg and the water content from 90 ppm (Karlfisher) to 65 ppm (Karlfisher). The system shows continuously good operating conditions for the gear box after the installation.

EUROPAFILTER
KEEP IT CLEAN

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RecondOil®

REFERENCE STUDY
MARINE

tide

CLIENT

Tide sjø in Norway is a subsidiary company of Tide ASA with a fleet of 80 vessels. MF Hardingen is a ferry, trafficking Hordaland on the Norwegian west coast

Contact: Chief Engineer Einar Støldal

APPLICATION

Hydraulic power unit - Bow hydraulics

CHALLENGE

OVERHEATING, NOISES AND TROUBLE WITH VALVE MANEUVERS

Onboard MF Hardingen, one of the hydraulic power units that operate the bow hydraulic port was overheating and making a lot of noise during operation.
The high temperature caused varnish deposits to build up rapidly within the hydraulic system, creating trouble with valve maneuvers and interfering with the hydrostatic balance within the oil system.

SOLUTION

AN EUROPAFILTER OIL FILTRATION UNIT

In order to solve the noise and overheating problems, an Europafilter oil filtration unit was connected to the oil reservoir. The unit cleaned the contaminated oil causing the overheating and loud noise. A vast amount of contamination was removed from the hydraulic oil system. Varnish deposits were efficiently removed and the temperature reduced.

RESULT

A DECREASE OF TEMPERATURE FROM 70°C TO 40°C

Six days after the installation, the temperature had decreased from 70°C to 45°C, and the NAS value had gone from 8 to 4. After another 43 days with the Europafilter installed, the temperature were down to 40°C and the NAS value was 3.
The problems disappeared with the new safe operating conditions and a cleaner oil system - giving less wear, friction, energy consumption and noise in the machine room environment.

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REFERENCE STUDY
MARINE

SKF®

CLIENT

Drønen Havfiske AS , "MS Storeknut"

Contact: Reidar Vassnes (chief engineer)

SYSTEM

Scana Volda 2000 Kva, transmission gearbox with Mobilgear XP 600 oil.

CHALLENGE

EXTEND THE LIFETIME OF THE GEARBOX

Transmission gearbox was assembled onboard "MS Storeknut" in 1996.
The gearbox has operated approximately 15000h before the EF system installation took place.

SOLUTION

AN EF2110V WITH PRESSURE REDUCER

Europafilter was installed in January 2006 and no oil changes have been made since. The oil has been in operation for 34 000 hours on the gearbox with the EF system in service. Total time of operation on the gearbox is 50 500 hours.

RESULT

CLEAN LUBE CLEANS THE GEARBOX

It is common that machine components are very clean when the lubricant system is treated with the EF system. When oil is as clean as new it keeps its deterging quality and cleans the system and its components, this happens thru natural cleaning additives in the oil and "washes" away varnish / resin.

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