

Nanoparticle removal improves compressor oil performance

How RecondOil's Double Separation Technology (DST) removes nanoparticles minimising compressor degradation.

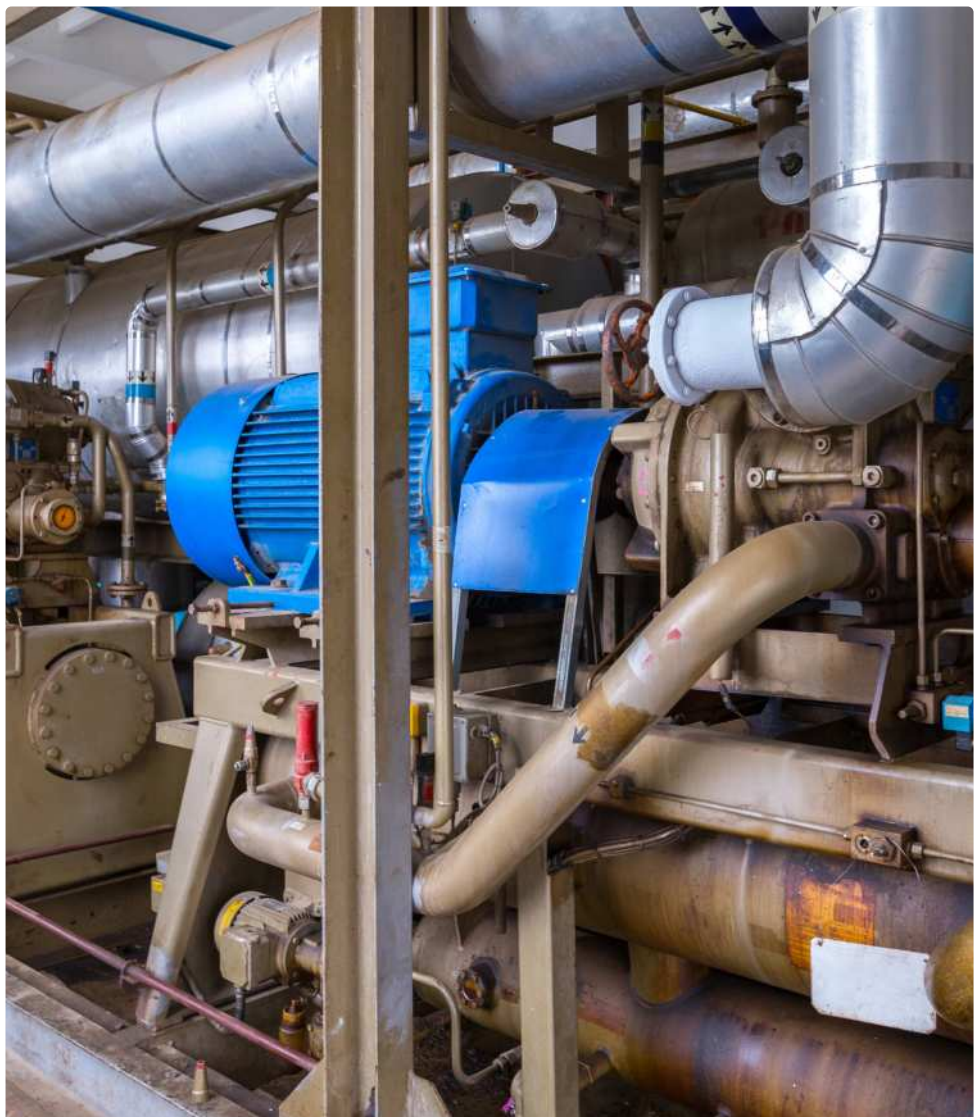
The role of nanoparticles in compressor oil degradation

Compressors are indispensable across industrial operations – powering refrigeration, manufacturing and countless process systems. Their performance and reliability directly affect productivity, energy efficiency and safety.

Yet one of the most common causes of compressor failure is overheating, often linked to dirt buildup and lubricant degradation. Lubricants play a critical role in controlling heat, minimizing wear and removing contaminants. When oil quality deteriorates, friction rises, components wear faster, and both uptime and efficiency suffer.

Building on growing evidence of the role of nanoparticles in **lubricant breakdown**, this study examines how SKF RecondOil's Double Separation Technology (DST) restores compressor oil performance by removing contaminants down to the nanoscale.

The findings show that DST not only improves oil cleanliness but also restores vital functional properties – extending oil life, improving compressor reliability, and supporting a circular use of oil.





Nanoparticles – the overlooked catalyst of oil degradation

Compressor oils degrade through oxidation, heat stress and contamination. Over time, these processes generate acidic byproducts, varnish and microscopic wear particles that conventional filtration cannot remove.

Among these contaminants, nanoparticles – ultra-fine oxidation and wear debris – play a particularly destructive role. Because of their high surface reactivity, they accelerate oxidation and catalyze further degradation of additives and base oil molecules. Once present, they form a self-sustaining cycle of wear and chemical instability.

DST interrupts this cycle. By continuously removing even the smallest reactive particles, it prevents further oxidation and stabilizes the oil, effectively keeping it in a 'like-new' condition for extended periods.

40%

Oil can account for 5% of your maintenance budget, but affects 40% of maintenance costs.

Study design:

New, used, and DST-treated compressor oil

To quantify the effect of nanoparticle removal, three oil samples were compared from a rotary screw air compressor operating at 85 °C, with an oil sump <100 L and a glass fiber filter:

- New oil – baseline performance.
- Used oil – after 1 000+ hours in operation.
- DST-treated oil – used oil regenerated using RecondOil's DST.



Physicochemical results:

Restoring oil quality beyond used condition

Laboratory analysis confirmed significant recovery in key oil health parameters following DST treatment.

DST-treated oil not only regained its cleanliness but also exceeded the oxidation stability of the new oil. The sharp drop in TAN and MPC values confirms the removal of degradation products and varnish precursors – restoring the lubricant’s chemical balance and integrity.

Analysis	Unit	Method	New	Used	DST	Effect
Particle count		ISO 4406	17/16/10	18/16/13	17/15/12	Restored to new oil level
MPC rate	ΔE	ASTM D7843	0.4	8.4	3.6	Lower varnish potential
RPVOT	min	ASTM D2272	946	792	951	Improved oxidation stability
TAN	mg KOH / g	ASTM D974	0.06	0.78	0.46	Reduced acidity

Tribological performance:

Restored lubricity and surface protection

1. Friction behaviour (MTM test)

The Mini Traction Machine (MTM) evaluated oil performance under boundary (BL) and elastohydrodynamic (EHL) lubrication regimes.

- The friction coefficient was 20% lower in DST-treated oil compared to used oil.
- Performance closely matched new oil, indicating restored lubricity and film strength.

2. Micropitting resistance (MPR test)

DST-treated oil demonstrated:

- 60% less wear compared with used oil.
- 30% lower weight loss from micropitting.
- Visibly lower micropitting severity, confirming restored anti-wear properties.

3. Wear resistance: Four ball test

Wear testing showed smaller wear scar diameters in the DST-treated oil compared with the used oil – a clear sign of recovered wear protection under high-load conditions.



Findings:

Nanoparticle removal restores compressor oil performance

Together, these results confirm that removing nanoparticle contaminants not only cleans the oil but actively restores its functional performance, extending its service life and reliability.

- **Restored oil properties** – oxidation stability, TAN, and varnish potential improved.
- **Reduced friction** – up to 20% lower compared to used oil.
- **Improved wear protection** – reduced wear scar diameters and micropitting.
- **Supported sustainability** – extends oil service life, lowers consumption, and reduces waste.





Implications for industry:


Turning oil care into a performance advantage

By turning oil maintenance into a performance advantage, DST redefines lubricant management for compressor operators – shifting from reactive oil replacement to proactive oil regeneration that supports both operational efficiency and circular sustainability goals.

DST enables:

 Extended oil life – less frequent replacement and lower operating costs.

 Improved compressor reliability – reduced risk of overheating and failure.

 Sustainability benefits – less waste oil and reduced environmental impact.

Conclusion:

A cleaner path to compressor reliability

This study confirms that RecondOil DST effectively restores compressor oil properties to near-new condition – reducing wear, extending lubricant service life and improving compressor reliability.

By addressing nanoparticle contamination at its root, DST transforms lubrication from a consumable into a sustainable asset – enabling compressors to run longer, cleaner, more safely and more efficiently.



Curious about the details?

Download our “circular use of oil” brochure [here](#).

skf.com

© SKF and RECONDOIL are registered trademarks of AB SKF (publ).

© SKF Group 2025. All rights reserved. Please note that this publication may not be copied or distributed, in whole or in part, unless prior written permission is granted.

Every care has been taken to ensure the accuracy of the information contained in this publication, but no liability can be accepted for any loss or damage whether direct, indirect or consequential arising out of the use of the information contained herein.

PUB LS/S7 20236 EN · November 2025

Certain image(s) used under license from shutterstock.com