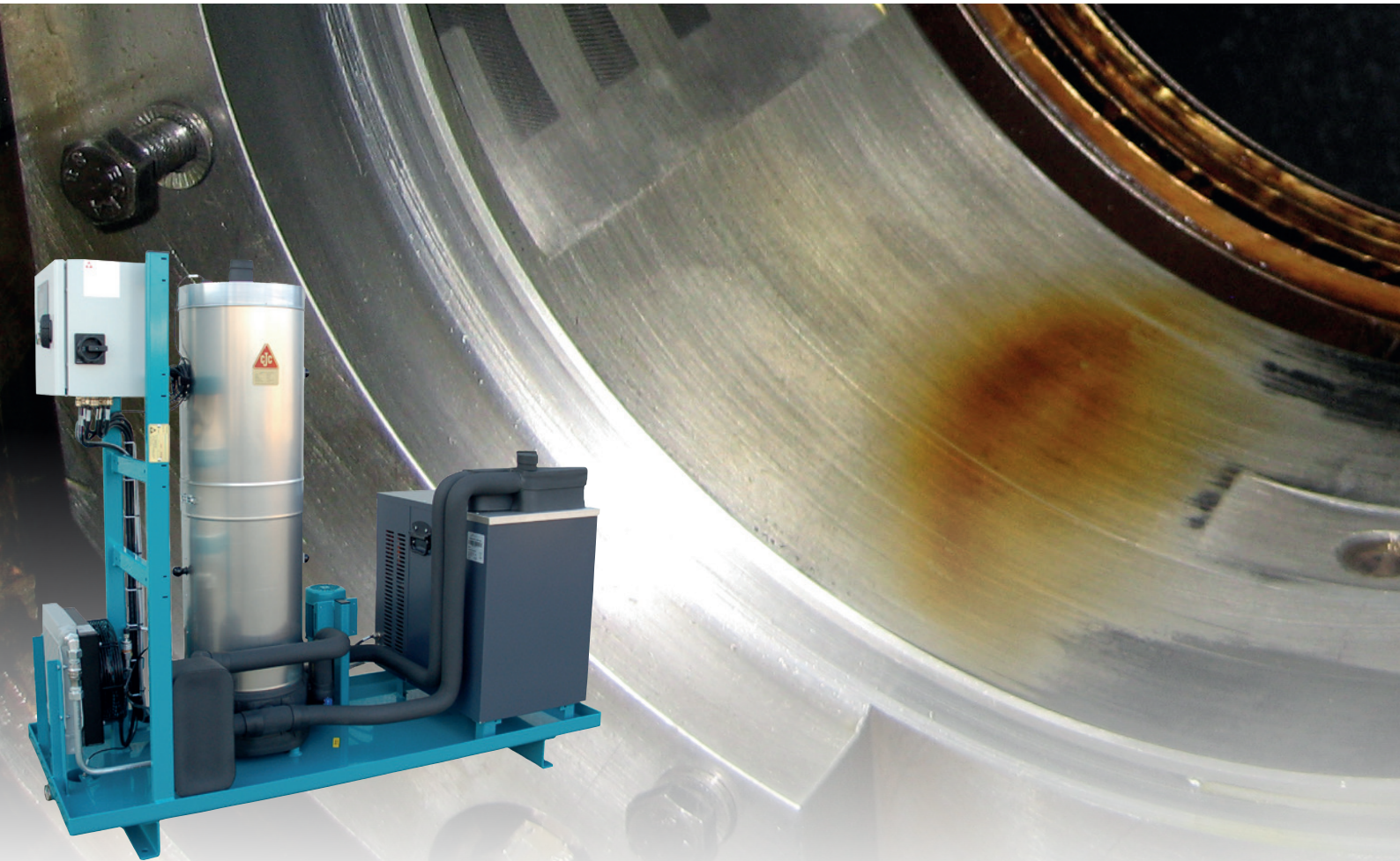




CJC® Varnish Removal Unit

Remove varnish efficiently as preventive maintenance



Oil-Care Systems
for lubrication and hydraulic systems



www.cjc.de



The Problem

Oil degradation | clogged in-line filters | sticky layers on valves |
Deposits on bearings | Malfunctions and downtimes

Varnish is a common problem in hydraulic and lubrication systems. The costs for production losses caused by varnish are often very high.

The pre-cursors of varnish, so-called soft contaminants, are created during the oil degradation process. The speed of the oil degradation process depends on oil type (base oil and additive package), load (operation temperature and pressure) and catalytical factors as e. g.:

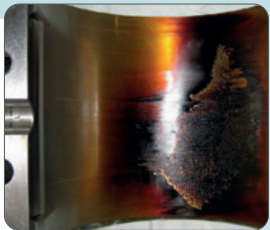
- Oxidation
- Water
- thermal load
- Copper, iron and aluminium particles (component wear)

Soft contaminants are dissolved or suspended in the oil, depending on the solubility in the base oil, temperature and flow rate. Undissolved reaction products form agglomerations and lead to deposits within the system (varnish, sludge) especially on hot and cold spots, i. e. in stress zones, areas without flow and small passages as e. g.:

- Valves
- Coolers
- In-line filter
- Bearings
- Tubes
- Tank walls

The temperature dependency leads especially in oil systems with start-stop operation, i. e. temperatures < 40 °C over several hours or days, to increased precipitation of the dissolved compounds and thus to an even heavier deposit. Varnish is the description for resin- and varnish-like deposits, which forms a stable, sticky layer on metal surfaces to which particles adhere and create a sandpaper effect so that the wear rapidly increases.

To avoid the formation of varnish, both the suspended as well as the dissolved soft contaminants should be removed. Dissolved soft contaminants, typically at oil temperatures above 40 °C, cannot be removed by conventional mechanical or electrostatic filters.



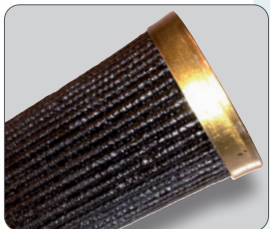
Bearing-seat with varnish



Valve punger with varnish



Heat exchanger with varnish



In-line filter with varnish

Impact of varnish

- decreased machine reliability and unscheduled downtimes
- reduced service life of components ► increased maintenance
- Malfunctions of valves ► worse controllability ► Failures during the start
- changed geometry of the bearing ► increased wear ► higher temperatures
- efficiency-loss of the coolers ► higher oil temperatures ► oil degradation
- clogged in-line filters ► frequent filter replacements and higher oil temperatures ► oil degradation
- blocked oil pipelines/tubes and drilled holes
- Sealing problems
- Increase of viscosity and acid number ► lower lubricity, corrosion
- reduced service life of the oil ► regular system flushings and tank cleanings

The MPC-Test (Membrane Patch Colorimetry according to testing standard ASTM D7843)

The MPC-Test developed for turbine lubrication oil is also applicable for other lubrication oils and hydraulic oils. The higher the MPC value, the heavier the colour change on the membrane and the higher the potential of the oil to generate deposits like varnish and sludge. Information how to determine the MPC-index available on request.

| 0 - 10 | 11 - 25 | 26 - 30 | 31 - 45 | 46 - 50 | 51 - 55 | 56 - 60 |
|------------------------|---------------------------------|---|---|--|--|----------------------------------|
| NORMAL | MONITOR | CRITICAL ► NEED FOR ACTION | | | | |
| Normal oil degradation | Critical value is achieved soon | Many soft contaminants, formation of deposits | Extremely high amount of soft contaminants, formation of deposits | Formation of deposits and generation of further particles due to abrasive sandpaper effect | Deposits on bearings, valves, in tanks, etc. well-advanced | Deposits in the whole oil system |
| | | | | | | |
| MPC value 2 | MPC value 19 | MPC value 35 | MPC value 41 | MPC value 49 | MPC value 53 | MPC value 60 |

The solution

high-efficient | reliable | easy to install | low-maintenance

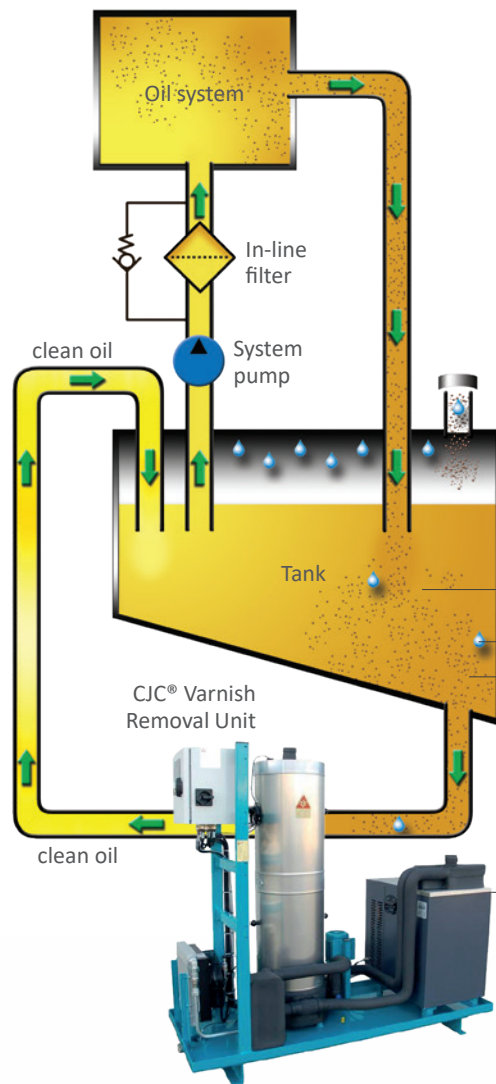
CJC® Varnish Removal Unit for oil care in the off-line circuit

The CJC® Varnish Removal Unit (VRU) removes soft contaminants – undissolved and dissolved – with revolutionary high efficiency from the oil. The VRU is ideal for lubrication and hydraulic oils.

The cellulose fibres of the optimised CJC® Fine Filter Insert VRi have an immense polar attraction. Any additional load on the oil, energetically or chemically, which could have a harmful impact on dissolved additives, is avoided.

The warm oil is drawn from the lowest point of the tank and continuously conditioned and filtered in the VRU until the oil is, released from varnish, returned to the system tank.

The clean oil dissolves further varnish from the system components with which it comes into contact so that varnish is wholly removed from the entire system. Due to the combination of filtration type, filter material and installation principle, high oil cleanliness classes and extremely low MPC values are achieved efficiently and within the shortest time.



Varnish

Soft contaminants – dissolved and suspended – are removed from the oil and the system components.

Wasser

Water – dissolved and suspended – is absorbed by the CJC® Fine Filter Insert VRi.

Particles

Solid particles are permanently retained between the cellulose fibres. The insert has a filtration degree of 3 µm with particle retention up to 1 µm.

3-in-1-solution

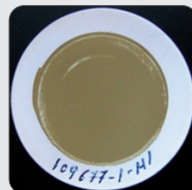
The specially developed CJC® Fine Filter Insert VRi, which is exclusively made of the natural material cellulose, can absorb and adsorb varnish as well as large amounts of particles and water.

BEFORE filtration - WITHOUT CJC® VRU

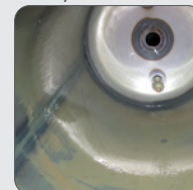
Turbine oil BEFORE
filtration with VRU



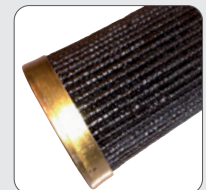
Millipore-membrane
MPC > 50



Varnish-like deposits
on metal surfaces
clearly visible



Varnish on
in-line filter



AFTER filtration - WITH CJC® VRU



Turbine oil AFTER
only a few weeks



Millipore-membrane
MPC < 10



Varnish-like deposits
were removed from
metal surfaces.



No varnish on
in-line filter

Best Practises

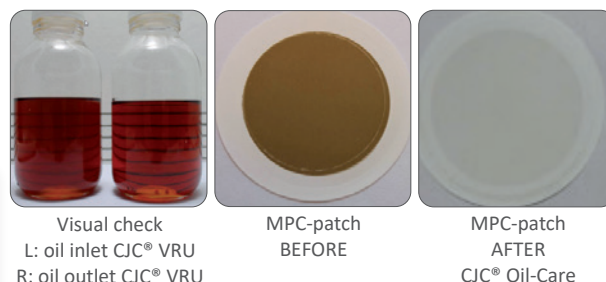
MPC value < 10 | no sticky valves | protect in-line filters |
avoid malfunctions and downtimes



Lubrication oil

ALSTOM gas turbine type GT8C2 (56 MW)
30,000 Litres turbine lubrication oil Shell Turbo CC 46

- Varnish-like deposits (varnish) on valves and bearings led to limited controllability of the gas turbine, especially during the heating period.
- Due to the continuous oil care with CJC®, an MPC value < 10 is permanently achieved.
- The flexible turbine start could be guaranteed again.
- Based on these convincing results two further Siemens steam turbines (oil volume: approx. 9,000 Litres) were equipped with CJC® Oil-Care Systems.

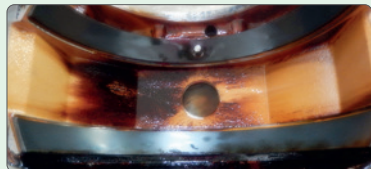


| | MPC value BEFORE | MPC value after CJC® Oil-Care |
|---------------------|---------------------|----------------------------------|
| Gas turbine GT8C2 | 54.9 | 3.8 |
| Steam turbine T8435 | 59.2 | 9.9 |
| Steam turbine T6192 | 32.8 | 7.8 |

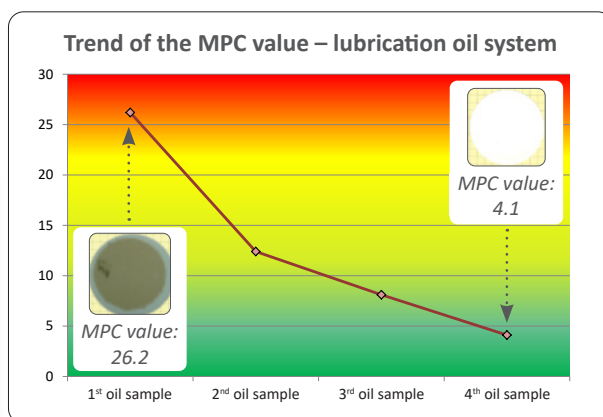
Lubrication oil

MAN steam turbine Marc® 2 C10
7,000 Litres turbine lubrication oil Aral Kosmol TF46

- Heavy varnish formation on components and in the tank lead to increased maintenance costs:



- After the commissioning of the CJC® Oil-Care System, significant regeneration of the MPC value from 26.2 to 4.1
- The clean oil solves already deposited impurities.
- The results and the immense savings potential prompted the customer to equip the control hydraulics and two further steam turbines with the CJC® Oil-Care Systems.

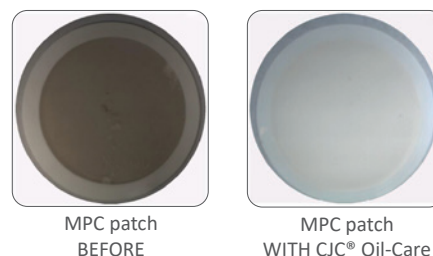


Due to the excellent results, three further oil systems have already been retrofitted with CJC®!

Hydraulic oil

Water turbine, turbine governors
400 Litres hydraulic oil Aral Motanol HE 100

- Due to the continuous fine filtration and care of the oil within the CJC® Varnish Removal Unit, the MPC value dropped from 61.6 to 8.1 within the first three months.
- The cleanliness class of the oil could be improved from 22/19/13 to 15/14/10 according to ISO 4406 – the number of particles > 4 µm were reduced by > 99 %.
- The independent laboratory confirmed that the oil can still be used. It corresponds to the cleanliness required by the manufacturers for the sensitive components.



| | BEFORE | AFTER approx. 3 months CJC® Oil-Care |
|-------------------|-----------|--|
| MPC value *) | 61,6 | 8,1 |
| Particles > 4 µm | 3,803,793 | 31,132 |
| Particles > 6 µm | 366,940 | 8,248 |
| Particles > 14 µm | 5,375 | 939 |
| ISO Code 4406 *) | 22/19/13 | 15/14/10 |



Your advantages

No varnish-related, unscheduled breakdowns and downtimes |
Preventive maintenance to avoid unnecessary costs



Higher Productivity

- increased reliability and availability
- improved process stability
- more flexible controllability of the control systems
- more efficient coolers and constant cooling performance

Less Maintenance

- longer lifetime for components and oil
- No varnish-related malfunctions at valves
- less wear and tear at bearings
- No blocked in-line filters ► fewer cartridge replacements
- No varnish and sludge in heat exchangers
- Avoid extensive tank cleanings and system flushings

Efficient Oil Care

- permanently low MPC-index < 10
- simultaneous removal of particles, water and varnish – dissolved and suspended
- extremely high absorption and adsorption capacities
- shut down of the main oil system not necessary for filter insert replacement
- low-maintenance and no need for monitoring ► filter insert replacement at pressure signal

Protection of Environment and Resources

- as a result of the longer lifetime of oil and components the energy and resources consumption necessary for production and disposal of spare parts and operating material (new oil etc.) decrease
- Improvement of the carbon footprint by oil conditioning
 - Thermal disposal of waste oil causes approx. 2.6 kg of the harmful greenhouse gas CO₂ per 1 litre
- Filter material consists to 100 % of renewable raw material
 - Natural fibres produce O₂ during the period of growth
 - No additional impact on the environment during the disposal of the filter material
 - Easy disposal according to the (German) Waste Product Key 150202





– worldwide



Karberg & Hennemann GmbH & Co. KG

Marlowring 5 | 22525 Hamburg | Germany

Phone: +49 (0)40 855 04 79 - 0 | Fax: +49 (0)40 855 04 79 - 20

filtration@cjc.de | www.cjc.de

History

Founded in 1928 and located in Hamburg, we develop and manufacture CJC® Fine Filter Technology since 1951. With substantial know-how and in-house analysis and test facilities we are experts when it comes to the maintenance of oils and fuels.



Quality

Competent advice and individual solutions, even for the most difficult filtration problems of our customers – that is our daily claim. The certification of our company according to DIN EN ISO 9001:2015 provides us with assurance and motivation.

CJC® worldwide

CJC® Fine Filter Systems are available worldwide through subsidiaries and distributors. Find your nearest distributor on our website www.cjc.de – or give us a call!

