



CJC<sup>®</sup> Oil Filtration presents

# CJC<sup>®</sup> Varnish Removal Unit

Solution for removal of dissolved and suspended soft contaminants from oil in  
Gas & Steam Turbines



Avoid varnish related turbine trips,  
downtime & expensive repairs.

Prevent oil change & reduce CO<sub>2</sub> footprint.



# Your challenges

turbine trips | oil aging | valve sticking | in-line filter blocking



- send us your oil sample  
- contact your nearest CCJ Distributor

When varnish strikes, the costs associated with a production outage are often very high. The precursors to varnish, the so-called soft contaminants, are created in the hot spots in the oil system, e.g. bearings, pumps and high flow in-line filters. Recent studies have found that the soft contaminants exist in both dissolved and suspended phases and should be removed in order to avoid varnish formation. Once formed, varnish can seize and clog valves, filters and other small passages and reduce the oil life considerably.

When soft contaminants are dissolved in oil, typically at temperatures above 40°C (100 °F), they cannot be removed through standard mechanical filters or electrostatic filters. The soft contaminants are polar in nature and adsorb onto dipolar, colder metallic surfaces in “cold spots”, e.g. valves and coolers. They will also settle out when the oil temperature decreases during outages. The soft contaminants also have lower thermal stability than the oil so they are more likely to bake onto cold and hot surfaces, e.g. journal bearings.



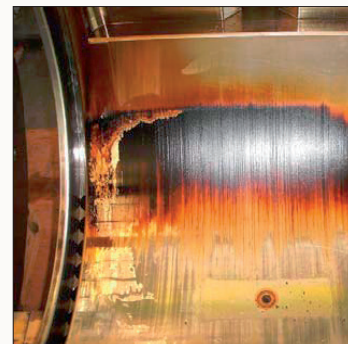
Varnish coated in-line filter of IGV servo valve hydraulics



Varnish on plate heat exchanger



Varnish on valve spool



Varnish on journal bearing, gas turbine

## FACTS

### Consequences of Varnish

- Valve sticking ▶ loss of control, which results in turbine trips or fail-to-start
- Filter blockage ▶ restriction of oil flow, which increases oil temperature and wear
- Sandpaper surface ▶ increases component wear
- Ineffective heat exchangers ▶ increases oil temperature
- Lacquer baked onto bearings ▶ flow restriction, increased wear and temperature
- Frequent oil changes and system flushing

# Your solution

high efficiency | low maintenance | reliable | easy to install

## 3 in 1 Solution

use the CJC® VRU and remove  
varnish, particles & water - in one single pass

C.C.JENSEN A/S introduces the CJC® Varnish Removal Unit with a revolutionary high efficiency for removing soft contaminants from oil – dissolved and suspended – even from hot operating gas and steam turbines.

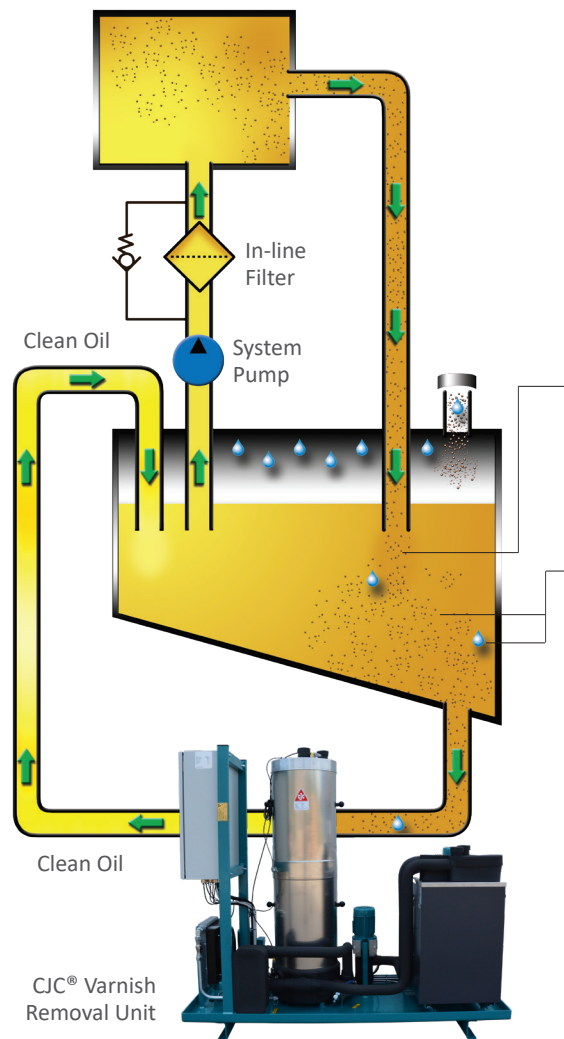
The CJC® VRU is designed to remove dissolved and suspended soft contaminants by polar attraction in the optimized, cellulose based CJC® Varnish Removal inserts, VRi. It does this without any additional power, chemicals or beads which may be harmful to the oil's additive package.

The hot oil is drawn from the lowest point of the system tank to the CJC® Varnish Removal Unit by means of the transfer pump on the unit. The process inside the unit includes passing the oil through the efficient CJC® Varnish Removal insert, VRi 27/27 specially designed for varnish removal in combination with the CJC® Varnish Removal Unit. After cleaning, the oil is returned to your system.

The varnish free oil will start cleaning all system components it comes in contact with, ultimately resulting in a completely varnish free system. The varnish level in the oil will typically be cut in half within a few weeks of operating the CJC® VRU.

### Oil System

- Turbine lube and control oil
- Hydraulic oil
- Compressor oil



### Contamination

now under Control!

### 3 in 1 Solution

The optimized filtration and treatment in the CJC® VRU captures the soft contaminants, which can then be removed from the system completely by replacing the CJC® Varnish Removal insert, VRi

### Varnish

Oil degradation products – dissolved and suspended – are removed from the oil and system components.

### Particles & Water

Not only varnish is removed, also particles and water is retained in the inserts and removed from the oil.

## FACTS

The specially designed CJC® Varnish Removal inserts VRi, used in the CJC® Varnish Removal Unit make it possible to remove oil degradation products from oil in gas and steam turbines, up to 45,000 L (11,900 gal) – dissolved and in suspension

– even from high temperature operating turbines!

# Our result

no turbine trips | no oil aging | no valve sticking | no in-line filter blocking

## Before and After installation of CJC® VRU

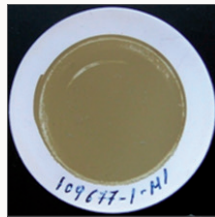
Turbine oil BEFORE filtration with the VRU



Turbine oil AFTER just a few weeks of filtration with the VRU®



Millipore membrane MPC>50



Millipore membrane AFTER filtration with the VRU, MPC <10



Ultra Centrifuge test, initial sample before the VRU (inlet)



Ultra Centrifuge test, sample after a single pass through the VRU (outlet)



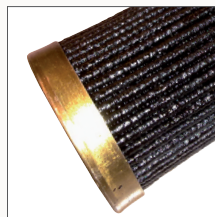
Clearly visible varnish at the metal surface BEFORE startup the VRU



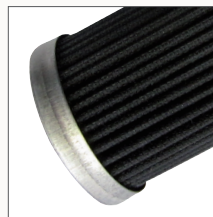
No more varnish at the metal surface AFTER startup the VRU



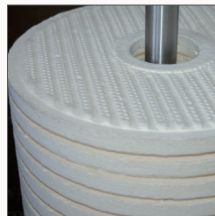
6 months WITHOUT VRU: Varnish on the in-line filter



6 months WITH VRU: No varnish on the in-line filter



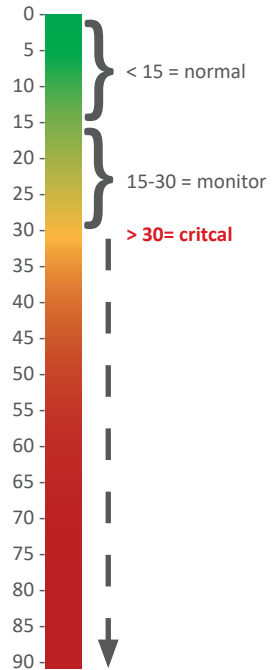
Varnish Removal insert, VRi before startup



Varnish Removal insert, VRi, after filtration



### MPC Safe Level



## CASE

### Customer

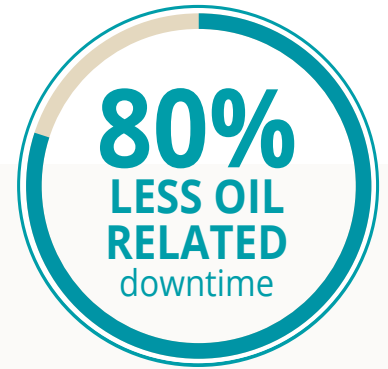
A 95 MW Combined Cycle Power Plant in Spain. Two base loaded gas turbines each containing 6,500 L (1,700 gal) of Mobil DTE 832 oil. Varnish level measured with Membrane Patch Colorimetric was reduced from MPC 55 to MPC 15 within two weeks of operating the CJC® VRU. By using the CJC® VRU, a pending oil change and flushing were not necessary anymore, and turbine trips due to varnish were avoided!

The savings obtained from reduced oil purchases, flushing and oil handling, add up to approximately

**\$ 35,000**  
per gas turbine.

# Your benefits

no expensive turbine trips | no uncontrolled shut downs



## Benefits

- **80% drop in oil-related turbine trips**
- **MPC of <15 guaranteed**
- Increased system reliability and availability
- No turbine trips or sticking valves due to varnish
- Prevent uncontrolled shutdowns and reduces maintenance costs
- Extends the lifetime of both oil, additives, and components, e.g. bearings, valves, seals etc.
- No need for system flushing and tank cleaning
- Improved lifting oil pressure
- More stable bearing temperature
- Less vibrations due to varnish in bearings



## Savings (average)

Avoiding a turbine trip and prolonging oil life can result in huge savings.

A real example:

- \$ 40,000 saved by avoiding a turbine trip (not including lost revenue)
- \$ 35,000 saved on oil, flushing and disposal costs
- \$ 4,600 per hour penalty for not supplying energy

Total cost for a turbine trip can easily exceed \$ 100,000 including downtime penalties.



## Environment

- **75% reduction in oil consumption**
- With the CJC® VRU the oil lifetime can be extended to **10-20 years** in operation without compromising its properties
- Extend the lifetime of components
- No use of ion exchange resin
- Prolonged oil and additive lifetime
- CJC® VRi Varnish Removal insert is made of 100% natural cellulose



## Less Maintenance

- **50% shorter oil service time during outage**
- No need for system flushing and tank cleaning
- Avoid malfunction of hydraulic valves e.g. inlet guide vane valves
- Reduced consumption of in-line filters
- Avoid sludge and varnish build-up in heat exchangers
- Minimal maintenance and supervision of the CJC® VRU
- Maintenance of the CJC® VRU does not require shutting down the main oil system



# C.C.JENSEN

## - contact us today!



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