



# Varnish Removal Unit

Solution for removal of dissolved and suspended  
soft contaminants from oil in

Gas & Steam Turbines



“Avoid varnish related  
turbine trips and  
expensive oil changes”





# The Problem

turbine trips | oil aging | valve sticking | inline filter blocking



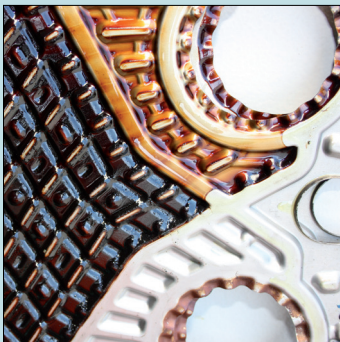
- send us your oil sample  
- contact your nearest CJC Distributor

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.



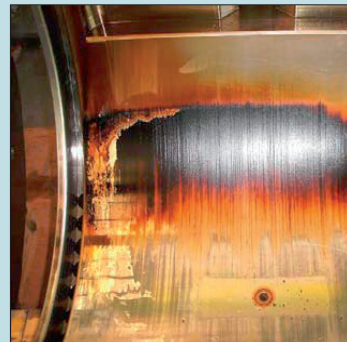
*Varnish coated in-line filter of IGV servo valve hydraulics*



*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

# The 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.

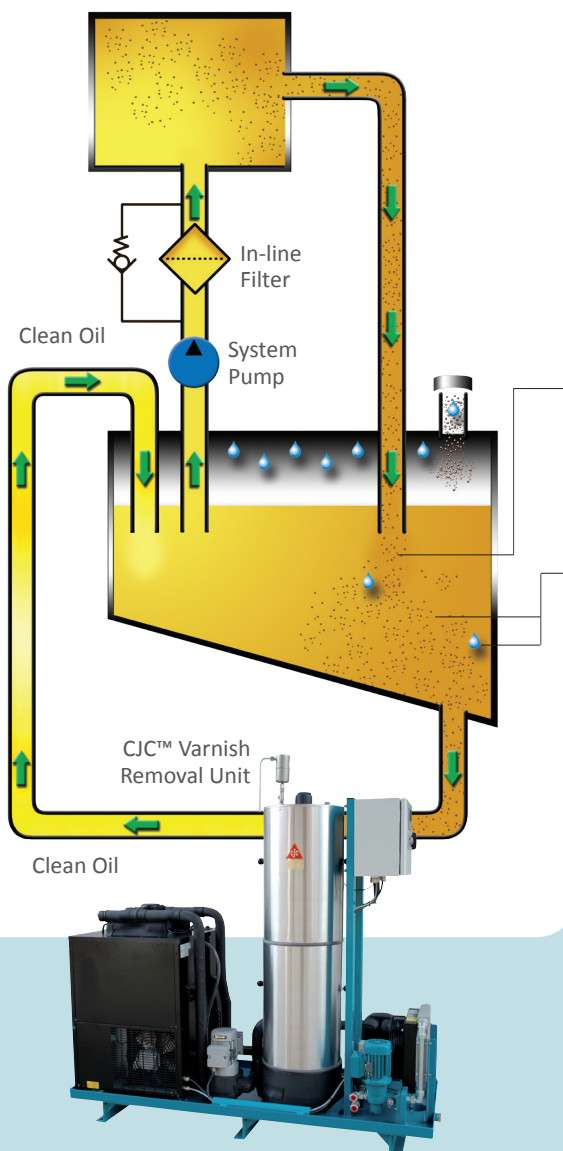
The CJC™ VRU is designed to remove dissolved and suspended soft contaminants by polar attraction in the optimized, cellulose based CJC™ Varnish Removal inserts, VRi. It does this without any additional power, chemicals or beads which may be harmful to the oil's additive package.

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!



# The Result

no turbine trips | no oil aging | no valve sticking | no inline filter blocking



## Before and After installation of CJC™ VRU

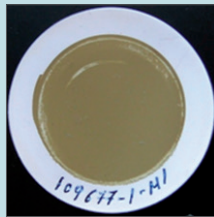
Turbine oil BEFORE  
filtration with the VRU



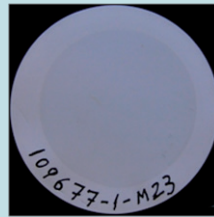
Turbine oil AFTER just  
a few weeks of filtration  
with the VRU



Millipore membrane  
MPC>50



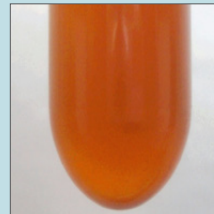
Millipore membrane  
AFTER filtration with  
the VRU, MPC <10



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



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



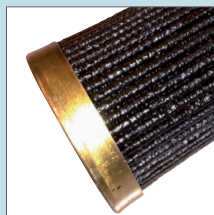
Clearly visible varnish at  
the metal surface BEFORE  
startup the VRU



No more varnish at  
the metal surface  
AFTER startup  
the VRU



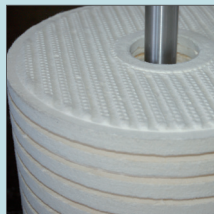
6 months WITHOUT VRU:  
Varnish on the inline filter



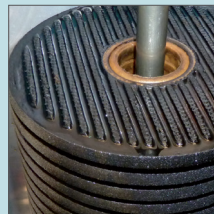
6 months WITH VRU:  
No varnish on the  
inline filter



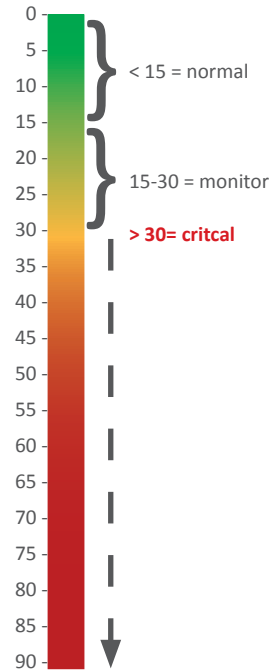
Varnish Removal insert,  
VRi before startup



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.

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# The Benefits

no expensive turbine trips | no uncontrolled shut downs

## Benefits

- Increased system reliability and availability
- No turbine trips or sticking valves due to varnish
- Prevent uncontrolled shut downs 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
- MPC values at extreme low levels
- Improved lifting oil pressure
- More stable bearing temperature



## 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 down-time penalties

## Environment

- With the CJC™ VRU the oil life time can be extended to **10-20 years** in operation without compromising its properties
- Extend the lifetime of components
- Prolonged oil and additive lifetime
- No use of ion exchange resin

## Less Maintenance

- 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
- Less vibrations due to varnish in bearings



# C.C.JENSEN

## - Contact us Today!



60 years of  
increasing reliability  
& reducing costs



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