

What is Varnish ?

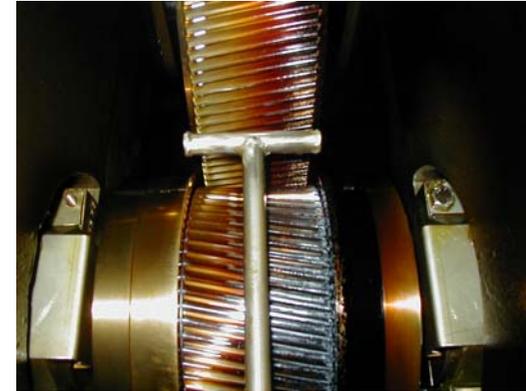
- Varnish is a **soft contaminant** composed of lubricant degradation by-products that are **less than 1 micron** in size and is not measured by traditional particle count.
- Varnish deposit is a **thin-orange, brown or black insoluble film deposit** occurring on internal of lubricant systems .
- Varnish is a high molecular weight substance that is unstable in oil.
- Varnish deposit is unable to remove by mechanical filtration



Varnish formation on pencil filter



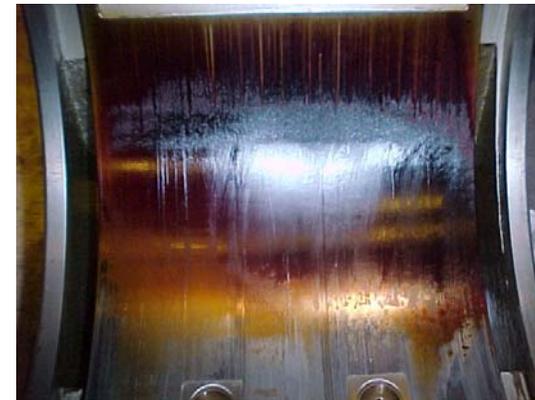
Varnish formation on spool valve



Varnish formation on gas compressor -gear



Varnish formation on Inlet Guide Vane



Varnish formation on a turbine bearing

What is **Sludge** ?

- Sludge is varnish which have higher water content
- Sludge looks like a **soft mud-like deposit** that settles out of the oil
- Sludge is also a **soft contaminant**.
- **Sludge contaminant** , if prolonged elevated temperatures will evaporate the moisture from the sludge contaminant.



Sludge



Sludge



Combination of varnish & sludge



Sludge

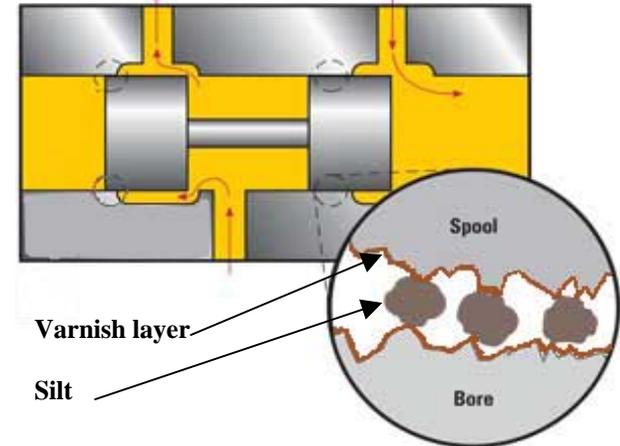
What are the negative impacts ?

Varnish build-up has long been a problem , particularly in turbine and hydraulic .

System failures due to varnish problem can be :

- **Sticking or seized occurs in moving mechanical parts such as servo control valve.**
- **Plugged or restricted small oil flow orifices**
- **Loss of heat occurs in heat exchangers due to varnish's insulation effect , cause to increase oil temperature**
- **Attract dirt and larger contaminants , increasing wears and component failure.**
- **Encourage premature bearing failure.**
- **Catalytic deterioration of turbine oils and hydraulic oils**

Spool valve sticking due to varnish formation



Varnish formation on spool valve



Varnish plated on heat exchangers

What is VsPI™ ?



- VsPI™ stands for Varnish & Sludge Potential Index™
- VsPI™ is a test method that have been developed by Focus Laboratories Ltd
- VsPI™ will predict varnish & sludge contamination condition and status in lubricant system .

Also , VsPI™ will monitor varnish & sludge build up rate in lubricant systems

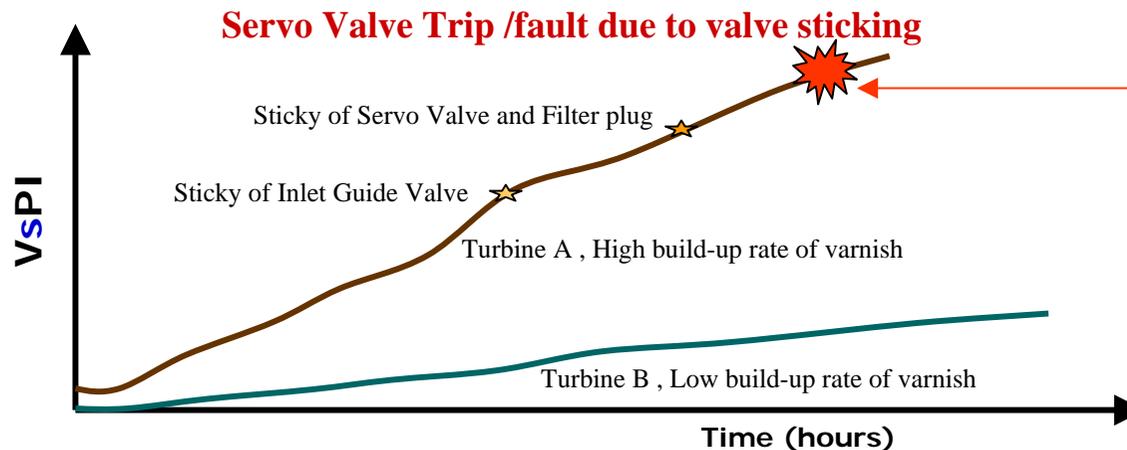
- Result of “ VsPI™ ” will present in rating unit.
- Application : gas & steam turbines , hydraulic systems , turbo compressors and clean lubricant systems .



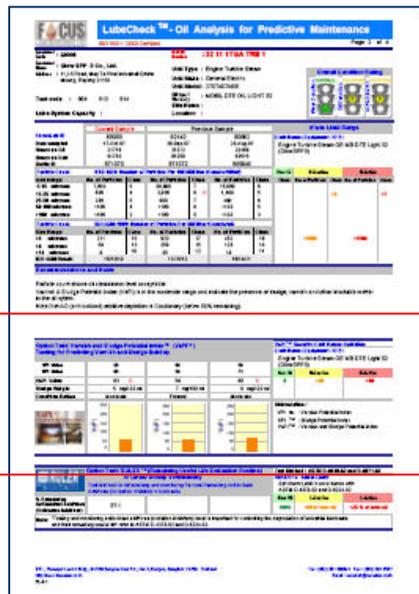
Importance of Varnish & Sludge Detection and Monitoring

Catching Varnish & Sludge Before It Costs You

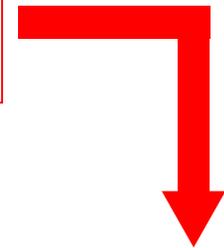
- 1 Detect varnish & sludge levels in the lube oil system
- 2 Monitor the varnish & sludge build-up rate in the lube oil system
 - High build-up rate or Low build-up rate
 - If High build-up rate, will be critical and/or have any adverse impacts
- 3 Correction the problem in the early stage.



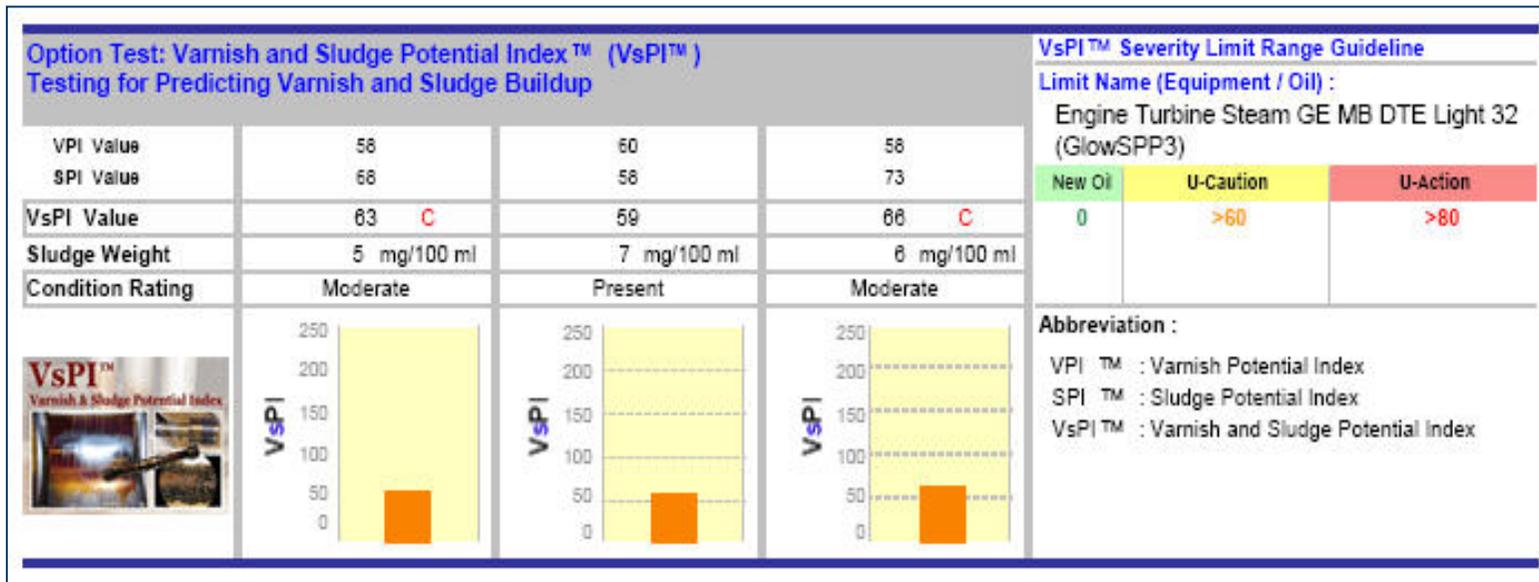
Will you wait until **servo valve trip/fault** before you identify and dealing with varnish & sludge in gas turbine ?



← Oil Analysis Report



VsPI Result in the report



Varnish & Sludge Potential Index Value (VsPI)

