

# Lubricant Varnishing and Varnish Mitigation Strategies

J. W. Evans <sup>1</sup>, M. G. Hobbs <sup>2</sup>, R. Bartley <sup>3</sup>

<sup>1</sup> Hy-Pro Filtration, 6810 Layton Road, Anderson, IN, USA.

<sup>2</sup> EPT, 4772 50<sup>th</sup> Ave. S.E. Calgary, AB, Canada.

<sup>3</sup> ADE, Dartmouth Ind. Centre, Kylemore Road, Dublin 10

## ABSTRACT

Varnish is an organic residue produced by irreversible chemical degradation of mineral oil lubricants. Varnish can lead to numerous equipment problems including: filter plugging, restricted oil flow, poor heat transfer, valve sticking, fail-to-start conditions and costly unit trips.

Varnish has traditionally been defined as an insoluble deposit, however, varnish also exists in an often-overlooked soluble state. While varnish forms as the result of an irreversible chemical reaction, the conversion between soluble and insoluble varnish is a physical process determined by lubricant solvency; importantly, this process is reversible.

Due to the costly nature of varnish-related failures and their prevalence, numerous strategies have been developed to mitigate its effects. Lubricants are formulated with the aim of providing superior degradation protection, however, changes in modern lubricant formulation have brought about unintended consequences. This has created a market for many varnish removal systems. Most technologies focus on the removal of the most obvious signs of varnishing: insoluble particles/deposits. Unfortunately, these particle removal systems have no effect upon varnish in its soluble form; once they have removed particulate varnish, soluble varnish persists and continues to deposit. Soluble varnish removal systems provide the only means of removing varnish in both its soluble and insoluble states.

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