

VARNISH REMOVAL SYSTEM (VRS)

PREVENTS VARNISH FORMATION BY REMOVING & PREVENTING DISSOLVED OIL PRODUCTS IN LUBRICANTS

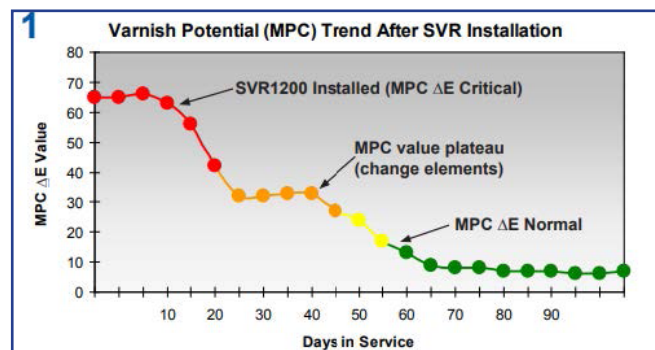
BENEFITS OF VRS (ION CHARGE BONDING) TECHNOLOGY

- ✓ Improves efficiency by maximizing fluid and bead contact time
- ✓ Prevents deposits by eliminating varnish feedstocks
- ✓ Reduces depletion of anti-oxidant additives
- ✓ Restores oil solvency
- ✓ Stainless steel design prevents ruptures during operation
- ✓ Captures free floating dissolved varnish
- ✓ Eliminated the varnish removal cycle
- ✓ Low cost of ownership a
- ✓ Eliminates servo valve sticking
- ✓ Pulls 100% of reservoir volume every day



EXAMPLE CASE 1: VARNISH REMOVAL

- A heavily varnished CT was treated with VRS technology
- The initial VRS filter element was able to bring the Membrane Patch Colorimetry (MPC) readings down from ~63 to ~35 in 25 days
- The first filter was removed and a second VRS filter brought the system down to single MPC digits
- The two elements effectively removed most varnish from the system and allowed a return to normal operations



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EXAMPLE CASE 2: ANTI-OXIDANT PRESERVATION

- Remaining Useful Life Evaluation Routine (RULER) tracks remaining Phenol and Amine anti-oxidant (AO) levels
- Dropping below 20% of new phenol AO levels puts the system at risk for deposit formation and severe oil degradation
- The chart to the right shows RULER test results for a turbine lube reservoir with an VRS system added after a lube change
- The numbers show very little change in additives over a year with the VRS system in place
- Turbine had previously been losing 20% or more of it's phenol AO annually

Example RULER Test						
Date		8/1/2017	5/12/2017	2/15/2017	9/22/2016	7/13/2016
Lab No	Reference					
RUL %	>25%	91.3	85	90.3	97	90.2
Amines		92.2	99.4	99	95.5	
Phenols		99.8	98	95.4	91.5	



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