

SVR^{*TM}

Soluble Varnish Removal

A complete recovery and maintenance solution for turbine lubricants. SVR targets and removes the dissolved varnish pre-cursors which are the cause of varnish. By removing these waste oxidation by-products, you restore the oils original solvency properties which forces any solid varnish deposits to be dissolved back into the oil where they are removed permanently.



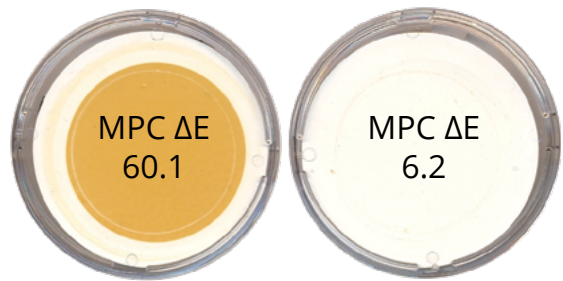
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*SVR is a registered trademark of EPT CLEAN OIL.

Stop varnish related fail-to-starts and unit trips.

SVR attacks the source of the problem on a molecular level, removing the oxidation by-products that form varnish deposits. SVR reverses the chemical process of varnish deposit formation by restoring oil health removing varnish throughout the system and in critical components so your servo valves operate more efficiently than ever.



Advanced media technologies.

ICB's patented ion-exchange resin technology removes soluble oxidation by-products and restores demulsibility during normal turbine operation without damaging additive chemistry. With the most advanced media, SVR has 4x more capacity than competing varnish removal systems.

Remove acid.

Acid in turbine oil is by-product of oxidation, a leading pre-cursor to varnish formation. SVR removes acid improving oxidative stability, slowing oxidation rate and dramatically reducing a source of varnish production.



Attack the problem, not the symptoms.

Turbine oil is condemned when anti-oxidant (AO) additive levels deplete to 20% of new. A dedicated SVR performs in parallel with AO additives to slow depletion to drastically extend the life of your oil. On top of being the ultimate varnish deposit recovery system, SVR restores and protects oil health and actively prevents new varnish from forming. Once varnish is under control the benefit of longer oil life can be fully realized.

Work with the experts.

With SVR, you'll work alongside industry experts and receive comprehensive oil analysis and results interpretation to provide the best solution to extend your fluid life and make varnish vanish, for good.



Endless applications.

In addition to a range of options including the PM-1 Particle Monitor, explosion proof models, a range of power options, even stainless steel vessels, SVR can be completely customized to provide the perfect solution for your application.



SVR Quick Reference Guide

SVR1200CT model shown

ICB vessel crane post

Top loading ICB housing with 2 elements stacked

ICB vessel inlet sample port

ICB vessel pressure gauge

ICB vessel flow control meter

High efficiency post-filter housing

Electric motor

Particulate filter ΔP gauge

SVR inlet large suction

Cast iron gear pump with internal relief

Steel retention tray with fork guides



Elements that go beyond industry standard.

ICB Advanced Resin Technology.

Turbine oil varnish deposits form when oil becomes saturated with oxidation by-products from fluid breakdown. ICB goes where other technologies can't to remove polar oxides on a molecular level. When varnish deposits are affecting servo valve response time, that means the oil is saturated. SVR addresses this by removing dissolved oxidation by-products and restoring the oil's solubility. The restored oil dissolves deposits back into solution which can then be removed by the SVR. The process repeats during recovery until the entire system and the oil are varnish free. That's when you see a white patch. Once the varnish is gone, SVR continues to work by removing by-products as they form to prevent future deposits. ICB also slows anti-oxidant additive depletion to boost oil life. ICB is the only technology that treats the dissolved varnish during normal turbine operation to prevent varnish from forming.



HP107 for ISO Code Management.

DFE rated advanced media technologies provide the highest level of particulate capture and retention so your equipment operates unimpeded by contamination. The coreless filter element in every SVR delivers remarkably low ISO Codes, taking the dirt load off of critical system lube and hydraulic control filter elements (IGV, pump discharge). In addition to particulate control, the HP107 with VTM media also removes the insoluble oxidation by-products that are suspended in the oil, working hand-in-hand with the ICB media to rapidly reduce varnish potential and restore the health of your oil. The element is oversized to perform over a long element lifespan and to ensure low environmental and bottom line impact. To top it off, the HP107 element comes standard with an integral zero leak bypass so with every filter change, you get a new bypass along with peace of mind.

Top loading ICB housing with 2 elements stacked

ICB vessel drain valve

High efficiency post-filter housing

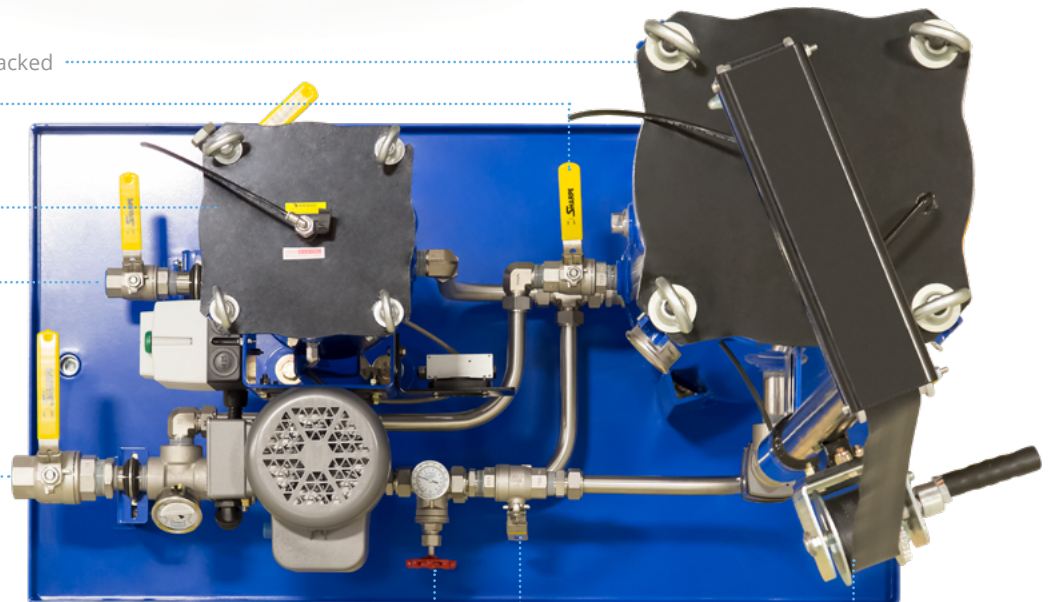
SVR outlet

SVR inlet large suction

ICB vessel flow balancing valve

ICB vessel flow isolation valve

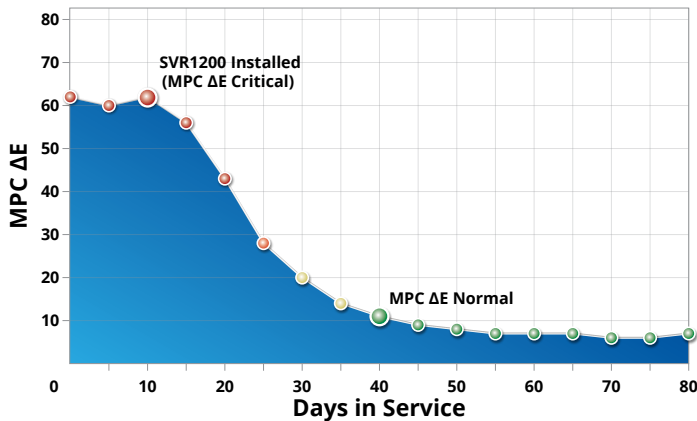
Crane for ICB element removal and draining



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The Proven Varnish Solution

Varnish Potential (MPC) Trend After SVR Installation



MPC ΔE Condition Scale

Normal	Monitor	Abnormal	Critical
<15	16-25	26-35	>36

Figure 1 depicts SVR1200 on a 7FA gas turbine with critically high varnish potential (MPC ΔE) experiencing slow servo valve response time and sticking. SVR had an immediate impact on the 6,200 gallon / 24,000 liter lube reservoir. Within 45 days MPC values were reduced to condition normal.

Starting RULER was 5 meaning only 5% AO remained in the oil, below condemning level. By installing SVR before a fluid change, all varnish deposits were removed before the oil change which allowed new oil to be added to a clean reservoir. If not for the deposit removal, AO in the new oil could have immediately depleted to as low as 65%.

Varnish Potential (MPC) Trend After SVR Installation

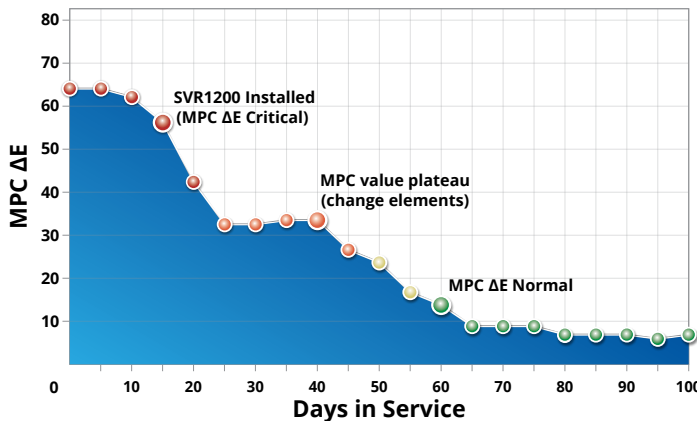


Figure 2 is the restoration of a combustion turbine with heavy varnish deposits where MPC varnish potential dropped to 35 after SVR installation. 40 days into service, the ICB elements were changed as they were fully loaded with oxidation by-product. Once changed, MPC dropped to single digits. In the case of a heavily varnished turbine, 2 to 3 sets of ICB elements might be required to achieve condition normal. Once MPC drops to single digits, the ICB elements would normally be replaced annually to maintain the lubricant in optimal condition.

Note: Graph lines have been smoothed to demonstrate long term performance and MPC values will fluctuate as varnish is drawn from the system back into solution and subsequently removed from the system by the SVR.



VTK Varnish Test Kits

Colorimetric analysis per ASTM D02.C0.01 WK13070 is used to determine varnish potential in turbine lube oil. A mixture of the sample oil and petroleum ether is used to make the soluble by-products available for collection on a patch. The patch is analyzed with a spectrometer measuring ΔE reported as the MPC ΔE value.



SVR Specifications

Dimensions ¹	SVR1200	Height 58" (147 cm) 98" (249 cm) with crane	Length² 48" (122 cm)	Width² 26" (66 cm)	Weight 700 lbs (318 kg)
	SVR2400	–	70" (178 cm)	30" (76 cm)	1000 lbs (454 kg)
Connections	Inlet 1.5" FNPT with locking ball valve			Outlet 1" FNPT with locking ball valve	
Max Reservoir Size	SVR1200 + SVR1200X 8,000 gal (30,000 liter) reservoir			SVR2400 Max 16,000 gal (60,000 liter) reservoir	
Element Configuration	Particulate filter SVR1200: HP107L18-VTM710V SVR2400: HP107L18-VTM710V SVR1200X: no particulate filter included			Main Filter SVR1200: ICB600524-V x 2 SVR2400: ICB600524-V x 4 SVR1200X: ICB600524-V x 2	
Seals	Fluorocarbon + silicone				
Operating Temperature	Fluid Temperature 86°F to 176°F (30°C to 80°C)			Ambient Temperature -4°F to 104°F (-20C to 40C)	
Materials of Construction	Housings Carbon steel with industrial coating ASME U Code optional		Tray Carbon steel with industrial coating	Fittings Swagelok® stainless	
Electric Motor	TEFC, 56-145 frame 1-1.5 hp, 1150-1750 RPM				
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.				
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.				
Pump Bypass	Full bypass at 90 psi (6.2 bar)				
Total System Flow ³	SVR1200 7-11 gpm		SVR2400 14-16 gpm		
ICB Canister Flow Rates ⁴	SVR1200 + SVR1200X 5 gpm (18.9 lpm) max		SVR2400 10 gpm (37.9 lpm) max		
Pneumatic Option Air Consumption ⁵	~40 cfm @ 80 psi				
Media Description	VTM β _{3[C]} ≥ 4000 particulate, insoluble oxidation by-product and water removal media			ICB Patented ion-exchange bonding resin media for molecular removal of acids, varnish deposits, soluble oxidation by-products and dissolved metal ions from mineral based turbine oil.	
Fluid Compatibility	Petroleum and mineral based fluids only (standard). For phosphate ester and other specified synthetic fluids, see FSA (page 112) or contact factory.				
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements.				

¹Dimensions are approximations taken from base model and will vary according to options chosen.

²Spill retention pan standard size. Contact factory for custom pan sizing.

³Controlled via flow control valve + flow meter (included standard).

⁴Maximum system flow dependent on and will vary with motor selection.

⁵Air consumption values are estimated maximums and will vary with regulator setting.



SVR Part Number Builder

SVR -

Model Turbine Type Indicator Power Options Special Options

Model	Particulate Filter	ICB	Recommended Reservoir Size
1200	HP107L18-VTM710V	ICB600524-V x 2	Max 8,000 gal (30,000 liter) reservoir
2400	HP107L18-VTM710V	ICB600524-V x 4	Max 16,000 gal (60,000 liter) reservoir
1200X	none (omit ΔP indicator and power options)	ICB600524-V x 2	Max 8,000 gal (30,000 liter) reservoir

Turbine Type	CT	Combustion turbine - mineral based oil
	ST	Steam turbine - mineral based oil

ΔP Indicator ¹	D	22 psid visual gauge + electric switch
	E	22 psid visual gauge

Power Options	60 Hz, 1150-1750 RPM	50 Hz, 1450 RPM	Pneumatic
Contact factory for options not listed	12 120 V ac, 1P	11 110 V ac, 1P	00 Pneumatically driven air motor & PD pump. FRL & flow meter included.
	22 208-230 V ac, 1P	21 220 V ac, 1P	
	23 208-230 V ac, 3P	40 380-440 V ac, 3P	
	46 460-480 V ac, 3P	52 525 V ac, 3P	
	57 575 V ac, 3P		

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X_ Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options	A	Air cooled heat exchanger (consult factory)	O	On-board PM-1 particle monitor & clean oil indicator light
	C	CE marked for machinery safety directive 2006/42/EC	S	All wetted components 304 or higher stainless steel ²
	D	High filter ΔP auto shutdown	U	CUL and/or CSA marked starter enclosure for Canada
	E	100 mesh cast iron basket strainer	U1	U Code (ASME U code certified) + CRN
	F	Filter element ΔP gauge with tattle tale follower needle	V	Lifting eye kit
	H	Automatic high temp shut down (160°F, 71°C)	W	Automatic air bleed valve (includes one per vessel)
	L	High filter element ΔP indicator light (particulate filter only)	Y	VFD variable speed motor frequency control
	M	Total system flow meter (120 cSt max)	Z	On site start-up training

¹Particulate filter only. ICB housing is equipped with 0-100 psi static pressure gauge. Industrial, liquid filled.

²With exception to cast iron gear pump.

For all up to date option details and compatibilites, please reference our Contamination Solutions Price List or contact customer service.



Filtration starts with the filter.

Lower ISO Codes: Lower Total Cost of Ownership Hy-Pro filter elements deliver lower operating ISO Codes so you know your fluids are always clean, meaning lower total cost of ownership and reducing element consumption, downtime, repairs, and efficiency losses.

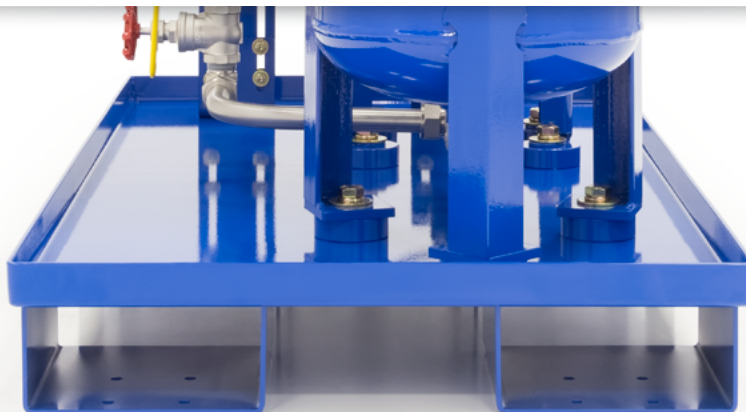
DFE Rated Filter Elements DFE is Hy-Pro's proprietary testing process which extends ISO 16889 Multi Pass testing to include real world, dynamic conditions and ensures that our filter elements excel in your most demanding hydraulic and lube applications.

Upgrade Your Filtration Keeping fluids clean results in big reliability gains and upgrading to Hy-Pro filter elements is the first step to clean oil and improved efficiency.

Advanced Media Options DFE glass media maintaining efficiency to $\beta_{1\mu} > 4000$, Dualglass + water removal media to remove free and emulsified water, stainless wire mesh for coarse filtration applications, and Dynafuzz stainless fiber media for EHC and aerospace applications.

Delivery in days, not weeks From a massive inventory of ready-to-ship filter elements to flexible manufacturing processes, Hy-Pro is equipped for incredibly fast response time to ensure you get your filter elements and protect your uptime.

More than just filtration Purchasing Hy-Pro filter elements means you not only get the best filters, you also get the unrivaled support, training, knowledge and expertise of the Hy-Pro team working shoulder-to-shoulder with you to eliminate fluid contamination.



Want to find out more? Get in touch.

hyprofiltration.com
info@hyprofiltration.com
+1 317 849 3535

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