



VPS and SULFURIZED ESTEROLS - MULTIFUNCTIONAL ADDITIVES FOR METALWORKING

Based on vegetable ester derivatives, VPS and SULFURIZED ESTEROLS series offers a complete solution when metalworking lubricants have to bear hydrodynamic, boundary and mixed shear regimes. They offer oiliness, anti-wear and extreme pressure properties depending on the addition rate. Clear for VPS or dark for ESTEROL their main benefits are a low odor and high flash point products.

COMMERCIAL SPECIFICATIONS

		Product	VPS 11	VPS 15	VPS 17	ESTEROL 10S	ESTEROL 18S
		Method					
Appearance	Visual		Clear brown liquid	Clear brown liquid	Clear brown liquid	Dark liquid	Dark liquid
Sulfur content (weight %)	X fluorescence		> 10	> 14.5 / <16	> 16 / < 18	> 9.5 / < 11	> 17 / < 20
Color	ASTM D 1500		< 7	< 6.5	< 5	N/A	N/A
Viscosity (mm ² /s)	ASTM D 445 @ 40°C		>200 / <300	>550 / <750	>10 / <30	-	>40 / <60
	ASTM D 445 @ 50°C		-	-	-	>10 / <25	-
Copper strip corrosion	ASTM D 130 (10%, 3h, 100°C)		< 1b	< 1b	-	≤ 1b	-
H ₂ S test	Acetate paper color		< 3	< 3	< 5	-	-

N/A: not applicable

TRIBOLOGICAL PROPERTIES

Extreme pressure test with four ball machine are used to establish tribological characteristics of VPS and SULFURIZED ESTEROLS (1450 rpm; ambient temperature) according to ASTM D 2783

Anti-wear tests with four ball machine (IP 239 method) are used to compare anti-wear properties of polysulfides (TPS® range): 40kg for 1h period are applied on the balls in tested lubricant.

The Reichert machine is used to conduct wear tests. Its principle consists in rubbing together two cylinders with orthogonal axes over a fixed distance, under a 300N load.

Base oil	VPS 11	VPS 15	VPS 17	ESTEROL10S	ESTEROL18S
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4 ball extreme pressure test ASTM D 2783	Welding load (kg)	126	250	400	315	250	315
	Last non seizure load (kg)	20	80	80	63	50	63
	Load Wear Index	15	42	62	62	35	52

4 ball wear test IP 239	Wear diameter (mm)	1.33	0.50	0.76	0.72	0.63	0.79
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Reichert test	Wear scar (mm ²)	31	1.2	0.8	1.0	6.2	3
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Extreme pressure and anti-wear properties (5% by weight in a ISO VG32 paraffinic base oil)

CORROSION WITH FERROUS ALLOY

ASTM D 665-part A is used to evaluate the corrosive impact of an additive in a formulation with ferrous alloys. Tests are conducted 24h at 60°C with 30ml of distilled water.

	VPS 11	VPS 15	VPS 17
Test result	Pass: no corrosion	Pass: no corrosion	Pass: no corrosion

Blends are formulated at 5% by weight in ISO VG22 paraffinic base oil.

CORROSION WITH NON-FERROUS ALLOY

ASMT D 2619 is used to evaluate the corrosive impact of an additive in a formulation with non-ferrous alloys in presence of water. Tests are conducted during 48h at 93°C with 25ml of distilled water.

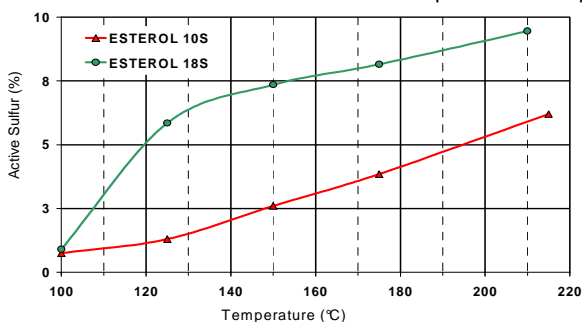
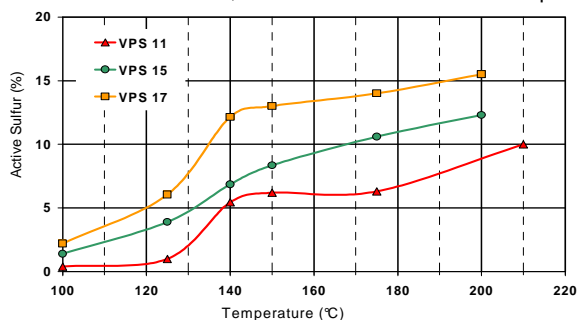
ASTM D 2619 : Hydrolytic stability

	VPS 11	VPS 15	VPS 17
Copper aspect	no change	black	black
Metal loss (mg/cm2)	0.02	8.51	30.00
Viscosity @ 40°C before test (mm2/s)	35.20	35.60	32.20
Viscosity @ 40°C after test (mm2/s)	34.60	34.50	31.90
TAN before test (mg KOH/g)	0.24	0.24	0.24
TAN after test (mg KOH/g)	0.24	0.28	0.25
Water acidity (mg KOH/g)	4.48	5.22	24.13
% non soluble	0.00	0.08	0.33

Blends are formulated at 5% by weight in a ISO VG22 paraffinic base oil.

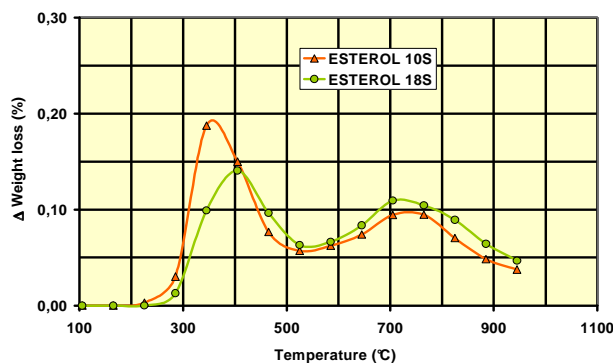
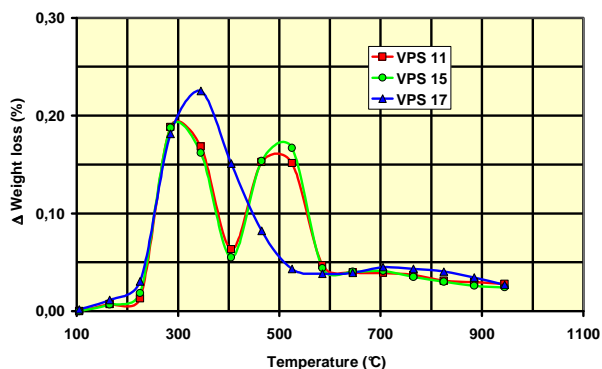
ACTIVE SULFUR

The knowledge of the reactivity of an extreme pressure additive is a key parameter to make the good choice between the different products. According to ASTM D1662 method, the active sulfur at various temperatures shows the sulfur release of the additive in presence of copper powder.



THERMAL STABILITY

Thermal behavior of additives is an other good indicator of performances and stability of the VPS and SULFURIZED ESTEROL. Charts underneath show the lost of product in function of temperature by ThermalGravimetric Analysis.



Thermogravimetry tests are performed with pure products under nitrogen flow at 20°C/min heating rate.

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