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The Chemical Company

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IRGANOX® L 150 Antioxidant Blend

Typical chemical and physical properties

IRGANOX L 150 is a mixture of aminic and high molecular weight phenolic antioxidants for lubricants

Appearance	Clear, highly viscous, yellow to brown liquid
Viscosity at 40 °C	2800 mPa.s
Density at 20 °C	1.0 g/cm^3
Flash point	180 °C , (COC)
Solubility	
Water	< 0.01%
Mineral oil	5%
Ester	> 5%
Sulphur content	0.8%

Applications and typical treat levels recommended

Industrial lubricants, especially	
gas turbine oils	0.5 - 0.7%
Metal working fluids, especially	
rolling oils and heat transfer fluids	0.1 - 0.5%
Engine oils, especially	
natural gas engine oils	0.2 - 0.8%

Benefits

Protects against high temperature oxidation and nitro-oxidation of engine oils

Contains no diluents

Approved by FDA/USA for use in blending lubricants with incidental food contact

Restrictions

Solubility in finished fluid must be checked

Product may solidify after prolonged storage. Heat up to 60 °C in order to reliquify

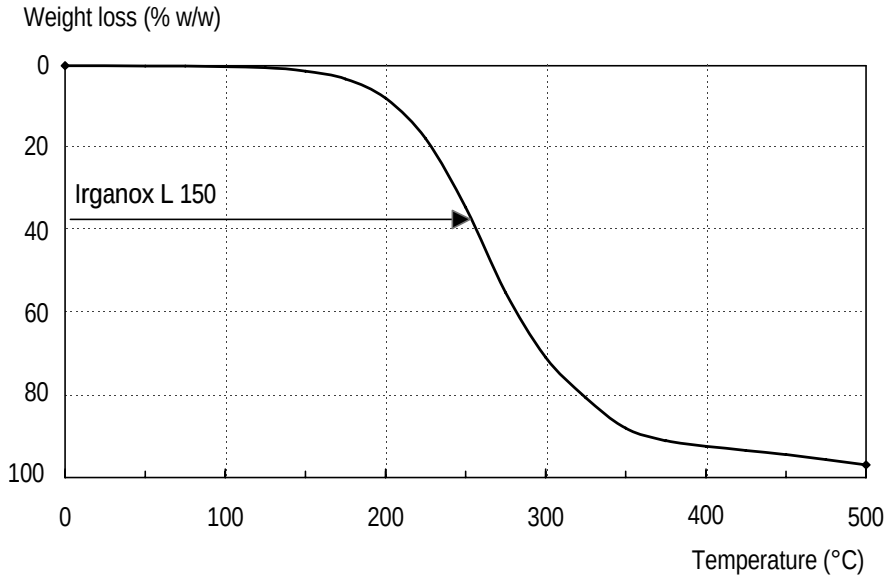
May darken upon prolonged storage and upon exposure to light.

Additive volatility characteristics.

The volatility of additives can have a major impact on lubricant performance

Thermogravimetric analysis (TGA) provides information about the volatility of an additive, as well as its thermal and oxidative stability.

Test procedure Additive < 50 mg , is heated in a controlled atmosphere (air) at a rate of 10 °C per minute from 25 °C up to as high as 500 °C. The weight loss (in %) of the sample as a function of temperature is represented graphically.



Lubricants with incidental food contact

BASF can offer a full range of additives cleared by FDA/USA for formulating lubricants which may come into contact with food. Please see Product Selection Guide for the complete list.

Cleared by the FDA under 21 CFR 178.3570 for use in USDA H-1 lubricants with incidental food contact.

	Maximum treat level [1]
IRGANOX L 150	0.71 % wt/wt

[1] The maximum allowed concentration may exceed the solubility limit of this additive in some base stocks.

Water extractability

When used at recommended treat levels for industrial lubricants IRGANOX L 150 contributes extremely low levels of phenol in water. These levels are actually below the detection limits of the current analytical method for phenolic materials in waste water.

Analytical method

USA EPA Test Method 420.1 (1978), Total Recoverable Phenols (4-amino antipyrine titration).
Detection limit in water is 0.05 ppm.

Test design

The Chrysler Motor Kokomo Casting Plant modification to EPA Method 420.1 (for raw materials) was used. This involves mixing 50 ml of neat additive with 450 ml distilled water, adjusting to pH 4, and distilling. The analysis for phenols is conducted on the condensate.

Additives	A Recommended additive treat level for industrial lubricants (%)	B Measured phenolic content of water after above procedure (ppm)	A x B = Potential phenolic contribution in waste water of a lubricant formulated at recommended additive treat level (ppm)
IRGANOX L 150	0.25	3	< 0.01
Phenolic AO (1)	0.25	6	0.02
Phenolic AO (2)	0.25	1 700	4.25

(1) 4,4-methylene-bis-2,6-di-t-butyl phenol

(2) More soluble form of the Phenolic AO (1) (containing a mixture of 2-tert. and 2,4-tert.butyl phenol)

Circulating oils
Gas turbine oils

IRGANOX L 150 is a uniquely balanced blend of antioxidants for formulating gas turbine oils meeting the General Electric specification GEK 32568 C.

Test fluids

IRGANOX L 150	(%)	0.7	0.5	General Electric Spec. GEK 32568 C
Irgamet 39	(%)	0.05	0.05	
Irgacor L 12	(%)	0.05	0.05	
Base stock (1)		balance	balance	

Oxidation stability

TOST (ASTM D 943)
95 °C, H_2O, Fe and Cu catalysts

Time to TAN = 2.0	(hrs)	9700	7000	2000 min.
1000 hrs TOST Sludge (ASTM D 4310)	(mg)	42	94	-
TOST colour (ASTM D 1500) after				
0 hrs		0.5		
2000 hrs		4.0		
6000 hrs		4.5		

RBOT (ASTM D 2272)

Induction period	(mins)	1037	755	450 min.

RBOT modified: N_2 blown test

Induction period	(mins)	1043	760	> 80% of initial value

Thermooxidative stability

(FTMS 791 b 5308.6)
72 hrs, 175 °C, 5 l air/hr

Change of TAN	(mg KOH/g)	+ 0.15	+ 1.9	3.0 max.
Viscosity change at 40 °C	(%)	+ 3.0	+ 9.3	+ 20/ -5
Sludge	(mg/100 ml)	8.3	-	-
Metal weight change	(mg/cm^2)			-
Steel		+ 0.012	+ 0.032	
Silver		+ 0.008	+ 0.020	
Aluminium		+ 0.012	+ 0.028	
Magnesium		+ 0.020	+ 0.028	
Copper		+ 0.048	+ 0.004	

Metal protection

Iron (ASTM D 665)
60 °C, 24 hrs

Procedure B: synthetic sea water Iron rod	(rating)	pass	pass	pass

Copper (ASTM D 130)
100 °C, 3 hrs

Copper strip	(rating)	1b	1b	1 b max.

(1) Base stock characteristics				
ISO VG		32	32	
VI		95	-	
C (aromatic)	(%)	1.6	4.0	
Sulphur	(%)	nil	0.38	

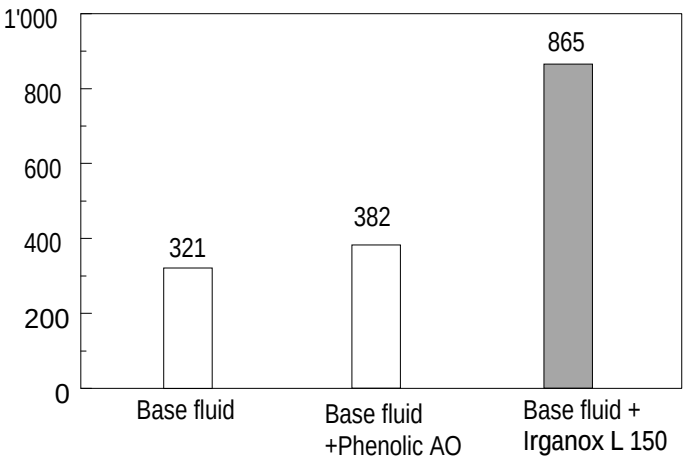
Heavy duty diesel engine oils
Deposit control

IRGANOX L 150 significantly extends the induction period of a fully formulated heavy duty diesel engine oil. It clearly outperforms a competitive phenolic antioxidant.

Test fluids

IRGANOX L 150	(%)	-	-	0.6
Phenolic antioxidant (1)	(%)	-	0.6	-
Base fluid (2)		neat	balance	balance

Pressurised Differential Scanning Calorimetry (PDSC) test
180 °C (isothermal), test pan steel SX, oxygen pressure 10 bar



(1) 4,4'-Methylene bis-(2,6 di-tert.-butyl phenol)

(2) Base fluid characteristics	Heavy duty diesel engine oil without ashless antioxidant Fully formulated it meets API CD/CCMC D3
Viscosity	SAE 10W-30

Oxidation inhibition

IRGANOX L 150 increases the high temperature thin film oxidation stability of diesel engine oils.

Test fluids

IRGANOX L 150	(%)		0.5	0.75	
CEC RL 134 low reference oil		neat	balance	balance	
CEC RL 133 high reference oil		-	-	-	neat

PDSC test
Isothermal: 200 °C, NO_X

Induction period	(mins)	20	28	32	32

PDSC test
Non-isothermal: 5 °C/min, O_2

Onset temperature	(°C)	220	231	235	231

Marine diesel engine oils

The addition of IRGANOX L 150 to a fully formulated marine diesel engine oil enhances the performance significantly beyond that of the Caterpillar specification.

Test fluids

IRGANOX L 150 (%)	-	-	0.5
ASTM reference oil REO 217 (1)	neat	-	-
Fully formulated marine lubricant (2)	-	neat	balance

Caterpillar micro-oxidation test
A thin film of oil,20 mg, is placed on a steel coupon and heated, 230 °C, for varying lengths of time.
The coupon is rinsed with tetrahydrofuran and the deposit (mg) formed is determined.

Induction period (3) (mins.) (time to 6% deposit)	ca. 120	130	182

(1) REO 217 is a passing Caterpillar 1K reference oil

(2) Fully formulated marine diesel engine oil SAE 40, TBN 30 mg KOH/g, in a solvent neutral base oil

(3) An ideal isothermal plot of percent deposit vs. time would have an S-shape curve. The induction period can be determined on this plot by drawing a straight line tangent to the curve where the slope is steepest. The induction period is where this line intersects the time axis (x-axis).

According to Caterpillar an oil is considered "passing" if it has an induction period of more than 120 minutes.

Heat transfer fluids
Oxidation inhibition

IRGANOX L 150 effectively improves the oxidative stability of mineral oil based heat transfer fluids

Test fluids

IRGANOX L 150 (%)		0.5	1.0
Commercially available heat transfer fluid	neat	balance	balance

Modified oxidation test
(IP 48)
200 °C; 15 l air/h; 48 hrs

TAN			
Initial (mg KOH/g)	0.03	0.11	0.12
Change after 48 hrs (mg KOH/g)	10.4	8.4	7.5
Viscosity change at 40 °C after 48 hrs (%)	291	121	102

Safety and Handling	Please read Material Safety Data Sheet (MSDS) before handling.
Product Specification	This information is available on request through our local representative.
Packaging	This information is available on request through our local representative.

Safety

When using this product, the information and advice given in our **Safety Data Sheet** should be observed. Due attention should also be given to the **precautions** necessary for handling chemicals.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights, etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

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