

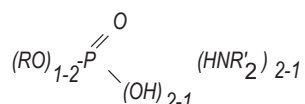
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IRGALUBE® 349

Extreme pressure / antiwear additive

Typical chemical and physical properties

IRGALUBE 349, a mixture of amine phosphates, is an ashless multi-functional additive with extreme pressure / antiwear and antirust activity.



Appearance	Clear, viscous, colourless to yellow liquid
Viscosity at 40 °C	2200 mPa.s
Density at 20 °C	0.92 g/cm ³
Flash point	135 °C, Pensky-Martens
Solubility	
Water	<0.01 %
Mineral oil	3 %
Phosphorus content	4.8 %
Nitrogen content	2.7 %

Applications and typical treat levels recommended

Industrial lubricants	0.1–0.5 %
Grease	0.5–1 %
Metal working fluids, especially rolling oils	0.3–0.5 %
Engine oils and power transmission fluids	0.2–0.5 %
Synthetic and partial synthetic lubricants	0.5–1 %
Lubricants with incidental food contact	0.1–0.5 %

Benefits

Provides multifunctional performance as EP/AW additive and corrosion inhibitor

Improves FZG performance of lubricants

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

Demonstrates EP/AW synergism with Irgalube TPPT

Improves frictional characteristics of lubricants and greases

Easy to handle liquid, contains no diluents

Restrictions

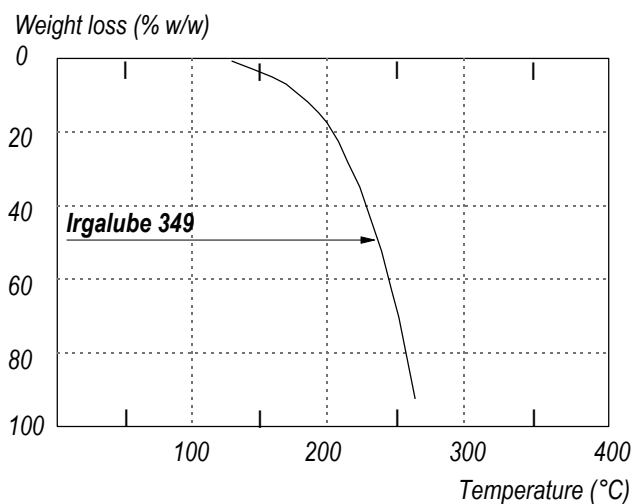
Not recommended when calcium compatibility of lubricant is required
May adversely affect structure of complex greases
Solubility in PAGs should be carefully checked, in some PAGs gel formation occurs
Good hydrolytic stability can be obtained by using correct treat levels

Additive volatility

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

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 400 °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 under 21 CFR 178.3570, for use in USDA H-1 lubricants with incidental food contact

IRGALUBE 349 Maximum treat level ⁽¹⁾
0.5 % wt/wt

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

Performance benefits: Metal surface protection (wear inhibition, rust prevention and friction reduction)

Wear inhibition

IRGALUBE 349 improves the extreme pressure and antiwear characteristics of mineral oil, synthetic fluid and vegetable oil based lubricants.

Test fluids

IRGALUBE 349	(%)	1.0	–	0.25	–
Base stock HVI solv.neutral				–	–
ISO VG 100		balance	neat		
Base stock HVI solv.neutral		–	–		
ISO VG 32				balance	neat

4 ball test (ASTM D 2783)

Initial seizure load	(N)	1000	800	–	–
Weld load ⁽¹⁾	(N)	1800	1500	–	–
Wear scar diameter after 60 min, 400N ⁽²⁾	(mm)	0.30	0.95	–	–

FZG gear test (DIN 51 354)
A/8.3/90

Failure load stage ⁽³⁾	–	–	11	5
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⁽¹⁾ Weld load 2500N required in U.S. Steel 224 industrial gear oil specification

⁽²⁾ Wear scar 0.8 mm maximum required in U.S. Steel 126 steam turbine specification

⁽³⁾ Failure load stage 10 required for DIN 51 524 Part 2 hydraulic oil specification

Rust prevention

IRGALUBE 349 protects ferrous metal surfaces, at low concentrations, against corrosion in a wide range of base fluids.

Test fluids

IRGALUBE 349	(%)	0.1	–	0.1	–	0.05	
Base fluid ⁽¹⁾ ISO VG 32	balance			–	–	–	
Base fluid ⁽¹⁾ PAO				balance	neat	–	
Base fluid ⁽¹⁾ PE ester						balance	neat

(ASTM D 665)
(60 °C, 24 h)

Proc. B: Synt. sea water Iron rod (rating)	pass	severe rust	pass	severe rust	pass	severe rust
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⁽¹⁾ Base fluid characteristics ISO VG	32 Solvent neutral HVI	– PAO	Pentaerythritol ester
Visc. at 100 °C (mm ² /s)	–	6	–
Visc. at 40 °C (mm ² /s)	–	–	3.5

Lubricating oils Friction reduction

Test fluids

A lower coefficient of friction is obtained with IRGALUBE 349 than with a ZnDTP when added to a lubricating oil

IRGALUBE 349	(%)	2.0	-	-
ZnDTP	(%)	-	2.0	-
Base stock ISO VG 100		balance	balance	neat

SRV friction test
OPTIMOL apparatus
Oscillating steel ball on steel plate
200N, 140 °C, oscillation 1 mm, 50 Hz

Friction coefficient	0.080	0.105	0.125
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Greases Friction reduction

Test greases

Greases formulated with IRGALUBE 349 have excellent friction characteristics and corrosion protection

IRGALUBE 349	(%)		0.75
Li-12-OH stearate grease (NLGI 2)		neat	balance

SRV friction test
OPTIMOL apparatus
Ring on plate: 600 N, 2 hrs, 40 °C, 200N, 0,5 mm amplitude, 50 Hz

Friction number at the start of the test	0.11	0.10
Friction number at the end of the test	0.092	0.066
Curve type	very rough	smooth / coarse

Rust inhibition

EMCOR test
(IP 220 / DIN 51 802)

Bearing 1	(rating)	4	0
Bearing 2		5	0

Engine oils Rust prevention

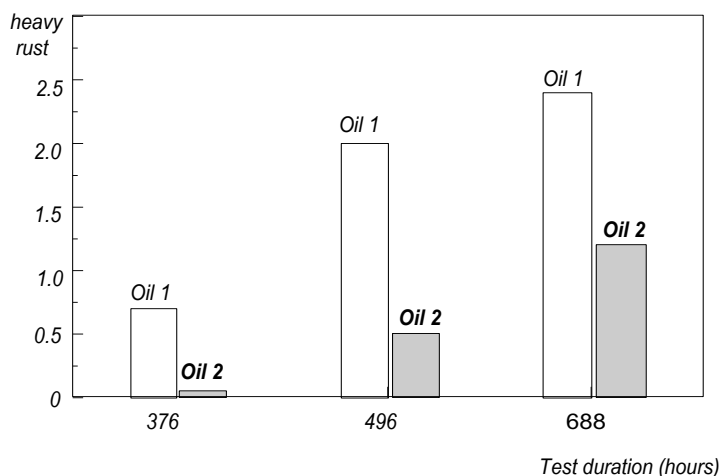
Test oils

IRGALUBE 349 provides excellent corrosion control in a first fill engine oil.

IRGALUBE 349	(%)	Oil 1	Oil 2
Fully formulated passenger car engine oil		–	0.2
SAE 15W-40		neat	balance

Humidity cabinet test (DIN 51 349)
100 % relative humidity, 50 °C

Average panel rating



Synergy with Irgalube TPPT Wear inhibition

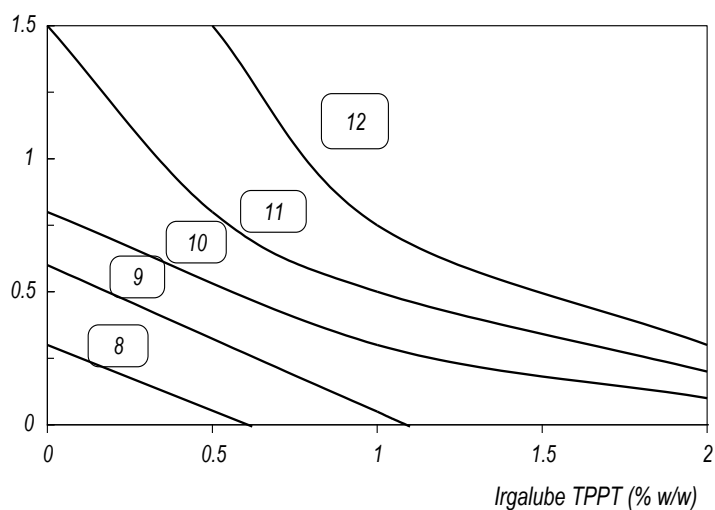
Test fluids

In certain synthetic base fluids, combinations of IRGALUBE 349 with Irgalube TPPT show synergy as assessed by the FZG gear test.

IRGALUBE 349	(%)	variable
Irgalube TPPT	(%)	variable
Pentaerythritol tetraester fluid ISO VG 22, VI 126		balance

FZG gear test (DIN 51 354)
A/8.3/90

Irgalube 349 (% w/w)



Areas of constant failure load stage as indicated.

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.

September 2017