DOVER Chemical Corporation
A Subsidiary of ICC Industries Inc.

HIGH-PERFORMANCE ADDITIVES

Dover, Ohio facility

DOVER Chemical Corporation

A Subsidiary of ICC Industries Inc.

Dover Chemical Corporation is a leading producer of alkylphenols, chlorinated alkanes, polymer additives, liquid and solid antioxidants (including organophosphites), flame retardants, additives for water-based and oil-based metalworking fluids and drilling-fluid additives.

Our manufacturing facilities are located in Dover, OH and Hammond, IN. Our Dover location is along Interstate 77 in east central Ohio, providing easy access for shipping. The Hammond location is just 17 miles south of Chicago, along the Interstates 80-94 corridor.

Dover Chemical is proud to have earned ISO 9001:2008 certification in recognition of our ongoing commitment to uncompromising quality. We join other members and partners of the American Chemistry Council in our dedication to the principles of Responsible Care, including product stewardship, community awareness, emergency response, pollution prevention, process safety, distribution, and employee health & safety. Dover Chemical Corporation is a subsidiary of ICC Industries Inc., which is headquartered in New York.

Hammond, Indiana facility

ABOUT ICC INDUSTRIES INC.

The ICC Industries Inc. group of companies (www.iccindustries.com) develops, manufactures, trades and markets a diverse range of chemicals, plastics, pharmaceuticals, dietary supplements and related products. ICC is also an investor in a global leader in the field of flavors and ingredients for the food-and-beverage industries.

Headquartered in New York City since 1950, the ICC Group's origins trace back to Central Europe during the early 20th century, when Eugene Farber founded the United Factory for Varnishes and Paints in his home town of Timisoara, Romania. That company was nationalized after the Second World War, and in 1948 the Farber family left Romania. Eugene's son John made his way to the newly formed State of Israel, later immigrating to New York City to pursue his doctorate in the emerging field of polymer chemistry. There, he joined his father-in-law, Leslie Kleyman, at Mr. Kleyman's textile import-export business. Soon Dr. John Farber began sourcing chemical ingredients for the paints that his family had produced in Romania, selling them to European customers. That activity developed into ICC's chemical-trading business.

In the following decades, the ICC group expanded by adding companies that develop and manufacture a variety of products. One of them is the reprivatized paint and coatings company that the Farber family started in Romania, now known as SC Azur. ICC remains a family-owned company with Dr. Farber as its Chairman. Sandra Farber, representing the third generation of the family, serves as Vice Chair. We are proud of our history, and we look forward with enthusiasm to a future of sustainable growth and continued success of the ICC Group.

Clear Advantages to Keep You Covered

DOVERPHOS® LGP-PLATFORM

DOVERPHOS® LGP-11® & LGP-12

Introducing the Doverphos® LGP Platform, an innovative, proprietary liquid-polymeric-phosphite stabilizer that is a suitable alternative to TNPP.

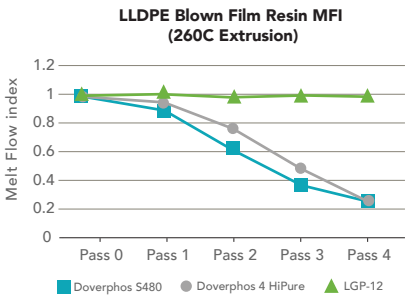
Doverphos® LGP is unique in that it contains no alkylphenols. Additionally, it offers excellent compatibility in thermoplastic resins, resulting in reduced additive migration and exposure, especially for indirect food-contact applications.

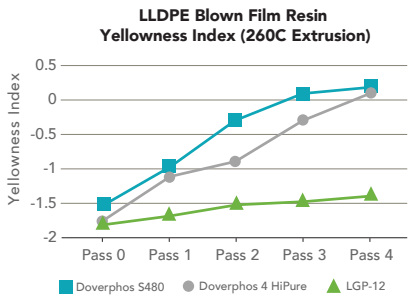
Our umbrella of products is designed to meet stringent protocols, including many with FDA approval, while delivering thermal and hydrolytic stability and excellent color. DoverPhos® LGP phosphite stabilizers provide compatibility in thermoplastic resins and rubber, resulting in reduced additive migration and exposure.

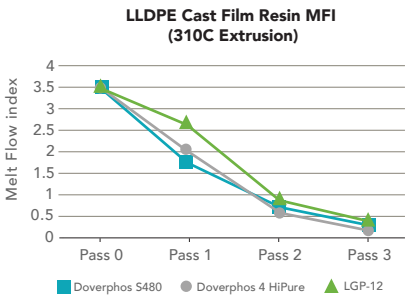
Dover Chemical's family of products improves the performance of resins including:

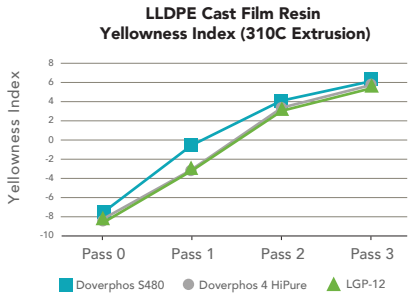
- **Polyolefins**
- **PVC**
- **Coatings**
- **Adhesives**
- **Rubber**
- **Elastomers**
- **Engineering Plastics**
- **PUF**

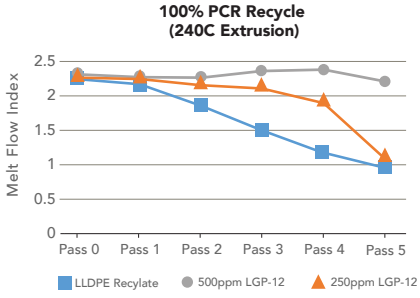
PERFORMANCE











Doverphos LGP-12 can help produce a more stable PCR recyclate stream

Doverphos LGP-12 cleared melt fracture without the use of conventional PPA's, including fluoropolymers (for pics below)

PROPERTY	TYPICAL RESULT
Appearance	Clear to slightly hazy liquid
Refractive Index @ 25°C	1.4588
Specific Gravity @ 25°C	0.98
AV	0.01
Color, APHA	<50
Viscosity, CPS @ 25° C	~600

APPLICATIONS

- Plastic/cling wrap
- Deli wrap
- Snack food packaging
- Boil-in bags
- Lidded plastic food storage containers
- Resealable sandwich bags
- Diapers

APPLICATION INFORMATION:

Doverphos® can be used in LLDPE, HDPE, PP and other polymers to protect against the effects of oxidative and thermal degradation to maintain MI and low color. Doverphos® is effective as a replacement for TNPP on a part-for-part basis.

FDA APPROVED

www.doverchem.com/doverphos-lgp

DOVERGUARD E-35

Chlorinated Esters for Secondary Flame Retardant Plasticizer

Doverguard E-35 is a patented chlorinated ester that is used in PVC applications as secondary flame retardant plasticizers. **Doverguard E-35** can be used as cost effective replacement of phosphates and phthalates and as an alternative to chlorinated paraffins. It offers improved compatibility, melt processing and increased efficiency. The maximum loading level is formulation dependent.

Additional benefits versus common phthalate plasticizers:

- Acts as a flame retardant
- Lower volatility
- Lower water extractability
- Increased flex strength
- Lower plastisol viscosity
- Not listed on Prop 65
- Based on renewable materials from plant sources (new carbon)
- Not considered a substance of very high concern (SVHC)
- The US-EPA has reviewed Doverguard E-35 and in 2018 cleared it for use in all metalworking and plastic applications

PROPERTY	TYPICAL RESULT
Chlorine, %	35-40
Specific Gravity	1.16
Density (lb/gal)	9.6
Viscosity @ 25°C	6
Pour Point (°C)	<-30
Color, Gardner	<2

It is recommended to store Doverguard E-35 in temperatures ranging from 80° to 100°F. Darkening of products may result due to prolonged exposure to temperatures exceeding 100°F.

ANTIOXIDANTS

for Heat Stabilization and Property Maintenance

Dover Chemical has grown into a leading producer of organophosphites by continuing to identify and meet market needs of product consistency, high purity, and fast-response time. Our ability to continually develop innovative products and our commitment to working closely with customers have contributed to our success with these products. Dover Chemical offers a line of solid antioxidants for use in a wide range of polymers to further broaden our product range.

DOVERPHOS® SOLID ORGANOPHOSPHITES

Product	Appearance	Melting Point, °C	Phosphorus, %	Volatility, % @ 105°C/2 hr.	Assay, %	Refractive Index @ 60°C	Specific Gravity @ 60°C	Acid Number (mgKOH/gm)
Doverphos S-9228® Bis (2, 4-dicumylphenyl) pentaerythritol diphosphite	Off-white free-flowing powder	230	7.3	0.2	99.5	—	—	0.5
Doverphos S-9228T Bis (2, 4-dicumylphenyl) pentaerythritol diphosphite plus triisopropanolamine	Off-white free-flowing powder	230	7.3	0.2	99.5	—	—	0.5
Doverphos 480 Tris (2, 4-di-tert-butylphenyl) phosphite	White free-flowing powder	185	4.8	0.1	99.5	—	—	0.1
Doverphos S-680 Distearyl pentaerythritol diphosphite	White flake	55	8.0	—	—	1.457	0.926	0.2
Doverphos S-682 Distearyl pentaerythritol diphosphite plus triisopropanolamine	White flake	56	8.0	—	—	1.457	0.926	0.2

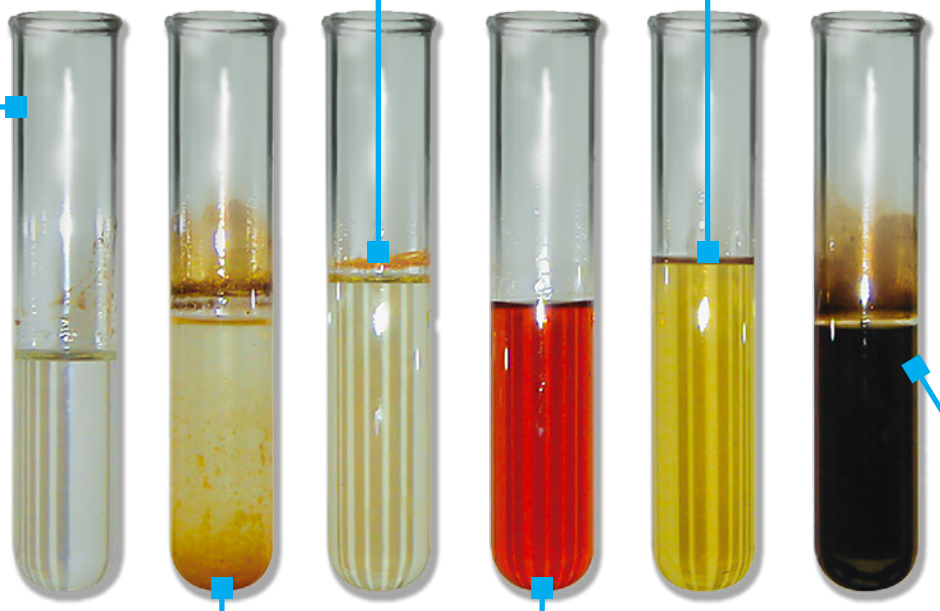
DOVERNOX® SOLID ANTIOXIDANTS

Product	Appearance	Melting Point, °C	Molecular Weight	Solubility (gm/100 ml @ 20°C)				
				Acetone	Hexane	Methanol	Water	Ethyl Acetate
Dovernox 10 Tetrakis methylene (3,5-di-t-butyl-4-hydroxyhydrocinnamate) methane	White crystaline powder	115	1178	47.0	0.3	1.00<	0.01	46.0
Dovernox 76 Octadecyl 3,5-di-t-butyl-4-hydroxyhydrocinnamate	White free-flowing powder	51	531	19.0	32.0	0.6<	0.01	38.0

DOVERPHOS S-9228®

Clearly Superior High-Performance Phosphite

Doverphos S-9228® compared to various commercial phosphites after heating at 280°C for 120 minutes.



Doverphos S-9228® Bis (2,4–di-cumylphenyl) pentaerythritol diphosphite. CAS registry No. 154862-43-8

Doverphos HiPure® 4 Trisnonylphenyl Phosphite

Tris (2,4-di-t-butylphenyl) phosphite

Bis (2,4-di-t-butylphenyl) pentaerythritol diphosphite

Phosphorus trichloride, reaction products with 1,1'-biphenyl and 2,4-bis (1,1-dimethylethyl) phenol

Bis (2,6-di-t-butylphenyl-4-methyl pentaerythritol) diphosphite

Doverphos S-9228®'s high-molecular weight, low volatility, and high phosphorus content provide superior thermal stability that offers outstanding protection against discoloration and thermal degradation. Its unsurpassed hydrolytic stability prevents the formation of black specks.

Additional advantages of Doverphos S-9228® include:

- Excellent for high temperature processing
- Low migration
- Low gel counts
- REACH compliant
- Global Regulatory sanction for use in food contact applications
- FDA sanctions for use in all polymers with no limitations on Conditions of Use and Food Types

DOVERPHOS®
LIQUID ORGANOPHOSPHITES

Dover Chemical is a leading global producer of organophosphites, designed to meet the antioxidant needs of a number of markets, including PVC and polyolefins.

Product	Color, APHA	Acid Number (mgKOH/gm)	Refractive Index @ 25°C	Specific Gravity @ 25°C/15.5°C	Appearance	% P	Density (lb/gal)	VISC cps @ 25°C
Doverphos 4 Trisnonylphenyl Phosphite	75 max.	0.1 max.	1.5255-1.5280	0.980-0.992	Clear Liquid	4.3	8.2	6000
Doverphos HiPure 4 Trisnonylphenyl Phosphite	75 max.	0.1 max.	1.5275-1.5295	0.980-0.997	Clear Liquid	4.5	8.2	7700
Doverphos 6 Triisodecyl Phosphite	50 max.	0.1 max.	1.4530-1.4610	0.884-0.904	Clear Liquid	6.2	7.4	15
Doverphos 7 Phenyl Diisodecyl Phosphite	50 max.	0.05 max.	1.4780-1.4810	0.938-0.947	Clear Liquid	7.1	7.8	17
Doverphos 8 Diphenyl Isodecyl Phosphite	50 max.	0.05 max.	1.5160-1.5190	1.022-1.032	Clear Liquid	8.3	8.6	14
Doverphos 9-EH Ethylhexyl Diphenyl Phosphite	50 max.	0.1 max.	1.5200-1.5240	1.040-1.047	Clear Liquid	9.0	8.7	9.5
Doverphos 10 Triphenyl Phosphite	50 max.	0.5 max.	1.5880-1.5900	1.180-1.186	Clear Liquid	10.0	9.8	17
Doverphos 11 Tetraphenyl Dipropyleneglycol Diphosphite	50 max.	0.2 max.	1.5770-1.5620	1.164-1.188	Clear Liquid	10.9	9.8	80
Doverphos 12 Poly (dipropyleneglycol) Phenyl Phosphite	50 max.	0.1 max.	1.5340-1.5380	1.168-1.180	Clear Liquid	12.0	9.8	487
Doverphos 49 Tris (tridecyl) Phosphite	50 max.	0.1 max.	1.4600-1.4650	0.882-0.900	Clear Liquid	4.9	7.4	41
Doverphos 54 Tris Alkyl (C12-C15) Phosphite	50 max.	0.1 max.	1.4545-1.4595	0.872-0.882	Clear Liquid	5.3	7.3	20
Doverphos 213 Diphenyl Phosphite	250 max.	15 max.	1.5540-1.5600	1.210-1.230	Clear Liquid	13.3	10.1	12
Doverphos 253 Dioleyl Hydrogen Phosphite	<3 Gardner	15 max.	1.4640-1.4700	0.880-0.910	Clear Liquid	5.3	7.5	35
Doverphos 613 Alkyl (C12-C15) Bisphenol A Phosphite	100 max.	0.1 max.	1.4910-1.4970	0.940-0.985	Clear to Slight Pink Liquid	5.4	8.0	230
Doverphos 675 Alkyl (C10) Bisphenol A Phosphite	100 max.	0.5 max.	1.4940-1.5090	0.910-0.980	Clear Liquid	6.7	7.9	275

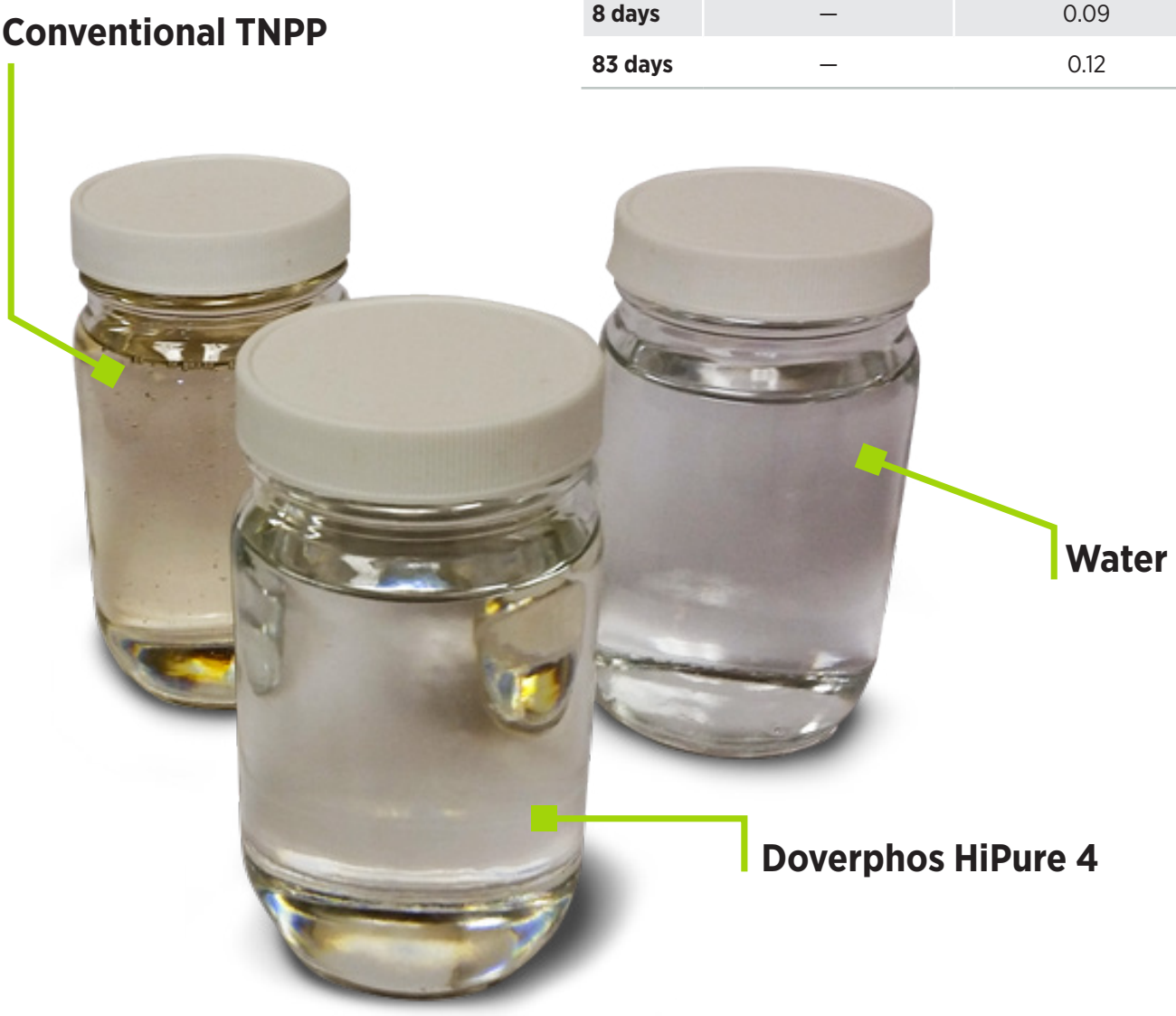
DOVERPHOS® HiPure 4 TNPP

BETTER HYDROLYTIC STABILITY THAN OTHER TNPP PRODUCTS

Hydrolysis conditions: 35°C and 85% relative humidity

TNPP is often used in a water emulsion for stabilizing polymers. It is critical that TNPP used in this application has good hydrolytic stability, since hydrolyzed TNPP is not an effective stabilizer and can also cause black specks.

	Doverphos 4HR	Doverphos HiPure 4HR
Time	**% Free Nonylphenol**	
Initial	4.0	0.03
4 hours	4.3	0.04
7 hours	4.6	0.04
12 hours	5.4	0.04
24 hours	5.5	0.04
48 hours	—	0.06
4 days	—	0.07
8 days	—	0.09
83 days	—	0.12



Doverphos 4HR and Doverphos HiPure 4HR contain TiPA to extend the hydrolytic stability of these products.

GET MORE ACTIVE PHOSPHITE

And less free nonylphenol with Doverphos HiPure 4 TNPP

Doverphos HiPure 4, HiPure 4HR and HiPure 4HR Plus offer the highest purity TNPP with the lowest level of free nonylphenol of any commercially available product.

Doverphos HiPure 4HR and Doverphos HiPure 4HR Plus provide enhanced hydrolytic stability to give better final color in end-use products. All Doverphos HiPure 4 grades are produced in totally automated ISO 9001 certified processes.

FOOD CONTACT PACKAGING

Doverphos HiPure 4 is Kosher-approved and sanctioned under FDA regulations for food-contact packaging applications in a number of polymer and rubber systems.

HEAT STABILIZATION

Doverphos HiPure 4 is an effective liquid phosphite heat stabilzer for a wide variety of polymer and rubber systems, including:

- Polyolefins
- Elastomers
- Adhesives
- Coatings
- Acrylics
- ABS
- PVC
- Nylon
- Polycarbonates
- Polyethylene Terephthalate
- Polyurethanes
- Polystyrenes

Typical use levels range from 0.05% - 3.0% for most applications.

NOMENCLATURE $(C_9H_{19}\text{-}C_6H_4\text{-}O\text{-})_3P$

CAS name	Trisnonylphenyl Phosphite
Molecular Weight	688
CAS Number	26523-78-4
U.S. Patent No.	5,532,401

PHYSICAL PROPERTIES

Appearance	Clear liquid
% Phosphorous	4.3
Density, lb./gal	8.2
Viscosity	7800cps @ 25°C

SPECIFICATIONS

Free Nonylphenol	0.1% maximum
Color, APHA	75 maximum
Acid No., mg KOH/gm	0.1 maximum (HiPure 4)
Refractive Index, 25°C	1.5275 - 1.5295
Specific Gravity	0.980 - 0.997

Doverphos HiPure 4
Gives better final color in end-use products and less free nonylphenol release during processing.

Doverphos HiPure 4HR
Contains 0.75% maximum triisopropanolamine for improved hydrolytic stability.

Doverphos HiPure 4HR Plus
Contains 1.0% triisopropanolamine for maximum hydrolytic stability.

STORAGE AND HANDLING

Phosphites tend to hydrolyze when exposed to moisture such as humid air. The extent of the hydrolysis will depend on the type of phosphite, temperature, degree of humidity and length of exposure.

Liquid phosphites, such as Doverphos HiPure 4, are more hydrolysis resistant than solid phosphites, due to a lower surface area exposed to moisture. The degree of hydrolysis can be determined by running an acid value on the phosphite. If the acid value is above the specification, some hydrolysis has occurred. A small degree of hydrolysis should not greatly affect the performance of the phosphite.

Doverphos HiPure 4HR and Doverphos HiPure 4HR Plus can be hazy at room temperature. This will not affect performance.

If the practices below are followed, unopened drums of liquid phosphites will have a shelf life of at least one year.

- Store bulk containers of phosphites under a dry atmosphere of nitrogen. Use either stainless steel tanks glass-lined tanks or carbon steel tanks coated with a phenolic lining such as Plasite® 3066 from Wisconsin Protective Coating Corporation.
- Handle phosphites in a dry nitrogen atmosphere.
- Use the entire drum of phosphite at one time. If the drum needs to be re-sealed, purge the vacant volume with dry nitrogen and re-seal the drum tightly.
- Store unopened drums inside to minimize temperature fluctuations that can cause the drum to breathe.

ALKYLPHENOLS

Building Blocks for High Performance Chemicals

In 1997, Dover Chemical built a state-of-the-art manufacturing facility to produce alkylphenol products. After several expansions and updates, today's facility is totally automated, assuring our customers of consistent quality para- and di-nonylphenol and para- and di-cumylphenol.

This plant represents a major investment for Dover Chemical's strategy to become a global supplier to the polymer industry. Alkylphenols typically are not used by themselves as additives, but are intermediates to produce high performance products. Markets for these products include surfactants, lube-oil additives, stabilizers for rubbers and plastics, dispersants, adhesives, and plasticizers for resins.

ALKYLPHENOL APPLICATIONS

SURFACTANTS: The largest industrial use for alkylphenol is in the manufacturing of nonionic surfactants. These ethoxylated alkylphenol surfactants have good chemical stability and excellent wetting, emulsifying and detergent properties.

TNPP: Nonylphenol is reacted with phosphorus trichloride to produce trisnonylphenyl phosphite (TNPP), a common antioxidant for a wide range of polymer systems.

PHENOLIC RESINS: Nonylphenol reacts with aldehydes to yield phenolic resins. When used with other phenols, even in small quantities, it makes the phenolic resins more water resistant, more soluble in oil, and improves electrical properties.

RUBBER CHEMISTRY: Nonylphenol sulfide has been used as a reclaiming agent for synthetic rubber.

PVC: Nonylphenol and nonylphenol derivatives can be used in PVC stabilizers.

EPOXY RESINS: Nonylphenol can be used in an epoxy resin hardener.

MISCELLANEOUS: Other applications for alkylphenols include pharmaceuticals, corrosion inhibitors, dyestuffs, ore flotation agents, insecticides, bactericides, chemical stabilizers, and the leather industry. Overbased calcium salt nonylphenol also can be used as a dispersant in hydraulic fluid and motor oil.

ALKYLPHENOL TYPICAL PROPERTIES

	Color, APHA	NP %	Ortho NP %	Para NP %	DNP %	Water, ppm
Para-nonylphenol	20	98	5	93	2	150
	Color, Gardner		**Specific Gravity**		**DNP %**	
Di-nonylphenol 90%	6		0.900 – 0.940		90.3	
	Color, APHA		**PCP %**	**Molecular Weight**	**Melting Point**	
Para-cumylphenol	20		99.8	212	70° C	
	Color, Gardner		**2,4 DCP %**	**Molecular Weight**	**Melting Point**	
Di-cumylphenol	1		97.0	330	~60°	

METALWORKING, LUBRICANTS, & FUEL ADDITIVES

for Straight Oils, Soluble Oils and Synthetic Coolants

Dover Chemical, a leading chemical producer, offers one of the widest arrays of metalworking, lubricant & fuel additives available in the lubricants industry. Our core product line of extreme pressure (EP) additives answers the lubrication requirement needed in modern machining or driveline applications.

Dover is the sole chemical producer capable of delivering the full suite of S, Cl, P & synthetic EP additives. Our lubricant additives for MWF are both oil-soluble as well as water-soluble. Our S & P EP additives in driveline applications are important AO supplements. Dover Chemical also produces several supporting chemistries including corrosion inhibition, paraffin and asphaltene inhibition, pour point depression, dispersion, detergents, AO/AW, wetting, emulsifiers, and alkalinity sources which find use in metalworking, lubrication, fuel additives and oilfield & refinery production. Also, we have fully formulated MWF packages to allow for off the shelf solutions.

EXTREME PRESSURE ADDITIVES

SULFUR ADDITIVES

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	Vis @ 210°F, SUS	Vis @ 100°C, cS	% Sulfur	% Active	Neut #	Flash Point, °F	Description
LARD OILS AND ESTERS – NON STAINING TO COPPER									
Base 10SE	102	21	42.5	9	10	0	8	400	Sulfurized methyl ester
Maysperm 2011LV	1750	370	200	40	10.5	0	9	400	Sulfurized lard/ester
Mayco Base 1351	1775	375	175	35	10.5	0	7	400	Sulfurized lard/olefin
Maysperm 2011	3500	750	300	55	10.5	0	11	425	Sulfurized lard oil
Mayco Base 1210	5500	1150	425	85	10.5	0	12	440	Sulfurized lard oil
Base 10L	6100	1155	425	85	10	0	25	350	Sulfurized fatty cmpd
LARD OILS AND ESTERS – STAINING TO COPPER									
Base 12SE	110	20	40	5	13	3	4	350	Sulfurized methyl ester
Mayco Base 4220	650	135	80	15	18	6	1	410	Sulfurized esters
Mayco Base 1362	2900	575	245	50	17.5	6	8	400	Sulfurized lard/olefin
Mayco Base 1217LV	5000	1050	335	75	17	6	10	400	Sulfurized lard/ester
Base 14L	9000	1700	525	120	13	3	26	350	Sulfurized fatty cmpd
Mayco Base 1214G	9500	2300	650	140	16.5	6	11	420	Sulfurized lard oil
OLEFINS – STAINING TO COPPER									
Mayco Base 1535	400	90	69	11	31	20	0	360	Sulfurized hydrocarbon
Mayco Base 1540	500	100	70	15	38.5	27	0	360	Sulfurized hydrocarbon

EXTREME PRESSURE ADDITIVES (CONT.)

CHLORINE ADDITIVES

Product	Color Gardner	Chlorine Content, % by Wt.	Specific Gravity @ 25°C	Viscosity Poise @ 77°F	Viscosity SUS @ 210°F	Density Pounds per Gallon	Volatility % Loss, 24hrs @ 100°C	Stability JQD %HCL, 4hrs @175°C	Flash Point F (Cleveland Open Cup)	
VERY LONG-CHAIN CHLORINATED ALKANES, C21+										
Paroil CW-50A0	1	46.6	1.220	110.0	282	10.2	0.03	0.25	392	
MEDIUM-CHAIN CHLORINATED ALKANES, C14; C14-16										
Paroil 10-NR	<1	40.1	1.102	0.4	37	9.2	0.8	0.2	>350	
Paroil 152	1	51.9	1.270	15.0	69	10.6	0.9	0.3	>450	
Paroil 54-NR	1	55.3	1.294	17.8	75	10.8	N/A	0.2	>450	
Paroil 58-NR	2	59.0	1.380	300.0	176	11.5	0.5	0.3	>450	
Paroil 63-NR	1	63.6	1.439	450.0	314	12.0	0.5	0.2	>450	
CHLORINATED LUBRICANTS										
DA-8527	3	29			110			4		
Doverguard E-35	<2	35	1.16			9.6				
ACID SCAVENGERS										
Doverflex 100		N/A	0.99 (60°F)			8.25	N/A	N/A	590	ESO Chlorinated Stain Inhibitor

PHOSPHORUS ADDITIVES – EXTREME PRESSURE, ANTI-WEAR, ANTI-OXIDANT

Product	Vis @ 100°F, SUS	Vis @ 210°F, SUS	% Phos	Acid #	EP	AO	AW	Comments
Mayfree 2033	3,500	215	4	110	x		x	Phosamide
Mayfree 133	44,000	750	4	155	x		x	Phosamide
Doverphos EP-425	1,260	91	4.3	< 1	x	x	x	Polymeric Phosphite Ester
Doverphos 253	148	-	5.3	10	x	x	x	Di-Oleyl Hydrogen Phosphite Ester
Doverphos 54	140	-	5.3	< 1		x	x	Tri-Alkyl Phosphite Ester
Mayphos 45	90,000	1,750	5.4	200	x			Ethoxylated Phosphate Ester
EM 706	1,550	155	5.5	157	x			Alkyl Phosphate Ester
Maylube S-830	1,500	-	1.2	72	x			Water Soluble Phosphate Ester Booster
Doverlube NCL-2	9300	470	3	150	x		x	Phosphorus Package

SYNTHETIC LUBRICANTS

Product	Vis @ 100°F, SUS	Vis @ 210°F, SUS	Acid #	Color (ASTM)	Comments
Doverlube NCEP	300	-	10	> 5	S&P free Vegetable oil based EP (1.5% N by wt.)
Doverlube 31700	17,000	1150	5	3.5	Polymeric Ester
Maylube S-003	300	-	20	5	Water Soluble Ester pkg. that brightens surface finish
Lube Booster II	2300	-	65	4	Water Soluble Polymer
Inversol 140	7600	600	15	3.5	Complexed Ester; cloud point at 140F
Inversol 170	7500	600	14	3.5	Complexed Ester; cloud point at 170F
Maylube E-112	105	32	9	2.0	NPG Ester, Suitable HP Aluminum cutting
Maylube E-101	95	35	2	0.5	Tridecyl Stearate Ester, Suitable Aluminum Machining
Maylube E-190	43	32	1.5	0.5	Synthetic Ester, Excellent Wetting, light duty stamping and finning

PACKAGES & / OR DUAL EP

Product	Vis @ 100°F, SUS	Vis @ 210°F, SUS	Acid #	% Phos	% Chlorine	% Sulfur	% Active	Comments
Maychlor 1010	900	170	1	-	10	10	3.5	Sulfur-chlorinated fatty additive
Maychlor HV-Lite	18,000	1,200	5	-	6	6	0	Light colored sulfur-chlorinated fatty additive
Mayco Base 930	3,800	150	-	-	31	9	3.2	Stainless steel cold heading additive
Mayco Base CF-95	350	65	4	-	-	4.5	1.5	Sulfurized sulphonate
Mayco Base CF-74	550	95	2	-	-	2.5	0	Sulfurized sulphonate

CORROSION INHIBITORS & PH BUFFERS

AMINE BORATE CORROSION INHIBITORS

Product	Vis @ 100°F, SUS	Boron %	Acid #	TBN	Comments
Synkad 204	4400	4.1	NR	370	High performance Boramide
Synkad 202	6300	4.4	NR	420	Cost effective Boramide
Synkad 3100	3800	4.4	NR	400	Cost effective mixed Amine Borate

FATTY ACID BASED CORROSION INHIBITORS

Product	Vis @ 100°F, SUS	Alkalinity	Acid #	TBN	Comments
Mayco Base RP 8708	90	22	16	240	Excellent rust protection and hard water stability
Mayco Base RP 8765	176	20	185	236	Provides excellent rust protection plus lubricity
Synkad 828	215	22	155	250	DEA-free Carboxylic acid condensate

FATTY ACID BASED CORROSION INHIBITOR

Product	Appearance	SG @ 25°C	Imidazoline %	TBN	Comments
Doverhib CI 181TO	Dark amber liquid	0.985	65	230	TOFA Imidazoline Corrosion Inhibitor

EMULSIFIERS, DISPERSANTS & DETERGENTS

ALKANOLAMIDES

Product	Vis @ 100°F, SUS	pH @ 1%	Acid #	TBN	Mol Ratio	Comments
Emulamid FO5DF	2,000	9.2	4	140	2:1	Fatty DIPA Amide
EM 996	1,060	9.5	28	144	2:1	Tall Oil DIPA Amide
EM 980	2,800	9.7	50	180	2:1	Fatty Amide
Emulamid 2C22	1,100	9.8	30	165	2:1	Coco Amide
Emulamid 1O23	950	9.5	5	50	1:1	Fatty DIPA Amide
Emulamid 2O32G	1,520	8.9	50	150	2:1	Non-DEA alkanolamide, good corrosion inhibition and emulsion stability

PIBSA & PIBSI

Product	Physical Form	Acid Value, mgKOH/g	Free Maleic Acid, %	Viscosity, cSt @ 100°C	Hydrolysis, %
Dovermulse H-1000	Viscous dark amber/brown liquid	54	<0.5	470	≤5.0
Dovermulse H-1013P	Viscous amber liquid	50	0.25	290	≤5.0
Dovermulse H-1020P	Viscous amber liquid	46	0.25	220	≤5.0
Dovermulse H-1035N	Viscous amber liquid	34	0.25	74	≤5.0
Dovermulse H-1335P	Viscous amber liquid	29	0.25	140	≤5.0
Dovermulse H-2300	Viscous amber liquid	24	<0.5	2,300	≤5.0

Product	Physical Form	TBN	% N	Viscosity, cSt @100°C	Specific Gravity
Doversperse H-1015P	Viscous dark amber/brown liquid	77	3.2	450	0.92
Doversperse H-1035P	Viscous dark amber/brown liquid	62	2.2	160	0.91
Doversperse H-1335P	Viscous amber liquid	26	1.2	252	0.908

EMULSIFIER BASES AND COUPLERS

Product	Vis @ 100°F, SUS	Acid Value	Appearance	Comments
Base 7800	8,000	23	Amber-brown liquid	Emulsifier base for naphthenic and paraffinic basestocks
Base 8000P	7,700	24	Amber-brown liquid	Emulsifier base for paraffinic basestocks
Base 1142PB	6,500	50	Amber-brown liquid	PIBSA based emulsifier base for Group II & III basestocks
EM 40	530	5	Yellow liquid	Modified glycerol monotallate
EM 600	310	7	Yellow liquid	Co-emulsifier for semi-synthetics and soluble oils

POUR POINT DEPRESSANTS

HYDROCARBON

Product	Vis @ 100°C, cSt	Pour Point °C	Flash Point (COC)	Chlorine %	Color (G)	Comments
Keil-Flo 150	70	-35	182°C (360°F)	0	14	50% active pour point depressant
Keil-Flo 195	890	-40	204°C (400°F)	0	14	95% active pour point depressant

MWF PACKAGES

SEMI-SYNTHETIC CONCENTRATES

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	pH @ 5%	Acid #	Alkalinity	Comments
Maysol SSD-50	800	170	9.5	25	10	50/50 (product/water); Boron-free; General Purpose
Maysol HOSS	1500	325	9.4	60	12	50/50 (product/water); High Oil Content; EP-fortified

SYNTHETIC COOLANTS

Product	PH (neat)	pH @ 5%	Acid #	Alkalinity	Comments
Maysyn S-168	8.7	8.3	50	8	Ready-to-Relabel HD Machining & Grinding on Ferrous and Nonferrous
Maysyn S-122	9.7	9.3	73	17	Cut 60/40 (water/product) for medium duty machining of Ferrous alloys

CHLORINATED ALKANES

Dover Chemical continues to be the leading producer of the most widely used extreme pressure additives — Chlorinated Alkanes. Our ability to custom-formulate unique corrosion inhibition and viscosity properties ensures our continued success as an innovative manufacturer in the industry. Paroil®, Dover Chemical's brand of liquid chlorinated alkanes, is based on the chlorination of waxes, olefins and normal paraffins. A variety of products are available with chlorine contents from 40 to 70 percent and with viscosities from 2 to 1000 poise at 25°C. Chain lengths available include MCCP, LCCP, and vLCCP.

VERY LONG-CHAIN CHLORINATED ALKANES, C21+

Product	Color, Typical Gardner (1933 Std.)	Chlorine Content % by Wt.	Specific Gravity @ 25°C	Viscosity, Poise @ 77°F	Viscosity, SUS @ 210°F	Density, Pounds per Gallon	Volatility % Loss, 24 hrs. @ 100°C	Stability JQD % HCl, 4 hrs. @ 175°C	Flash Point ° F (Cleveland Open Cup)
Paroil CW 38-AO	1	38.9	1.139	13.9	122	9.5	0.01	0.23	392
Paroil CW 40-AO	1	43.3	1.169	27.5	161	9.7	0.02	0.25	392
Paroil CW 50-AO	1	46.6	1.220	110.0	282	10.2	0.03	0.25	392

LONG-CHAIN CHLORINATED ALKANES, C18+

Product	Color, Typical Gardner (1933 Std.)	Chlorine Content % by Wt.	Specific Gravity @ 25°C	Viscosity, Poise @ 77°F	Viscosity, SUS @ 210°F	Density, Pounds per Gallon	Volatility % Loss, 24 hrs. @ 100°C	Stability JQD % HCl, 4 hrs. @ 175°C	Flash Point °F (Cleveland Open Cup)
Chloroflo 42	2	40.0	1.120	6.5	85	9.3	0.5	0.20	>450
Paroil 140	2	43.1	1.980	37.0	150	9.9	0.8	0.15	>450
Paroil 140 LV	2	43.5	1.185	30.0	140	9.9	N/A	0.20	>450
Paroil 142	2-3	45.5	1.221	85.0	200	10.2	0.8	0.30	>450
Paroil 142 LV	2-3	46.1	1.201	49.0	170	10.0	0.8	0.16	>450
Paroil 145	2-3	47.3	1.235	118.0	230	10.3	0.8	0.20	>450
Paroil 150	3	51.0	1.286	375.0	444	10.7	1.0	0.50	>450
Paroil 500	4	53.2	1.309	N/A	649	10.9	N/A	N/A	>450
Chlorowax 40®	2	43.7	1.175	27.0	136	9.8	0.8	0.20	>450
Chlorowax 41SW	2	42.7	1.173	24.0	125	9.8	0.5	0.30	>450
Chlorowax 50®	3	48.0	1.230	116.0	230	10.2	0.8	0.20	>450

MEDIUM-CHAIN CHLORINATED ALKANES, C14: C14-C16

Product	Color, Typical Gardner (1933 Std.)	Chlorine Content % by Wt.	Specific Gravity @ 25°C	Viscosity, Poise @ 77°F	Viscosity, SUS @ 210°F	Density, Pounds per Gallon	Volatility % Loss, 24 hrs. @ 100°C	Stability JQD % HCl, 4 hrs. @ 175°C	Flash Point °F (Cleveland Open Cup)
Paroil 10-NR	<1	40.1	1.102	0.4	37	9.2	0.8	0.2	>350
Paroil 45	1	47.2	1.203	1.9	48	10.0	1.5	0.2	>400
Paroil 51-NR	2	50.1	1.228	5.8	57	10.2	N/A	0.2	>450
Paroil 53-NR	1.8	52.9	1.270	15.0	69	10.6	1.0	0.3	>450
Paroil 54-NR	1	55.3	1.294	17.8	75	10.8	N/A	0.2	>450
Paroil 56-NR	1	56.9	1.327	119.0	119	11.1	N/A	0.3	>450
Paroil 58-NR	2	59.0	1.380	300.0	176	11.5	0.5	0.3	>450
Paroil 63-NR	1	63.6	1.439	450.0	314	12.0	0.5	0.2	>450

CHLORINATED FATTY COMPOUNDS

Product	Material	Color, Typical Gardner	Chlorine Content % by Wt.	Specific Gravity @ 50°C	Viscosity, SUS @ 100°F	Viscosity, SUS @ 210°F	Viscosity, Poise @ 25°C	JQD % HCl, 4 hrs. @ 175°C
DA-8506	Chlorinated Methyl Ester	3	35	1.14	950	752	6	0.5
DA-8527	Chlorinated Fatty Acid	3	29	1.09	1800	110	12	4

FLAME RETARDANTS

DOVERSPERSE

Both Doversperse A-1 and Doversperse 3-NR typically contain 45% available chlorine for maximum flame retardant efficiency. Because of their non-ionic base they find application in both cationic and anionic emulsion systems.

In addition to their flame-retardant contribution, they improve adhesion, impact chemical and water resistance and allow the user to formulate aqueous systems rather than solvent systems. Doversperse A-1 is recommended if increased hardness is required. Use Doversperse 3-NR for plasticizing and tackifying. Application areas include adhesives, rubber, coatings, inks, carpet backings, and paper-and-fabric coatings.

DOVERSPERSE AQUEOUS FLAME RETARDANTS

Dover offers two aqueous flame retardant systems:

- Doversperse A-1 is a dispersed solid and is used to flame-retard coatings and textiles.
- Doversperse 3-NR is an emulsion based on a high viscosity liquid and is typically used to flame-retard adhesive systems.

Product	% Solids	Poise @ 25°C	% Chlorine	Specific Gravity @ 25°C	Appearance
Doversperse A-1	65	64 [1]	45	1.60	Cream White
Doversperse 3-NR	66.5	150-300 [2]	40	1.54	Cream White

[1] #5 spindle, 20 rpm [2] #6 spindle, 10 rpm

RESINOUS CHLORINATED FLAME RETARDANTS

Product	Color, Gardner	% Chlorine	Specific Gravity @ 25° C	Bulk Density (g/L)	Particle Size, % thru 297 Micron	Softening Point, °C	Heat Stability, % HCl	Physical Form
Hordaflam 70R	6	71	1.6	1,619	95	103	0.2	White Powder

Lab tests <u>with</u> and <u>without</u> flame-retardant additives prove their effectiveness.

STEARATES

Doverlube metallic stearates are recommended as a general lubricating additive in plastics processing; internal lubricating properties ease extrusion and mold flow of many plastics compounds. They are also used as mold release agents, preventing preforms from delaminating, reducing adhesion of compounds to inside surfaces of molds and increasing mold life. Metallic stearates provide excellent resistance to color degradation at elevated temperatures, and are particularly suitable as internal lubricants and mold release agents where higher-than-usual processing temperatures are encountered. Metallic stearates are recommended for maximum clarity in unpigmented PVC and polystyrene compounds, and minimize "plate-out" tendencies in PVC extrusion compounds. They increase water repellence of concrete, cement, stucco washes, magnesite and fiberboard, and impart water resistance to asbestos, paper stocks, boxboard, cardboard, textiles and explosives used in mining.

Product	% Total Ash (Metal Oxide)	% Free Fatty Acid	% Moisture	Melt Point, °C	Apparent Density (lb/ft3)	% Passing thru #20 US Mesh	% Passing thru #100 US Mesh	% Passing thru #200 US Mesh	% Passing thru #325 US Mesh
Doverlube CA-20	11.4	1.0 max.	3.5 max.	152	41	95 min.	20 max.	—	—
Doverlube CA-22	10.5 – 12.0	1.0 max.	3.5 max.	152	15	—	—	—	99 min.
Doverlube ZN-20	13.5	1.0 max.	0.5 max.	121	37	—	20 max.	—	—
Doverlube ZN-22	13.5	1.0 max.	0.5 max.	121	21	—	—	—	95 min.

Dover Chemical Corporation's Calcium Stearate products are NSF Certified.

OILFIELD CHEMICALS

Dover Chemical, a leading chemical producer, offers a line of oilfield chemicals that include well bore and coiled tubing lubricants, corrosion inhibitors, and surfactants.

Dover has been supplying the highest performance downhole drilling and coiled tubing lubricants for over 30 years. Lubricants for drilling off the Louisiana shelf, the challenging Bakken brine of North Dakota's Williston basin, and lubricants to make easy work in produced water of the Permian.

LUBRICANTS FOR DOWNHOLE DRILLING AND COILED TUBING

Product	CoF	% Torque Red	lbs/ gal	Application	Pour Pt °F (°C)	Comments
DOWNHOLE DRILLING						
Doverlube DFA-0938	0.15	64	8.0	Downhole Drilling	60 (-16)	LC 50
Doverlube DFA-0938W	0.10	76	7.9	Downhole Drilling	14 (-10)	Cool Temp
Doverlube DFA-0938XW	0.10	76	7.9	Downhole Drilling	-4 (-20)	Cold Temp
Doverlube DFA-1010	0.13	55	8.3	Downhole Drilling	65 (18)	Use w/ DFA 600
COILED TUBING						
Doverlube DFA-1535	0.10	65	8.5	CT	-31 (-35)	Fresh Water
Doverlube DFA-1535EM	0.09	75	8.5	CT	5 (-15)	Produced Water & Divalent Brine
Doverlube DFA-1540	0.09	68	8.9	CT	-35 (<-37)	Fresh Water
Doverlube DFA-1540EM	0.08	79	8.9	CT	8 (-18)	Produced Water & Divalent Brine
ESTERS						
Doverlube DFA-1121	0.15	64	8.0	Downhole Drilling	60 (-16)	WBM & OBM; LC 50
SULFUR AND CHLORINE						
Doverlube DFA-277	0.11	58	9.2	Off Shore - LA Shelf	36 (2)	Pass LC 50 Shrimp Test
Doverlube DFA-3552	0.13	70	8.2	CT	-40 (-40)	Produced Water and Divalent Brine
Doverlube DFA-4052	0.13	70	8.2	CT	-35 (-37)	Produced Water and Divalent Brine
Doverlube DFA-OS52	-	-	10.0	Synergy w/ Sulf Based Lubes	14 (-10)	Cost Effective Diluent

CORROSION INHIBITORS, EMULSIFIERS & SURFACTANTS

Product	Pounds/gal	Vis, Sus, @100 °F	TBN	Acid Value	pH @1%	Comment
Doverhib DFA 181TO	7.8	60	250	10 Max	-	Imidazoline (DETA)
Doverhib DFA 1-TO-22	8.0	1000	40	5	9.6	1:1 TOFA:DEA
Doverhib DFA 1-O-23	8.0	950	45	<5	9.5	1:1 Oleic:DIPA
Doverhib DFA 2-TO-23	8.0	1050	115	12	9.5	2:1 TOFA:DIPA
Doverhib DFA 2-C-22	8.0	1100	165	30	9.8	2:1 CFA:DEA

Product	Pounds/gal	Vis, Sus, @100 °F	TBN	Acid Value	Pour Pt °F (°C)	Comment
Doverlube DFA 600	8.7	260	-	8	65F (18C)	Polyol Fatty Ester

TECHNICAL ASSISTANCE

Dover Chemical Corporation has state-of-the art research and quality-control laboratories. This facilitates the development of new products and enables us to prove a product's ability to perform as required. These modern facilities, complemented by our ISO 9001 Certification, assure consistent and continuing conformance to ever-changing needs. The following is a sampling of the capabilities of our technical and quality departments.

ANALYTICAL

- FTIR—Fourier Transform Infrared Spectroscopy
- DSC—Differential Scanning Calorimetry
- TGA—Thermal Gravimetric Analysis
- GC—Gas Chromatography
- GC/MS—Gas Chromatography / Mass Spectrometry
- GPC—Gel Permeation Chromatography
- HPLC—High Pressure Liquid Chromatography Colorimetry
- LC-MS—Liquid Chromotography– Mass Spectrometry
- ICP-OES—Inductively Coupled Plasma—Optical Emission Spectrometry

PROCESSING

- 1 Roll Mill
- Boy Injection Molder
- Sheets & Pellet Extrusion
- RC-1 Mettler Reactor Colorimeter
- NFM—26mm co-rotating twin screw extruder
- Brabender—18mm single screw extruder
- Brabender—18mm conical counter rotating twin screw extruder
- Brabender—18mm co-rotating twin screw extruder
- 2 Brabender—3 piece bowl mixers
- Wabash—Compression Molder

PHYSICAL ANALYSIS

- Acid Number
- Color Determination
- Viscosity Measurement
- Chlorine Content
- Phosphorus Content
- Softening Point— Ring & Ball Method
- Specific Gravity
- Particle Size
- Stability Test
- Volatility Test
- Flash Point
- Corrosion Test
- Ash Content
- Iron Content
- Ofite Lubricity Tester
- Fann Viscometer
- Fluid Loss Apparatus
- Emulsion Stability Meter

PHYSICAL, MECHANICAL, FLAMMABILITY

- Instron—Flex and Tensile
- Izod Impact Tester
- Falling Dart Impact Tester
- Vicat Softening Point
- Heat Deflection
- QUV—Weathering Test
- Oxygen Index Tester
- UL-94 Flammability Cabinet
- Polymer Melt Flow
- Falex Pin & V-Block Friction and Wear Tester
- Microtap Tapping Torque
- Custom Designed Drawbead Apparatus
- Four Ball Wear Test Machine
- Bridgeport CNC Machining Center

SERVICE

Focusing Extraordinary Resources on Customer Needs

Dover Chemical Corporation is uniquely equipped to provide timely solutions to your needs for chlorinated alkanes, organophosphites, brominated compounds, flame retardants, antioxidants, lubricant additives and drilling-fluid additives.

Total Quality is assured from product development through actual production. Our research center, with state-of-the-art equipment , is able to develop new products to perform to your specifications. This modern facility, complimented by our ISO 9001 certification, means consistent, continuing conformance to your ever-changing needs.

Demanding "just-in-time" delivery schedules are not a problem with Dover Chemical. We are dedicated to anytime delivery – nights, days, weekends, whenever you need our products—allowing you to eliminate costly inventory warehousing while still meeting your own production requirements.

The bottom line of our customer service advantage is our people. People with the knowledge and flexibility to make sure you obtain the timely chemical solutions you need.

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ISO 9001 Certified

American Chemistry Council

Certification No. QSR-130

Responsible Care®
Our Commitment to Sustainability

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