Product Bulletin

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BUILT-IN DEFENSE

Phosflex® 362

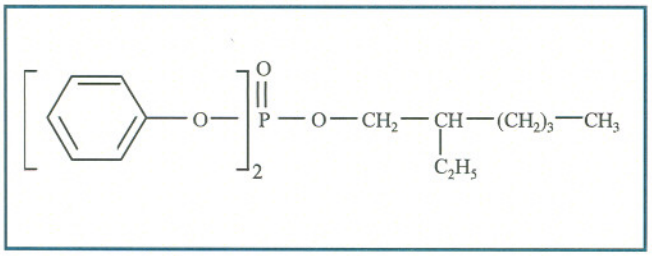
MARKETED BY
HARWICK STANDARD
DISTRIBUTION CORPORATION
60 S. Seiberling Street • Akron, Ohio 44305

Phosflex®
Flame Retardant Plasticizers

Chemical Name: 2-Ethylhexyl Diphenyl Phosphate

CAS #

2-ethylhexyl diphenyl phosphate	1241-94-7
Triphenyl phosphate	115-86-6



Phosflex® Product Selector

	Key applications	Key characteristics
4	• Primary plasticizer for nitro-cellulose, chlorinated rubber • Anti-foam agent	• Low viscosity • Low density
31L	• PVC film and sheet compounds • Dispersant for plastisols	• Low color • Blendable with non-FR plasticizers
41L	• PVC film and sheet compounds • Dispersant for plastisols	• Low color • Blendable with non-FR plasticizers
71B	• Flame retardant plasticizer for PVC	• Excellent flame retardant properties • Low volatility
362	• Flame retardant plasticizer for PVC alloys	• Low temperature and low smoke • Excellent vinyl solvating properties • Approved for packaging materials in food contact
390	• Flame retardant plasticizer for PVC sheets and coatings	• Excellent low temperature flexibility • Low smoke, good weathering properties
314, 318, 321, 327	• Blended plasticizer for film and sheet vinyl goods	• High efficiency • High solvating

Overview

Phosflex® 362 is a highly efficient plasticizer for PVC, with very good low temperature flexibility and excellent solvating properties for fast fusion.

One of the unique characteristics of Phosflex® 362 is its ability to reduce flammability while also reducing smoke. Typically when flame retardants are used, the combustion efficiency of the compound is decreased, and as a result, smoke (incomplete combustion particles and gases) increase. Phosflex® 362 can deliver low smoke properties and effective levels of flame retardancy in many types of polymer systems, especially flexible vinyl and vinyl alloys.

Phosflex® 362 has excellent compatibility in PVC and other plastics. Formulated correctly, it performs well in vinyl composites for outdoor applications where exposure to UV irradiation and weathering is critical. Phosflex® 362 has been found useful in flame retardant foamed vinyl and vinyl alloys (PVC/nitrile rubber), calendared sheet goods, and outdoor PVC applications. In certain rubbers, it can be useful as a solvating material to improve the tactile feel and flexibility of elastomeric composites. Phosflex® 362 also has the advantage of FDA approvals for certain food packaging applications.

Key Applications

Formulations for Flexible Suspension PVC at 50 phr Plasticizer

	1	2	3	4	5
PVC Geon (103EP)	100	100	100	100	100
$CaCO_3$	50	50	50	50	50
Zinc Borate (Firebrake ZB)		3	6	3	6
ATH (Hydral 710)				20	40
Plasticizers	50	50	50	50	50
ESO (Plastoflex 2307)	5	5	5	5	5
Stabilizers (Ba/Zn mixed metals)	5	5	5	5	5
Totals (parts)	210	213	216	233	256

These five formulations represent basic formulation and component variations typically seen for FR-PVC. The resultant flammability and physical properties are shown in the following tables with comparisons to similar flame retarded vinyl systems.

Phosflex® 362 in PVC Suspension Resin (GEON 103EP)

		Tensile Properties			Hardness		LOI	UL-94
Component	Additive phr	Strength psi (MPa)	E Mod. psi (MPa)	Elong. %	Shore "A" Initial	Creep (15 sec.)	100 Mils	1.6mm
DIDP	50	1844(12.7)	858(5.9)	426	88	85	23	FAIL
ZB	3	2018(13.9)	907(6.2)	461	88	84	23.2	FAIL
ZB	6	1824(12.6)	906(6.2)	417	90	86	23.2	FAIL
ZB/ATH	3/20	1635(11.3)	945(6.5)	359	91	86	23.6	FAIL
ZB/ATH	6/40	1715(11.8)	1081(7.4)	374	93	89	25	FAIL
Phosflex® 362	50	1389(9.6)	602(4.1)	394	82	78	27	V-0
ZB	3	1365(9.4)	610(4.2)	387	82	78	27.6	V-0
ZB	6	1284(8.8)	629(4.3)	359	82	78	27.6	V-0
ZB/ATH	3/20	1319(9.1)	706(4.9)	366	83	80	28.2	V-0
ZB/ATH	6/40	1227(8.5)	784(5.4)	345	87	84	30.4	V-0

Typical Properties

Physical appearance	Clear, transparent liquid
Phosphorus content, wt. %	8.5
Specific gravity, 20°C/20°C	1.090
Density @ 20°C, lbs/gal	9.1
kg/m^3	1090
Viscosity @ 25°C, mPa.s	18
Acidity, as phosphoric acid, %	0.01
Water content, wt. %	0.10
Color, APHA	40

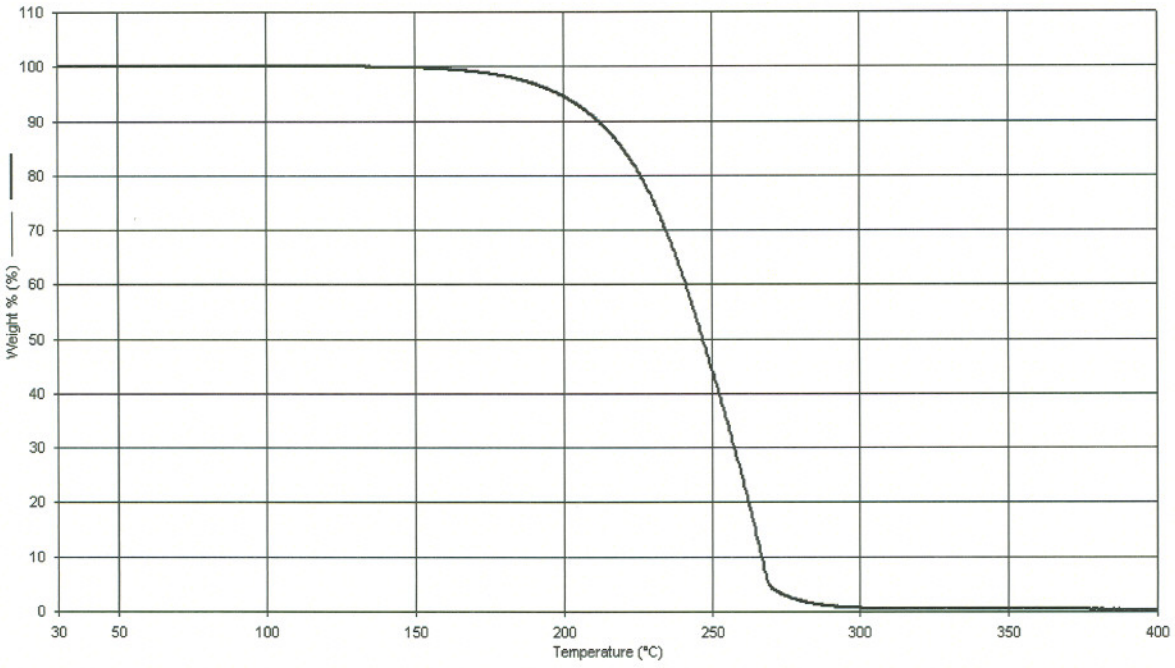
Safety & Handling

Consult the Material Safety Data Sheet for this product.

Shipping Information

Available in bulk tank trucks, isocontainers, 2,200 lb totes, and 480 lb drums.

Thermogravimetric Analysis: Phosflex® 362
(10°C rise/minute in nitrogen)



2% wt. Loss	182°C
5% wt. Loss	198°C
10% wt. Loss	211°C

For more information about our products and to place an order, please contact one of Supresta's regional sales offices.

AMERICAS REGIONAL SALES OFFICE
Ardsley Park at 420 Saw Mill River Road
Ardsley, New York 10502 USA
914.269.5900, 800.666.1200
fax 914.674.9735

ASIA PACIFIC REGIONAL SALES OFFICE
12/B, Sun Tong Plaza, No.55 Huai Hai Road West
Shanghai 200030 China
86 21 5298 9058
fax 86 21 5298 9352

EUROPEAN REGIONAL SALES OFFICE
Hoefseweg 1, PO Box 2501
3800 GB Amersfoort, The Netherlands
31 33 4534 575
fax 31 33 4534578

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Harwick Standard Distribution Corporation

Plasticizers

Harwick Standard offers a broad line of plasticizers to meet the needs of both rubber compounders and flexible PVC formulators. By offering a large range of products, we provide our customers the versatility of identifying a plasticizer family that is effective with various polymers, and gives several product options from which to choose for optimum performance characteristics - from general use to most demanding requirements.

Harwick Standard's experienced technical and sales staff can assist in selecting the best plasticizer to meet your requirements. Please contact us for assistance with your compounding needs.

Non-Phthalate C-9

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Polycizer® DHIN	1-2 cylcohexane dicarboxylic acid diisononyl ester	R-1,2/P-1	√						Performance similar to DOP in NBR compounds

Adipates

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Polycizer® DOA	Di-2 ethylhexyl adipate	R-1,2/P-1,2	√	√					FDA, low water extraction, UV stability
Merrol® 4206 (DBEA)	Dibutoxyethyl adipate	R-1,2,3/P-2		√					
Polycizer DBEEA Merrol 4226	Dibutoxyethoxyethyl adipate	R-1,2,3		√	√	√	√		

Azelates

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Merrol DOZ-E	Di-2 ethylhexyl azelate	R-1,2/P-1,2	√	√	√				Excellent low temp

Polymer Usage Key	
R-1	NBR, NBR/PVC
R-2	CR, CPE, CSM
R-3	ECO, Fluoroelastomers, Polyacrylates

Polymer Usage Key	
P-1	PVC
P-2	PVAC, PS, ABS, Cellulosics
P-3	Eng, Resins, Polyester, Alloys

Benzoates

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Benzoflex® 9-88	Dipropylene glycol dibenzoate	R-1/P-1,2			√			√	Polyurethanes
Benzoflex 50	Diethylene/ dipropylene glycol dibenzoate	R-1/P-1,2			√			√	Water-based adhesives
Benzoflex 2088	Diethylene glycol dibenzoate, triethylene glycol dibenzoate, dipropylene glycol dibenzoate	R-1/P-1,2			√	√		√	High solvator, low VOC's, FDA

Chlorinated Paraffins

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Flame Resistance	High Solvating	Miscellaneous
Chloro Flo/ Paroil Series	Liquid chlorinated paraffins	R-2/P-1	√		√		√		

Mono-Esters

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Polycizer Butyl Oleate	N-butyl oleate	R-2/P-2		√					Primary light color plasticizer for polychloroprene
Polycizer MO	Vegetable Oil	R-2		√	√		√	√	Low & high temp for polychloroprene
Plasticizer OLN	Oleyl nitrile	R-1				√		√	Low & high temp for polychloroprene
Natroflex® IOT	Isooctyl tallate	R-1,2	√	√					
Merrol 818T	Alkyl tallate	R-1/P-2	√	√					

Polymer Usage Key	
R-1	NBR, NBR/PVC
R-2	CR, CPE, CSM
R-3	ECO, Fluoroelastomers, Polyacrylates
P-1	PVC
P-2	PVAC, PS, ABS, Cellulosics
P-3	Eng, Resins, Polyester, Alloys

Petroleum Process Oils

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Stan-Lube Series	Paraffinic oils	Non-polar	√						Light color, good for EPRs
Stan-Plas Series	Naphthenic oils	R-1	√						General Processability
Duoprime® Series	White oils	Non-polar	√						FDA

Phosphate Esters

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Flame Resistance	High Solvating	Miscellaneous
Lindol®	Tricresyl phosphate	P-1,2	√		√		√	√	
Phosflex® 41L Merrol 521	Isopropylated triaryl phosphate	R-1,2/P-1					√		
Phosflex T-BEP	Tributoxylethyl phosphate	R-1,2,3/P-1,2		√			√	√	
Phosflex 71-B	Butylated triphenyl phosphate	R-1,2/P-1					√		
Phosflex 362	2-ethyhexyl diphenyl phosphate	R-1,2/P-1,2					√		
Phosflex 390	Isodecyl diphenyl phosphate	R-1,2/P-1,2					√		

Polymer Usage Key	
R-1	NBR, NBR/PVC
R-2	CR, CPE, CSM
R-3	ECO, Fluoroelastomers, Polyacrylates
P-1	PVC
P-2	PVAC, PS, ABS, Cellulosics
P-3	Eng, Resins, Polyester, Alloys

Phthalates

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Merrol DAP	Diallyl phthalate	R-1,2/P-3						√	Co-curing
Polycizer DBP Merrol DBP	Di-n-butyl phthalate	R-1,2/P-1,2	√					√	Good emollient for cosmetics
Polycizer DIDP	Diisodecyl phthalate	R-1,2/P-1,2			√	√			Also E grade
Polycizer DINP Merrol DINP	Dissononyl phthalate	R-1,2/P-1,2			√				
Polycizer DOP Merrol DOP	Di-2-ethylhexyl phthalate	R-1,2/P-1,2	√						
Polycizer DUP	Diundecyl phthalate	R-1,2/P-1,2		√	√		√		Low fogging Also CA grade

Polymerics

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Perme-ability	Migration Resistance	Low Extraction	Heat Aging	Miscellaneous
Admex® P-27	Polyester adipate	R-1/P-1,2				√			High purity, good electrical properties
Admex 409	Polyester adipate	R-1/P-1,2	√			√		√	Good electrical properties
Admex 412	Polyester adipate	R-1/P-1		√	√				Low viscosity, easy processing
Amdex 429	Polyester adipate	R-1,2/P-1,2				√			Non-fogging, humidity resistance
Admex 523	Mixed polyester	R-1/P-1,2	√			√	√		Low viscosity
Admex 760	Polyester adipate	R-1,2/P-1,2			√	√			Excellent permanence, low water extractability
Admex 761	Polyester adipate	R-1/P-1,2					√		
Admex 770	Mixed polyester	R-1,2/P-1,2			√	√			Excellent weatherability (decals)
Admex 775	Mixed polyester	R-1/P-1,2							Excellent resistance to aqueous & organic solvents
Admex 910-001	Mixed polyester	R-1/P-1,2					√		Low water extraction
Admex 1723	Mixed polyester	R-1/P-1,2			√				Printability
Admex 2632	Mixed polyester	R-1/P-1,2	√						FDA

Polymerics (continued)

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Perme-ability	Migration Resistance	Low Extraction	Heat Aging	Miscellaneous
Admex 6187	Polyester adipate	R-1/P-1,2				√	√		Solvent & oil resistance
Admex 6985	Polyester adipate	R-1/P-1,2				√	√	√	Very low volatility
Admex 6994	Mixed polyester	R-1/P-1,2				√			Mar resistance, low fogging
Admex 6995	Polyester adipate	R-1/P-1,2			√				UV weatherability
Admex 6996	Polyester adipate	R-1/P-1,2		√					Printability

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatility	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Merrol P-6320	Polyester adipate	R-1,2/P-1		√		√			Solvent & oil resistance, low temp flexibility
Merrol P-6412	Polyester adipate	R-1,2/P-1,2				√			Medium viscosity, FDA
Merrol P-6410	Polyester adipate	P-1,2			√	√			
Merrol P-6420	Polyester adipate	P-1				√			Good color

Sebacates

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Low Volatitity	Low Extraction	Heat Aging Resistance	High Solvating	Miscellaneous
Polycizer DBS	Di-n-butyl sebacate	R-1,2/P-1,2		√				√	FDA
Polycizer DOS Merrol DOS	Di-2-ethylhexyl sebacate	R-2/P-1,2	√	√		√			Low temp greases & caulks

Harwick Standard Distribution Corporation

www.harwickstandard.com

330-798-9300

Polymer Usage Key	
R-1	NBR, NBR/PVC
R-2	CR, CPE, CSM
R-3	ECO, Fluoroelastomers, Polyacrylates
P-1	PVC
P-2	PVAC, PS, ABS, Cellulosics
P-3	Eng, Resins, Polyester, Alloys

Specialty

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Perme-ability	Migration Resistance	Low Extraction	Heat Aging	Miscellaneous
Plasticizer SC-B	Triethyleneglycol dicaprate/caprylate	R-1,2,3		√				√	FDA
Plasticizer SC-E	Triethyleneglycol di 2-ethylhexanoate	R-1,2,3		√					Flexibilitity over a wide temp range
Hercoflex® 600	Pentaerythritol ester of fatty acids	R-1,2		√	√	√	√	√	Excellent low and high temp
Hercoflex 707, 707A	Pentaerythritol ester of fatty acids	R-1,2		√	√	√	√	√	Excellent low and high temp
Polycizer ESO Merrol E-68	Epoxidized soybean oil	R-1/P-1,2,3			√	√		√	Good heat stabilizer

Trimellitates

Tradename(s)	Chemical Name	Polymer Usage	General Purpose	Low Temperature/ Flexibility	Perme-ability	Migration Resistance	Low Extraction	Heat Aging	Miscellaneous
Polycizer TOTM	Tri-2-ethylhexyl trimelliatate	R-1,2/P-1,2			√		√	√	Also E&CA grades, excellent water resistance
Merrol 810TM-E	Tri(n-octyl/n-decyl) trimellitate	R-2		√	√		√	√	Oxidation resistance, excellent water resistance
Polycizer TINTM	Triisononyltrimellitate	R-1,2/P-1,2			√	√	√	√	

Polymer Usage Key	
R-1	NBR, NBR/PVC
R-2	CR, CPE, CSM
R-3	ECO, Fluoroelastomers, Polyacrylates
P-1	PVC
P-2	PVAC, PS, ABS, Cellulosics
P-3	Eng, Resins, Polyester, Alloys

Harwick Standard Distribution Corporation

60 South Seiberling Street

P.O. Box 9360

Akron, OH 44305-0360

Phone: 330-798-9300

Fax: 330-798-0214

Technical Fax: 330-798-9328

Sales Fax: 330-798-4089

www.harwickstandard.com