Phosflex® T-BEP

Application Data Sheet for Synthetic Rubber Compounds, Vinyl Polymers and Floor Polishes and Waxes

Tributoxyethyl Phosphate ***Phosflex® T-BEP***, is a non-reactive, medium viscosity liquid that shows strong resistance to hydrolysis. It has high solvency for many natural and synthetic resins and is compatible with waxes, vinyls, cellulosics, polystyrene, polyacrylates, styrene acrylic copolymers, shellac, nitriles and chlorinated rubbers. (see properties in Table 1).

Table 1: Properties of *Phosflex® T-BEP*

Physical appearance	Clear, transparent liquid
Phosphorus content, wt%	7.8
Specific gravity, 20^0C	1.02
Density @ 20^0C, lbs/gal	8.5
Density @ 20^0C, kg/m^3	1020
Viscosity @ 25^0C, mPa.s	12
Acidity, mg KOH/g	0.5
Water content, wt%	0.2
Color, APHA	<75

Phosflex® T-BEP is used commercially as a leveling agent in waxes, floor polishes and paper coatings and is also an excellent antifoaming agent in ore beneficiations. It can also be used as a partial plasticizer in vinyl plastics, imparting flame retardancy and low temperature flexibility.

Phosflex® T-BEP is used as a softener in chlorinated rubber and nitrile formulations. It imparts exceptionally good low temperature flexibility, good resilience, low compression set and lower flammability. Recommended uses are for seals, gaskets, hoses, shoe soles and similar applications.

❑ Typical formulation - Nitrile Rubber

Typical Formulation	Parts
Nitrile rubber	100
Zinc Oxide	5
Sulfur	1.5
Stearic Acid	1.5
SRF Carbon Black	60
Benzothiazyl disulfide	1.5
Phosflex® T-BEP	30

Table 1: Test results for Original Properties of the Vulcanizate made out of the above Formulation

Test	Cure, 30 minutes @ 310^{0}F	Cure, 45 minutes @ 310^{0}F
Modulus @ 300% elongation, psi	1010	1210
Ultimate Tensile Strength, psi	1825	2050
Ultimate elongation, %	435	440
Hardness (Shore)	46 (A)	46 (B)
Lupke Rebound, %	-	57
Compression Set, % - ASTM Method B, 22 hours @ 158^{0}F	1825	2050
ASTM Freeze Test	Pass - 60; Fail - 70	-
Specific Gravity	-	1.2

Table 2: Test results for Aged Properties of the Vulcanizate made out of the above Formulation and cured for 30 minutes @ 310^{0}F

Emersion Fluid	Ult. Tensile Strength, psi	Ult. Elongation, %	Hardness, Shore A	Vol. Change, %	Weight Change, %
ASTM #3 Oil	2050	385	48	+1	
ASTM #2 Oil	1400	255	55	-7	
ASTM #1 Oil	2200	385	60	-12	
Ethylene Glycol	2000	265	47	+8	
Distilled water	1250	235	47	+26	
SR-10 Fuel	1600	385	50	+2	
SR-6 Fuel	800	235	40	+25	
Air oven	1500	275	48	-	-1

All aging done at 212^{0}F for 70 hours

Table 3: Comparison of "Low Temperature Flexibility of Softeners" in a typical Nitrile Formulation

Softener	Low Temperature Flexibility
Coal Tar Pitch	0
Chlorinated Tricresyl Phosphate	0
Glyceryl Triacetate	-10
Tricresyl Phosphate	-10
Methyl Cyclohexyl Adipate	-10
Butyl Captyl Phthalate	-20
Camphor	-20
Dicapryl Phthalate	-25
Cyclohexyl Phthalate	-30
Dibutyl Phthalate	-35
Cyclohexyl Adipate	-40
Dibenzyl Sebacate	-45
Phosflex® T-BEP	-45

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❑ Typical formulation - Vinyl Polymers Plasticizer

Phosflex® T-BEP is a good plasticizer for vinyl polymers. It imparts excellent low temperature flexibility and self-extinguishing properties. It can be used in combination with other plasticizers for producing low-viscosity plastisols.

Typical Formulation	Parts
PVC resin	100
Stabilizer	1
Phosflex® T-BEP	44

Table 4: Test results obtained for the above Formulation

Test	Cure, 30 minutes
Modulus @ 100% elongation, psi (*)	1470
Ultimate Tensile Strength, psi (*)	2800
Ultimate elongation, %	290
Hardness (Shore A)	78
Low Temperature Flexibility – SPI Crack Test 80% passed at 50% passed at	 -40^0F -45^0F
Flammability SPI in/sec	Self-Extinguishing

**@25^{0}C, 50% RH*

❑ Typical formulations - Floor Polishes and Waxes

Phosflex® T-BEP is an important ingredient in high quality floor polishes. It is widely used in polystyrene, polyacrylate and styrene acrylic copolymer formulations. It acts as a plasticizer and improves leveling and spread. Films can be cast that do not show puddling or drawing-in without excessive softening. It can readily be emulsified and is compatible with many resins, polymers and natural waxes. ***Phosflex® T-BEP*** is not completely compatible with microcrystalline waxes.

Typical Polystyrene Emulsion Floor Polish	Parts
Shellac modified polystyrene emulsion at 14%	70
Shellac solution at 14%	20
Polyethylene emulsion at 14%	10
Phosflex® T-BEP	1

Typical Acrylic Emulsion Floor Polish	Parts
Acrylic emulsion	80
Ammonia	12.5
Morpholine Oleate	7.5
Leveling agents	1
Phosflex® T-BEP	0.7

❑ Health – Safety - Environmental aspects

Phosflex® T-BEP has undergone extensive toxicological and environmental testing, and no risk to health and the environment is expected.

As part of an ongoing Product Stewardship Program and Customer oriented policy, ICL-IP is committed to implement further toxicological and environmental tests if needed.

For further advice and assistance, contact our representatives in your area:

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