THIOKOL TP™-759 Plasticizer

Product Specifications	Limits
Color - Gardner (VCS) Scale	5.0 Max.
Water Content - Wt. %	0.22 Max.
Acid Number - mg KOH/g	1.38 Max.
Hydroxyl Number - mg KOH/g	7.0 - 17.0
Viscosity @ 25°C	20.0 - 35.0 cps

Typical Properties	
Specific Gravity @ 25°C	1.020 - 1.050
Refractive Index @ 25°C	1.4400 - 1.4600
Volume Resistivity - ohm/cm	1.43×10^{8}
Dielectric Constant @ 1KC	11.8
Dissipation Factor @ 1KC	0.534

Best combination of low temperature and high temperature resistance – properties.

TP-759 is a mixed ether/ester type plasticizer that exhibits low volatility. Compounds made with TP-759 plasticizer retain their properties after heat aging. Tables I –XIII show the properties (especially low temperature flexibility) obtained when TP-759 plasticizer is compounded with a variety of elastomers.

Applications

TP-759 plasticizer can be used successfully to develop optimum low temperature flexibility characteristics in fuel hose, automotive parts, wire jacketing and a wide variety of molded and extruded products.

Typical Properties	
Specific Gravity 77° F (25° C)	1.032
Refractive Index at 77° F(25°C)	1.442
Viscosity, cps. at 77°F (25°C)	25
Moisture, %	0.2 Max
Flash Point (ASTM D-73-73)	338°F (170°C)
Fire Point (ASTM D-73-73)	409.6°F (192°C)
Volatility, % loss after 2 hrs. (ASTM D-22-88) at 311°F (155°C)	0.2 Max

The information in the table below shows the effects of TP-759 plasticizer in a Hypalon 40 rubber compound. Column 1 represents the original property values obtained after a cure of 30 minutes at 310°F (154°C). Column 2 represents the properties after heat aging for 70 hours at 302°F (150°C).

Table I
Hpyalon 40/TP-759 Properties

Properties	Original	Heat Aged 302°F (150°C)
Tensile strength, psi (MPa)	2890 (19.9)	2350 (16.2)
Elongation, %	230	160
100% Modulus, psi (MPa)	900 (6.2)	1350 (9.3)
200% Modulus, psi (MPa)	2500 (17.2)	-
Hardness, Shore A	77	84
Low Temp. flexibility G10,000 psi (69 MPa) °F (°C)	31 (-35)	-27 (-33)
Low Temp. brittlenes ASTM-D-746 °F (°C)	-44 (-42)	-46 (-43)
Plasticizer, loss, %	none	3
Formulation, pbw		
Hypalon 40	100	
N774	55	
MBTS	2	
UV Check AM104	0.5	
Tetrone A	2	
TP-759	20	
Litharge	20	
Elastomag 170	10	

The information in the table below shows the effects of TP-759 plasticizer on a Nipol 1052 compound. Column 1 represents the original property values obtained after a cure of 30 minutes at 310°F (154°C). Columns 2, 3, and 4 illustrate properties after 70 hours of heat aging at the temperatures indicated.

Table II
NIPOL 1052/TP-759 Properties

Properties	Original	Heat Aged 212° F (100°C)	Heat Aged 225°F (106°C)	Heat Aged 250°F (121°C)
Tensile strength, psi (MPa)	2380 (16.4)	2510 2570 (17.7)	2570 (17.7)	2300 (15.9)
Elongation, %	510	360	290	190
100% Modulus, psi (MPa)	275 (1.9)	470 (3.2)	625 (4.3)	960 (6.6)
200% Modulus, psi (MPa)	720 (5.0)	1270 (8.8)	1740 (12.0)	-
Hardness, Shore A	61	71	73	78
Low Temp. flexibility G10,000 pus (69 MPa) °F (° C)	-37 (-38)	-32 (-36)	-33 (-36)	-29 (-34)
Low Temp. brittlenes ASTM-D-746 °F	-48 (-44)	-42 (-41)	-45 (-43)	-38 (-40)
Plasticizer, loss, %	none	1	2	3

Formulation, pbw	
Nipol 1052	100
N774	60
Zinc Oxide	5
Stearic Acid	1.5
Sulfur	1.75
MBTS	1.5
DPG	0.25
TP-759	20

The information in the table below shows the effects of TP-759 plasticizer on a Krynac 34E50 compound. Column 1 represents the original property values obtained after a cure of 8 minutes at 356°F (180°C). Columns 2, 3, and 4 illustrate properties of the compound after 70 hours of heat aging at the temperatures indicated.

Table III
Krynac 34E50/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 212°F (100°C)	Heat Aged 225°F (106°C)	Heat Aged 250° F (121°C)
Tensile strength, psi (MPa)	1690 (11.6)	1960 (13.5)	1460 (10.1)	1330 (9.2)
Elongation, %	410	290	160	150
100% Modulus, psi (MPa)	210 (1.4)	425 (2.9)	750 (5.2)	720 (5.0)
200% Modulus, psi (MPa)	600 (4.1)	1200 (8.3)	-	-
Hardness, Shore A	68	65	70	72
Low Temp. flexibility G10,000 pus (69 MPa) °F (°C)	-44 (-42)	-34 (-37)	-33 (-36)	-22 (-30)
Low Temp. brittlenes ASTM-D-746 °F	-50 (-46)	-40 (-40)	-39 (-39)	-29 (-34)
Plasticizer, loss, %	none	1	3	6
Formulation, pbw				
Krynac 34E50	100			
B-L-E-25	2			
Zetax	2			
N550	15			
N990	85			
Di-Cup 40C	3.5			
TP-759	20			

The information in the table below shows the effects of TP-759 plasticizer on a Cyanacryl R compound. Column 1 represents the original property values obtained after a 30 minute cure at 302°F (150°C) and tempering for 24 hours at 302°F (150°C). Columns 2, 3, and 4 illustrate properties of the compound after 70 hours of heat aging at the temperatures indicated.

Table IV
Cyanacryl R/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 275°F (135°C)	Heat Aged 302 °F (150°C)	Heat Aged 347 °F (175°C)
Tensile strength, psi (MPa)	1295 (8.9)	1380 (9.5)	1380 (9.5)	1190 (8.2)
Elongation, %	250	230	250	240
100% Modulus, psi (MPa)	425 (2.9)	500 (3.4)	450 (3.1)	410 (2.8)
200% Modulus, psi (MPa)	1090 (7.5)	1220 (8.4)	1210 (8.3)	980 (6.8)
Hardness, Shore A	57	60	60	75
Low Temp. flexibility G10,000 pus (69 MPa) °F (°C)	-32 (-36)	-31 (-35)	-28 (-33)	-11 (-24)
Low Temp. brittlenes ASTM-D-746 °F	-38 (-39)	-37 (-38)	-35 (-37)	-18 (-28)
Plasticizer, loss, %	none	1	3	9
Formulation, pbw				
Cyanacryl R	100			
N550	50			
Amine Antioxidant	2			
Stearic Acid	1			
NPS Red Oil Soap	3.5			
Sulfur	0.3			
TP-759	20			

The information in the table below shows the effects of TP-759 plasticizer on a HyTemp compound. Column 1 represents the original property values obtained after a 4 minute cure at 338°F (170°C). Column 2 represents the properties obtained after heat aging the compound for 70 hours at 350°F (176°C), and a post-cure of 8 hours at 347°F (175°C).

Table V
HyTemp 4051/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 374° F (175°C)
Tensile strength, psi (MPa)	1400 (9.7)	1280 (8.8)
Elongation, %	220	170
100% Modulus, psi (MPa)	415 (2.9)	750 (5.2)
Hardness, Shore A	63	73
Low Temp. flexibility G10,000 pus (69 MPa) °F (°C)	-32 (-36)	-4 (-20)
Plasticizer, loss, %	none	8
Formulation, pbw		
HyTemp 4051	100	
Stearic Acid	1	
TE-80	2	
N330	65	
Sodium Stearate	3.5	
Rhenocure Diuron	2.67	
TP-759	20	

The information in the table below shows the effects of TP-759 plasticizer on a HyTemp 4052 compound. Column 1 represents the original property values obtained after a 4 minute cure at 338°F (170°C). Column 2 represents the properties after heat aging the compound for 70 hours at the temperature indicated, and a post-cure of 8 hours at the same temperature.

Table VI
HyTemp 4052/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 374 °F (175°C)
Tensile strength, psi (MPa)	1150 (7.9)	1090 (7.5)
Elongation, %	305	160
100% Modulus, psi (MPa)	185 (1.3)	580 (4.0)
Hardness, Shore A	66	76
Low Temp. flexibility G10,000 pus (69 MPa) °F (°C)	-56 (-49)	-32 (-36)
Plasticizer, loss, %	none	8
Formulation, pbw		
HyTemp 4052	100	
Stearic Acid	1	
TE-80	2	
N550	75	
Sodium Stearate	3.5	
Rhenocure Diuron	2.67	
TP-759	20	

The information in the table below shows the effects of TP-759 plasticizer on a HyTemp 4054 compound. Column 1 represents the original property values obtained after a 4 minute cure at 338°F (170°C). Column 2 represents the properties obtained after heat aging the compound for 70 hours at the temperature indicated, and a post-cure at the same temperature.

Table VII
HyTemp 4054/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 374 °F (175°C)
Tensile strength, psi (MPa)	850 (5.9)	700 (4.8)
Elongation, %	240	150
100% Modulus, psi (MPa)	250 (1.70)	480 (3.3)
Hardness, Shore A	62	74
Low Temp. flexibility G10,000 psi (69 MPa) °F (°C)	-72 (-58)	-47 (-44)
Plasticizer, loss, %	none	8
Formulation, pbw		
HyTemp 4054	100	
Stearic Acid	1	
TE-80	2	
N550	80	
Sodium Stearate	3.5	
Rhenocure Diuron	2.67	
TP-759	20	

The information in the table below shows the effects of TP-759 plasticizer on a Hydrin H rubber compound. Column 1 represents the original property values obtained after a cure at 310°F (154° C). Column 2 represents the properties obtained after heat aging the compound for 70 hours at the temperature indicated.

Table VIII
Hydrin H/TP-759 Plasticizer Properties

Properties	Original	Heat Aged °F (150°C)	302
Tensile strength, psi (MPa)	1760 (12.1)	1150 (7.9)	
Elongation, %	320	200	
100% Modulus, psi (MPa)	490 (3.4)	570 (3.9)	
200% Modulus, psi (MPa)	1100 (7.6)	1075 (7.4)	
Hardness, Shore A	68	80	
Low Temp. flexibility G10,000 psi (69 MPa) °F (°C)	-38 -39(	-24 (-31)	
Low Temp. brittleness ASTM D-746 (69 MPa) °F (°C)	-49 (-45)	-35 (-35)	
Plasticizer, loss, %	none	2	
Formulation, pbw			
Hydrin H	100		
Red Lead	5		
ETU 75% MB	2		
TE-75	1.5		
UV Check AM104	1		
N550	50		
TP-759	20		

The information in the table below shows the effects of TP-759 plasticizer on a Hydrin C rubber compound. Column 1 represents the original property values obtained after a 35 minute cure at 310°F (154°C). Column 2 represents the properties obtained after heat aging the compound for 70 hours at the temperature indicated.

Table IX
Hydrin C/TP-759 Plasticizer Properties

Properties	Original	Heat Aged °F (150°C)	302
Tensile strength, psi (MPa)	1750 (12.1)	1490 (10.3)	
Elongation, %	380	220	
100% Modulus, psi (MPa)	500 (3.4)	610 (4.2)	
200% Modulus, psi (MPa)	1100 (7.6)	1250 (8.6)	
Hardness, Shore A	66	78	
Low Temp. flexibility G10,000 psi (69 MPa) °F (°C)	-60 (-51)	-57 (-49)	
Low Temp. brittleness ASTM D-746 (69 MPa) °F (°C)	-70 (-57)	-68 (-56)	
Plasticizer, loss, %	none	3	
Formulation, pbw			
Hydrin H	100		

Red Lead	5
ETU 75% MB	2
TE-75	1.5
UV Check AM104	1
N550	50
TP-759	20

The information in the table below shows the effects of TP-759 plasticizer on a Tyrin CM-0136 chlorinated polyethylene compound. Column 1 represents the original property values obtained after a cure of 35 minutes at 320°F (160°C). Column 2 and 3 represents the properties obtained after heat aging the compound for 70 hours at the temperature indicated.

Table X
Tyrin CM-0136 Chlorinated Polyethylene/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 212°F (100°C)	Heat Aged 302 °F (150°C)
Tensile strength, psi (MPa)	1800 (12.4)	1950 (3.4)	1330 (9.2)
Elongation, %	480	490	200
100% Modulus, psi (MPa)	300 (2.1)	340 (2.3)	720 (5.0)
200% Modulus, psi (MPa)	740 (5.1)	860 (5.9)	1330 (9.2)
Hardness, Shore A	69	73	83
Low Temp. flexibility G10,000 psi (69 MPa) °F (°C)	-35 (-37)	-30 (-34)	-14 (-26)
Low Temp. brittlenes ASTM-D-746 °F	-40 (-40)	-35 (-37)	-19 (-28)
Plasticizer, loss, %	none	1	7
Formulation, pbw			
Tyrin CM-0136	100		
White Lead	10		
N744	60		
Drapex 6.8	10		
TAIC	2		
Di-Cip 40C	7.5		
TP-759	20		

The information in the table below shows the effects of TP-759 plasticizer on a Vamac 124 compound. Column 1 represents the original property values obtained after a 20 minute cure at 350°F (177°C). Column 2 represents the properties obtained after heat aging the compound for 7 days at the temperature indicated.

Table XI
Vamac 124/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 275°F (135°C)
Tensile strength, psi (MPa)	1450 (10.0)	1700 (11.7)
Elongation, %	540	250
100% Modulus, psi (MPa)	450 (3.1)	650 (4.5)
200% Modulus, psi (MPa)	680 (4.7)	1200 (8.3)
Hardness, Shore A	52	56

Low Temp. flexibility G10,000 psi (69 MPa) °F (°C)	-44 (-42)	-25 (-32)
Plasticizer, loss, %	none	4
Formulation, pbw		
Vamac 123	124	
N774	35	
MDA	1.25	
DPG	4	
TP-759	20	

The information in the table below shows the effects of TP-759 plasticizer on a Vamac 123 compound. Column 1 represents the original property values obtained after a 20 minute cure at 350°F (177°C). Column 2 represents the properties obtained after heat aging the compound for 7 days at the temperature indicated.

Table XII
Vamac 123/TP-759 Plasticizer Properties

Properties	Original	Heat Aged 275°F (135°C)
Tensile strength, psi (MPa)	1100 (7.6)	1300 (9.0)
Elongation, %	570	290
100% Modulus, psi (MPa)	160 (1.1)	460 (3.2)
200% Modulus, psi (MPa)	300 (2.1)	1210 (8.3)
Hardness, Shore A	46	66
Low Temp. flexibility G10,000 psi (69 MPa) °F (°C)	-46 (-43)	-26 (-32)
Plasticizer, loss, %	none	4
Formulation, pbw		
Vamac 124	124	
Multiflex MM	35	
MDA	1.25	
DPG	4	
TP-759	20	

Supplier References

Product	Type	Supplier
Nipol 1052	NBR Rubber	Zeon Chemicals L.P.
HyTemp 4051	Polyacrylate Rubber	Zeon Chemicals L.P.
HyTemp 4052	Polyacrylate Rubber	Zeon Chemicals L.P.
HyTemp 4054	Polyacrylate Rubber	Zeon Chemicals L.P.
Hypalon 40	Chloro-sulfonyl-polyethylene	DuPont Dow Elastomers, L.L.C.
Stearic Acid	Activator; Softener	Several
N550	Carbon Black	Several
Diak No. I	Curing Agent	DuPont Dow Elastomers, L.L.C.
Octamine	antioxidant	Uniroyal Chemical Co.

N774	Carbon Black	H. M. Royal, Inc.
Zinc Oxide	Activator	Several
Sulfur	Curing Agent	Several
Litharge (Red Lead)	Activator	Several
Elastomag 170	Magnesium Oxide	Rohm and Haas Corp.
UV Check AM104	Antioxidant	Ferro Corp.
Epoxidized Soybean Oil Drapex	Stabilizer	Witco, A Crompton Business
Monobasic Silicate White Lead (No. 202)	Stailizer	Eacle Picher Industries
Triallyl Isocynaurate (TAIC)	Coagent	Several
Dicumyl Peroxide (Di-Cup 40C)	Curing Agent	Hercules, Inc.
Tetrone A	Accelerator	DuPont Dow Elastomers, L.L.C.
MBTS	Accelerator	Several
Tyrin CM-0136	Chlorinated Polyethylene	DuPont Dow Elastomers, L.L.C.
Hydrin H	Epichlorohydrin	Zeon Chemicals, L.P.
Hydrin C	Epichlorohyrdin	Zeon Chemicals, L.P.
DPG	Accelerator	Several
Rhenocre Diuron	Curative	Rhein Chemi Corp.
ETU 75% Dispersion	Accelerator	
TE-75	Internal Lubricant	Technical Processing
TE-80	Internal Lubricant	Technical Processing
Krynac 34E50	Synthetic Rubber	Polysar Division, Mobay Corp.
B-L-E-25	Antioxidant	Uniroyal Chemical Co.
Zetax	Accelerator	R.T. Vanderbilt
N990	Carbon Black	R.T. Vanderbilt
Cyanacryl R	Polyacrylate Rubber	Enichemi Elastomeri
Vamac124	Ethylene Acrylic	E.I. du Pont de Nemours & Co.
Multiflex MM	Filler	Specialty Minerals, Inc.
Sodium Stearate	Curing Agent	Witco, A Crompton Busines
MDA	Curing Agent	E.I. du Pont de Nemours & Co.
Vamac 123	Ethylene Acrylic	E.I. du Pont de Nemours & Co.
NPS Red Oil Soap	Curative	National Purity Soap & Chemical Co.

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