

SEALANT FORMULATION GUIDE



KALAR[®] Partially Cross-linked Butyl Rubber

DPR[®] Liquid Natural Rubber

ISOLENE[®] Liquid Synthetic Rubber

KALENE[®] Liquid Butyl Rubber

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BUTYL SEALANTS

KALAR CONSTRUCTION CAULK CONFORMING TO FEDERAL SPEC. TT-S-001657

KALAR 5215	100
Indopol H-100	125
Drikalite	500
Mistron Vapor Talc (MVT)	125
TI-PURE	12
Silverez 2T5100	20
Marble Dust	125
Mineral Spirits	175
Irganox 1010	0.2

MIXING PROCEDURE

Charge Sigma blade mixer with total of MVT, TI-PURE Indopol H-100, StaTec 80 and ¼ Microwhite - blend 1 minute then add KALAR. Mix 10 minutes then slowly add remaining Microwhite and Irganox 1010. After 25 minutes of mixing, begin incremental additions of Mineral Spirits. Continue mixing an additional 35 minutes.

MIXING EQUIPMENT

Sigma blade mixer.

TYPICAL PROPERTIES

rated in accordance with Federal Spec. TT-S-001657

Solids %	85
Slump	Pass
Extrudability (sec/ml)	3.7
Shrinkage, %	19
Adhesion Loss	Pass
Tack Free Time	Pass
Durability	Pass

KALAR PUNCTURE-RESISTANT TIRE SEALANT

KALAR 5263	100
Pliolite S6B	5
Flexon 765	40
Vistanex LMMS	50
Calcium Stearate	2
N-347 Carbon	90
Irganox 1010	0.4

MIXING PROCEDURE

Charge total of KALAR 5263 and blend 0.5 minutes. Add ½ of N-347 Carbon and total of all other dry ingredients. Blend 2 minutes, then sweep. Continue mixing. At 3 minutes, add remaining N-347 Carbon and mix. At 4 minutes, sweep and continue mixing. At 5

minutes, add ½ of LMMS and mix. At 6 minutes, add balance of LMMS and mix. At 7 minutes, sweep and continue mixing. At 7.5 minutes, dump.

MIXING EQUIPMENT

Banbury @ 82°C on second speed.

TYPICAL PROPERTIES

Shear/fail temperature, of 1/8" x 1" x 1", sealant lapped Al/Al under 1 lb. load: 110°C

Canister Puncture with 20D nail, canister pressurized to 30 psi and lined with 1/8" thickness of sealant:

@ 113°C	Pass
@ -29°C	Pass
Flex @ 88°C	2 hrs.
Cracking:	None
Adhesion:	Good
Bleed:	None
Hardness, Shore A	50
Mooney Plasticity, ML 1+4 @ 100°C	37

ARA test track results performed on HR-78-15 Steel Belted.

Tire interior pre-cleaned and primed. Primer @ 20% solids, e.g., 2% Cumar XL 209, 15% Toluol and 65% Rubber Solvent and 18% Cushion Gum Stock. Primer air dried 20 minutes at room temperature.

Sealant applied in 2 ft. sections 1/8" thick overlapped at seams at least ¼". After sealant is applied, surface is lightly dusted with talc.

An inner tube is inserted, inflated to 20 psi and the assembly is conditioned 20 minutes @ 113°C to insure that the sealant is bonded properly.

RESULTS

1. Tires preconditioned 30 minutes @ 70 MPH.
2. Punctured with 20D nail (2½" center groove).
 - A. 45 minutes @ 30 MPH.
 - B. 45 minutes @ 45 MPH.
 - C. 30 minutes @ 70 MPH.
 - D. Nail still in, repeated A, B, C.
3. Nail removed.
 - A. 1 hour @ 50 MPH.
 - B. 1000 miles @ 70 MPH.
4. Tires repunctured, repeated 1 and 2. Nail still in.
5. Second nail removed, 1 hour @ 50 MPH.
6. Tires preconditioned 1½ hours @ -29°C.
7. Repeated 1 and 2, nail still in.
8. Third nail removed 1 hour @ 50 MPH.

Air loss	None
Total Mileage	1671

KALENE ARCHITECTURAL SEALANT

BASE

KALENE 800	50
Calcene TM	30
Indopol H100	60
A-187	4
QDO	4
Toluene	5
Irganox 1010	0.4

CURATIVE

KALENE 800	50
HiSil 243B	20
Stearic Acid	1
TI-PURE	10
Zinc Oxide	5
PbO ₂ (VFC)	15
Toluene	25

This two-part general purpose sealant has sufficient resistance to cycle deformation to pass the cyclic durability test of Federal Spec. TT-S-0027E.

MIXING PROCEDURE

Base and Curative are mixed independently in a Sigma blade type mixer. The batch must be kept as "tight" as possible during the initial stages of mixing. QDO should be added to the polymer first to ensure an adequate dispersion. Likewise, the lead peroxide must be added to the polymer first to obtain an adequate dispersion.

MIXING EQUIPMENT

Sigma blade type mixer.

MIX RATIO

100 parts Base to 75 parts Curative by weight.

CURE SCHEDULE

Work Life @ 25°C	2-4 days
Cure Time @ 25°C	7 days

CURED PHYSICAL PROPERTIES

Press cured 1 hour @ 66°C + post cured 3 days @ 25°C:

Tensile Strength, MPa/psi	1.24/180
Modulus @ 100% Elongation, MPa/psi	.20/30
Elongation, %	600
Hardness, Shore A	15

KALENE INSULATING GLASS SEALANT

BASE

KALENE 800	75.0
QDO	4.0
Age-Rite White	1.5
OMYA BLH	75.0
A-187	4.0
Toluene (dry)	20.0

CURATIVE

KALENE 800	25
PbO ₂ (VFC)	15
Cab-O-Sil M5	5
Toluene (dry)	20

This two-part sealant adheres to glass and aluminum in 24 hours.

MIXING PROCEDURE

The individual base and curative components are mixed separately following the basic technique as outlined for the architectural sealant.

MIXING EQUIPMENT

Sigma blade type mixer.

MIX RATIO

100 parts Base to 30 parts Curative by weight.

CURE SCHEDULE

Work Life @ 25°C	2-5 days
Cure Time @ 25°C	18-24 hrs.

CURED PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	1.48/215
Modulus @ 100% Elongation, MPa/psi	.89/130
Elongation, %	240
Hardness, Shore A	45

BUTYL TAPES AND PREFORMS

KALAR AUTOMOTIVE TAPE SEALANT

KALAR 5215	100
N-347 Carbon	90
Indopol H100	55
Sunpar 2280	30
Irganox 1010	0.4

MIXING PROCEDURE

Pre-heat Sigma blade mixer for approximately 3 minutes, thereafter use cold water. Charge KALAR, ½ black, 2/3 Indopol and total of Sunpar 2280. After 12 minutes of mixing, charge balance of Indopol, Iragnox 1010, and ½ of remaining black. When 20 minutes of mixing time has elapsed, begin adding remaining black slowly. Batch may be dumped in about 35 minutes from start of mix.

An alternate procedure first utilizes a Banbury to make an intermediate mix by omitting the Indopol. This intermediate mix is later charged to a Sigma blade mixer for finishing with the addition of the Indopol.

Batches by the former procedure require about 1/3 more Indopol to reach the same compression values of similar stocks by the latter method.

MIXING EQUIPMENT

Sigma blade type mixer.

TYPICAL PROPERTIES

Compression, psi	112
Yield Strength, psi	11
Heat Flow (.001")	
Tape Thickness,	
1 hr. @ 25°C	212
24 hrs. @ 88°C	215
2 weeks @ 88°C	208
Net Flow Change, .001"	-4

KALAR SOUND DAMPING PAD

	I	II
KALAR 5215	10	
KALAR 5275 (or 5280)		7
G&E Blended Butyl		3
Indopol H 300	4.5	4.5
Indopol H 1500	13.5	13.5
Wingtack 95	10	10
Camel Carb	40	40
Mistron Vapor Talc	20	20
Carbon Black	1	1
Stearic Acid	1.0	1.0
Irganox 1010	<u>0.1</u>	<u>0.1</u>
	100	100

PROPERTIES

Needle Penetration @ 25°C, 100 gm. Force, 5 seconds (1/10 th mm)	85	87
Oberest Loss Factor @ 25°C	>0.2	>0.2
Sag Test on CRS Panel 6" x 6" Vertical and Inverted, 20 min. @ 350°F (167°C)	NONE	NONE

MIXING PROCEDURE

Preheat Sigma blade mixer to 60°C – 80°C. Charge Indopol H-300, Indopol H-1500, Wingtack 95, Stearic Acid, Irganox 1010, and ½ Camel Carb. Blend 2 minutes. Add rest of fillers, KALAR, and butyl (if used). Mix 30 to 40 minutes.

KALAR ARCHITECTURAL TAPE

KALAR 5215	100
Indopol H100	100
Camel Carb	25
Mistron Vapor Talc	125
HiSil 233	20
TI-PURE R-900	20
Calcene TM	250
Indopol H1900	25

MIXING PROCEDURE

Charge all ingredients except KALAR, 1/3 Indopol and ½ filler to Sigma blade mixer. Blend 1 minute then begin addition of KALAR. After mixing 10 minutes add ½ of remaining filler and balance of Indopol.

After mixing 15 minutes begin addition of remaining filler and continue mixing for 15 minutes.

MIXING EQUIPMENT

Sigma blade mixer.

TYPICAL PROPERTIES

Compression, psi	80
Yield Strength, psi	6
Extrusion Rating	Excellent
Heat Flow (.001")	
Tape Thickness,	
1 hr. @ 25°C	241
24 hrs. @ 88°C	238
Net Flow Change, .001"	-3

@ 121°C	87
Hardness, Shore A,	
Instantaneous	72
After 5 seconds	20

Two Weeks Sunlamp Exposure:

Tack	None
Creep	None
Surface	Firm
Appearance	Slight Yellowing

KALAR TAPE FOR INSULATING WINDOWS

KALAR 5215	100
ASTM N539	50
Ultrathene EVA	20
Camel Carb	50
Vistanex LMMS	75
Irganox 1010	0.5

MIXING PROCEDURE

Charge total of Vistanex and EVA to mixer. Bring mixer temperature to flux point of EVA. After above ingredients are blended, add fillers as accepted by batch. Finish with the addition of KALAR and blend until homogeneous mix is reached.

MIXING EQUIPMENT

Sigma blade mixer of the kneader-extruder type capable of being heated.

TYPICAL PROPERTIES

Compression, psi @ 25°C	395
@ 66°C	250
@ 121°C	110
Yield Strength, psi	
applied to substrate @ 270°F	25
Elongation, %	250
Type of Failure	Adhesive
Heat Flow (.001")	
Tape Thickness,	
1 hr. @ 25°C	266
24 hrs. @ 88°C	285
2 weeks @ 88°C	267
Net Flow Change, .001"	+ 1
Penetration Method D5, Needle, 5 sec.	
50 grams @ 25°C	16
@ 66°C	26

OTHER SEALANTS

TWO PART, SULFUR CURED CABLE SEALANT

BASE

DPR 400	50.0
Captax	4.1
Methyl Zimate	4.1
TI-PURE	1.5
ZnO	9.1
Britol 7T	8.3
Butyl 8	5.0

CURATIVE

DPR 400	50.0
Agerite HP-S	1.5
Sulfur	3.0
ZnO	10.0
Red Iron Oxide	5.0
DEA	5.0
Britol 7T	7.5

MIXING PROCEDURE

The base and curative components are mixed independently using the same technique which follows.

Charge Sigma blade type mixer with the total of rubber and all the powders. Mix for 30 minutes then finish the batch with the slow addition of the liquids which continuing to mix. Total mix time is approximately 60 minutes.

An alternate procedure would be to first form a master batch using ¼ of the rubber and all the other ingredients. After the master batch is thoroughly blended pass it through a paint mill. The predispersed master batch may be charged directly to a Day mixer for blending with the remaining rubber.

MIXING EQUIPMENT

Sigma blade type mixer or a three roll paint mill and Day mixer.

MIX RATIO

1:1 by weight or volume,

CURE SCHEDULE

Pot Life @ 25°C	18-24 hours
Cure Time @ 25C	30 days

CURED PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	6.20/900
Modulus @ 100%, Elongation, MPa/psi	.55/80
Elongation, %	530
Hardness, Shore A	40

ONE COMPONENT CABLE SEALANT

DPR 75	100
Camelwite	75
ZnO	10
DOP	15
Austin Black 325	3
PAB 8342	9

MIXING PROCEDURE

Charge total of rubber, Austin Black 325, ZnO and PAB 8342 to Day mixer and blend 15 minutes. Then alternately add 1/3 increments of DOP and Camelwite while continuing to mix. Total mix time is about 60 minutes.

MIXING EQUIPMENT

Day mixer.

CURE SCHEDULE

2 hours @ 121°C.

CURED PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	.51/75
Elongation, %	250
Hardness, Shore A	13

ONE PART SEMI-CONDUCTIVE CABLE SEALANT

DPR 400	100.00
Conductex 975	30.00
Bardol	5.00
Zinc Oxide	3.00
Methyl Tuads	4.85
Methyl Zimate	0.90
Captax	0.90
Sulfur	0.78
RPO	3.90

MIXING PROCEDURE

Charge jacketed Baker-Perkins or other suitable internal mixer with total of DPR. While cold water is on, charge total of Bardol and blend 5 minutes. Incrementally add Conductex; mixer should be off while additions are being made. After the balance of Conductex has been charged, mixing should be continued for 35 minutes. All remaining ingredients may be added after the Conductex is well dispersed. The batch should be further blended for at least 20 minutes. The sealant's conductivity may be maximized by further processing on a three-roll mill.

MIXING EQUIPMENT

Jacketed internal mixer and three-roll mill.

SEALANT CONSISTENCY @ 23°C Heavy Paste

CURE CYCLE

Press-cure @ 121°C for 30 minutes.

CURED PHYSICAL PROPERTIES

Surface Conductivity – ohms resistance measured with 1/8" diameter probes @ 23°C, probe interval 1"	7000
Tensile Strength, MPa/psi	1.79/260
Modulus @ 100% Elongation, MPa/psi	0.41/60
Elongation, %	375
Hardness, Shore A	30

DPR/PVC EXPANDABLE AUTOMOTIVE SEALANT

ELASTOMER BASE

DPR 400	100.00
Paroil 57-61	100.00
Stearic Acid	2.00
Zinc Oxide	5.00
Agerite Stalite ST	0.75
Vanox ZMTI	0.75
Sulfur	3.00
Captax	1.00
Methyl Tuads	1.00
Methyl Zimate	0.75
Antimony Oxide	30.00
Dechlorane 515	40.00
Hydral 710	100.00

PVC BASE

Geon 136	215.0
DOP	140.0
Stabilizer 75-001	6.5
Celogen OT	21.5

MIXING PROCEDURE

The above formulation is best prepared in two steps. The elastomer base and PVC base are mixed separately and combined later to form the finished expandable sealant.

(ELASTOMER BASE)

All ingredients except the Dechlorane and Hydral are charged to a charge-can-type mixer. The charged ingredients are blended approximately 15 minutes, then transferred to a paint mill to optimize the dispersion of the active rubber chemicals and Antimony Oxide. The milled compound is returned to the original mixing vessel, where the balance of ingredients is added. The mixing time of this final step is approximately 15 minutes.

(PVC BASE)

Charge Day mixer with 1/3 of DOP; add total of stabilizer and Celogen OT. With mixer on slow speed, incrementally add total of Resin 7401. After resin is completely wetted out, slowly add balance of DOP. Total mixing time is approximately 15 minutes.

The bases, when blended, result in a soft thixotropic paste. This combination offers a sealant with properties of both polymers to produce low-density, flame-retardant sealant which remains in a thixotropic state during the vulcanization/fusing process. Physical properties of this type of compound may be varied by adjusting the proportion of the PVC base to the elastomer base.

MIXING EQUIPMENT

Day mixer and paint mill.

CURE SCHEDULE

8 minutes @ 149°C.

CURED PHYSICAL PROPERTIES

Tensile Strength, Mpa/psi	1.02/150
Elongation, %	100
Hardness, Shore A	50
Calculated Density, lbs./cu. ft.	66

In accordance with ASTM 635-68, compound is self-extinguishing.

FILLED HOT MELT CABLE SEALANT WITH DPR

	I	II
Kraton Polymer D1102	9.6	9.3
Zonarez 7085	38.5	37.0
Red Iron Oxide	51.9	50.0
DPR 400	----	3.7
Irganox 1010	0.1	0.1

MIXING PROCEDURE

Charge hot melt kettle with total of resin and Irganox 1010 following the preceding procedure. When the resin is completely melted, raise the temperature to 149°C-176°C and begin the addition of Iron Oxide. When addition of Iron Oxide is complete, add Kraton. The DPR should be added last while mixing is continued until a homogeneous blend is reached.

MIXING EQUIPMENT

Hot melt kettle.

TYPICAL PROPERTIES

	I	II
Melt Viscosity @ 149°C, cps	50,000	18,000
Peel Strength, untreated steel, N/cm (pli)	8.9(5)	44.5(25)
Bond Failure	Adhesive	Adhesive

ISOLENE or DPR can be used in hot melt sealants as plasticizer/oil substitutes to afford sealants which are easily applied at moderately elevated temperatures. The addition of these polymers often augments the sealant's adhesive qualities.

DPR 40 PEROXIDE CURED AUTOMOTIVE SEALANT

DPR 40	100.00
CaCO ₃	50.00
Zinc Oxide	7.00
Stearic Acid	1.00
t-Butyl perbenzoate	7.70
Sartomer 633	30.00
Maglite D	2.00

MIXING PROCEDURE

Charge Sigma blade type mixer with total amount of DPR 40. Add all dry ingredients in three or four increments; permit each addition to be complete dispersed before adding the next. After the mixed compound is completely homogeneous, allow the batch to cool below 50 °C before adding the t-Butyl perbenzoate.

MIXING EQUIPMENT

Sigma blade type mixer.

CURE SCHEDULE

Cure time @160 °C 25 min.

CURED PROPERTIES

Adhesion:

Lap Shear CRS/CRS,(MPa/psi)	4.55/660
Aged 2wks@ 130 °C	4.79/700
Physicals:	
Tensile Strength, (MPa/psi)	4.20/613
Elongation,%	<100
Durometer, Shore A	90

TWO PART FLAME RETARDANT CABLE SEALANT

BASE

ISOLENE 75	100.00
QDO	3.75
Antimony Oxide	25.00
Dechlorane 515	90.00
MVT	40.00
DMSO	0.80
Paroil 57-61	30.00
C-33	40.00

CURATIVE

PbO ₂ (VFC)	10.00
Paroil 57-61	10.00
C-33	10.00

MIXING PROCEDURE

Charge Day mixer with total of rubber, QDO, Antimony Oxide, Dechlorane, DMSO and 1/3 Paroil. Blend for 15 minutes, then alternately add remaining Paroil and C-33; continue mixing an additional 30 minutes. Finish batch by slowly adding the MVT. Total mix time is about 60 minutes.

Curative is mixed on a three-roll paint mill.

MIXING EQUIPMENT

Day mixer and paint mill.

MIX RATIO

100 parts Base to 7 parts Curative by weight.

GEL TIME @ 25°C 45 minutes

CURE SCHEDULE @ 25°C 24 hours

CURED PHYSICAL PROPERTIES
from sheets press cured 1 hour @ 66°C

Tensile Strength, MPa/psi .68/100

Elongation, % 100

Hardness, Shore A 65

In accordance with ASTM 635-68, compound is self-extinguishing.

LIQUID ELASTOMER CURE SYSTEMS

AMBIENT CURE SYSTEMS

A basic two-part, room temperature formulation used for the liquid elastomers is below.

	<u>Base</u>	<u>Curative</u>
Polymer	100	----
p-quinone dioxime	3.5	----
PbO ₂	----	10 - 20
Vehicle	Variable	Variable
Filler	Variable	Variable

The reactive titanates may be used for cross-linking one-part sealants or pressure-sensitive adhesives.

BASIC AMBIENT TITANATE CURE

DPR 400	100
Camelwhite	50
Tyzor TPL	15

CURE CYCLE: 70 mil pad aged 28 days @ 25°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	.15/22
Modulus, @ 100% Elongation, MPa/psi	.12/18
Elongation, %	130
Durometer, Shore A	5
Brabender Plasticity @ 100°F, 50 rpm, MG	600

The skeleton formulation and the structures above illustrate the reaction mechanism and the usual formulating proportions of the reactants, i.e., polymer, p-quinone dioxime (QDO) and lead peroxide.

Vehicle and filler levels are determined by specific application goals. Vehicles may be selected from a wide variety of plasticizers, resins or solvents. Fillers are selected for reinforcement, pigmentation and/or extension for cost reduction.

The physical properties of compounds on either DPR or KALENE are optimized when plasticized extension is held to a minimum and when the finer particle size fillers are utilized.

Significant factors that govern cure rate are the compound's dispersion and the particle size of lead peroxide.

LOW DUROMETER CURE

ISOLENE 400	100.00
ZnO	5.00
Methyl Zimate	0.90
Sulfur	0.78
Methyl Tuads	4.85
MBT	0.90

CURE CYCLE: 18 hours @ 82°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	.96/140
Modulus, @ 100% Elongation, MPa/psi	.48/70
Elongation, %	205
Durometer, Shore A	15

KALENE SULFURLESS CURE

KALENE 800	100.00
QDO	4.0
MBTS	5.0
LIO85	9.0
ZnO	5.0
Stearic Acid	1.0
Molecular Seive 4A	5.0

CURE CYCLE: 20 minutes @ 150°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	1.65/240
Modulus, @ 100% Elongation, MPa/psi	.38/55
Elongation, %	450
Durometer, Shore A	27

KALENE SULFUR CURE

KALENE 800	100.00
Tellurac	3.0
MBTS	1.0
ZnO	10.0
Stearic Acid	1.0
Sulfur	0.5

CYCLE CURE: 25 minutes @ 150°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	.82/120
Modulus, @ 100% Elongation, MPa/psi	.1/15
Elongation, %	>700
Durometer, Shore A	15

ALTERNATE CURE SYSTEMS

The following platform formulations are intended to acquaint the formulator with these alternative systems: they do not necessarily demonstrate optimum properties.

ISOLENE SEMI-EFFICIENT VULCANIZATION

ISOLENE 400	100.0
ZnO	5.0
Octoate Z	1.5
Sulfur	0.7
AMAX	1.7
Butyl Tuads	0.7
DPG	0.5

CURE CYCLE: 25 minutes @ 149°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	.38/55
Modulus, @ 100% Elongation, MPa/psi	.1/15
Elongation, %	400
Durometer, Shore A	10

ISOLENE HALOGENATED RESIN CURE

ISOLENE 400	100
ZnO	5
CaCO ₃	45
SP 1056	20
Britol 7T	10

CURE CYCLE: 25 minutes @ 138°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	1.13/165
Modulus, @ 100% Elongation, MPa/psi	.21/30
Elongation, %	400
Durometer, Shore A	25

KALENE HALOGENATED RESIN CURE

KALENE 800	100
ZnO	25
SP 1055	15

CURE CYCLE: 45 minutes @ 150°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	1.44/210
Modulus, @ 100% Elongation, MPa/psi	.18/27
Elongation, %	650
Durometer, Shore A	20

ISOLENE can be a useful material for modifying many thermosets when the two are co-reacted via a peroxide cure.

BASIC ISOLENE PEROXIDE CURE

ISOLENE 400	100
t-butyl perbenzoate	3

CURE CYCLE: 10 minutes @ 149°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	.51/75
Modulus, @ 100% Elongation, MPa/psi	.27/40
Elongation, %	250
Durometer, Shore A	20

ISOLENE MONOMER PEROXIDE CURE

ISOLENE 400	100	100
Sartomer SR-230	10	----
Sartomer SR-351	----	10
t-butyl perbenzoate	3	3

CURE CYCLE: 10 minutes @ 149°C

PHYSICAL PROPERTIES

Tensile Strength, MPa/psi	.89/130	1.08/157
Modulus, @ 100% Elongation, MPa/psi	.89/130	----
Elongation, %	100	70
Durometer, Shore A	40	50

APPENDIX

TABLE I

TYPICAL SOLUBILITY DATA

Viscosity (cps) determined @ 25°C with Brookfield Model RVT

	TOLUENE	MIBK	VM&P	HEXANE	MINERAL SPIRITS
% DPR 40					
10	13	9	11	1	7
50	176	150	150	76	280
90	14,000	17,700	24,200	12,700	26,200
% DPR 400					
10	16	8	10	8	13
50	600	640	480	260	820
90	114,000	99,000	90,000	93,000	119,000
% ISOLENE 40					
10	14	12	13	8	10
50	100	110	110	45	250
90	22,000	22,000	21,500	13,600	20,500
% ISOLENE 400					
10	25	15	20	10	12
50	540	645	510	250	1,230
90	108,000	134,000	139,000	95,000	146,000
% KALENE 800					
10	12	IC	10	8	25
50	380	IC	1,340	280	1,200
90	1,400,000	IC	648,000	435,000	1,500,000

APPENDIX

TABLE II

KALAR SOLVENT SWELLING EFFICIENCY

A 10% solids mixture was allowed to stand at room temperature without agitation for two hours. Below are listed the relative swelling efficiencies of a variety of solvents for KALAR 5215,

SOLVENT	GRAMS SOLVENT ABSORBED PER GRAM OF KALAR 5215 (2 hours at room temperature)
Perchloroethylene	9.1
Butyl Ether	5.5
Cyclohexane	5.3
VM & P Naphtha	4.8
Xylene	4.7
Toluene	4.5
Mineral Spirits	4.3
Heptane	4.0
Hexane	3.7
Kerosene	3.3
Benzene	2.8
Methyl Ethyl Ketone	0.5
Butyl Alcohol	0.0

TABLE III

VISCOSITY OF KALAR SOLVENT CUTS

Table III compares pelletized KALAR 5215 and Butyl 268 in mineral spirits and VM&P Naphtha cuts. The mixing requirements as measured by torque are lower for the KALAR 5215 than the standard polymer. Hence, KALAR 5215 based intermediates can be mixed in equipment which normally employs butyl solvent cuts.

Ingredient	1	2	3	4
KALAR 5215	100	100	----	----
Butyl 268	----	----	100	100
Mineral Spirits	100	----	100	----
VM & P Naphtha	----	100	----	100
TORQUE VALUES*	290	130	390	310

MIXING PROCEDURE: Cold Baker-Perkins. Add all solvents and polymer and allow to mix for 90 minutes.

* Measured after five minutes in Sigma blade mixer, 75 RPM at room temperature, Brabender Plastograph. Units of torque, metergrams.

The information herein is currently believed to be accurate. We do not guarantee its accuracy. Purchasers shall not rely on statements herein when purchasing any products. Purchasers should make their own investigations to determine if such products are suitable for a particular use. The products discussed are sold without warranty, express or implied, including a warranty of merchantability and fitness for use. Purchases will be subject to a separate agreement, which will not incorporate this document.

RAW MATERIAL SUPPLIERS

<u>Trade Name or Designation</u>	<u>Chemical Name/Description</u>	<u>Supplier</u>	<u>Phone</u>
1RSS 65% DPR 40 (dry form)	#1 ribbed smoked sheet rubber	AlcanRubber & Chemical, New York, NY Natrochem Inc., Savannah, GA	(212) 952-9230 (912) 236-4464
Accelerator 808 Agerite HP-T Agerite Resin D Agerite Stalite ST Altax (MBTS) Amax ASTM N539 Austin Black 325	butyraldehyde-anine condensation product antioxidant polymerized 1,2-dihydro-2,2,4-trimethylquinoline sym. Dibetanophthyl-p-phenylenediamine benzothiazyl disulfide n'oxydiethelene benzothiazole-2-sulfanamide carbon black	R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT Harwick Standard Distribution Co., Akron, OH Harwick Standard Distribution Co., Akron, OH	(800) 243-6064 (800) 243-6064 (800) 243-6064 (800) 243-6064 (800) 243-6064 (800) 234-6064 (330) 798-9300 (800) 899-4412
Bardol Britol 7T Butyl 365 Butyl 8 Butyl Tuads	mineral oil polyisobutylene polyisoprene copolymer activated dithiocarbamate tetrabutylthiuram disulfide	Honeywell, Morristown, NJ R.E. Carroll Inc., Trenton, NJ R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 421-2133 (800) 257-9365 (800) 243-6064 (800) 243-6064 (800) 234-6064
C-33 Cab-O-Sil M5 CaCO3 Calcene TM Calcium Stearate Calsol 8240 Camel Carb Camelwite Captax (MBT) Celogen OT Conductex 975 Cumar LX 509 Cyanox 2246	hydrated alumina fumed colloidal silica calcium carbonate calcium carbonate coated stearic acid napthenic oil calcium carbonate calcium carbonate 2-mercaptobenzothiazole benzenesulfonyl hydrazide conductive black coumarone - indene resin 2,2'-methylene-bis (4-methyl-6-t-butyl-phenol)	Alcoa Industrial Chemicals, Bauxite, AR 72011 Cabot Corp., Tuscola, IL H.M. Royal, Trenton, NJ Witco Performance Chemical, Louisiana, KY R.E. Carroll Inc., Trenton, NJ H.M. Royal, Trenton, NJ H.M. Royal, Trenton, NJ R.T. Vanderbilt Co., Inc., Norwalk, CT Uniroyal Chemicals, Middlebury CT Columbian Chemicals, Marietta, GA Neville Chemical, Pittsburgh, PA Cytec Industries, West Paterson, NJ	(800) 860-3290 (800) 222-6745 (609) 396-9176 (877) 948-2662 (800) 257-9365 (609) 396-9176 (609) 396-9176 (800) 243-6064 (800) 243-3024 (800) 822-7266 (412) 331-4200 (973) 357-3100
DBP DEA DEAP Dechlorane 515 Dechlorane Plus 515 DLTDP DMSO DOP (Plasthall DOP) DOTG DPG DPR@ 35 DPR@ 40 DPR@ 400 DPR@ 75 Drikalite Durite Resin AD5043	dibutylphthalate diethanolamine 2,2 diethoxy-acetophenone chlorinated paraffin chlorinated paraffin dilauryl thiodiopropionate dimethyl sulfoxide dioctyl phthalate diorthotolyl guanidine diphenyl guanidine Liquid Natural Rubber Liquid Natural Rubber Liquid Natural Rubber Liquid Natural Rubber natural ground calcium carbonates phenolic resin	C.P. Hall Co., Chicago, IL (Mfg. by Denza in Czech Repub.) C.P. Hall Co., Chicago, Illinois First Chemical, Pascagoula, MS OxyChem, Dallas, TX OxyChem, Dallas, TX Witco Polymer Chemicals, Louisiana, KY Monomer-Polymer & Dajac Labs Inc., Feasterville, PA C.P. Hall Co., Chicago, Illinois R.T. Vanderbilt Co., Inc., Norwalk, CT Solutia, St. Louis, MO Royal Elastomers, Belleville, NJ Royal Elastomers, Belleville, NJ Royal Elastomers, Belleville, NJ Royal Elastomers, Belleville, NJ Imerys, Rosewell, GA Borden Chemicals & Plastics	(708) 594-5923 (708) 594-5923 (800) 828-7940 (800) 752-5151 (800) 752-5151 (877) 948-2662 (215) 364-1155 (708) 594-5923 (800) 243-6064 (800) 321-3416 (888) 442-7362 (888) 442-7362 (888) 442-7362 (888) 442-7362 (888) 277-9636 (800) 451-1037
Escorez 2101 Escorez 5300 Elvax 750	aromatic/aliphatic hydrocarbon resin cycloaliphatic hydrocarbon resin ethylene vinyl/acetate copolymer	ExxonMobil Chemical Company, Houston, TX ExxonMobil Chemical Company, Houston, TX DuPont, Delaware	(800) 231-6633 (800) 231-6633 (800) 438-7225

RAW MATERIAL SUPPLIERS

<u>Trade Name or Designation</u>	<u>Chemical Name/Description</u>	<u>Supplier</u>	<u>Phone</u>
Flexon 765	process oil	Exxon Lubricants and Petroleum Division Corp., Houston, TX	(888) 228-4437
Flexon 845	process oil, hydrogenated paraffinic	Exxon Lubricants and Petroleum Division Corp., Houston, TX	(888) 228-4437
Foral 105	penterythritol ester of fully hydrogenated wood resin	Hercules Inc., Wilmington, DE	(800) 247-4372
Foral 85	glycerin ester of fully hydrogenated wood resin	Hercules Inc., Wilmington, DE	(800) 247-4372
Geon 136	4% vinyl ester/vinyl chloride copolymer	GEON Company, Avon Lake, OH	(800) 438-4366
Hard Rubber Dust	cured and reground rubber	H.M. Royal, Trenton, NJ	(609) 396-9176
Heptanoic Acid		Celanese, Dallas, TX	(800) 235-2637
Hercolyn D	methyl ester of fully hydrogenated wood resin	Hercules Inc., Wilmington, DE	(800) 247-4372
HiSil 233	hydrated silica	PPG Industries Inc., Pittsburgh, PA	(800) 243-6745
HiSil 243B	hydrated silica	PPG Industries Inc., Pittsburgh, PA	(800) 243-6745
HiSil 422		PPG discontinued (try BASF 800-798-1235)	
Hydral 710	aluminum trihydrate	Alcoa Industrial Chemicals, Bauxite, AR 72011	(800) 860-3290
Indopol H100	polybutene	B.P. Amoco Chemicals Corp., Naperville, PA	(877) 701-2726
Indopol H1900	polybutene	B.P. Amoco Chemicals Corp., Naperville, PA	(877) 701-2726
Irganox 1010		Ciba Specialty Chemicals, Tarrytown, NY	(800) 431-2360
ISOLENE® 40	Liquid Synthetic Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
ISOLENE® 400	Liquid Synthetic Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
ISOLENE® 400S	Liquid Synthetic Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
ISOLENE® 40S	Liquid Synthetic Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
ISOTARV	oil	Exxon Lubricants and Petroleum Division Corp., Houston, TX	(888) 228-4437
IT 3X Talc	magnesium calcium silicate	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
KALAR® 5210	Cross-linked Butyl Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
KALAR® 5215	Cross-linked Butyl Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
KALAR® 5246	Cross-linked Butyl Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
KALAR® 5263	Cross-linked Butyl Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
KALAR® 5275	Cross-linked Butyl Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
KALENE® 1300	Liquid Butyl Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
KALENE® 800	Liquid Butyl Rubber	Royal Elastomers, Belleville, NJ	(888) 442-7362
King Prince	dixie clay (hydrated aluminum silicate)	H.M. Royal, Trenton, NJ	(609) 396-9176
Kraton Polymer D1102	SBS block copolymer	Shell Chemical Co., Houston, TX	(800) 457-2866
Kraton Polymer D1107		Shell Chemical Co., Houston, TX	(800) 457-2866
Levapren 500HV	ethylene-vinyl acetate copolymer	Bayer Corporation, Akron OH	(330) 836-0451
LIO85 (powdered reagent)	red lead oxide	Spectrum Laboratory Products, Gardena, CA	(800) 772-8786
Litharge	lead monoxide	Akrochem - Akron, OH	(800) 321-2260
Maglite K	magnesium oxide	C.P. Hall Co., Chicago, Illinois	(708) 594-5923
Marble Dust		Imerys, Rosewell, GA	(888) 277-9636
MBT (Captax)	2-mercaptobenzothiazole	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
MBTS (Altax)	benzothiazyl disulfide	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
Methyl Tuads	tetramethylthiuram disulfide	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
Methyl Zimate	zinc dimethyldithiocarbamate	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
MicroCel E	calcium silicate	World Minerals, Lompoc, CA	(800) 342-8667
Mineral Spirits	petroleum distillates	Ashland Chemical, Columbus, OH	(888) 274-2436
MISTRON Vapor Talc (MVT)	magnesium silicate	H.M. Royal, Trenton, NJ	(609) 396-9176
MnO2*	manganese dioxide	Eagle-Picher Indus., Cincinnati, Ohio	(417) 623-8000
Molecular Seive 4A		UOP, Mt. Laurel, NJ	(877) 867-7487
MVT (Mistron Vapor Talc)	magnesium silicate	H.M. Royal, Trenton, NJ	(609) 396-9176

RAW MATERIAL SUPPLIERS

<u>Trade Name or Designation</u>	<u>Chemical Name/Description</u>	<u>Supplier</u>	<u>Phone</u>
N-347 Carbon		Columbian Chemicals, Marietta, GA	(800) 822-7266
Neo-heptanoic Acid		Exxon Chemical Corp., Houston, TX	(800) 231-6633
Norsorex (100%)	pure polymer	Zeon Chemicals, Louisville, KY	(800) 735-3388
Octoate Z		R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
Oleic Acid		Aldrich Chemical Co., Inc., St. Louis, MO	(800) 771-6737
OMYA BLH	treated calcium carbonate	Omya Inc., Proctor, VT	(800) 459-4468
PAB 8342		Flow Polymers	(800) 445-4924
Paroil 57-61	chlorinated paraffin oil	Dover Chemical Corp.	(800) 321-8805
PbO2 (FC)*	lead peroxide (fast cure)	Eagle-Picher Indus., Cincinnati, Ohio	(417) 623-8000
PbO2 (MC)*	lead peroxide (medium cure)	Eagle-Picher Indus., Cincinnati, Ohio	(417) 623-8000
PbO2 (VFC)*	lead peroxide (very fast cure)	Eagle-Picher Indus., Cincinnati, Ohio	(417) 623-8000
PbO2*	lead peroxide	Eagle-Picher Indus., Cincinnati, Ohio	(417) 623-8000
Pliolite S6B	high styrene reinforcing resin	Goodyear Chemical., Akron, OH	(800) 633-3965
PVP K30	2-Pyrrolidone	ISP Van Dyke, Wayne, NJ	(877) 812-7501
Pyrax A	pyrophyllite	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
QDO	p-quinone dioxime	Lord Corp/Chemical Product Division, Erie, PA	(814) 868-3611
Raven 880 Ultra		Columbian Chemicals, Marietta, GA	(800) 822-7266
Red Iron Oxide		H.M. Royal, Trenton, NJ	(609) 693-9176
Santicizer 141	sanitizer	Solutia, St. Louis, MO	(800) 321-3416
Sartomer 633	metallic diacrylate	Sartomer Company, Inc., Exton, PA	(800) 727-8663
Sartomer SR-230	diethylene glycol diacrylate	Sartomer Company, Inc., Exton, PA	(800) 727-8663
Sartomer SR-350	trimethylolpropane trimethacrylate	Sartomer Company, Inc., Exton, PA	(800) 727-8663
Sartomer SR-351	trimethylopropane triacrylate	Sartomer Company, Inc., Exton, PA	(800) 727-8663
Satromer SR-395	isodecyl acrylate	Sartomer Company, Inc., Exton, PA	(800) 727-8663
Sartomer SR-2000		Sartomer Company, Inc., Exton, PA	(800) 727-8663
Satin Tone		Englehard Specialty Pigments & Additives, Iselin, NJ	(732) 205-5000
Shellflex 371	process oil	Shell Chemical Co., Houston, TX	(800) 231-6950
Silane A-187	silane	OSI Specialties, Greenwich, CT	(800) 334-4674
Silverez 2T5100		Arizona Chemicals, Jacksonville, FL	(800) 733-1374
Silverez TR1135	turpene based resin	Arizona Chemicals, Jacksonville, FL	(800) 733-1374
SP 1055	synthetic resins	Schenectady Chemicals Inc., Schenectady, NY	(518) 370-4200
SP 1056	synthetic resins	Schenectady Chemicals Inc., Schenectady, NY	(518) 370-4200
SP 553	synthetic resins	Schenectady Chemicals Inc., Schenectady, NY	(518) 370-4200
Stabilizer 75-001		Ferro Corp., Walton Hills, Ohio	(800) 321-9946
Stearic Acid	triple pressed stearic acid	H.M. Royal, Trenton, NJ	(609) 396-9176
Struktol TR354		Struktol Company, Stow, OH	(800) 327-8649
Sulfur	sulfur	H.M. Royal, Trenton, NJ	(609) 396-9176
Sundex 790		Sun Oil Co., Philadelphia, PA	(800) 395-2786
Sunpar 2280		Sun Oil Co., Philadelphia, PA/RE Carroll	(800) 395-2786
Talc Nytal 300	hydrous magnesium calcium silicate	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
t-butyl perbenzoate	peroxide	Elfatochem NA Fine Chemicals Group, Phil. PA	(215) 419-7000
Tellurac (TDEDIC)	ethyl tellurac	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
Thermax N-990	thermal process carbon black	R.T. Vanderbilt Co., Inc., Norwalk, CT	(800) 243-6064
TI-PURE	titanium dioxide	DuPont, Wilmington, DE	(800) 441-7515
TI-PURE R-900	titanium dioxide	DuPont, Wilmington, DE	(800) 441-7515
TI-PURE RF-30	titanium dioxide	DuPont, Wilmington, DE	(800) 441-7515
Toluene	toluene	Solutia, St. Louis, MO	(800) 325-4330
Triethanolamine	TEA	Spectrum Laboratory Products, Gardena, CA	(800) 772-8786

RAW MATERIAL SUPPLIERS

<u>Trade Name or Designation</u>	<u>Chemical Name/Description</u>	<u>Supplier</u>	<u>Phone</u>
Twinkling Star Antimony Oxide Tyzor TPL	silica treated with antimony trioxide titanate	H.M. Royal, Trenton, NJ DuPont, Wilmington, DE	(609) 396-9176 (800) 441-7515
Univolt 60 Ultrathene EVA	transformer or insulation oil ethylene vinyl acetate copolymer	Exxon Lubricants & Petroleum Division Corp., Houston, TX Equistar Chemicals, Houston, TX	(888) 228-4437 (800) 615-8999
Vanox ZMT1 Varox DCP-40C Varsol 18 Vertical Quicklime Vistanex LMMS Vulklor	Dibetanophthyl-p-phenylenediamine resin mineral oil calcium oxide polyisobutylene tetrachloro-p-benzo quinone	R.T. Vanderbilt Co., Inc., Norwalk, CT R.T. Vanderbilt Co., Inc., Norwalk, CT Exxon Lubricants and Petroleum Division Corp., Houston, TX Mississippi Lime Company, Alton, IL Exxon Chemical Corp., Houston, TX Uniroyal Chemicals, Middlebury, CT	(800) 243-6064 (800) 243-6064 (888) 228-4437 (800) 437-5463 (800) 231-6633 (800) 243-3024
White Fonoline Wingtack 95	petrol atum aliphatic c-5 petroleum hydrocarbon resin	Crompton Corporation, Petrolia, PA Goodyear Chemical., Akron, OH	(877) 948-2688 (800) 633-3965
Zinc Oxide Zonarez 7085	zinc oxide polyterpene resins	H.M. Royal, Trenton, NJ Arizona Chemical Co., Jacksonville, FL	(609) 396-9176 (800) 526-5294