



SEALANT FORMULATION GUIDE

DPR Liquid Natural Rubber

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.