

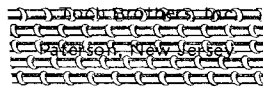
A comprehensive guide to...

Sealants and Caulking Compounds



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The post-war building boom throughout the world, coupled with new concepts in architectural design and components and a cost factor spiraling upward, has brought about a need for new types of materials for buildings which would enable these new designs to be built, while keeping costs, in particular remedial and maintenance, to a minimum. One area where these new materials have played an extremely important part is in the field of sealants, including caulking compounds and crack and seam sealers.

Raw material manufacturers and compounders have developed many new polymers and formulations to serve this field. They are: (1) One part (no mixing), one package catalyst and base packed together with a miscible barrier between; (2) two part (base and activator packed separately), and (3) tapes, curing and non-curing types.

Extruded tapes of polybutene, polyisobutylene/butyl, especially the latter, are available in many states of cure, and in various combinations with other resins.

There are many specialized industrial-type sealants which include vinyl plastisol and foam-in-place. Most of these sealants may be used alone, or in conjunction with another. Some are limited to specific uses, while others suit a variety of uses. Experience points out that use of the most expensive sealant does not necessarily provide the best material for the use. In selection of the proper sealant for the job, its properties and the joint design are the most important considerations.

Primers for sealants play an important part in the performance of the sealant. The selection of primers

is based on (1) substrate, (2) sealant, and (3) performance conditions. Those primers in most common use are chlorinated rubber, polyvinyl chloride solutions, aminosilicones, polyurethanes, and two part epoxy/amide and/or epoxy polysulfide and others based on vinyls.

Back-up materials recommended for use with sealants of these types include butyl rod stock, polyurethane foam, neoprene rod stock, polyethylene foam, and untreated oakum or jute. It is essential and must be insisted upon that the backing materials be asphalt and creosote free, in order that sealant performance provides expected service. Another caution is that sealants not be in contact with any compound containing asphalt, creosote, oil, or extractible plasticizers.

Types of Materials

These available materials are of the following generic types: Soya oil alkyd, polybutene resin (non drying), polybutene resin (drying), polyisobutylene (curing and non-curing), butyl, nitrile, neoprene, Hypalon, neoprene/Hypalon, polyacrylic, polysulfide, silicone, urethane, epoxy.

In many cases they are modified further, such as: epoxy/polysulfide/amines, polysulfide/coal-tar, polyvinyl acetate/cork, polyurethane/coal-tar and neoprene/asphalt.

Schedule I — Traffic Bearing Sealants

	2 part Poly-Sulfide	2 part Poly-urethane Prepolymer	2 part Poly-Sulfide Coal Tar	2 part Poly-urethane Coal Tar	2 part Poly-Sulfide/Epoxy	Neoprene Asphalt Hot Melt *
Compounded to Shore "A" Req't	40-55	25-35	5-15	15-35	65-80	50-70
Form	pour gun	pour gun	pour	pour	pour	hot melt
Tensile psi	100-300	150-400	60-125	100-300	800-1200	50-100
Modulus psi @ 100%	75-100	75-100	50-75	50-100	—	fails
Ultimate elongation	150-250	200-350	75-150	100-150	50	15
Recovery %	35-50	90-99	40	85-95	25	5

*Recommended only where initial economy requires it.

Schedule II — Non Traffic Bearing Sealants

PROPERTIES	Flexible Epoxy Crack Filler	Drying, Oil-Base Caulk	Non-Dry Polybutene Caulk or Tape	Non-Cure Polyisobutylene Bed. Compound	Curing Polyisobutylene or Butyl Sealant	1 Part Nitrile or Butyl Seam Sealant	1 Part Neoprene Sealant	1 Part Hypalon Sealant	1 Part Polyacrylic Sealant	1 Part Polysulfide	1 Part Silicone	1 Part Polyether Polyurethane Sealant Shore A Less Than 25	2 Part Polyurethane Shore A 20-35	2 Part Urethane Shore A 40-60	2 Part Polysulfide Shore A Less Than 25	2 Part Polysulfide Shore A Greater Than 25	2 Part Polysulfide Epoxy Sealant	2 Part Polysulfide Coal Tar Sealant	2 Part Polyurethane Coal Tar Sealant
Tack free time @ 75° F. 250°/R.H.	2 hours	1-3 hrs	Not Rec	Not Rec	2-4 hrs	10-20 Min.	15-30 Min.	12-48 hrs.	2-8 hrs.	12-48 hours	2-4 hours	12-24 hours	8-24 hours	8-24 hours	6-12 hours	4-12 hours	2-8 hours	1-4 hours	12-24 hours
Cure time (days) 1/4" x 1/4" Channel ...	3	120	Not Rec	Not Rec	120	7	30	180	30	60	5	30	3-6	3-4	4-7	4-7	3-7	3-4	7-10
Tensile strength psi ...	1200-1500	2-4	0-1	4-10	10-20	250-400	100-200	20-40	40-60	100-200	60-150	250-500	150-400	250-600	75-200	100-300	800-1200	60-125	100-300
Elongation %	15	5	Not Rec	20	25	75-125	20-40	15-50	25-60	150-200	100-200	300-450	250-600	200-350	200-350	150-250	40-50	75-150	100-150
Modulus @ 100% Elongation	Not Rec	Not Rec	Not Rec	Not Rec	Not Rec	200-300	Not Rec	Not Rec	Not Rec	75-100	40-80	30-80	50-100	100-150	40-100	75-100	Not Rec	50-75	50-75
Shore "A" Initial	75	Not Rec	Not Rec	Not Rec	10-18	40-60	50-65	12-25	20-40	30-45	25-35	30-50	20-35	40-60	15-24	25-55	65-80	35-50	40-60
Recovery after 100% Elongation	10	Not Rec	Not Rec	Not Rec	15	35	22	20	20	45	83	90	60-75	75-82	33-65	40-65	25	50	70
Continuous Service Range Deg. F.	-30 +300	-10 +180	-60 +150	-45 +210	-25 +210	-40 +268	-25 +210	-25 +225	-15 +210	-45 +250	-90 +400	-60 +275	-60 +275	-45 +275	-60 +250	-45 +265	-20 +225	-25 +210	-30 +210
Water Immersion Properties	Excell.	Very Poor	Poor	Fair	Fair	Good	Fair	Fair	Fair	Good	Good to Fair	Fair to Good	Very Good	Very Good	Good	Very Good	Good	Fair	Excell.
Primer Recommended Underwater	None	Not Rec	Not Rec	*R or M	*R or M	None	*R or M	*R or M	**V	*M or **V	***S	*M or ***S	***M or ***S	**M or ***S	**M or ***S	**M or ***S	None	*R or **M	**M or *R
Dilute Acid Resistance	Excell.	Fair	Good	Good	V. Good	V. Good	Good	Fair	Fair	V. Good	Good	Good	V. Good	V. Good	V. Good	Excell.	V. Good	Good	Excell.
Dilute Alkali Resistance	Excell.	V. Poor	V. Poor	V. Poor	Fair	Good	Fair	Good	Fair	Good	Fair	V. Good	Excell.	Excell.	Excell.	Excell.	Excell.	V. Good	Excell.
Solvent Resistance	Excell.	V. Poor Not Rec	V. Poor Not Rec	Poor Not Rec	Poor Not Rec	V. Good	Good	Fair Not Rec	Good	Excell.	Excell.	Excell.	Excell.	Excell.	Excell.	Excell.	Excell.	V. Good	V. Good
Fire Resistance	Good	Poor Not Rec	Poor Not Rec	Poor Not Rec	Poor Not Rec	Fair Not Rec	Good	V. Good	Fair Not Rec	Good	Excell.	V. Good	V. Good	V. Good	V. Good	V. Good	Fair Not Rec	Fair Not Rec	Excell.
Electrical Insulation Properties	V. Good	Poor NR	Good	Good	V. Good	Good	Fair NR	Poor NR	Good	Good	V. Good	Excell.	Excell.	Excell.	V. Good	Excell.	V. Good	Good	Good
Aging Properties	V. Good	V. Poor NR	V. Good	Excell.	Good	Good	Fair NR	Good	V. Good	V. Good	Excell.	Excell.	Excell.	Excell.	Excell.	Excell.	V. Good	Good	Good

*Chlorinated Rubber
 **Moisture cured polyurethane
 ***Aminossilicone

Schedule III — Average Life Expectancy (years) of Non Traffic Bearing Sealants

Joint Size & Performance Conditions	Surface	Flexible Epoxy Crack Filler	Drying, Oil-Base Caulk	Non-Dry Polybutene Caulk or Tape	1 Part Non-Cure Polyisobutylene bed Compound	Sealant 1 Part Curing Polyisobutylene Butyl	1 Part Nitrile or Butyl Seam Sealant	1 Part Neoprene Sealants	1 Part Hypalon Sealant	1 Part Polyacrylic Sealant	1 Part Polysulfide	1 Part Silicone	1 Part Polyether Polyurethane Sealant Shore A Less Than 25	2 Part Polyurethane Shore A 20-35	2 Part Polysulfide Shore A Less Than 25	2 Part Polysulfide Coal Tar Sealant	2 Part Polyurethane Coal Tar Sealant	2 Part Silicone Sealant	1 Part Vinylacrylic Cork Filled Sealant
Hairline Cracks—to 1/8" Wide Joint Above Grade	concrete	11	0 (NR)	(NR)	(NR)	(NR)	7	4	(NR)	(NR)	(NR)	(NR)	(NR)	5-P	(NR)	(NR)	(NR)	(NR)	(NR)
	wood	9	1 (NR)	(NR)	(NR)	(NR)	6	5	(NR)	(NR)	(NR)	(NR)	(NR)	8-P	(NR)	(NR)	(NR)	(NR)	(NR)
	metal	10	0 (NR)	(NR)	(NR)	(NR)	8	5	(NR)	(NR)	(NR)	(NR)	(NR)	4-P	(NR)	(NR)	(NR)	(NR)	(NR)
Joint Above Grade	glass	10	0 (NR)	(NR)	(NR)	(NR)	5	3	5	5	7	10	(NR)	2-P-S	(NR)	(NR)	(NR)	(NR)	(NR)
	concrete	12	(NR)	(NR)	B	5	5	6	6	5	8-R	7-M	9-M	10-M	8	(NR)	(NR)	8	5
	wood	10	2 (NR)	(NR)	B	4	6	5	7	7	8-M	8-M	10-M	10	9	(NR)	(NR)	(NR)	4
From 1/8" to 1/4" Wide Above Grade	metal	12	(NR)	B	8	5	8	5	7	7	11	10-S	8-S	8-S	10	(NR)	(NR)	(NR)	4
	glass	10	2 (NR)	B	B	6	8	5	6	7	9	10-S	8-S	10-S	9	(NR)	(NR)	(NR)	5
	concrete	12	(NR)	(NR)	B-M	3	1 (NR)	5-R	5	5-V	6-M	5-M	6-M	9-M	7-V	(NR)	(NR)	(NR)	(NR)
From 1/8" to 1/4" Wide Under Water	wood	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)
	metal	(10)	(NR)	(NR)	B-M	2 (NR)	3	3-V	4	4-V	6-S	6-S	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)
	glass	8	(NR)	(NR)	B	2 (NR)	2 (NR)	2-S (NR)	3	4-S	6-S	5-S	4-S	5-S	3-S	(NR)	(NR)	(NR)	(NR)
From 1/4" to 3/4" Wide Above Grade	plastic	(NR)	(NR)	(NR)	B	3	5	5	4	5	2 (NR)	6-S	5-S	6-S	4-S	(NR)	(NR)	(NR)	3
	concrete	(NR)	(NR)	B-M	B	5	(NR)	5	6	5	8-M	7-M	9-M	8-M	8-R	7	8-M	(NR)	4
	wood	(NR)	2 (NR)	B-M	B	3	2 (NR)	5	5	4	6-M	8-M	10-M	10-M	9-R	8-M	9-M	(NR)	3
From 1/4" to 3/4" Wide Under Water	metal	(NR)	(NR)	B	B	4	2 (NR)	5	4	10	9-S	7-S	10	11	5-V	7-S	9-M	(NR)	5
	glass	(NR)	2 (NR)	B	B	5	3	6	4	11	10-S	9-S	12-S	12	6-S	8-S	8-S	12-S	5
	plastic	(NR)	(NR)	(NR)	B	3	5	5	4	5	2 (NR)	6-S	5-S	6-S	4-S	(NR)	(NR)	9-S	3
From 3/4" to 1 1/2" Wide Above Grade	concrete	(NR)	(NR)		B-M	2 (NR)	(NR)	5-M	(NR)	(NR)	7-M	5-M	6-M	9-M	6-V	2-M (NR)	6-M	(NR)	(NR)
	wood	(NR)	(NR)		(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)
	metal	(NR)	(NR)		B-V	1 (NR)	(NR)	3-V	(NR)	(NR)	6-S	5-S	5-V	5-S	7-S	(NR)	4-V	(NR)	(NR)
From 3/4" to 1 1/2" Wide Under Water	glass	(NR)	(NR)		B-S	2 (NR)	(NR)	1-S (NR)	(NR)	(NR)	1-V (NR)	5-S	5-S	3-S	2-S (NR)	(NR)	(NR)	5-S	(NR)
	plastic	(NR)	(NR)		B-V	3	(NR)	5-V	(NR)	(NR)	1-V (NR)	5-S	5-S	3-S	2-S (NR)	(NR)	(NR)	5-S	(NR)
	concrete	(NR)	NR except for temporary use, & then on non-porous surfaces	poly-sulfides polyurethane silicone sealants	B	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	9-R	7-R	6	8	(NR)	(NR)
From 3/4" to 1 1/2" Wide Above Grade	wood	(NR)			B	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	11-M	7-R	7	9	(NR)	(NR)
	metal	(NR)			B	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	8	8	4	7	8-S	(NR)
	plastic	(NR)			B	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	3-S	2-S (NR)	(NR)	(NR)	5-S	(NR)
From 3/4" to 1 1/2" Wide Under Water	glass	(NR)			B	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	12-S	12	4-S	4	12	(NR)
	concrete	(NR)			B-M	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	7-M	6-M	(NR)	6-M	(NR)	(NR)
	wood	(NR)			(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	5-M	(NR)	(NR)	(NR)	(NR)	(NR)
From 3/4" to 1 1/2" Wide Under Water	metal	(NR)			B-S & V	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	5-S	6-V	(NR)	4-V	4-S	(NR)
	glass	(NR)			B-S	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	4-S	3-S	(NR)	(NR)	5-S	(NR)
	plastic	(NR)			B-S	(NR)*	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	(NR)	2-S (NR)	1-S (NR)	(NR)	(NR)	4-S	(NR)

*The Butyl sealant must be of the type that will not harden beyond a Shore A of 40

Explanation of Numbers and Letters for Schedule II and III

- B = Backing or bedding filler only
- (NR) = Not recommended for this use
- P = Pourable (self-leveling) grade
- M = Polyurethane primer
- R = Chlorinated rubber primer
- S = Aminosilicone primer
- V = Vinyl or butyral solution primer

A three year life expectancy is the minimum requirement for recommendation.

Numbers indicate expected service in years.

A letter following a number indicates a primer must be used prior to application of compound or sealant.

We have attempted in Schedule II and II to detail the properties and recommended uses of these materials on areas not subject to traffic. Traffic bearing areas present other problems and requires higher standards which are detailed below and in Schedule I.

Traffic Bearing Sealant

Joints and seams on grade, in decks, horizontal joints, expansion joints, and in those areas subject to heavy traffic, present conditions which require sealant performance far in excess of sealants used in non-traffic bearing areas. Experience has shown that only by following the procedures listed below, will sealant performance live up to expectations:

(1) Joint design and construction shall conform to this formula:

<i>Joint Width</i>	<i>Joint Depth</i>
to 1/2"	not greater than width
to 1"	not greater than 1/2"

Joints subject to traffic are recommended not to exceed 1 inch in width.

(2) Oil and asphalt free back-up must be used.

(3) Selection of the primer suitable for the substrate, e.g., Concrete — polyurethane or chlorinated rubber

Metal, glass and plastic — amino-silicone

Wood — polyurethane, neoprene

(4) Only those sealants having the following properties can perform properly:

(a) Shore "A" hardness from 40-60.

(b) Full cure in 7 days.

(c) Modulus for elongation of 100 per cent, not less than 75 psi minimum, 100 psi maximum.

(d) Minimum recovery 50 per cent.

(e) Minimum elongation 15 per cent.

Sealants exhibiting properties other than the foregoing will fail.

It appears that for the heavy traffic bearing surfaces described above, the 2 part polyurethane prepolymer sealant exhibits the best performance potential of those polymers known to today's technology. A further recommendation for sealants for traffic bearing surfaces

is that in selecting colors, emphasis be placed on pigments having reinforcing properties such as black, charcoal or dark grey, rather than colors which tend to downgrade the sealant performance such as white or tan.

The authors have determined during the seven years in which this study has been made that the following properties are essential in obtaining optimum performance from the sealant.

(1) *Joint Design* — There must be room enough to place enough sealant in order to elongate and recover properly within the limits of the sealant selected. There should be not less than 1/4 inch width by 1/4 inch depth. In joints to 1/2 inch x 1/2 inch the depth of the sealant shall be the same as the width. In joints greater than 1/2 inch wide and to 1 inch, the depth of the sealant shall be not greater than 1/2 inch. In joints greater than 1 inch wide, the depth of sealant shall be not greater than 50 per cent of the width.

(2) Where back-up or bedding materials are used, care must be taken that these materials be compatible with the sealant used. In the case of polysulfides, polyurethanes, silicones, etc., these must be free of oil, asphalt and the ingredients used in compounding such a material must be of a non-migrating nature and exhibit no cold flow. There has been much interest shown of late in recently marketed and proven, "gun type", *non-curing* bedding compounds which act as a second line of defense against moisture, should there be a failure in the sealant. These must be certified free of

asphalt, oil, creosote, and migrating ingredients not compatible with sealants of polysulfide, polyurethane, silicone, etc., bases.

(3) Consult the manufacturer as to the type of joint substrate, then specify and detail the drawings as well as the specific primer recommended, if any, and have your job superintendent see it is applied.

(4) Sealants serve an extremely important function in a building. Specify the proper sealant for the purpose and use more than the type polymer or resin in its description. State the properties required in detail and always, when using a known standard for 2 part materials and for one part materials, make certain the standards used require the highest performance.

(5) Require of the manufacturer certified performance tests showing compliance to these standards.

(6) Use the sealant that will do the job. This is not necessarily the most expensive sealant. Consider the type of structure, joint size and then, using charts I, II, and III, proper selection for the use can be made. For purposes of simplicity, the following "rule of thumb" may be used: (Sealants recommended here have minimum life expectancy of 5 years). In joints greater than 1/4 inch x 1/4 inch, it is recommended that the 2 part materials be used, because the 1 part materials presently available take too long to cure in the larger joints.

For a detailed outline, consult the accompanying charts.

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