Versalink® 740M Diamine Curative

For High-Performance Polyurethane Elastomers and Epoxies

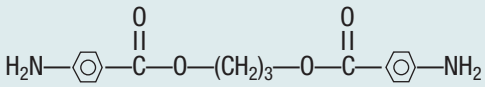
Description

Versalink 740M is a diamine curative specifically designed and patented as a safe, high-performance curative for mixed isomer liquid polyurethane prepolymers. It also has been shown to be effective for epoxy resins.

Versalink 740M curative has been evaluated with several types of commercially available prepolymers. These evaluations were conducted with polyether and polyester-backbone TDI prepolymers. TDI prepolymers, formulated with the 80/20-TDI 2,4 – 2,6 isomer blend, produced cured elastomers with excellent physical properties.

Versalink 740M curative is not recommended for use with prepolymers based on pure 2-4, TDI isomers.

Table 1 – Typical Properties of Versalink 740M Curative



Chemical Name	Trimethylene glycol di-p-aminobenzoate
Acronym	TMAB
Equivalent Weight	157
Molecular Weight	314
Purity	98% minimum
Product Form	Granular powder
Color	Off-white to light tan
Odor	Very slight ester odor
Melting Range	125-128 °C (257-263 °F)
Moisture Content	0.2% maximum by weight
Flash Point, Melt, Open Cup	288 °C (550 °F)
Specific Gravity Melt (@ 140 °C)	1.14 grams/cc
Storage Stability	Excellent (non-hygroscopic)

Solubility of Versalink 740M Curative at 25 °C

Solvent	*Percent by Weight*
Dimethyl Sulfoxide	56
Dimethyl Formamide	56
Tetrahydrofuran	30
2-Methoxyethanol	29
2-Ethoxyethyl Acetate	19
Acetone	18
Methyl Ethyl Ketone	10.6
Ethyl Acetate	9.6
Dichloromethane	3.7
Methanol	3.3
Trichloroethylene	<0.5
Benzene	<0.5
Toluene	<0.5
Water	<0.1

Polyurethane elastomers formulated with Versalink 740M curative, while exhibiting outstanding physical properties, also have excellent chemical properties. Tests conducted on Versalink 740M-cured elastomer formulations disclose excellent hydrolytic stability, dry heat aging, high temperature performance, electrical properties and chemical resistance (including oil, solvent, weather and ozone resistance).

Property and processing information on elastomers produced from several commercially available prepolymers cured with Versalink 740M curative are shown in Table 2.

Table 2 – Elastomer Physical Properties

Prepolymer	Vibrathanes®			Versathane®	Adiprenes®		
	B-835	B-839	8011	A-9	L-83	L-300	L-367
NCO, %	4.01	6.23	3.33	4.50	3.22	4.23	6.23
Formulation, pbw							
Prepolymer	100	100	100	100	100	100	100
Versalink 740M Curative (95% Stoichiometry)	14.2	22.1	11.9	16.3	11.5	15.1	22.1
Processing Conditions							
Polymer Temperature, °C	85	85	85	85	85	85	85
Versalink 740M Temperature, °C	140	140	140	140	140	140	140
Cure Conditions, hours/°C	6/100	6/100	6/100	6/100	6/100	6/100	6/100
Working Life, mins.	5-6	3-4	8-10	4-5	10-12	5-6	3-4
Physical Properties							
Hardness, Shore A/D	93A/43D	97A/53D	87A	95A/50D	90A/35D	93A/45D	97A/53D
Tensile, psi	6,200	7,100	10,500	10,000	9,400	8,300	8,100
Elongation, %	440	420	640	570	520	470	400
Modulus, psi							
100%	1,080	1,840	740	1,100	880	1,020	1,500
300%	2,220	3,930	1,440	2,330	1,760	2,040	4,100
Tear Strength, pli							
Die C	511	680	545	591	522	517	693
Split	107	188	131	143	126	150	175
Bashore Rebound, %	50	46	33	40	53	43	41
Compression Set, %	27	43	34	54	33	36	46

Health and Safety Information

Information regarding safety and health concerns when handling these products is contained on the product label and in the Material Safety Data Sheets. It is recommended that you read and become familiar with this information before working with the products.

Toxicity

Versalink 740M curative is the diester of trimethylene glycol, (1,3-propanediol) and p-aminobenzoic acid. It is worth noting that esters of p-amino-benzoic acid have long been in commercial use as local anaesthetics and in other similar applications. Substantial toxicological characterization is reported in the available literature.

Acute toxicity and mutagenicity testing has been conducted on Versalink 740M by Arthur D. Little, Inc. of Cambridge, Mass. and other evaluators.

Results of these evaluations show that:

1. Versalink 740M curative was determined to be a non-irritant under no-rinse dermal testing with albino rabbits.
2. Versalink 740M curative's LD_{50} was determined to be greater than 5000 mg/kg.
3. Versalink 740M curative was found to produce some degree of eye irritation on albino rabbits after 24 hours under no-rinse conditions. All eyes examined after seven days showed recovery.
4. Using the standard Ames Salmonella Test, Versalink 740M curative was found to be non-mutagenic with and without metabolic activation at levels up to 1000 µg per plate.

Metabolism – Investigation of the metabolism of Versalink 740M curative by the Research Triangle Institute disclosed the primary metabolites to be 1,3-propanediol and the monoester
1-hydroxy-3-propane aminobenzoate.

FDA – The Food and Drug Administration has amended 21 CFR Part 177, Paragraph 177.1680(b) to add Versalink 740M curative for use in the manufacture of polyurethane elastomers intended to contact dry food.

Thermal Characteristics

Versalink 740M curative has been shown to have excellent thermal stability. It has been melted and held at process temperatures for up to 21 hours with no significant loss in vulcanizate physical properties.

Versalink 740M curative exhibits non-exothermic thermal decomposition at about 482 °F (250 °C) with decomposition vapors exhibiting a flash point at 550 °F (288 °C). There have not been any identifiable hazardous products from combustion or decomposition, to date.

Because there is always a possibility of a pressure buildup in a closed vessel, it is recommended that effective pressure relief be part of any system in which Versalink 740M curative is being processed.

Thermal burns resulting from molten Versalink 740M curative should be treated in the same way as any other thermal burn. After removing the solidified material, which can be done mechanically, follow with a gentle application of soap and water to remove residual traces. Consult a physician.

Spills – If a large spill of molten curative should occur, mechanical action can be used to break and clean up the material after it has solidified. Efficient ventilation is recommended to avoid human exposure until the melt has solidified and cooled to a safe handling temperature. Disposal should be to a chemical sewer or other approved chemical disposal facility.

Storage – Versalink 740M curative is shipped in polyethylene-lined containers. There is essentially no hazard associated with storage when protected from weather, excessive humidity and excessive temperatures. Storage stability is excellent under normal conditions. Containers should not be left open to the atmosphere for any period of time, in order to minimize oxidation and unnecessary exposure to moisture.

Safety and First Aid Precautions

The complete toxicological characterization of Versalink 740M curative has not been determined. It is recommended, as with any organic chemical compound, that precautions be taken to avoid ingestion, inhalation and contact with skin and eyes. It is also recommended that employees handling or processing Versalink 740M curative be equipped with appropriate protective equipment as well as protective uniforms or clothing that is laundered on a regular basis.

In case of contact with skin, wash thoroughly with soap and water. In case of contact with eyes, flush with water for at least 15 minutes and consult a physician.

Processing Parameters

Handling

As with any reactive organic chemical, the use of Versalink 740M curative should be within the framework of a comprehensive industrial hygiene program requiring efficient ventilation in all work areas, appropriate protective equipment and clothing, and use of recognized industrial safety principles for handling and processing. Protective gloves and eye goggles are recommended.

Based on an evaluation of a variety of prepolymers, Versalink 740M curative demonstrates a relatively versatile and "forgiving" capability for providing excellent, frequently superior elastomer physical property. Formulation and processing conditions can be selected and optimized for specific or general enhancement of the elastomers depending upon the requirements of the user. (See Figure 1 when using Versalink 740M curative.)

Whether processing Versalink 740M curative by the "hand batch" method or by automatic dispensing equipment, the best overall results will be obtained by using the following general processing conditions.

1. Select an amine stoichiometry in the range of 85 to 100% of the reported NCO content of the prepolymer. If Versalink 740M curative is being evaluated in a formulation as a replacement for another diamine curative, initially evaluate the same stoichiometry before varying the ratio of curative to prepolymer.

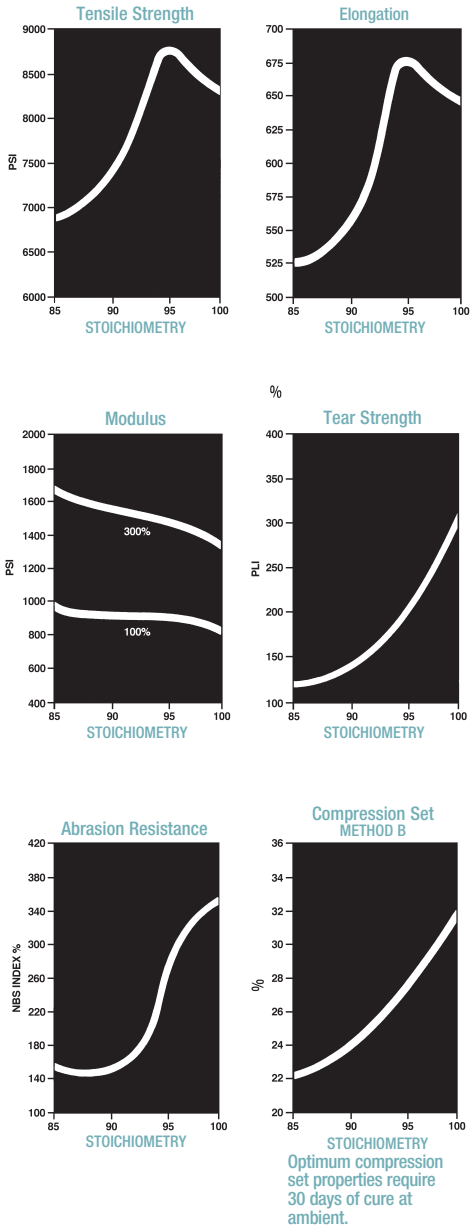
2. Versalink 740M curative, which has a melting range of 257 °F – 263 °F (125 °C – 128 °C), should be processed at 285 °F (140° C).

The melted curative is thoroughly mixed with the liquid prepolymer which has been heated to 185 °F – 195 °F (85 °C – 90° C). It is generally good practice to degas the prepolymer before mixing with the curative as well as after mixing. A minimum of 5 mm of mercury should be maintained in the degassing chamber.

The degassed mixture should then be poured into a mold which has been heated to 212 °F (100 °C).

The final elastomer part should then be demolded at an optimum time, which may vary between 15 minutes and 60 minutes depending on the prepolymer used. While various post-cure conditions may be employed, our recommendation is 6 hours at 212 °F (100 °C) for ethers and 16 hours at 212 °F (100 °C) for esters.

Figure 1 Effects of Ratio Changes on Elastomer Properties Processed Using Standard Conditions for a 3.6% NCO Mixed Isomer TDI Ether Prepolymer



Optimum compression set properties require 30 days of cure at ambient.

AIR PRODUCTS

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