

# CONATHANE® EN-11 & EN-12

### DESCRIPTION

CONATHANE EN-11 and EN-12 are two-component, highly flexible liquid polyurethane molding and encapsulating systems that ensure the performance of electrical/electronic assemblies exposed to severe environmental extremes. Elastomers prepared from these systems exhibit the following outstanding properties:

- Superior hydrolytic stability
- Non-MbOCA curing systems
- Excellent flexibility
- Low dielectric constant
- Low viscosity
- Thermal shock resistance (-70°C to 135°C)
- Exceptionally high dielectric strength (600 vpm)
- Fungus resistance

The systems are recommended for cable and connector potting and molding - both military and commercial, electronic module potting, wire wound device encapsulation, and strain sensitive component potting. Their excellent moisture resistance also suggests their use as 100% solids thick-film coatings for printed circuitry or, because of their solubility in most commercially available solvents, as flexible thin-film coatings. These systems have also shown exceptional adhesion to a wide variety of substrates. The electrical properties of these systems are excellent; the dielectric constant and dissipation factor are exceptionally low and remain relatively unchanged over the recommended operating temperature range of -65°C to 130°C.

### CHARACTERISTICS AND PROPERTIES

**Table 1 | Product Description**

Property	EN-4 PART A	EN-11 PART B	EN-12 PART B
Color	Translucent Amber	Amber	Amber
Viscosity @ 25°C, cps	8500	4000	6000
Specific Gravity @ 25°C	0.97	0.91	0.91
NCO Content, %	9.0	---	---
Shelf Life, from date of manufacture	15 months	15 months	15 months

**Table 2 | Processing Parameters**

Property	EN-11	EN-12	Test Method
Color	Translucent Amber	Translucent Amber	Visual
Specific Gravity @ 25°C	0.98	0.99	ASTM D-792
Hardness, Shore A	60	50	ASTM D-2240
Tensile Strength, psi	750	400	ASTM D-412
100% Modulus, psi	300	150	
300% Modulus, psi	425	---	
Ultimate Elongation, %	350	350	ASTM D-412
Tear Strength, Graves, pli	100	75	ASTM D-624
Shrinkage, Linear, %	1.15	1.25	CYTEC
Water Absorption, % 24 hours	0.23	0.20	ASTM D-570
30 days	0.42	0.31	
Heat Stability, % Wt. Gain, After 7 days @ 135°C	0.13	0.05	MIL-I-16923E
Fungus Resistance	Non-Nutrient	Non-Nutrient	MIL-STD-810B
Thermal Shock, 10 cycles, Olyphant washer 130°C to -70°C	Passes	Passes	MIL-I-16923E
Peel Strength, piw			MIL-M-24041
Aluminum primed with AD-1146-C	>20	>20	
Stainless Steel primed with AD-1146-C	>20	>20	
Neoprene primed with CONAP® PR-1167	>20	>20	
PVC primed with CONAP® AD-1161	>20	>20	
Compression Set, %, 22 hours @ 70°C	24	10	ASTM D-395 Method B

**Table 3 | Typical Cured Electrical Properties**

Property	EN-11		EN-12		Test Method
	25°C	130°C	25°C	130°C	
Dielectric Constant, 100 Hz	3.3	3.4	3.4	3.1	ASTM D-150
1 KHz	3.1	3.4	3.2	3.2	
1 MHz	2.9	3.2	2.9	3.1	
Dissipation Factor, 100 Hz	0.027	0.030	0.026	0.029	ASTM D-150
1 KHz	0.028	0.036	0.025	0.036	
1 MHz	0.009	0.023	0.010	0.017	
Volume Resistivity, ohm-cm @ 25°C	>4.3 x 10 <sup>15</sup>	>4.3 x 10 <sup>15</sup>	ASTM D-257		
@ 130°C	4.8 x 10 <sup>11</sup>	4.5 x 10 <sup>11</sup>			
Surface Resistivity, ohms, @ 25°C	>1.0 x 10 <sup>15</sup>	>1.0 x 10 <sup>15</sup>	ASTM D-257		
@ 130°C	5.3 x 10 <sup>12</sup>	2.5 x 10 <sup>12</sup>			
Insulation Resistance, ohms, @ 25°C	>2.5 x 10 <sup>13</sup>	>2.5 x 10 <sup>13</sup>	MIL-M-24041		
@ 130°C	6.3 x 10 <sup>10</sup>	6.6 x 10 <sup>10</sup>			
Dielectric Strength, vpm (1/16")	610	600	ASTM D-149		
Arc Resistance, sec.	>120	>120	ASTM D-495		
Flame resistance, 55 amps D.C.	No Ignition	No Ignition	MIL-M-24041		

## COLORING

These systems cure to a translucent amber solid. CONAP® DS-1830 color concentrates can be added to make color variations. Please request technical Bulletin AC-112.

## AVAILABILITY

CONATHANES EN-4 Part A, EN-11 Part B, and EN-12 Part B are available in quart, gallon, 5-gallon and 55-gallon sizes. An EVALUATION KIT of either of these systems is available at a nominal fee.

## HYDROLITIC STABILITY

Elastomers prepared from these systems offer unsurpassed reversion resistance. Physical property test data is available for each of these systems exposed to 97°C - 95% relative humidity, at 28-day periods, up to 112 days of continuous exposure. Electrical properties are also reported after completion of the 112 day exposure period.

## RECOMMENDED PROCESSING PARAMETERS

Property	EN-11	EN-12
Mix Ratio, pbw, EN-4 Part A with respective Part B's	100/55	100/95
Mixed Viscosity @ 25°C, cps		
Initial	5750	6500
30 minutes	12,000	18,500
60 minutes	75,000	100,000
Exotherm (2 lb. Mass), mixed @ 25°C	55°C	55°C
Cure Time @ 60°C	24 hours	24 hours
@ 80°C	16 hours	16 hours
Demold Time @ 60°C	8-10 hours	8-10 hours
@ 80°C	2-3 hours	2-3 hours

NOTE: CONATHANE EN-4 Part A may crystallize upon storage or during shipment. If this has occurred, heat to 60°C, mix thoroughly, and cool to room temperature before processing.

CONATHANE EN-11 PART B AND EN-12 PART B COMPONENTS SHOULD BE THOROUGHLY MIXED PRIOR TO USE.

Thoroughly mix the CONATHANE EN-4 Part A with either the CONATHANE EN-11 Part B or EN-12 Part B at 25°C to 40°C using metal, plastic, or glass stirrers and containers. Degas the mixed material at 1-5 mm of mercury and pour into molds at 25°C-80°C. Containers should be large enough to allow for volume expansion during the degassing cycle. Any material or container that could introduce moisture in the system should be avoided.

### SPECIAL NOTICE:

Due to the excellent solubility of these liquid systems in solvents, such as methyl ethyl ketone, xylene, toluene, and various blends of them, these systems also show promise as flexible conformal coatings for printed circuitry and electronic assemblies. Initial laboratory evaluation has shown excellent dipping and spraying qualities when diluted 40-60% with a 50/50 blend of MEK/Toluene.

## HANDLING AND STORAGE INSTRUCTIONS

The component parts of these systems are storage stable for 15 months from date of manufacture in the original, unopened containers when stored at temperatures of 70°F-85°F. If containers are opened and the contents only partially used, containers should be flushed with dry nitrogen (see CONAP® Dri-Purge) or dry air before resealing to prevent waste of material availability.

CONATHANE EN-14 or EN-14 Black are available in quart, gallon, 5-gallon, and 55-gallon units. An evaluation kit is available for a nominal fee.

## CAUTION

Avoid contact with the resins and hardeners. The use of protective clothing is recommended. Should contact occur, wash with mild soap and water. Use only in well-ventilated areas and avoid prolonged or repeated breathing of fumes. Curing ovens should be vented to the atmosphere. Responsible handling of Cytec Industries Inc. products requires a thorough review of safety, health, and environmental issues prior to use. Review the Material Safety Data Sheets(s) for the specific Cytec Industries Inc. product(s) and container label information before opening containers. Ensure that employee exposure issues are understood, communicated to all workers, and controls are in place to prevent exposures above Permissible Exposure Limits (PELs). Review safety and environmental issues to be certain controls are in place to prevent injury to employees, the community, or the environment, and ensure compliance with all applicable Federal, State, and Local laws and regulations. For assistance in this review process, please call your Cytec Industries Inc. representative or our office noted below.

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