Technical Data Sheet

Hysol®

Electronic Formulated Liquid

1.0 DESCRIPTION

ES4212/ES4312/ES4412 are two-component casting systems with excellent handling properties. They combine low cost and flexibility with ease in handling. These products mix in 1-to-1 ratio by volume and are filled with non-abrasive fillers for machine metering and dispensing. ES4212 has a long pot life, while ES4312 and ES4412 are shorter pot life, faster curing systems.

ES4212/ES4312/ES4412 have good thermal shock resistance and low exotherm, making them suitable for encapsulation of various components and modules. These are general purpose casting systems suited for many applications because of their low cost, ease of handling, and flexibility. Gas control valves potted with ES4212 have been approved for service by the American Gas Association.

ES4212 has been tested to UL-94, "Test for Flammability of Plastic Materials", by Underwriters Laboratories, Inc., and meets the requirements of 94HB in a 1/8 inch cross section. ES4212 is listed in UL's Recognized Component Index with this flammability rating.

ES4312 is a faster gelling version of ES4212 with nearly identical cured properties. ES4412 is a low viscosity material with similar cured properties.

2.0 TYPICAL UNCURED PROPERTIES

		ES4212		ES4312		ES4412		TEST METHOD
		A	B	A	B	A	B	
Color		Black	Tan	Black	Tan	Black	Tan	Visual
Filler content, %		50	50	50	55	50	55	ASTM D 2584
Density @ 25ºC (77ºF), gm/cc		1.60	1.45	1.60	1.41	1.82	1.65	ASTM D 1475
Viscosity @ 25ºC (77ºF)	A							STM D 2393
Brookfield RVF								
Spindle 7, Speed 20 cps		45,000		45,000				
Spindle 6, Speed 2 cps					15,000	14,000		
Spindle 6, Speed 20 cps			9,000					
Spindle 3, Speed 20 cps	3,500							
Shelf Life @ 25ºC (77ºF), months min. from date of shipment		6	6	6	6	6	6	

3.0 TYPICAL CURED PROPERTIES – Values are not intended for use in preparation of specifications. All measurements taken at 25ºC (77ºF) unless otherwise noted.

3.1 Cured Physical Characteristics

		ES4212	ES4312	ES4412		TEST METHOD
Color	B	lack	B lack	B lack	Vis ual	
Coefficient of linear thermal expansion in/in/ ºC below Tg alpha$_1$	95	x 10^{-6}	148 x 10^{-6}	74 x 10^{-6}		
above Tg alpha $_2$		235 x 10^{-6}	173 x 10^{-6}	180 x 10^{-6}		
Glass Transition (Tg), ºC	20		47	36	A	STM D 3386
Compressive strength, psi	10,500		11,300	14,000	A	STM D 695
Linear Shrinkage, %	0.053		0.03	0.007	A	STM D 2566
Filler Content, %	51		52	52	A	STM D 2584
Hardness, Shore D	75-	80	80- 85	70- 80	A	STM D 2240
Tensile strength, psi	2,250		1,985	1,400	A	STM D 638
Elongation, %	14		16	45	A	STM D 638
Specific Gravity	1.57		1.60	1.79	A	STM D 792
Thermal conductivity cal x cm/sec cm^2 x ºC	A	10 x 10^{-4}	10 x 10^{-4}	7 x 10^{-4}		STM D 1674
Izod impact strength, ft – lb/in of notch		0.30	0.30	0.30		ASTM D 167
Moisture absorption (24 hr immersion), %	A	0.76	1.7	1.1		STM D 570
Flammability, 1/8" cross section		94HB				

3.2 Cured Electrical Properties

	E	S4212/ES4312/ES4412	T	EST METHOD
Dielectric strength, volts/mil	1,100	A		STM D 149

	RE2039/HD3719			
	25ºC		105ºC	
	K	D	K	D
100 Hz	5.7	0.120	20.3	4.63
1 kHz	4.9	0.007	11.8	0.974
10 kHz	4.4	0.063	8.6	0.104
Volume Resistivity	2.0 x 10^{13}		4 x 10^9	
Surface Resistivity	1 x 10^{14} 2		x 10^{11}	

K= Dielectric constant by ASTM D 150
D = Dissipation factor by ASTM D 150
Volume resistivity in ohm-cm by ASTM D 257
Surface resistivity in ohm-cm by ASTM D 257

4.0 HANDLING

	E		S4212	E	S4312	E	S4412
Mix ratio, parts by weight*		100/	90	100/	87	100/	87
Mix ratio, parts by volume*		100/	100	100/	100	100/	100
Pot Life @ 25ºC (77ºF), minutes							
200 gram mass	230			120		60	
500 gram mass	180			85		58	
1000 gram mass	135			65		47	
Viscosity, @ 25ºC (77ºF),							
Spindle 5, Speed 2, cps			25,000		30,000		-
Spindle 4, Speed 10, cps			-		-		10,000
Peak exotherm temperature							
(200 gram mass), ºC (ºF)			36 (97)		39 (102)		42 (108)

*The standard mix ratio of ES4212/ES4312/ES4412 is 100 parts A to 100 parts B by volume. By decreasing the amount of hardener to 90 parts Part B by Volume, maximum rigidity and hardness will be obtained. By increasing the amount of hardener to 110 parts Part B by volume, flexibility will be increased. No mix ratio beyond these two extremes should be used.

4.1 Mixing of ES4212/ES4312/ES4412

ES4212/ES4312/ES4412 will settle upon storage, especially at temperatures exceeding 80ºF. Refrigerated storage will minimize filler settling. Each container must be thoroughly mixed before combining Part A and Part B. For ease of mixing, store containers upside down. Approximately 10 minutes on a standard paint shaker will normally ensure complete dispersion of the filler.

Cure Schedule	**E**	**S4212**	**E**	**S4312/ES4412**
Recommended cure		38-48 hrs. @ 25ºC (77ºF)		24 hrs. . @ 25ºC (77ºF)
Alternate cure		3 hrs. @ 60ºC (140ºF)		2 hrs. @ 60ºC (140ºF)

Typical cured properties were determined using the recommended cure schedule. Some difference in properties may occur with the alternate or other schedules.

Cure temperatures for ES4212, ES4312, ES4412 must be maintained at 25ºC or higher to insure a tack-free surface.

For additional information in the Americas, please contact one of the following locations:

New York		**Canada**		**Brazil**
TEL: 716.372.6300	T	EL: 905.814.6511	T	EL: 011.55.11.4143.7000
FAX: 716.372.6864	F	AX: 905.814.5391	F	AX: 011.55.11.4143.7100

For a complete listing of worldwide locations and information on related products, please visit our website **www.henkelna.com/electronics**

Users should review the Material Safety Data Sheet (MSDS) and product label for the material to determine possible health hazards, appropriate engineering controls and precautions to be observed in using the material. Copies of the MSDS and label are available upon request