

ENTHONE® SR1000/SR1010

Solder Resist

DESCRIPTION

Solder resists SR1000 and SR1010 are screen printable, high solids, epoxy-based resists. These resists contain no MDA. During thermal cure, these resists release approximately 5% volatile material. Both products are one component which eliminates weighing, mixing and pot life restrictions. SR1000 and SR1010 cure to a matte finish providing an excellent base for the adhesion of legend inks and conformal coatings. Both resists have a UL rating of 94V-0 and conform to the IPC-SM-840 (B) standard.

SR1000 has outstanding adhesion to copper, tin-lead solder, tin-nickel, nickel, bright acid tin and gold. This resist has been formulated to withstand reflow, wave or dip soldering and solder leveling by hot air, hot oil or hydro-squeegee methods. SR1000 is a medium viscosity resist.

SR1010 is a higher viscosity version of SR1000. The higher viscosity is achieved by 10% addition of talc to the formulation. Because the raw materials used in SR1010 are identical to SR1000, curing procedures, adhesion, physical properties, and electrical properties are the same or similar.

PREPRINT SURFACE PREPARATION

Epoxy based resins offer outstanding adhesion characteristics if handled properly. Most solder mask adhesion failures can be traced to deficiencies in surface preparation before printing. All oils, grease, fingerprints, foreign particles, oxides, moisture and chemical residues must be removed before the solder mask coating is applied. Suggested precleaning procedures for various substrates follow.

COPPER: Circuit boards may be physically precleaned, or precleaned by a combination of these two methods.

Physical roughening includes abrasion by brush, pad, or pumice slurry. These systems usually incorporate water spray. Following the abrasion procedure, water rinse; then immediately oven dry the substrate to avoid reoxidation of the copper.

Chemical removal of contaminants can be achieved by a dip process using one of many commercially available copper cleaning solutions. Enthone recommends HYSOL PWB Products SS2825 solution. Following chemical cleaning, surfaces should be rinsed free of chemical residues and briefly dried by heat.

TIN-LEAD (FUSED SOLDER): Following heat fusing, wash circuit boards thoroughly to assure removal of fusing oil residues, then dry the surface. Vapor degreasing is a good quality control measure if boards are stored for extended periods of time. Although not always an acceptable option, light physical abrasion further increases solder resist adhesion.

BRIGHT ACID TIN, GOLD, NICKEL, TIN-NICKEL: Detergent wash and/or vapor degrease all surfaces. When using detergent, be certain final rinse provides adequate removal of all chemical films. Briefly oven dry.

SCREEN PRINTING

FABRIC: Monofilament, polyester or stainless steel fabric can be used. Generally polyester is preferred for solder mask applications. A mesh count from 110 to 240 is recommended. For 2 ounce copper panels or tin-lead panels with fine line traces, a coarser mesh is usually selected to avoid skips. For light build-up and/or less dense circuitry, a finer mesh will yield better results. Mesh tension should be to the manufacturer's recommendation. Proper "off contact" will vary with the type of job printed. A good starting point is .125.

SQUEEGEE MATERIAL: 60 to 80 durometer, sharp, and free of nicks or bumps. Squeegee durometer, pressure, angle and speed should be adjusted according to ink film thickness required for circuit tolerances and individual plated board densities.

STENCIL MATERIAL: SR1000 and SR1010 can be screen printed with direct, indirect, direct/indirect, or capillary direct film stencils. Direct/indirect or capillary stencil systems with thickness of 35µ or greater are recommended for long run, one and two ounce SMOBC applications. The stencil system must be lacquer resistant.

THINNING: Apply SR1000 and SR1010 directly without thinning. Although thinning is not recommended, flow properties may be adjusted with a 1-2% addition of AD2003 or carbitol acetate.

FLOW AGENT: Surface conditions such as bubbling, crawling or pin-holing can sometimes be controlled by small additions of AD3002, flow agent. To use, add 2-4% AD3002 by weight, **mix gently** for 20 seconds then apply mask to screen.

REMOVAL: Uncured SR1000 or SR1010 may be removed from boards, screens and equipment with diacetone alcohol, butyl cellosolve, ketone or glycol solvents or any good lacquer-wash thinner. Numerous commercial screen washes may also be used. Enthone recommends SC1710 screen cleaner/stencil stripper. Chlorinated hydrocarbons, such as methylene chloride, 1,1,1 Trichloroethane, and 1,1,2 Trichloroethylene are not recommended. These solvents may cause polymerization, resulting in difficult cleaning of screens and equipment.

RECOMMENDED CURING

SR1000 and SR1010 contain solvents which volatilize during the curing cycle. Curing ovens must have sufficient air flow to remove these solvent vapors.

DOUBLE SIDED BOARDS:

First Side - 15 to 30 minutes at 300°F (149°C)*

Second Side - 60 minutes at 300°F (149°C)

*"Hold Time" between first and second side cure should not exceed 12 hours.

SINGLE SIDED BOARDS:

60 minutes at 300°F (149°C)

INFRARED (IR) OVEN CURING:

SR1000 and SR1010 resists respond to infrared curing equipment. Cure efficiency will depend on power availability, number of heat zones, unit size and air circulation.

Infrared curing will impart a harder, more glossy finish to the surface of SR1000 and SR1010. A brief exposure to IR followed by convection oven bake will also yield a gloss finish, however "hold times" should be observed (See 4.1).

REMOVAL

Once cured, SR1000 and SR1010 becomes a highly cross linked epoxy polymer. Careful inspection of the solder resist should be made before curing. Following full cure, SR1000 and SR1010 removal is impossible without damage to the laminate. If removal is essential, consult Enthone Electronic Materials Technical Service.

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TYPICAL CHARACTERISTICS

All measurements taken at 25°C (77°F) unless otherwise noted

Physical Properties	SR1000	SR1010	Test Method
Color	Green	Green	Visual
Nonvolatile Content, %	96-98	96-98	ASTM D 1259
Specific Gravity Method 4184	1.16	1.20	FTMS141a
Viscosity range, cps (x1000) ¹	32-42	47-57	ASTM D 2393
Moisture absorption, % ²	3.5	47-57	ASTN D 570
Flash point °C (°F) Seta Flash	>110 (230)	>110 (230)	ASTM D 3278
Flammability [Reference File No. E69934(M)]	94V-0	94V-0 UL94	
Abrasion Resistance Taber Method, Cycles per .001"	1350	1650	ASTM D 3389
encil Method, hardness at .001" - .002"	4H	4H	IPC TM 650 Para. 2.4.27.2
at .003" - .004"	3H-4H	3H-4H	
Total Mass Loss, %(TML) ³	0.65	1.62	ASTM E 595
Collected Volatile Condensable Material, %(CVM) ³	0.01	0.19	ASTM E 595
Hydrolytic Stability	Pass	Pass	IPC TM 650 Para. 2.6.7.1
Thermal Shock	Pass	Pass	IPC TM 650 Para. 2.6.7.1

Chemical Resistance	SR1000/SR1010 No Degradation After:	Test Method
		IPC-SM-840B Para. 4.8.6
Isopropanol	24 hours +	
Methyl Ethyl Ketone	24 hours +	
Toluene	24 hours +	
Acetone	24 hours +	
Perchloroethylene	24 hours +	
Methylene Chloride	24 hours +	
1,1,1 Trichloroethane	24 hours +	
1,1,1 Trichloroethane, Vapor Degreased	24 hours +	
1,1,2 Trichloroethylene	24 hours +	
Trichlorotrifluoroethane	24 hours +	
Trichlorotrifluoroethane, Vapor Degreased	24 hours +	
Freon TE*	24 hours +	
Freon TMS*	24 hours +	
Alkaline Detergent ⁵ at 60°C (140°F)	24 hours +	
Sodium Hydroxide (10% Solution)	24 hours +	
Hydrochloric Acid (37.2 Assay, reagent grade)	24 hours +	

¹ Brookfield RVF, for SR1000 - Spindle 6/20 rpm, for SR1010 - Spindle 7/20 rpm

² at 60°C, 168 hour immersion, percent by weight

³ Sample cured 149°C/60 minutes

⁴ SR1000/SR1010 cured on copper-clad laminate

⁵ Loncoterge 530

CURED ELECTRICAL PROPERTIES	SR1000	SR1010	Test Method
Dielectric Strength, Volts/.001"	1000	1000	ASTM D 149
Dielectric Constant (K) at 25°C 100 Hz	3.54	3.85	ASTM D 150

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1 Khz	3.44	3.85	
10 Khz	3.43	3.74	
100 Khz	3.38	3.58	
Dissipation Factor (D) at 25°C			
100 Hz	.0084	.0125	ASTM D 150
1 Khz	.0084	.0122	
10 Khz	.0117	.0232	
100 Khz	.0225	.0457	
Volume Resistivity at 25°C			
1 minute dwell-500V DC, ohms-cm	4.5 x 10 ¹⁵	1.2 x 10 ¹⁵	ASTM D 257
Surface Resistivity at 25°C			
1 minute dwell-500V DC, ohms	7.8 x 10 ¹⁴	6.7 x 10 ¹⁴	ASTM D 257
Insulation Resistance, ohms			
at 25°C (copper circuitry)			
Initial	>2.0 x 10 ¹²	>2.0 x 10 ¹²	IPC-SM-840B Para. 4.8.10.2
Aftet Flux/Solder	>2.0 x 10 ¹²	>2.0 x 10 ¹²	
Moisture/Insulation Resistance			
Copper Circuitry			
at 25°C initial	>2.0 x 10 ¹²	>2.0 x 10 ¹²	IPC-SM-840B Para. 4.8.10.3
at 35°C, 95% R.H.			
after 24 hours	7.8 x 10 ¹¹	3.5 x 10 ¹¹	
after 96 hours	8.8 x 10 ¹⁰	5.3 x 10 ¹⁰	
at 50°C, 95% R.H.			
after 24 hours	3.1 x 10 ¹⁰	7.1 x 10 ⁹	
after 168 hours	7.3 x 10 ⁹	3.4 x 10 ⁹	
Electromigration	Pass	Pass	IPC-SM-840B Para. 4.8.10.4

⁶ Solder at 260°C (500°F) 10 seconds using Lonco 735-11

SOLDERING

SR1000/SR1010 may be used with a variety of fluxes including R.M.A., R.A., O.A., and S.A. types. Fluxes should be pretested with any solder mask product to insure desired performance during soldering, and after post cleaning. This is especially true of "water soluble" flux products because of wide variation of post cleaning equipment, water conditions, and procedures in use. Fluxes blended inhouse should be constantly monitored for controlled activity level. A pH of 2-4 is recommended.

HOT AIR LEVEL (H.A.L.) PRECLEANS: If using copper preclean solutions before application of H.A.L. flux, follow manufacturer's recommendations for solution concentration, dwell times and solution temperatures. Failure to control process may lead to excess water/chemical absorption by the solder mask and resultant loss of adhesion or white residue following the leveling process.

H.A.L. DWELL: Soldering dwell time should not exceed 6 seconds or post cleaning efficiency may be affected. Solder pot temperature should range from 245° - 260°C (475° - 500°F). If thinning the H.A.L. flux, Enthone recommends use of butyl cellosolve acetate rather than water.

H.A.L. POST CLEANING: A two tank system is recommended to clean water soluble H.A.L. flux from circuit boards. The first tank should constantly drain at 3-5 G.P.M. minimum. Water temperature of both wash tanks should be at least 25°C (77°F), and **ideally warmer**, up to 100°F. Boards should be **physically separated** in the wash tanks to assure residual flux is removed from the entire surface. Post washing should occur **immediately** following the soldering procedure. Delays of ten minutes or more may affect cleaning efficiency. Deionized water is recommended in the final rinse chamber.

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WAVE SOLDERING: Consult flux manufacturer for recommended top-side board preheat temperature. After application of wave flux, soldering speed should be at least three (3) feet per minute. Slow soldering speed affect post cleaning efficiency, especially when using water soluble fluxes. Solder pot temperatures should be maintained between 245°-260°C (425°-500°F).

WATER SOLUBLE WAVE FLUX: SR1000/SR1010 is most compatible with those fluxes having controlled amounts of HCl acid and pH from 2-4. A recommended product list can be found below.

RECOMMENDED WATER SOLUBLE FLUXES:

H.A.L.	WAVE
Enthone Aqua Flux AF1811	Kester 2331 ZX
Enthone Aqua Flux AF1810	Hi Grade 3375
Enthone AF1807	Kenco 183, 188
	Aqua-Sol
Gyrex "Air Bright"	Lonco 735-11

These recommendations constitute only a small portion of suitable flux products presently available. Contact flux manufacturers for specific information and recommendations.

POST CLEANING - AQUEOUS: Post washing should occur **immediately** following the soldering procedure. Delays of ten minutes or more may affect cleaning efficiency. Deionized water is recommended in the final rinse chamber. Optimum post cleaning of aqueous flux requires a system approach using multiple water tanks with increasing water temperature. For a detailed discussion on systems, water, solution additives, etc., the user is directed to IPC bulletin IPC-AC-62 "Post Solder Aqueous Cleaning Handbook", available from TheInstitute for Interconnecting and Packaging Electronic Circuits, Lincolnwood, Illinois, 60646.

POST CLEANING - AQUEOUS, WATER ADDITIVES: Water wash efficiency can be **significantly improved** by addition of water additives. They are also useful in removing some types of white residues that are not soluble in water or common cleaning solvents.

RECOMMENDED WATER WASH ADDITIVES:

Alpha 2444
Chemelex Rinse Aid #85
Kenco 2240 and 2235 Series

These recommendations constitute only a small portion of suitable wash additives presently available. Contact water additive manufacturers for specific information and recommendations.

COLOR NUMBERS

SR1000	Green
SR1001	Clear
SR1003	Blue
SR1004	Red
SR1010	Green, High Viscosity
SR1011	Light Green

COLOR ADDITIVES

AD5000	Blue Dispersion
AD5001	Yellow Dispersion
AD5002	Red Dispersion
AD5003	Black Dispersion

As packaged entire or partial amount of color dispersion may be added to SR1001 gallon. Mix thoroughly and stir from bottom of container.

TOUCH UP

SR1000 may be touched up with any good quality epoxy ink. Enthone Electronic Material offers Cat-L-Ink standard light and dark green, or special Cat-L-Ink color AD5004 which is matched to SR1000. Enthone recommends the use of Catalyst No. 9 with these products.

PACKAGING

SR1000/SR1010 and colors are available in one gallon plastic containers. Color additives are packaged in half-pint containers. Please contact your Enthone Electronic Materials distributor for ordering information.

SHELF LIFE

SR1000/SR1010 has a shelf life of nine months from date of Enthone manufacture. AD color additives do not contain catalyst. Their shelf life is one year from date of Enthone shipment.

STORAGE AND HANDLING

SR1000/SR1010 should be stored at room temperature (80°F) or below and out of direct sunlight. If subjected to high heat, shelf life will be severely reduced.

DISPOSAL

Should be in accordance with Federal, State and Local environmental regulations.

AVAILABLE CERTIFICATIONS

UL94V-0 (All Colors)
File No. E69934
IPC-SM-840(B), Class III Qualification
Material Safety Data Sheet

SAFETY

Information on the safety, health and environmental attributes of this product is set forth in the material safety data sheet (MSDS) and on the product label. Enthone provides the MSDS and product label to customers with all samples, as well as with the initial shipment of product and whenever an update is issued. Copies of the MSDS and label are also available at any time upon request.

The safety, health and environmental information set forth in the MSDS and label should be considered in determining the appropriateness of this product for any particular application, and should be used to determine appropriate engineering controls, protective equipment, work practices, and other precautions to be observed in the use of this product in any particular process or working environment.

MATERIAL SAFETY DATA SHEETS

For more detailed information on the toxicological properties of the products described herein, reference can be made to the Material Safety Data Sheet (MSDS) for each product. If you do not have the proper MSDS, it can be requested from: Enthone Inc., attention: Regulatory Affairs Department, P.O. Box 1900, New Haven, CT 06508. For emergency assistance call CHEMTREC (800) 424-9300.

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CUSTOMER ORDER CENTERS

UNITED STATES		(800) 496-8326 Fax (203) 933-0249
SEL-REX® Precious Metal Products	(Phone: 8AM-6PM, M-F, East Coast time) (Fax: 24 hours, 7 days)	(800) 560-7214 Fax (203) 932-8688
CANADA	Mississauga Ontario Pointe Claire, Quebec	(800) 387-3766; (905) 507-9949 Fax (905) 507-9943 (514) 426-1451 Fax (514) 426-1453
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