QUICK TURN CIRCUITS

DEXTER ELECTRONIC MATERIALS DIVISION

TECHNICAL INFORMATION

1.0 DESCRIPTION

HYSOL® SR1020 solder resists are screen printable, high solids epoxy-based products. They are one component resists which are packaged "ready to use" with no "catalyzed" pot life restrictions. These solder resists cure to a gloss finish and provide an excellent base for the adhesion of legend ink and conformal coatings.

SR1020 solder resist is available in two versions. **SR1020-45K** is a medium viscosity resist. **SR1020-60K** is a high viscosity resist designed to yield high resolution images with coarse screen mesh counts. Because the raw materials are identical in both products, the cure requirements, adhesion, physical and chemical properties are considered alike.

2.0 USES

As a polymerized solder resist coating, SR1020 exhibits excellent adhesion to copper and is suitable for the encapsulation of nickel and gold circuitry. SR1020 is not recommended for reflow metals. The resist can be wave or dip soldered and will withstand solder leveling by hot oil, hot air or hydro-squeegee methods.

Because SR1020 solder resist has unusually good dielectric qualities, it is an ideal product for high-rel applications.

3.0 PREPRINT SURFACE PREPERATION

Epoxy based resins offer outstanding adhesion characteristics if handled properly. Most solder mask adhesion failures can be traced to deficiencies in surface preperation 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:

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

3.1.1 Physical roughening can be by brush, pads or ideally pumice slurry followed by a water rinse. The substrate should be oven dried immediately to avoid reoxidation of the copper and to remove any trace of moisture.

3.1.2 Chemical removal of contaminants can be acheived by a dip process using one of many commercially available copper cleaning solutions. Dexter recommends **HYSOL® Copperbrite 525** solution. Following chemical cleaning, surfaces should be rinsed free of chemical residues and briefly oven dried to prevent reoxidation of the copper and to remove any trace of moisture.

3.1.3 Field Tests indicate the best copper treatment is a combination of physical roughening followed by light micro etching. This combination helps ensure cleanliness of trace side-walls on high plated, fine line substrates.

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

4.0 SCREEN PRINTING

4.1 FABRIC: Monofilament polyester or stainless steel fabrics can be use. Generally, polyester is preferred for solder resist applications; however, on fine trace boards, stainless steel mesh will significantly improve resolution. A polyester mesh count range of 110 to 158 is recommended. For 2 ounce copper panels with fine line traces, a coarser mesh is usually selected to avoid skips. See figure 1.

4.2 SQUEEGEE MATERIAL: 60 to 70 durometer, sharp, and free of nicks or bumps. Squeegee durometer, pressure, angle and speed should be adjusted according to the ink film thickness required for circuit tolerances and individual plated board densities. Squeegee pressures should be kept at a minimum. Apply just enough pressure to yield a clear, sharp image. Off contact distance should be 0.125" or less.

4.3 STENCIL MATERIAL: SR1020 can be screen printed with direct, indirect, direct/indirect, or capillary direct film stencil systems. Stencil systems with thicknesses of 25 - 35 microns are recommended for long run, one and two ounce SMOBC applications. The stencil system must be lacquer resistant.

4.4 THINNING: Apply SR1020 directly without thinning. While thinning is not recommended, flow properties may be adjusted with a 1-2% addition of HYSOL® AD2003 or carbitol acetate.

5.0 REMOVAL

Uncured SR1020 may be removed from boards, screens and equipment with HYSOL® 110 Screen Wash, HYSOL® AD2001, diacetone alcohol, butyl cellosolve, ketones, glycol solvents, or any good lacquer-wash thinner. Chlorinated hydrocarbons such as methylene chloride, 1, 1, 1 trichloroethane, and 1, 1, 2 trichloroethylene are not recommended. These solvents may cause polymerization, resluting in difficult cleaning of screens and equipment.

Once cured, SR1020 solder resist becomes a highly cross-linked epoxy polymer. Removal is impossible without damage to the laminate. Careful inspection of the solder resist should be made before curing.

6.0 CURING

SR1020 contains solvents which volatize during the curing cycle. To ensure complete cure, ovens must have sufficient air flow to remove these solvent vapors.

6.1 Convection Oven Curing

SINGLE-SIDED BOARDS
Recommended
40-50 minutes at 150°C (300°F)
Alternate
50-60 minutes at 135°C (275°F)

DOUBLE-SIDED BOARDS
First Side
20-30 minutes at 150°C (300°F)
Second Side
40-50 minutes at 150°C (300°F)

Figure 1

POLYESTER (monofilament)

threads per inch	threads per cm	thread diameter microns	% open	tension newtons/cm
86	34	101	43	16
110	43	80	42	16
125	49	84	43	16
140	55	74	40	16
158	62	67	35	16

"Recommended curing" should be used as a starting point; times and temperatures will vary with the type and efficiency of the oven used. *Additional time should be provided to allow substrate to reach curing temperature.*

6.2 INFRARED (IR) OVEN CURING:
SR1020 solder resists can be fully cured in conveyorized infrared equipment. Cure efficiency will depend on power availability, number of heat zones, unit size and air circulation.

7.0 TYPICAL CHARACTERISTICS

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

7.1 PHYSICAL PROPERTIES

PHYSICAL PROPERTIES

Property	Value	Test Method
Color	Green	Visual
Nonvolatile Content, % by weight	82-85	Per Formula
Specific Gravity	1.17	FTMS 141a Method 4184
Viscosity Range, Brookfield RVF @25°C, cps		ASTM D 2393
Spindle 7, Speed 20RPM		
SR1020-45K	45,000±5,000	
SR1020-60K	60,000±5,000	
Flash Point °C (°F), Setaflash	79.4 (175)	ASTM D 3278
Flammability [Reference File No. E69934 (M)]	94 V-O	UL94
Abrasion Resistance		ASTM D 3384
Taber Method, cycles per .001"	6100	
Pencil Method, Hardness	6H	
Coefficient of Thermal Expansion		ASTM D 3386
Alpha 1 (20-140°C), in/in/°C	$57x10^{-6}$	
Glass Transition Temperature, °C (°F)	160 (320)	ASTM D 3386
Solderability	Pass	IPC-S-804
Soldering/Desoldering	Pass	IPC-SM-840B para 4.8.9.3
Hydrolic Stability/Aging	Pass	IPC-TM-650 para 2.6.11
Thermal Shock	Pass	IPC-TM-650 para 2.6.7.1
Adhesion-Copper		IPC-TM-650
Scribe/Tape, %Loss	0	para 2.4.28
Lap Shear Strength, psi	2411	ASTM D 1002

7.2 CHEMICAL RESISTANCE[1]

CHEMICAL RESISTANCE

Property	No Degredation After	Test Method
Isopropanol	>24 hrs.	
Methyl Alcohol	>24 hrs.	
Methyl Ethyl Ketone	>24 hrs.	
Toluene	>24 hrs.	
Acetone	>24 hrs.	
Perchlorothylene	>24 hrs.	
Methylene Chloride	>24 hrs.	
1,1,2 Trichloroethylene	>24 hrs.	
1,1,1 Trichloroethane, vapor degrease	>24 hrs.	IPC-SM-840B para. 4.8.6
Trichlorotrifluoroethane (Freon TF), vapor degreased	>24 hrs.	
Azeotrope: 4% Ethanol, 96% Trichlorotri-fluoroethane (Freon TE), vapor degreased	>24 hrs.	
Azeotrope: 6% Methanol, 94% Trichlorotrifluoroethane (Freon TMS)	>24 hrs.	
Alkaline Detergent, 60°C (140°F)[2]	>24 hrs.	
Sodium Hydroxide (10% solution)	>24 hrs.	
Hydrochloric Acid (37.2 Assay, reagent grade)	>24 hrs.	

[1]SR1020 Cured on Copper-Clad Laminate

[2]Loncoterge 530

CURED ELECTRICAL PROPERTIES

Property	Value	Test Method
Dielectric Strength, Volts/.001"	1300	ASTM D 149
Dielectric Constant (K) at 25°C		ASTM D 150
100 Hz	4.046	
1 kHz	3.993	
10 kHz	3.923	
100 kHz	3.752	
Dissipation Factor (D) at 25°C		ASTM D 150
100 Hz	.0067	
1 kHz	.0102	
10 kHz	.0207	
100 kHz	.0288	
Volume Resistivity at 25°C		ASTM D 257
1 minute dwell, 500 vDC, ohms-cm	1.3×10^{16}	
Surface Resistivity at 25°C		ASTM D 257
1 minute dwell, 500 vDC, ohms-cm	4.0×10^{15}	
Insulation Resistance, ohms, at 25°C		IPC-TM-650
(copper circuitry)		para. 2.6.3.1
Initial	5.2×10^{13}	
After Flux/Solder [1]	5.1×10^{13}	
Moisture/Insulation Resistance, ohms		IPC-TM-650
@25>65°C, cycling; 90% R.H.; 168 hour test		para. 2.6.3.1
Copper Circuitry, 12.5 mil comb pattern		
at 25°C, Initial	1.97×10^{14}	
at 65°C, 95% R.H.		
after 48 hours	2.98×10^{10}	
after 120 hours	2.12×10^{10}	
after 144 hours	1.82×10^{10}	
at 25°C, after 168 hours	5.31×10^{12}	
Moisture/Insulation Resistance		
@ 85°C, 95% R.H., 8.5 mil comb pattern		
after 1,000 hours, ohms	3.1×10^{8}	
Electromigration, ohms	1.48×10^{8}	IPC-TM-650
		para. 2.6.14

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

8.0 SOLDERING

HYSOL® SR1020 solder resists are formulated to withstand the various soldering processes commonly found in the printed circuit industry including hand soldering, roll thinning, hot air or hot oil leveling, and wave soldering.

SR1020 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 the wide variation of post cleaning equipment, water conditions, and procedures in use. Fluxes blended in house should be constantly monitored for controlled activity level.

8.1 HOT AIR LEVEL (H.A.L.) PRECLEAN: 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 the process may lead to excessive water/chemical absorbtion by the solder mask and resultant loss of adhesion or white residue following the leveling process.

8.1.1 RECOMMENDED H.A.L. FLUX

Dexter Aqua Flux AF1810
Dexter Aqua Flux AF1811
Dexter AF1807

8.1.2 H.A.L. DWELL: Soldering dwell time should not exceed 4-6 seconds or post cleaning efficiency may be affected. Solder pot temperature should range from 245-260°C (475-500°F).

8.1.3 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 3-5 G.P.M. minimum. Water temperature of both wash tanks should be at least 25°C (77°F), and ideally much warmer, up to 65.6°C (150°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.

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

8.3 POST CLEANING - AQUEOUS: Post washing should occur immediately following the soldering procedure. Delays of ten minutes or more may effect cleaning efficiency. Deionized water is recommended in the final rinse chamber. Optimum post cleaning of aqueous flux requires a systems approach using multiple water tanks with increasing 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 The Institute for Interconnecting and Packaging Electronic Circuits, Lincolnwood, IL 60203.

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

8.3.2 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.

9.0 COLORS

SR1020-Clear	(SR1021)
SR1020-Blue	(SR1023)
SR1020-Red	(SR1024)

Clear, blue and red versions are manufactured to viscosity specifications for SR1020-45K.

10.0 PACKAGING

SR1020 solder resists are available in one gallon plastic containers.

11.0 SHELF LIFE

SR1020 solder resists have a guaranteed shelf life of four months from date of Dexter shipment for all unopened containers.

11.1 STORAGE AND HANDLING: SR1020 solder resists may be stored at room temperature (21°C/77°F) for extended periods. Refrigeration is not necessary but will extend useful product life. Do not freeze the resist material. Keep material out of direct sunlight. If subjected to temperatures above 26.7°C (80°F), the shelf life will be severly shortened.

12.0 DISPOSAL

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

13.0 AVAILABLE CERTIFICATIONS*

UL94 V-O
IPC-SM-840(B), Class III
Material Safety Data Sheet

14.0 SAFETY

WARNING! SR1020 solder resists may cause injury to skin following prolonged or repeated contact. Avoid prolonged or frequent skin contact. If contact with skin occurs, wash with soap and water at the first opportunity.

*Contact Dexter or an authorized Dealer distributor for further information.

TROUBLESHOOTING GUIDE

PROBLEM	CURE
Poor Adhesion (legend ink)	• Insure surface of solder mask is clean • If two component legend, check mix ratio • Check time/temperature of legend cure
Poor Adhesion (solder mask)	• Insure laminate and trace surfaces are clean before printing (paragraph 3.0-3.2) • Insure adequate cure of resist (paragraph 6.0-6.2)
Bleed	• Increase screen mesh count • Angle squeegee (snowplow), use harder squeegee • Use thinner stencil • Reduce or eliminate flood stroke pressure • Reduce off-contact distance (paragraph 4.2) • Re-shoot stencil (paragraph 4.3)
Smear	• Reduce squeegee pressure (paragraph 4.2) • Re-tension screen mesh (Figure 1) • Re-shoot stencil • Increase off-contact distance, check peel-off (paragraph 4.2)
Bubbling*	• Reduce squeegee speed
Skipping	• Use coarser mesh (paragraph 4.1) • Use thicker stencil (paragraph 4.3) • Reduce ink viscosity (paragraph 4.4) • Reduce squeegee speed, use softer squeegee • Angle artwork to screen mesh; snowplow squeegee
Post Solder Residue	• Insure adequate cure (paragraph 6.0-6.2) • Check oven exhaust (paragraph 6.0) • Increase air blast following wash cycle • Review soldering instructions (paragraphs 8.0-8.3.2)

*Contact Dexter or an authorized Dexter distributor for further information.