enthone

Technical Data Sheet

ENTHONE® M-Series

Permanent Epoxy Marking Ink

DESCRIPTION

M-Series inks are permanent, two component, epoxy-based marking inks. They may be used with a selection of catalysts which cure at elevated and/or room temperatures. When properly applied and cured, M-Series inks have excellent adhesion to glass, metal and thermosetting plastics. They have excellent chemical and thermal resistance properties.

M-Series marking inks are used in the electronic, aerospace, automotive, appliance and decorative packaging industries. Uses include the permanent marking of semiconductor components, printed circuit boards, connectors, dials, nameplates, panels, chassis, glass and thermoplastics.

COLOR NUMBERS AND MIX RATIOS

Ink Number	Color	Recommended Catalyst	Mix Ratios Catalyst Additions Parts by Weight per 100 Parts Ink	
			All Catalysts (except Catalyst 5)	Catalyst 5 Only
M-1-N	Brown	*	5.0	7.5
M-2-N	Red	*	4.0	6.5
M-3-N	Orange	*	5.0	7.5
M-4-N	Yellow	*	5.0	7.5
M-5-N	Green	*	5.0	7.5
M-6-N	Blue	*	5.0	7.5
M-7-N	Violet	*	4.0	6.5
M-8-N	Gray	*	5.0	6.5
M-9-N	White	*	5.0	7.5
M-0-N	Black	*	5.0	7.5
M-0-NC	Inorganic Black	B-13	5.0	NR

* Use any catalyst in Section 3.0

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CATALYST DESCRIPTION

Catalyst	Description	Cure	Average Pot Life* (hours)
20/A	Basic air cure catalyst. Cures at room temperature in 5-7 days. Tack free after 1-2 hours. May also be heat cured.	R.T. or Heat	2
B-3	Basic heat cure only catalyst. Higher cure temperatures decrease cure time.	Heat	4
5	Long pot life. Excellent adhesion properties. Special mix ratios are required for this heat cure only catalyst (refer to Section 2.0).	Heat	24 +
B-13/28	Accelerated air cure catalyst. Cures at room temperature in 3 days. Shorter pot life.	R.T. or Heat	1
45	Long pot life. This heat cure only catalyst contains adhesion promoters. Provides excellent adhesion to glass and metals with good water resistance. Slightly decreases solvent resistance.	Heat	12
77	Adhesion promoting catalyst. Cures at room temperature in 5-7 days. Provides similar characteristics as Catalyst 45. Maximum adhesion is achieved by heat cure @ 65.6-93.3 ^{o}C (150-200^{o}F).	R.T. or Heat	1

* @ 21°C (70°F)

MIXING INSTRUCTIONS

Measure ink and catalyst at the proper mix ratio (refer to Section 2.0). Both the ink and catalyst should be weighed accurately. Excessive and insufficient amounts of catalyst are detrimental to cured ink film properties.
Mix thoroughly without introducing excessive amounts of air. Avoid the use of paper or wax coated cups. Stir from bottom of the container.
OBSERVE INDUCTION PERIOD
All catalysts: 30 minutes
Catalysts 45 and 5: 60 minutes
Allow ink/catalyst mixture to stand for at least 30 minutes prior to application. This provides an induction period ensuring a homogenous mix of resin and catalyst and allows any entrapped air to escape from the mixture. The average pot life begins after the induction period.
APPLICATION
M-Series inks may be applied by hand stamping, machine marking, screen printing, spraying, and roller printing. To ensure optimum adhesion, it is imperative that the surface to be printed is clean and free of any residues or particulates.
OPTIONAL ADDITIONS
Additions of thinner or flow agents should always follow the induction period. If the induction period is not observed, the thinner or flow agent may interfere with the catalyzation process and could effect the final cured properties.

POT LIFE

Pot life will vary with the catalyst used (refer to Section 3.0). To avoid waste, mix only an amount which can be consumed before the end of the pot life. High ambient temperatures will shorten the pot life. Solvent additions will increase the pot life. If an exceptionally long pot life is required (24+ hours), heat cure only Catalyst 5 is available through special order.

SHELF LIFE

M-Series Inks: 3 years from date of manufacture
All Catalysts: 2 years from date of manufacture

NOTE: Catalysts are hygroscopic. Containers should be kept tightly closed after each use to prevent moisture contamination.

METHODS OF APPLICATION

MACHINE MARKING
Minimum pressure is recommended for transfer-pad or flat-bed printers. Adjust rollers to 0.5 mils (0.0125mm) clearance prior to the addition of ink. Increase the depth of the ink on the roll feeds until ink is transferred. Additions of AD2003 retarder may be used during the print run.

HAND STAMPING
Use a brayer to roll out a thin film of ink onto a glass or metal plate. Transfer the ink from plate to the part with a rubber, neoprene, or urethane stamp. Minimum pressure provides a sharp image definition. Disposable stamp pads made of finely textured polyurethane foam or foam rubber may also be used. Because the ink begins to solidify at the end of its pot life, stamp pads cannot be reused.

SCREEN PRINTING
Monofilament polyester fabrics with a mesh count of 180-330 may be used. Mesh tension should be to the fabric manufacturer's recommendations. Stencils may be applied by direct, indirect, or direct/indirect methods. Squeegee material should be 70-80 durometer, sharp and free of nicks. Squeegee durometer, pressure, angle and print speed should be adjusted according to overall printing parameters to ensure high quality print definition.

THINNING
If thinning is required, add small amounts of AD2001 thinner. Additions should be made after the induction period. Thinner additions extend the pot life.

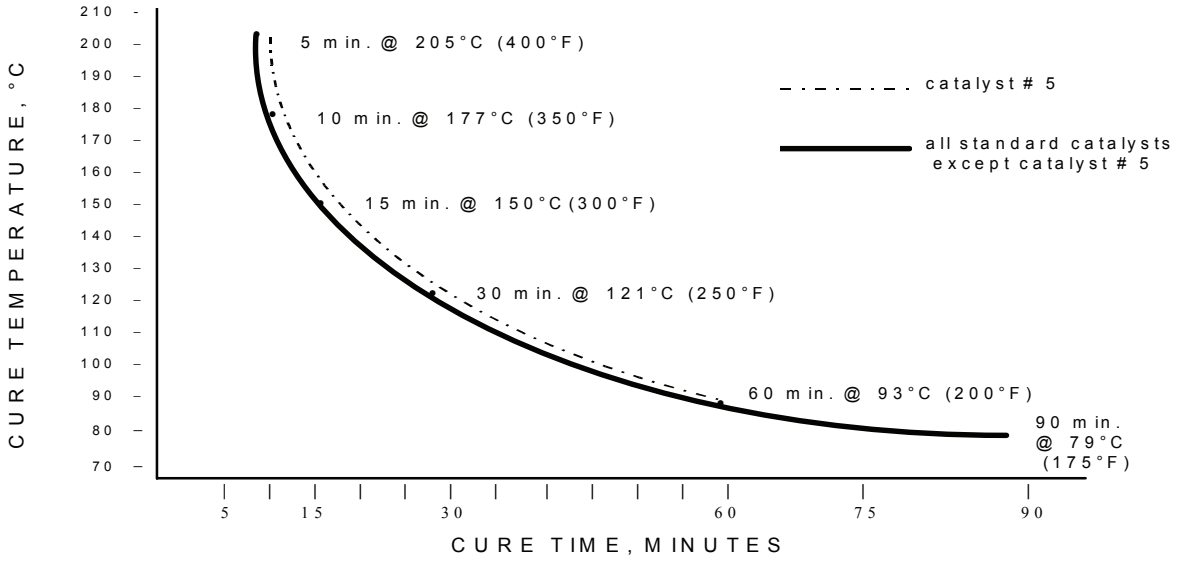
RETARDING
Small amounts of AD2003 or carbitol acetate are recommended. Additions should only be made after the induction period has been observed.

SPRAYING
Following the induction period, thin with AD2002 or a blend of 80% PM glycol ether and 20% methyl isobutyl ketone at 25-40% by volume, depending on air pressure and orifice of spray unit. Thinner additions will extend the pot life considerably.

REMOVAL
Enthone SC1710 screen cleaner, AD2003 or any lacquer wash will effectively clean stamps, screens, and equipment before the ink cures.

Recommended Cure

CURE SCHEDULE



ADDITIONAL CURE INFORMATION

Cure schedules denote times/temperatures for curing ink film only. Allow additional time for the substrate to reach the actual cure temperature. Convection ovens should have sufficient exhaust and air movement to ensure solvent removal.

Cure temperatures above 79 °C (175 °F) are recommended for Catalyst B-3 or 45. Cure temperatures above 93°C (200°F) are required for Catalyst 5.Air cure Catalysts 20/A, B-13/28 and 77 provide a tack-free ink surface after 1 - 1.5 hours, depending on the ink film thickness. When using an ambient cure, articles should be racked and/or spaced to allow air circulation for the designated cure schedule. Do not box, bag or package until the recommended cure time has been observed. Hot air blast can be used to expedite handling. These catalysts may be fully or partially heat cured (refer to Section 8.1). Heat cure enhances the final cured properties. M-Series marking inks may also be cured by infrared radiation. Recommended cured ink film thickness should be between 0.7-1.4 mils (0.017-0.035 mm). An extended cure of 30 min. @ 150◦C (300◦F) will result in low outgassing
properties.

CURED ELECTRICAL PROPERTIES

Property	**Value** **	**Test Method**
Insulation resistance, ohms		Mil-I-43553A
@ 25°C, initial reading		3.10 4.5.2.5
M-0-N	>2 x 10^{12}	
M-0-NC	>2 x 10^{12}	
All Other Colors	>2 x 10^{12}	
Insulation resistance, ohms		Mil-I-43553A
after humidity conditioning		3.10 4.5.2.5
@ 77 ±10 °F and 95% RH for 48 hours		
M-0-N	>1.5 x 10^{9}	
M-0-NC	>1.0 x 10^{10}	
All Other Colors	>1.0 x 10^{10}	

** All test samples were cured at 121°C (250°F) for 30 minutes. Variations in the cure schedule will affect electrical properties.

ACCESSORY PRODUCTS

AD2001	Thinner for nominal adjustments in viscosity. Incrementally add 3-6% by weight.
AD2002	Thinner for spray applications. Add 25-40% by volume.
AD2003	Retarder to extend open time. Incrementally add 3-6% by weight.
AD3002	Flow agent to eliminate crawling, pin-holing and bubbling. Incrementally add 2-4% by weight. Mix gently to avoid over mixing.

COLOR MATCH

Color matching to Federal Standard 595 and other opaque, custom colors are available. Contact Enthone Electronic Materials or an authorized distributor for details.

PACKAGING

M-Series marking inks are available in 1 oz. quarter pint, 6 oz. pint and quart open top metal containers. Catalysts are packaged in 8.5cc amber glass vials for 1 oz. ink kits, 20cc amber glass vials for 6 oz. ink kits and in quarter-pint cone-top metal containers for quarts. Catalyst 5 is available as a special order and is not included in the price of the ink, as are the other catalysts. Catalyst 5 is available individually for quarts and gallons of ink.

M-0-N black and M-0-NC nonconductive black and M-9-N white are also available in premeasured 10cc “bi-packs” with Catalyst 20/A or Catalyst B-3.

STORAGE AND HANDLING

M-Series inks and catalysts should be stored at or below room temperature (27^{o}C/80^{o}F maximum) and out of direct sunlight.

HEALTH, SAFETY AND ENVIRONMENTAL

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.

TROUBLESHOOTING

Problem	Cause	Cure
Bleed/Smear	Various	1. Verify uniform screen mesh tension and off contact distance 2. Check sharpness of squeegee 3. Decrease off contact distance 4. Increase squeegee durometer 5. Reduce flood pressure 6. Increase print stroke speed 7. Reduce stencil thickness
Bubbling	1. Screen mesh too coarse 2. Over aggressive mixing 3. Ink settling	1. Use finer screen mesh 2. Gently hand mix 3. Stir ink from bottom of can 4. Add AD3002 flow agent

Under Cure	1. Incorrect ink catalyst mix ratio 2. Insufficient cure schedule 3. Insufficient air movement in oven 4. Expired catalyst	1. Verify mix ratio 2. Confirm cure schedule time and temperature 3. Increase air circulation/ventilation 4. Check/clean exhaust duct(s) 5. Confirm expiration date on label
Poor Adhesion	1. Surface contamination 2. Insufficient cure schedule 3. Incorrect ink:catalyst mix ratio	1. Remove all surface residue and debris 2. Confirm cure schedule time and temperature 3. Verify mix ratio
Ink Drying in Screen	1. Screen left unattended 2. High shop temperature 3. End of pot life	1. Keep screen flooded with ink when not in use 2. Replenish ink supply frequently 3. Reduce room temperature 4. Mix fresh batch of ink 5. Retard with AD2003 or carbitol acetate
Ink Thickens Prematurely	1. Over catalyzed 2. Evaporation of solvent 3. High shop temperature	1. Verify mix ratio and mix fresh ink 2. Keep catalyzed ink covered 3. Reduce room temperature 4. Retard with AD2003 or carbitol acetate

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, 350 Frontage Road, West Haven, CT 06516. For emergency assistance call CHEMTREC (800) 424-9300.

WARRANTY AND DISCLAIMER

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For 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 a current MSDS, it can be requested from the W.H.M.I.S. coordinator, Enthone Inc. (Canada), 121 Watline Avenue, Mississauga, Ontario, L4Z-1P2. For emergency assistance regarding accidents with this product resulting in container rupture, spills, poisoning, bodily injury or threats to health call: CHEMTREC (800) 424-9300.

Enthone Inc. (Canada) WARRANTY AND DISCLAIMER

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CUSTOMER ORDER CENTERS

UNITED STATES	West Haven, Connecticut	
	Performance Coatings	(800) 496-8326
	Precious Metal Products	(800) 560-7214
		Fax (203) 933-0249
		ctchemorders@cooksonelectronics.com
	PWB Chemistry (U.S. and Canada)	(800) 877-9871
	Londonderry, New Hampshire	Fax (603) 645-4402
MEXICO	Mexico, D.F.	(011-52-55) 5078-3904
		Fax (011-52-5) 567-6326

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