

Instructions for Mixing Type PL-8 Liquid Plastic

Introduction

PL-8 is a room-temperature-curing two-component resin/hardener system for making contourable PhotoStress® plastic sheets. It has a K-factor (strain optical constant) of approximately 0.08, and is primarily used to coat metals and most other high-modulus materials exhibiting elongations less than 5%. PL-8 will not appreciably darken with time, and is therefore the preferred choice when coating parts for long-term testing.

Detailed instructions for preparation of the casting plate, and for preparation of the test-part surface, are provided in Application Note IB-221. Those instructions must be followed carefully to achieve consistent results.

Storing PL-8 Resin and Hardener

Shelf life for unopened resin and hardener containers, stored at room temperature [$+75^{\circ}\text{F}$ [$+24^{\circ}\text{C}$]] and 50% relative humidity, is 12 months. Once any container is opened, all of the material should be used as soon as possible. Storage life of opened material, even after tightly resealing the containers, will be significantly reduced. Refrigeration of PhotoStress resins and hardeners to extend storage life is not recommended, and, in fact, may shorten shelf life. Moisture inside the refrigerated containers will condense as the contents pass through the dew point, and rapidly degrade the characteristics of the active ingredients on the resin and hardener. If either the resin or hardener is cloudy or contains foreign particles, discard it in favor of a new container free of such impurities.

Important: These instructions apply for temperature conditions between $+70^{\circ}$ and $+75^{\circ}\text{F}$ [$+21^{\circ}$ to $+24^{\circ}\text{C}$] only. Because PL-8 is exothermic, its polymerization time is shortened by higher temperatures and/or casting thicker sheets. Casting of thin sheets at lower temperatures lengthens polymerization time.

Application

1. *Surface Preparation of the Test Part for Contouring*

- See the detailed instructions given in Application Note IB-221.

2. *Preparation of the Casting Plate* - See the detailed instructions given in Application Note IB-221, Section 2.0.

3. *Preparation of the Plastic* - The amount of plastic required depends upon the size and thickness of the

sheet to be cast. The total amount of plastic (resin plus hardener) is determined by:

$$W = 18.5 \times A \times t \text{ (English Units in inches)}$$

$$[W = 1.13 \times 10^{-3}] \times A \times t \text{ (Metric Units in mm)}$$

where: W = the total amount needed in grams,

A = the area of the sheet to be cast
(width x length),

t = the desired thickness.

Note: Plastic density = 18.5 gm/in^3 [$1.13 \times 10^{-3} \text{ gm/mm}^3$].

Example: To cast a sheet 7 in x 8 in x 0.10 in thick, the total amount of plastic required is:

$$W = 18.5 \times [8 \times 7] \times 0.10 = 104 \text{ grams}$$

Resin/Hardener Proportion - The amount of hardener required is calculated in parts per hundred, or "pph". PL-8 requires 17 parts of hardener for 100 parts of resin.

Continuing with the above example, if 104 grams of mixed plastic is required, the resin/hardener amounts are calculated as follows:

$$\text{PL-8 Resin: } 104 \times 100 / 117 = 88.89 \text{ grams}$$

$$\text{PLH-8 Hardener: } 104 \times 17 / 117 = 15.11 \text{ grams}$$

Weigh out the proper amounts of resin and hardener, in separate mixing cups, using an accurate scale such (± 0.01 gram). Six-ounce plastic-coated cups like Part No. 012-8 are recommended for mixing. Do not use wax-coated containers. Remember to account for the weight of the mixing cup when weighing. Prior to mixing, both the resin and hardener should be warmed to at least $+90^{\circ}\text{F}$ [$+32^{\circ}\text{C}$], but never higher than $+110^{\circ}\text{F}$ [$+43^{\circ}\text{C}$]. Warming will lower the viscosity of the resin and facilitate a more uniform mix with the hardener. As noted in Bulletin IB-221, the mold (casting plate) must be warmed to 100° - 110°F [38° - 43°C] for at least 30 minutes before pouring the plastic. This will allow the mixed plastic to flow properly after pouring.

Note: It is not necessary to weigh the material when using the PL-8 80-gram kit, since the exact proportions of both resin and hardener have been pre-weighed. To use the pre-weighed kit, the contents of the hardener are simply emptied into the resin container after warming.

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Add the hardener to the resin and stir with a stem thermometer (Part No. 012-6). It is very important to achieve a uniform mixture prior to pouring the resin on the casting plate. Stir slowly using a circular motion, to avoid introducing an excessive amount of air bubbles.

Stir slowly, but thoroughly, to achieve a clear, non-streaking mixture. As stirring progresses, the temperature rise caused by the exothermic reaction must be continually monitored with the stem thermometer. When the temperature reaches +125 °F [+52 °C], the plastic is ready to be poured onto the casting plate. Immediately prior to pouring the mixed plastic, set the temperature control switch on the casting plate heat controller to the OFF position.

When pouring sheets, move the cup over the casting plate area to improve flow to all edges of the mold, and keep the cup within 1 in [25 mm] of the surface of the casting plate to minimize the possibility of air bubbles forming.

After the plastic has been poured, it will begin to flow out and fill the mold. The stem thermometer may be used to help spread the material evenly. (The sheet will eventually level itself out with time.) After pouring, cover the mold with the plexiglass cover to keep out dirt and to avoid dust settling on the plastic during its polymerization. The approximate time for the cast PL-8 sheet to reach the contourable stage is approximately 2 to 2-1/2 hours, depending on size, thickness, and cure environment.

Instructions for monitoring the polymerization cycle, removing the semi-polymerized sheet from the casting plate, and contouring the sheet to the test-part surface are presented in Application Note IB-221, "Instructions for Casting and Contouring PhotoStress Sheets".

PL-8 Optical and Mechanical Properties

K-Factor: 0.08 nominal, calibration required for precise value

Maximum Elongation: 3 to 5%

Modulus of Elasticity: 420 000 psi [2.9 GPa]

Poisson's Ratio: 0.36

Maximum Usable Temperature: +400 °F [+205 °C]

Strain Optic Sensitivity Constant To: +160 °F [+70 °C]

Transparency: Excellent. Will not appreciably darken with time.

CAUTION

Epoxy resins and hardeners may cause dermatitis or other allergic reactions, particularly in sensitive persons. The user is cautioned to: (1) avoid contact with either the resin or hardener; (2) avoid prolonged or repeated breathing of the vapors; and (3) use these materials only in well-ventilated areas. If skin contamination occurs, thoroughly wash the contaminated area with soap and water immediately. In case of eye contact, flush immediately and secure medical attention. Rubber gloves and aprons are recommended, and care should be taken not to contaminate working surfaces, tools, container handles, etc. Spills should be cleaned up immediately. For additional health and safety information, consult the Material Safety Data Sheet.

Refer to these publications for additional information on:

Tech Note TN-704, "*How to Select PhotoStress Coatings.*"

Document 11222, "*PhotoStress Coating Materials and Adhesives.*"

Application Note IB-221, "*Instructions for Casting and Contouring PhotoStress Sheets.*"

Application Note IB-223, "*Instructions for Bonding Flat and Contoured PhotoStress Sheets.*"

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