

Best Practices For Mixing Epoxy Resins and Hardeners

Before You Start Mixing

Working with epoxy can be highly rewarding, as well as safe. Serious health problems associated with epoxy use are uncommon. Most epoxy-related health problems are minor, but they can cause discomfort and diminish the rewards of working with it. Fortunately, these problems are preventable. For both the resin component and the hardener component individual safe handling instructions exist, be aware of potential health problems in case of unsuitable exposure.

USER'S RESPONSIBILITY

The key to a high-strength epoxy mix and proper cure is to carefully read through *all* the product labels and Technical Data Sheets *before* you start mixing. This will help determine the correct ratios based on the products you are using and the environment you are working in.

Wear protective equipment appropriate for the job in hand. The recommended minimum for most epoxy users is gloves made from nitrile or butyl rubber with fully coated back, eye and face protection and protective clothing. Protect yourself from epoxy vapors by using a respirator with an organic vapor cartridge.

What should be expected.

A proper cure can be expected every time, if the resins and hardeners are:

- Sealed properly to avoid contamination
- Stored properly at a consistent temperature, i.e. room temp, and out of direct sunlight
- Measured accurately and accordingly for the products and the current environmental temperature
- Mixed thoroughly, according to the product labels and data sheets

Composite Envisions provides all epoxy systems with both mix by weight (PPW PPW – Parts Per Weight – When mixing resins, this is a mixing method where you measure out the resin and hardener on a scale by weight, not by volume) and mix by volume (PPV) ratios for your convenience
PPW = Parts Per Weight – When mixing resins, this is a mixing method where you measure out the resin and hardener on a scale by weight, not by volume. PPV = Parts per Volume – When mixing resins, this is a mixing method where you measure out by liquid volume in a measuring container, not with a scale by weight.

Here are some additional tips and best practices before you get started:

1. Volume Ratios ≠ Weight Ratios

DO NOT use volume ratios if you are measuring materials by weight, and visa versa. Check epoxy containers or Technical Data Sheets to get the correct ratio for your method of measurement.

Composite Envisions strongly recommends using mix by weight ratios for accuracy. Weight ratios are usually expressed in parts of hardener per 100 parts of resin.

Volume ratios are NOT necessarily directly equivalent to weight ratios because resins and hardeners will have varying densities. **Ex. A 2:1 volume ratio could be a weight ratio of 100:43**



2. Use a Digital Scale and Calculator to Measure by Weight

Mix by weight ratios are recommended for accuracy, especially for smaller batches. Use a reliable digital scale for weight ratios; one can typically be purchased for less than \$50.

Look for a digital scale with a capacity of at least 500 grams and an accuracy of +/- 1 gram. A scale with this accuracy, or better, can reliably weigh a batch that is less than 0.5 fluid ounces.

Have a calculator available for making accurate calculations.

3. Use the Proper Container(s) to Measure and Mix

To avoid contamination or chemical reactions, it is important to use the correct type of container when measuring and mixing.

Use plastic, metal, or a wax-free paper container. **DO NOT use glass or foam** containers as they could result in a dangerous exothermic heat build-up.

- Use a container with straight, vertical sidewalls and a flat bottom to help get a well mixed epoxy.
- Make sure your container is clean, dry, and free of any dust/dirt/contaminants.

4. Mix a Test Batch

It is recommended to mix a small test batch every time to become familiar with the mixing and curing process before applying the mixture to your project. This may prove to be a crucial step in preventing improper cures or costly mistakes, especially if you are working with different/new products, working in a different surrounding temperature, or mixing epoxy for the first time.

- Hardeners will have varying workable times based on the environmental temperature you are in.
- A test batch will help verify that your resin: hardener ratio is accurate each time and help familiarize you with the materials' handling characteristics.

DO NOT ATTEMPT TO ADJUST THE EPOXY CURE TIME BY ALTERING THE MIX RATIO.

An accurate ratio is essential for a proper cure and full development of physical properties.

Measuring and Mixing

(The mix by weight method is described below, as this is recommended for accuracy.)

Following the steps below will help ensure a high-strength epoxy mix, whether applied as a coating, or modified with fillers or additives.

1. Determine the proper mixing ratio for your application and environmental temperature using the information on the epoxy container and/or technical data sheets.
2. Place your clean container (see above) on the scale and zero out the scale using the "Tare".
3. Add the proper amount of resin to the container. If you poured too much into the container, adjust your calculation to make sure you add the correct amount of hardener to achieve an accurate ratio.

Example: If you measured 475 grams of resin and the ratio by weight of resin to hardener is supposed to be 100:33 PPW (100 parts resin to 33 parts hardener), calculate the amount of hardener by taking $475g \times 1.33 = 631.75g$ total grams when mixed. Or $475g \times .33 = 156.75g$ this will be the total amount of hardener only that would need to be added. Slowly add the hardener to the same container the resin was measured in until the



total weight is 631.75 grams. *Since most digital scales do not measure in fractions of a gram you can round the number(s) up or down to the nearest whole number, i.e. 632.

4. Mix the materials thoroughly (for large batches, use caution and be aware that greater chemical reactions and faster cures times are likely to result).
 - Stir well, being sure to scrape the sides and bottom of the container. Keep stirring until the mixture is no longer hazy. A few air bubbles are normal.
 - Mixing takes anywhere from a few to several minutes, depending on the viscosity of the material and the size and shape of the container. Cooler temperatures will also result in a longer mixing time. A good rule of thumb is to mix for 2-3 minutes until the mixture is uniform in color and viscosity. Then, when you think you've mixed sufficiently, stir for another 30 seconds, being sure to scrape the sides and bottom of the container.
 - You can also mix using the "two-container method": Mix in one container and then transfer the contents into a second clean container. TIP: Use a flat ended mixing stick to reach the inside corners/creases of the initial container to make sure all material is transferred to the second container.
 - *If using a power mixer or mixing bit*, the sides, bottom, and corners of the mixing container should still be scraped periodically to ensure a thorough mix.
 - *If adding pigment or fillers*: Follow the ratios as directed, and use the general mixing procedures from above.
 - *Filled epoxies, such as tooling surface coats*: When mixing filled epoxies, it is recommended to pre-mix the individual components prior to combining, as heavy particles of the filled materials tend to settle. Mixing times for part A and B combined may need to be increased as much as four times the durations noted in steps above, due to its thick consistency.

TIP: If you are using the epoxy mixture for coating, quickly pour it into a roller pan to extend the workable time.

Mixing Large Batches

It's most common to mix epoxy in small batches, blending several ounces at once. Batches this size are typically sufficient for most applications, but some projects, such as large laminating jobs, will require large batches of epoxy. Before you begin, you should understand the intricacies of mixing large batches.

Mixing large batches requires careful planning because large batches cure faster than small batches. The key to slowing down epoxy's cure is to create more surface area, exposing more of the mixture to the air. Epoxy will build up heat unless it is spread into thin film or quickly poured off into multiple small containers. This allows the epoxy's heat to dissipate, extending the working time.

TIP: Material working time is shorter when the surrounding air temperature is greater than 72° F. Mixing and working in an environment warmer than 80° F or cooler than 60° F can be more challenging and desired results will be harder to achieve without the aid of a faster or slower hardener. Cure times can be more unpredictable when working in these conditions.

To compensate for your working environment, use a slower curing hardener to further extend working time in warm surroundings or a faster curing hardener to shorten working time in cooler surroundings.

NOTE: Incorrectly measuring or mixing is likely to result in an improper cure. If this happens there is little to nothing that can be done to save the mixed material. If this would happen it is recommended to scrape away any and all resin and start over. Failing to do so may affect future layers or coating that would be applied.

A hot air gun can help soften the partially cured material so the majority can be scraped off. Try removing any remaining material with lacquer thinner, being sure to wear solvent resistant gloves and be in a well ventilated area. This has happened to the best of us please make notes of what had happened to prevent this from happening again. Please feel free to give us a call for anything that you might still need more clarification on.

Caution: Pots of curing epoxy can become hot enough to ignite surrounding combustible materials and give off hazardous fumes. Place pots of mixed epoxy in a safe and ventilated area, away from workers and combustible materials. Dispose of the solid mass only after it has completely cured and cooled. Follow local disposal regulations.

WASTE DISPOSAL Uncured epoxy resins shouldn't be disposed or – if necessary – disposed in compliance with the local laws (please consult also the SDS for more specific information). Cured epoxy resins can usually be disposed of as normal building waste, but expert advice should always be sought to ensure compliance with local regulations. Single-use containers should be emptied and disposed of properly, bearing in mind that they may still contain residue.

Print this off and use it as a reference. Follow all of these steps from start to finish whether you're making a new mold or a new part and check off each step as you complete them.

We have developed this guide over years of experience and helping customers through problems. This is intended to be a general guideline that works with almost all epoxy resins. Composite Envisions is not held responsible for results following this guide and you should always contact the manufacturer for specific instructions. Nothing in this guide or any statement by an employee or staff member of Composite Envisions will be construed as a promise or guarantee regarding the outcome of mixing epoxy resins and hardeners. No employee or staff member makes any such promise or guarantee. Composite Envisions makes no representation or warranty, express or implied, as to the accuracy or completeness of this guide. This guide is provided as is and with all faults. Neither Composite Envisions nor its officers, directors, employees, stockholders, owners, Affiliates or agents will have any liability for the use of or reliance on this guide.

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