Mixing Instructions for Epoxy Systems

Introduction:

Two part epoxy compounds are normally supplied in seperate A - B containers, either both full or in a pre-measured kit. Under the Resinlab designation; Part A is the epoxy resin and the Part B is the polyamine hardener, with some systems the Part B may be an anhydride. Epoxy resins are normally clear to slightly amber, high viscosity liquids which may be filled with mineral fillers to improve performance and lower cost. These sometimes can settle to the bottom of the container and must be stirred to a homogeneous consistency before adding the hardener. Epoxy resins can cause mild skin irritation and a form of dermatitis upon repeated contact. It is important to limit skin contact with any epoxy resin or hardener. Therefore, we recommend that you wear rubber gloves when mixing and using the epoxy compounds.

Hardeners:

Part B, the hardener, is typically a polyamine or mixture of polyamines and has can have strong ammonia-like smell. Most are considered DOT Corrosive materials and should be respected as such. They are typically light colored to dark amber liquids. The hardener, like the resin, can be filled with metal or mineral fillers to improve performance or lower costs. And just like the resin, these fillers may settle over time and must be stirred to a homogeneous consistency before mixing with the resin. Some epoxy hardeners are based on anhydrides rather than amines. These hardeners are more likely used in electrical potting and encapsulation applications and are likely to be heat cured in nature. Both polyamines and anhydrides are somewhat sensitive to moisture. Keep containers tightly sealed and when used in meter-mix-dispense equipment it is best to use a dry nitrogen purge or a dessicating air drier on the vent.

Static Mixing Guidelines

Resinlab Technical Data Sheets include this general guide for ranking the ability of a product to function acceptable in a range of applications. In general best case is a 1/1 ratio with even viscosity, worst case is a 10/1 ratio with a wide viscosity difference. The type of cartridge can also have a dramatic effect on dispense quality, especially when used in a pulsing mode. Larger and thin walled cartridges can induce a lead / lag effect where A and B show an extreme ratio change in a very short period do to the expansion and relaxation of the cartridge barrel. The thicker walled cartridges show much less tendency to produce this lead / lag effect which is a primary cause on intermittent tacky areas on small pottings or castings.

SIDE - BY - SIDE CARTRIDGE SUITABILITY RATING

POOR FAIR AVERAGE GOOD EXCELLENT

This rating scale is a general guideline to give the user an expected level of success in a typical bench-top dispensing scenario.

Important process variables to consider are: Cartridge type and size, wall thickness; manual or pneumatic gun type; static mixer design and dimensions; product viscosity spread and ratio; shot size, shot frequency, flow rate; temperature range during use.

This scale also address's product stability in a cartridge. Factors such as filler content and settling rate, storage temperature and cartridge orientation are important factors which affect this.

It is important for the user to define the optimum static mix for each dispensing process, a change in any of the above variables can affect the mix quality. Dispensing the product on a flat surface using the dispensing pattern can help show the quality of mixing in terms of thoroughness and lead/lag consistency.

Surface Preparation:

If the surfaces that you intend to adhere together are not prepared properly, the best adhesive in the world will not hold them together. The major problems in adhesive delamination is dirt and oil. Whenever possible, the surfaces to be adhered should be abraded with sand paper or by sand or shot blasting before the adhesive is applied. Oil on the surface of steel or even oil from fingerprints can ruin a bond. If the surface to be bonded is painted, the bond of the paint to the substrate will be a limiting factor in the overall bond quality. Plastic surfaces should be abraded and when possible flame treated or corona treated to remove

any plasticizer from the surface and provide an oxygen rich surface environment for the adhesive.

Mixing:

When hand mixing the epoxy resins and the hardeners, it is best to pour the resin, the Part A, into the mixing vessel first. The product should be weighed to the nearest gram or to the nearest 0.5%, whichever is more precise. Next, the Part B is added using the same weighing procedure. Mix the two components using a stir stick or a paint mixer in a drill or drill press. Mix the product for at least 3 minutes by the clock...scraping the sides and bottom of the mix vessel frequently. [Remember, it's just like baking a cake!] After the products have been thoroughly mixed, the mixture should be poured into the mold or used in the adhesive step. Often, the end product must be totally free of voids and bubbles. If this is the case, the mix must be vacuumed before being poured into the mold. This is done by putting the mix vessel into a vacuum chamber and pulling a vacuum of at least 28" Hg. This will usually degas the product within 5 minutes. The reaction mixture will bubble and froth. You should have a mix container at least 4 times the volume of the liquid in the container for vacuum degassing. Therefore, 1 quart of the liquid product will require a 1 gallon bucket to degas the mixture. If you intend to vacuum degas a product, make sure that you tell Star Technology about your wishes. We will need to formulate to product with a delayed gel time and extra air release additives to allow sufficient time to accomplish the process.

Reaction Rates:

Now is probably a good time to talk about the reaction rate of the mixture and what effects it. Reaction rates are usually stated at a certain temperature and at a certain mass of material [e.g.: 25 minutes in a 100 gram mass]. If you are working with a larger mass, the reaction time will be shorter. Lower masses and thin films will be much longer. If the reaction starting temperature is higher, the reaction rate will be faster. A rule of thumb is that for every 10 degrees C that you increase the temperature of the reactants, the reaction rate will double [the gel time will be cut in half]. That is why larger masses will react more quickly than small masses. As the reaction proceeds, it generates its own heat. The heat builds up inside the mixing vessel and the reaction goes faster, which makes more heat, which makes the reaction go even faster.....

Molds and Mold Releases:

If it is your intention to mold epoxy, the first thing that you need is a mold! Molds are often made from RTV silicones. The surface of an RTV mold is covered with reactive sites which will bond like gangbusters to your epoxy casting. To overcome this problem, you can make the mold out of something else, like urethane or you can use a mold release, which you would need to tell us in any

case. There are a plethora of mold releases out there on the market. We have found that the non-silicone containing versions work best. If you use a spray mold release, it is important to "cure" the mold before using it for the first time. This is done by spraying an excess of the mold release on both the inside and outside of the mold, placing the mold in an oven and baking the mold for some length of time. [Be careful when using flammable mold released in an oven.] This process will thin the mold release and make it flow into the pores of the mold, thus sealing the mold. Remove the mold from the oven, wipe off all of the excess mold release and give the mold a very thin coat of mold release. When it comes to mold releases, less is best. Too much mold release will cause bubbling over the surface of the molded part and will ruin your casting. Often, mold releases must be baked to insure that all of the solvent is removed from the release before the part is poured. We have found that Johnson's Paste Furniture Wax is an excellent mold release. The wax can be wiped on a warm mold to provide an excellent barrier between the mold and the casting. It can also be mixed with mineral spirits to provide a sprayable release.