



His Glassworks, Inc.

91 Webb Cove Road
Asheville, NC 28804
USA

828 254 2559 p
800 914 7463 tf
828 254 2581 f
www.hisglassworks.com

HXTAL Epoxy Adhesive is an ultra pure resin that remains water white (clear and totally transparent) over both time and with extreme exposure to direct light. This is an exotic and very high-tech adhesive that is far more sophisticated than hardware store epoxy adhesive, although it is a little more than twice the cost of most of these cheaper epoxies.

HXTAL is supplied in two liquid parts, both of low viscosity. Hxtal epoxy should be weighed out accurately, (one part by weight of Part *B* plus three parts by weight of Part *A*). This assures the maximum utilization of all the adhesive purchased.

The creator of HXTAL confirms that the mix ratio is not an extremely critical factor in the quality of the final achieved glue properties but an average of $3/1$ is recommended for maximum control of overall consistency.

After the two parts have been weighed into a mixing jar, mix it thoroughly with a glass stirring rod. There is no rush during the mixing stage and there will also be plenty of time for the glue to sit while the bubbles rise and pop. Freshly mixed HXTAL is very thin and this is the time to remove the bubbles from the mixture. The best way to do this is to use some kind of a vacuum to suck the air out of the glue. This is called de-gassing the glue (*see sidebar "Degassing Your Adhesive"*).

De-gassing Your Adhesive

A compressor out of an old refrigerator makes a great vacuum pump for this purpose. Simply cut the Freon lines with a hack-saw (*note: there is probably no Freon in the system since that is why most refrigerators get discarded in the first place*). Attach a rubber hose to the intake side and attach it to a stopper in the bottle you mixed the glue in. A word of caution here... watch the glue when it starts to bubble up because the glue bubbles can get up through the stopper, into the hose and even up into the vacuum pump. You will then need to find another vacuum pump. I learned this lesson the hard way! (Pulling the electrical plug is a good way to stop the vacuum from pulling too much too quickly, or put a hand valve in the vacuum line for more accurate control).

Now, when the glue is all bubble free you need to relieve the vacuum slowly or the in-rush of air into the vacuum will put new air into the mixture. Again a lesson learned from experience. This takes practice but is necessary for the best glue quality.

Freshly mixed HXTAL has a very thin viscosity. If it is too thin, let it stand (covered) and it will thicken over a period of several hours. The bond strength of thick or thin HXTAL is the same but various gluing applications may require varied viscosities of the HXTAL. Thin HXTAL will penetrate cracks for some repair applications, making them virtually disappear from view. The best results are obtained when the glass is warmed to about 120°F (a hair dryer or some other heat source is reasonable if the object is not heated too much or too quickly). Then apply a drop of the freshly mixed HXTAL onto the crack. If the crack absorbs sufficient glue the crack will virtually disappear and the remaining HXTAL should be wiped off the surface only with a clean cloth or paper towel. Don't forget that the glue in the crack will still take a long time to cure so just let it sit for a week before continuing any other work on that piece.

HXTAL sets slowly - at 75°F, it requires about one week to achieve most of the final bond strength, (*see Physical Properties Sheet*). However, ordinarily HXTAL is set sufficiently after 24 hours to hold the two parts together as long as no stress is applied to the glue joint. This is the best time to clean up if necessary. A single edge razor blade or an X-acto knife is a good tool to scrape off the excess resin. We don't recommend the use of any solvents to clean up at this stage because the solvents can migrate into the glue joint and can weaken the bond with the glass. The damage may not be evident until much later and will appear to be small bubbles at the edge of the joint. After 24 hours it will be extremely difficult to remove any excess glue from the object and grinding and polishing will be the next best way to remove it.

Many glass artists use HXTAL epoxy adhesive to glue pieces of various glass together to form art.

Often, in the process, glued assemblies of blocks are cut or sliced with diamond or other abrasive saws and then more blocks are glued onto the assembly. In cases where these abrasive cuts are made across HXTAL glued joints, we recommend treating all surfaces to be bonded with HXTAL epoxy with an A-1100 amino silane solution in reagent grade isopropanol. We have learned from our glass artist customers that pre-treatment with the A-1100 solution eliminates tiny micro bubbles that seem to form, often much later, in the glue line along the sawn edge.

Treatment with the A-1100 solution is simplicity itself. When the glass surfaces are totally clean and ready for gluing, simply apply the A-1100 solution over the entire surface to be glued. Apply with lintless rag, brush, etc., and allow the solvent to evaporate leaving an extremely thin film of the A-1100 coating the surface of the glass. Immediately bond with HXTAL in your usual way.

Because we have found that the purity of the isopropanol is important, we are making this solution ourselves in the reagent grade of isopropanol. We are reasonably sure that impure grades of isopropanol interfere with the bonding of the A-1100 to the glass surface.

Bond strengths achieved with HXTAL appear not to be better when freshly mixed, very thin HXTAL is used as opposed to thicker HXTAL that has been allowed to stand around somewhat. More viscous HXTAL does have a number of advantages.

If you are gluing two very large, heavy pieces of glass together, the simple weight of the two pieces is often enough to squeeze out too much HXTAL, especially if the glue is thin. Such very THIN joints are definitely weaker than standard thickness joint lines! Avoid excess squeeze-out of the glue. Using thicker HXTAL is one approach. In extreme cases, consider the use of tiny bits of glass shim at the corners, especially if these edges are to be ground or sawn off in later operations. Fragments of microscope cover glasses (available inexpensively at scientific supply companies) are ideal for use as shims.

Thicker HXTAL joint lines are also advantageous when joining materials with different coefficients of thermal expansion, such as glass to metal joints. We urge great caution in making these types of joints! HXTAL adheres so strongly to glass that when these joints fail, as they often do when subjected to temperature differentials, almost always the HXTAL adheres to the glass and pulls a large, well fractured piece of glass out of the joint area! These failures can be quite catastrophic to a piece of glass art. We do not enjoy hearing an artist cry over the phone to us!

You can improve the survival chances of these dissimilar joints by using a thick joint line - as much as 1 millimeter thick. Fully cured HXTAL is not brittle, but rather quite tough. We believe that this lack of brittleness allows the thick joint line to better accommodate slight expansion and contraction during its lifetime.

Many of our customers initially complain about HXTAL's long set time. Attempts to speed up the set of HXTAL must be approached with great caution! *NEVER, NEVER* attempt to heat freshly mixed HXTAL with an open flame, a heat lamp, a hot plate, a hair dryer or similar heating devices. Because of their high temperatures, HXTAL will begin to cure unevenly at the surface of the container and, despite your confidence in your stirring means, the HXTAL will frequently overheat and may even take fire! Even if you do not see evidence of overheating, you will create an uneven mixture of HXTAL where part of the mixture is more fully cured than other parts where the curing reaction may not have even started. Such is the route to trouble!

If you feel that you must heat the mixed HXTAL to speed the thickening, use only a water bath at 120°F. Heat initially for 15 minutes, remove the glass container with its HXTAL contents and continue stirring for a few minutes. Observe the new, thicker viscosity at room temperature and decide if additional 5 minute periods in the water bath are needed to reach the viscosity suitable for your specific job. Be very careful in these additional 5 minute heating periods! Once thickening has begun, it proceeds more rapidly with each subsequent heating period. Also, be more cautious as you mix larger and larger batches of HXTAL. The behavior upon heating becomes more critical as you increase batch size, large batches have a tendency to spontaneously exotherm from the internal heat of reaction. Keep a cold water bath handy when working with batch sizes over 100 grams.

It is also possible to reduce total curing time by placing the artifact in a warm 90-100°F area (most often used is a wooden cabinet with a light bulb or two installed plus a dial style thermometer poked in from outside) for a 24 hour period. Be sure that your piece is properly aligned as the initial heat will thin out the HXTAL somewhat and allow pieces to move more easily. Once the piece has been in the box for 24 hours, remove it and let it cool to room temperature for 24 hours. This will successfully give you a 90% bond cure in two days. You will have a slight ambering of the adhesive since you have increased the chemical reaction cure, but in thinner joints, this will never be seen.

We are always ready to help customers with HXTAL problems. HXTAL is a hi-tech glue and cannot be handled casually if serious results are required. Never hesitate to call us!

We are pleased to be able to offer you the first epoxy adhesive made specifically for conservation uses, not borrowed from another field. HXTAL NYL-1 is of exceptionally light color and yellows the least upon weathering of any epoxy known to us. The primary use for HXTAL is glass and china mending but many other uses for such a low colored epoxy resin have been found. For example HXTAL makes an excellent coating resin and can be air brushed on quite nicely from aromatic or ketone solvents. Used in this manner HXTAL is a superb china glaze. This low viscosity, hard colorless glasslike epoxy resin also adheres strongly to metals wood ivory and marble. This epoxy cures in about 1 week at 75°F or in 2 days at 90°F. Cure times can be cut sharply by preheating the mix to 100°F for 15 to 20 minutes before use. After cooling such preheated resin has a viscosity similar to the viscosity of the epoxies commonly sold in tubes. The cure time can be shortened by heating the cemented object up to 110°F for 18 to 24 hours.

HXTAL is a two-part epoxy resin system. The parts must be weighed accurately to insure good results. The resin (Part A) and the hardener (Part B) are mixed A:B=3:1 by weight. The unused mix can be kept for 4 to 5 days in the freezer. It is most important that the mix container be tightly stoppered. Cure at 96°F, 95% relative humidity produces the same highly glossy result as cure at 77°F, 50% RH; showing that humidity does not seem to affect the cure at all. The cured resin does not embrittle with time and is very resistant to yellowing and surface degradation, even after prolonged exposure outdoors. HXTAL's initial Yellowness Index is 6 to 8 which is unchanged after 1600 hours of Weatherometer exposure rising slowly to 13 to 14 at 3,000 hours. The best competitive epoxy has an initial Yellowness of 9 which rises to over 40 after 800 hours in the Weatherometer. After 800 hours exposure the coating began to erode away. When pigmented with titania the resin can be made to match the finest porcelain in color, translucency and surface appearance. With or without pigment, HXTAL NYL-1 can be used as a glaze that is highly resistant to water and most solvents. The cured resin can be removed from hard surfaces with an epoxy remover (such as Attack) but prolonged soaking may be required to soften joints.

Physical Properties (Typical)

Tensile Strength	5400 psi
Tensile Modulus	316,000 psi
Elongation	3%
Flexural Strength	10,100 psi
Flexural Modulus	365,000 psi
Impact Strength	0.14 ft.lbs/in.
Shore D. Hardness	78
Cure of 0.2mm Film at 25°C	
Set to touch	17 hrs.
Dry to touch	30.9 hrs.
Full cure	14 days

This information sheet is intended to provide general handling precautions. It should not be considered to be a substitute for the Material Safety Data Sheet (MSDS) of the individual product.

Technical advice furnished by the seller shall not constitute a warranty or condition, statutory or otherwise, which is expressly disclaimed, all such advice being given and accepted at the buyer's risk.