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XTR-311 is an optically clear, low viscosity, high impact epoxy adhesive developed for bonding and small volume potting of plastic and glass optical fibers, lenses and prisms, LED displays, and other optical components.
Recommended for laminating, bonding and sealing applications where excellent wetting, good pot life and improved impact strength properties are required. This two part adhesive is easily mixed and cured at room temperatures, and develops strong, tough bonds to glass and glass fibers, ceramics, and many metals. XTR-311 bonds offer resistance to mechanical impact and thermal shock, and are also resistant to weather, water, gasses and vapors, petroleum, salt solutions, and mild acids and alkalis.

XTR-311 is supplied in two liquid parts, both of low viscosity. XTR epoxy should be weighed out accurately, (ten parts by weight of Part *A* plus three parts by weight of Part *B*). This assures the maximum utilization of all the adhesive purchased.

After the two parts have been weighed into a mixing jar, mix it thoroughly with a glass stirring rod. Be aware that when mixing XTR, time if of the essence. Since XTR will cure in 24 hours at room temperature, a large quantity (say 24oz. or more) of adhesive will "set off" in approximately 40 minutes at room temperature. That being the case, you cannot let mixed XTR sit for very long periods. Once mixed it must be worked into the pieces. If you need to de-gas the adhesive, you may wish to look into a de-gassing system of some sort (see sidebar *"De-gassing Your Adhesive"*) .

Freshly mixed XTR has a very thin viscosity. Due to this fact it does not perform well for gap filling. XTR is mainly formulated for flat glass to flat glass bonding and will not perform well on pieces that do not match well. The XTR will tend to want to flow out of the spaces between the pieces instead of sticking into the cavities.

Thin XTR 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 XTR onto the crack. If the crack absorbs sufficient glue the crack will virtually disappear and the remaining XTR should be wiped off the surface only with a clean clothe or paper towel.

XTR sets slowly — at 75°F, it requires about 24 hours to achieve most of the final bond strength, (*see* Physical Properties). XTR will set well enough for your piece to be moved inside of 8 hours. This is an excellent time to clean up any overage by wiping with a clean cloth and using a razor or X-acto blade to scrape the overage off the piece. 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.

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.

Many glass artists use XTR 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 XTR glued joints, we recommend treating all surfaces to be bonded with XTR 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 XTR 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.

If you are planning on gluing very large, heavy pieces together, we advise looking into using HXTAL epoxy instead of the XTR. The XTR epoxy will not have adequate viscosity to prevent the adhesive from being pressed out of the joint. HXTAL will be your best choice for these types of bonds. The same is true when bonding disparate materials with different coefficients of thermal expansion such as glass to metal or glass to stone. XTR is inadequate for this type of bond and HXTAL is the best choice.

Even though XTR cures in a rather speedy 24 hours, you may be tempted to decrease that cure time by various methods. Attempts to speed up the set of XTR must be approached with great caution! *NEVER*, *NEVER* attempt to heat freshly mixed XTR with an open flame, a heat lamp, a hot plate, a hair dryer or similar heating devices. Because of their high temperatures, XTR will begin to cure unevenly at the surface of the container and, despite your confidence in your stirring means, the XTR will frequently overheat and may even take fire! Even if you do not see evidence of overheating, you will create an uneven mixture of XTR 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!

XTR should never be accelerated in batch quantities. From experience, the large amount of mixed XTR will set off very quickly creating an extremely hot and dangerous container of cured, yellow epoxy. XTR should be used as mixed and not accelerated until applied to the piece being bonded.

It is 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 8 hour period. Once the piece has been in the box for 8 hours, remove it and let it cool to room temperature for 8 hours. This will successfully give you a 90% bond cure in 16 hours and cut down on any effect humidity in your area may have on the XTR.

Humidity is a factor in XTR's cure rate and success. The higher the humidity in your glue area, the longer XTR will take to cure and stiffen. Oftentimes, in high humidity areas, XTR will remain tacky for up to a week. This is not uncommon. The actual bond joint is most likely cured, but the surface of the glue joint will retain moisture and not set correctly. We recommend gluing in a controlled environment if you are using XTR.

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

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. Alter 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)

Typical Uncured Properties (Liquid)	
Color	Clear/Transparent
Specific Gravity	1.15
Index of Refraction	1.55
Viscosity, cps mixed	500
Mix Ratio (parts by weight)	10:3
Typical Cured Properties (Solid)	
Operating Tempature Range (celsius)	-60—100
Shore D. Hardness	82
Coefficient of Expansion, cm/cm/	$5.50x10^{-5}$