

Epoxies consist of two components that react with each other forming a hard, inert material. Part A consists of an epoxy resin and Part B is the epoxy hardener. Epoxy properties are dependent upon the specific chemistry of the system and the nature of the cross-linking available.

Viscosity

Epoxies are usually described in terms of their viscosity from low (more fluid) to high (less fluid like a gel) to measure flowability. Viscosity is generally expressed in units called Centipoise (cps). The following examples will show the approximate centipoise for various materials:

	<u>Centipoise</u>	
1	Water	Low Viscosity
500	Motor Oil	Low Viscosity
2,500	Pancake Syrup	Medium Viscosity
10,000	Honey	Medium Viscosity
25,000	Chocolate Syrup	High Viscosity
50,000	Catsup	High Viscosity
250,000	Peanut Butter	Gel, Paste
1,000,000	Caulking	Gel Paste

Modulus

Epoxies are rated as High Modulus (high 'mod') or Low Modulus (low 'mod'). The modulus means Modulus of Elasticity and it is measured in psi or MPa. Modulus of Elasticity is a measure of how rigid or stiff material is after final cure. High modulus materials are used for stress transfer & where minimal movement can occur. Low modulus materials are more forgiving & can take more movement as compared to the high modulus materials.

For anchoring dowels or rebar into concrete or for structural crack repair, a high modulus epoxy should be used. However, for exterior use as a binder for an epoxy mortar or for a bridge deck overlay, a low modulus epoxy is best.

Epoxies vs. Polyester

Epoxies only undergo minor shrinkage, whereas polyesters could shrink up to 10%-15%. Epoxies also will exhibit greater bond to the surrounding concrete than the polyesters. Most importantly, when polyesters are exposed to moisture in cured concrete for long periods of time, the polymer resin will start to deteriorate and loose bond. This does not happen to epoxies that are 100% solids for they are much less moisture sensitive. Esters are affected by alkalinity (concrete is high in alkalinity). The reaction between 'esters' and alkali is called saponification and creates a soap-like substance which, when anchoring dowels or the like, can create performance problems.

Proportioning and Mixing

Epoxies must be proportioned and mixed at the correct ratios. If the ratio is off then the performance of the cured epoxy may be affected greatly. Improper ratios and mixing can cause or contribute to the following problems:

- streak
- soft spots
- blistering
- bubbling
- stickiness

It is recommended that the epoxies are first premixed, that is, to mix the 'A' component and the 'B' component separately then blend the two together being sure all the material is out of the containers.

Guide to Epoxies

Always mix as directed on the data sheet and until all the streaks have disappeared and the material is a homogenous color. When adding aggregate to make an epoxy mortar, be certain the aggregate is clean and dry. Wet or damp aggregate can create excessive bubbles in the epoxy.

Temperature and Mass

Epoxy curing is temperature and mass dependent which means that temperature has an effect on the material, with cold slowing the chemical reaction and higher temperatures accelerating the reaction.

Mass dependent means the more mass, the more heat that is generated by that mass, similar to concrete.

Dayton Superior does not recommend the use of their epoxies at temperatures (surface *and* ambient) below 40°F (however the J-52 is a min. of 50°F and the J-55 is a min. of 45°F).

As a rule the pot life of the epoxy will be cut in half for each 10-15 degree in temperature above 72°F and the pot life will double for each 10-15 degree drop below 72°F. Below 40°F most epoxies will set extremely slow so as to render them ineffective.

The exception is the Sure-Anchor All Weather Epoxy [J-51 AW and the Rapid Resin Repair gel that can be installed down to a temperature of -15° F [-26° C] and -20° F [-29° C] respectively

Miscellaneous information

- Semi-rigid epoxies should be used in control joints, not hi-Modulus or low modulus epoxies
- Epoxies are not U.V. stable & will discolor when exposed to sunlight
- Polyesters do not have the bond strength that epoxies do, however, they have good chemical resistance and good U.V. resistance
- When anchoring, the annular space should be 1/8" max., thus the hole should be no larger than 1/4" greater than the anchor

- Epoxies are vapor barriers and are not recommended for exterior slab-on-grade applications where they will be subjected to freeze-thawing action.
- When placing an epoxy mortar, always prime the substrate first with the neat epoxy that is being used for the epoxy mortar

ASTM Standard

ASTM C-881 is the current standard for epoxies. There are three classifications in this standard: Type, Grade and Class.

TYPE refers to the usage:

- I....Non-load bearing, bonding hardened to hardened concrete
- II...Non-load bearing, bonding fresh to hardened concrete
- III..Bonding skid-resistant materials to traffic bearing surfaces
- IV...Load bearing, bonding hardened to hardened concrete
- V....Load bearing, bonding fresh to hardened concrete

GRADE refers to their

Flow characteristics (viscosity)

- 1....Low viscosity (2,000 cps MAX.)
- 2....Medium viscosity (2,000 cps MIN.)
- 3... Gel, non-sag (1/4" max sag allowed)

CLASS refers to the temperatures for which they are suitable

- A....Application temperatures >40°F
- B....Application temperatures 40°-60°F
- C....Application temperature <60°F

NOTE: The AASHTO M-235 and ASTM C881 are the same

Dayton Superior Epoxies

Anchoring:

- Sure Anchor J50
- Sure Anchor I J51
- All Weather Epoxy J51 AW

Bonding:

- Sure Anchor J50
- Sure Anchor I J51
- Sure Bond J58
- Sure Bond J58 LPL

Crack Repair:

- Sure Anchor J50
- Sure Anchor I J51
- Sure Fil J52
- Sure Inject J56
- Sure Inject J56 SL
- Sure Bond J58

Patching: *Interior applications:*

- Sure Inject J56
- Sure Bond J58
- Sure Bond J58 LPL
- Sure Patch
 - Can be used for *both* interior and exterior

Flooring:

- Sure Inject J56
- Sure Patch
- Sure Bond J58
- Sure Bond J58 LPL

Cold Weather Anchoring:

- All Weather Epoxy J51 AW

Cold Weather Concrete Repair:

- Rapid Resin Repair (epoxy/urethane hybrid)

Anti-Corrosion Coating:

- Epoxy Rebar Spray J62

Epoxy-Modified Cementitious Bonding

Agent and Corrosion Inhibitor:

- Perma Prime 3C

Low Modulus Crack Healer/Sealer:

- Sure Seal LV/LM

Interior Control Joints [Non-Moving Joints]:

- Sure Fil J52

Grouting:

- Epoxy Grout J55
- Poxy Chock