



EUCLID'S GUIDE TO

UNDERSTANDING EPOXIES**BONDING AGENTS, ADHESIVES, AND MORE**

Epoxy resin bonding agents and adhesives are mostly two-component products comprised of a Part A resin and a Part B hardener that react with one another to form a hardened material. These epoxy resins tend to be very ASTM and specification driven and fulfill a number of different needs.

Products are differentiated mainly by their chemistry and general use(s), but they can also be differentiated through their physical properties as well. Some of these physical properties include viscosity, modulus, mixing ratios, and the temperature's effect on mixing and placement.

BONDING AGENTS & ADHESIVES: THE BASICS

Can fulfill a number of different needs such as:

- Promote adhesion of a topping or a mortar.
- Anchoring and doweling.
- Crack filling and mending.
- Prevent outgassing through fluid/flowable toppings.
- Prevent rapid moisture loss of toppings and mortars.
- Latex can be used as admixtures to improve bond, flexural, and tensile strength of concrete and mortars

There are different chemistries and general uses of bonding agents/adhesives:

Latex

- Comprised of stable dispersions of tiny polymer particles in water.
- Dries by evaporation; no chemical reaction to harden
- Applied neat, as an admixture, or as a slurry.

Three-component epoxy slurry

- Consists of a part A, part B, and part C (cementitious/aggregate blend.)
- Has very good bond strengths plus protects steel from corrosion.
- Can be spray or brush applied with an open time up to 24 hours.
- Not governed by ASTM C881

Two-component epoxy

- Higher chemical resistance than latex.
- Has the highest bond strengths and can be used neat or sand-seeded
- Requires an accurate combination and mixing of part A + part B and does not require SSD surface for application.
- Must be tacky when placing toppings and mortars.

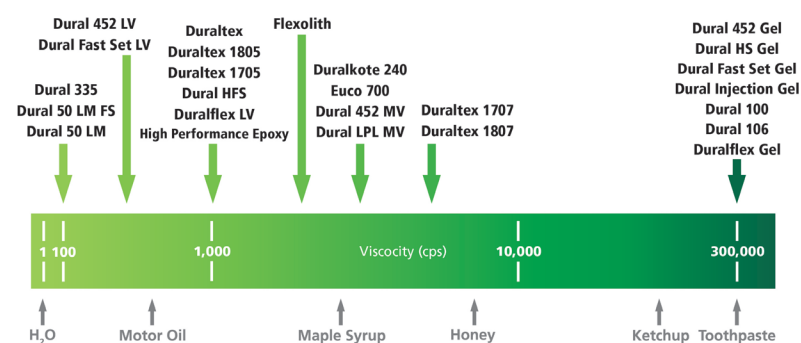
THE PHYSICAL PROPERTIES OF EPOXIES

VISCOSITY refers to the measure of flowability an epoxy has which is generally defined in units called Centipoise (cp). The more viscous an epoxy is, the less fluid it will be and the more it will be like a gel. The less viscous an epoxy is, the more fluid it will be.

Different viscosities are used in different applications, for instance:

- LV = Low Viscosity: sometimes referred to as "healer/sealers" and are used in pressure injections or gravity feeding of cracks.
- MV = Medium Viscosity: are used for neat bonding, sand-seeded bonding, and as a general adhesive.
- Gel: are used for anchoring, doweling, setting ports, and sealing crack faces prior to injection with LV. Also used to adhere pieces for segmental precast construction.

The graphic below gives an idea as to how our epoxy products' viscosities compare to everyday items:



MODULUS (or Modulus of Elasticity) Measures how much a material moves or deflects when a load is applied and how rigid/stiff the material is after final cure. This measurement is usually measured in psi or MPa. Epoxy resins are typically considered to be either high modulus or low modulus:

- High Modulus ("High Mod") epoxies are brittle materials used for structural bonding, anchoring, or for load or stress transfer where little to no movement will occur.
- Low Modulus ("Low Mod") epoxies are more forgiving, semi-flexible materials used for bridge deck overlays or crack healer/sealers.

MIXING Epoxies typically have a part A and a part B that have a mixing ratio that is unique to each individual epoxy. It is recommended to mix each part separately with different paddles before combining the two parts together at its intended ratio that can be found on the technical data sheet. It is important to mix each product to the intended ratio as instructed otherwise problems may arise such as blistering, bubbling, stickiness, or soft spots.

For each of Euclid Chemical's products, there is a unique respective technical data sheet that is available on our website. Please reference the respective product data sheet for exact mixing instructions and ratios.

EFFECTS OF TEMPERATURE When mixing and using epoxies, the ambient and surface temperatures must be in a specific range for the material to perform as intended. Temperature will affect the following properties:

- **Working Time:** Time you have to work with/apply the epoxy before it becomes too thick to use appropriately.
- **Open Time:** Time within which you must place a cementitious topping or repair mortar.
- **Gel Time:** Lab test that determines time for the epoxy to gel, or become mostly solid in a test cup.
- **Pot life:** Time for a mixed epoxy to double in viscosity indicating the beginning of user-unfriendliness (similar to gel time)

Higher temperatures can shorten your working time, open time, gel time, and the pot life of the epoxy and cooler temperatures can increase those times. The rule of thumb is that an 18 to 20 °F increase in temperature will reduce the pot life/cure time by half and likewise an 18 to 20 °F decrease in temperature will double the pot life/cure time.

Product	Viscosity (cp)	ASTM C881 Bonding		Crack Repair			Anchoring & Doweling	Surface Healer/Sealer	Precast Segment Adhesive	Patching/Repair Mortar	ASTM C881		
		Hardened Concrete to Hardened Concrete	Fresh Concrete to Hardened Concrete	Capping Gel	Pressure Injection	Gravity Feed					Type(s)	Grade	Class(es)
Dural 452 Gel	Non-Sag	✓	✓	✓			H, V			H, V	I, II, IV, V	3	C
Dural 452 LV	350	✓			✓	✓				H	I, IV	1	C
Dural 452 MV	3,700	✓	✓				H			H, V	I, II, IV, V	2	C
Dural HS Gel	Non-Sag	✓	✓	✓			H, V				I, II, IV, V	3	A, B, C
Dural Fast Set Gel	Non-Sag	✓		✓			H, V			H, V	I, IV	3	B, C
Dural Fast Set LV	500	✓			✓	✓				H	I, IV	1	A, B, C
Dural Injection Gel	Non-Sag	✓	✓	✓	✓					H, V	I, II, IV, V	3	C
Dural 335	80 to 100	✓				✓				H	I, IV	1	B, C
Dural LPL MV	3,400		✓							H	II	2	C, E, F
Dural 100	Non-Sag	✓									VI	3	D, E, F
Dural 106	Non-Sag	✓								✓	VI	3	D, E, F
Duralflex Gel	Non-Sag									H, V	III	3	B, C
Duralflex LV	1,800									H	III	1	B, C

ADDITIONAL RESOURCES

The Euclid Chemical Company has several pieces of published literature available on our website consisting of application guides, sell sheets, brochures, and technical bulletins to help guide and aid in the selection and usage of our epoxy products.

- [Epoxy Products Usage Chart](#) (pictured above)
- [Industrial Coatings and Repair Brochure](#)
- [Epoxy & Urethane Coatings Application Guide](#)
- [Manual Crack Injection Guide](#)
- [Anchor Bolt Grouting Guide](#)
- [Maintenance Bulletin for Epoxy and Urethane Coating Systems](#)
- [Using Epoxy Coatings in Cold Weather](#)
- [Wet Mills Conversion Chart](#)

ASTM C881 STANDARD CLASSIFICATION FOR EPOXY RESIN BONDING SYSTEMS FOR CONCRETE

ASTM C881 is the industry's standard for specifying the correct epoxy-resin bonding system through three main classifications: type, grade, and class. Normally epoxy resins are unpigmented and therefore when specifying one for use, a color should be stated if one is desired. Here is a breakdown into each of the three classifications outlined in this ASTM:

TYPE (Refers to the usage of the epoxy resin)

- Type I: Bonding hardened to hardened concrete (non-load bearing)
- Type II: Bonding fresh to hardened concrete (non-load bearing)
- Type III: Bonding skid-resistant materials to hardened concrete (low mod)
- Type IV: Bonding hardened to hardened concrete (load bearing)
- Type V: Bonding fresh to hardened concrete (load bearing)
- Type VI: Bonding and sealing precast elements with internal tendons
- Type VII: Sealing segmental precast elements

GRADE (Characterizes the viscosity of the epoxy through three grades of systems)

- Grade 1: Low viscosity (2,000 cp maximum)
- Grade 2: Medium viscosity (2,000 to 10,000 cps)
- Grade 3: Non-sag/gel

CLASS (Defines the installation surface temperature)

- Class A: Below 40 °F (4 °C)
- Class B: 40 to 60 °F (4 to 16 °C)
- Class C: Above 60 °F (16 °C)
- Class D: 40 to 65 °F (4 to 18 °C)
- Class E: 60 to 80 °F (16 to 27 °C)
- Class F: 75 to 90 °F (24 to 32 °C)

Note: Classes A, B, and C are for Types I through V and Classes D, E, and F are for Types VI and VII

SERVICE AND SUPPORT

The Euclid Chemical Company is unique in our offering of superior products, unparalleled customer service and industry support. The Euclid Chemical team delivers a range of value-added resources and in-depth industry experience to architects, designers, engineers, building contractors and owners. Our experts are highly-trained professionals who are available in local offices across the Americas, and are active members on industry technical committees including American Concrete Institute (ACI), International Concrete Repair Institute (ICRI) and American Society for Testing and Materials (ASTM). Our experienced field team is available to support you and your projects using Euclid Chemical solutions and products manufactured under the stringent standards of our ISO 9000 certified quality system. The Euclid Chemical Company works hand-in-hand with customers:

- Supplying field evaluations, recommendations and application problem solving on a project-by-project basis.
- Assisting in product selection, specification, installation and related technology.
- Attending pre-design meetings, assisting in clarifying specifications, and recommending product selection.
- Supporting you by providing proper pre-installation instructions and methods for achieving quality results.

RELATED PRODUCTS

EPOXY BONDING AGENTS AND ADHESIVES

Dural™ 452 Gel

Master Format #: 03 05 00

Two component, 100% solids, non-sag, high modulus, moisture insensitive, high strength epoxy adhesive and binder.

ASTM C881 Type I, II, IV, V, Grade 3, Class C

Dural™ 452 MV

Master Format #: 03 05 00

Two component, 100% solids, medium viscosity, high modulus, moisture insensitive, high strength epoxy adhesive and binder.

ASTM C881 Type I, II, IV, V, Grade 2, Class C

Dural™ 452 LV

Master Format #: 03 05 00

Two component, 100% solids, low viscosity, high modulus, moisture insensitive, high strength epoxy adhesive and binder.

ASTM C881 Type I, IV, Grade 1, Class C

Dural™ Fast Set Gel

Master Format #: 03 05 00

Two component, 100% solids, non-sag, high modulus, moisture insensitive, rapid-setting epoxy adhesive and binder.

ASTM C881 Type I, IV, Grade 3, Class B, C

Dural™ Fast Set LV

Master Format #: 03 05 00

Two component, 100% solids, low viscosity, high modulus, moisture insensitive, rapid-setting epoxy adhesive and binder.

ASTM C881 Type I, IV, Grade 1, Class A, B, C

Dural™ HS Gel

Master Format #: 03 05 00

Two component, 1:1 mix ratio, structural epoxy system that offers exceptional strength in anchoring and doweling applications.

ASTM C881 Type I, II, IV, V, Grade 3, Class A, B, C

Duralprep™ A.C.

Master Format #: 03 05 00

Three component, water-based epoxy combined with portland cement. For use as bonding agent and anti-corrosion coating for reinforcing steel.

EucoFloor™ Epoxy Primer

Master Format #: 03 05 00

Two component medium viscosity epoxy used neat or seeded with aggregate to create a strong bonding surface for application of concrete toppings and underlayments.

Dural™ 100

Master Format #: 03 05 00

Two component, 100% solids, non-sag, moisture insensitive epoxy adhesive used as a bonding agent for precast segmental box girders, bridge and other segmental construction.

ASTM C881 Type VI, Grade 3, Class D, E, F

Dural™ 106

Master Format #: 03 05 00

Two component, 100% solids, non-sag, moisture insensitive epoxy adhesive with a 6 hour open time for use as a bonding agent for precast segmental box girders, bridge, and other segmental construction.

ASTM C881 Type VI, Grade 3, Class D, E, F

Florida DOT Section 453

Dural™ LPL MV

Master Format #: 03 05 00

Two component, 100% solids, medium viscosity, high modulus, moisture insensitive, high strength epoxy adhesive and binder with a long pot life.

ASTM C881 Type II, Grade 2, Class C

Duralflex™ Gel

Master Format #: 03 05 00

Two component, 100% solids, non-sag, low modulus, moisture insensitive, high strength epoxy adhesive and binder.

ASTM C881 Type III, Grade 3, Class B, C

Duralflex™ LV

Master Format #: 03 05 00

Two component, 100% solids, low viscosity, low modulus, moisture insensitive, high strength epoxy adhesive and binder.

ASTM C881 Type III, Grade 1, Class B, C

Dural™ Injection Gel

Master Format #: 03 05 00

Two component, 100% solids, non-sag, high modulus, moisture insensitive, high strength epoxy adhesive designed for crack sealing projects.

ASTM C881 Type I, II, IV, V, Grade 3, Class C

HORIZONTAL EPOXY REPAIR MORTARS

Duralflex™ Fastpatch

Master Format #: 03 01 30.71

Low-modulus high strength epoxy repair mortar kit. Epoxy and sand pre-measured for achieving the proper consistency for use as a patching mortar.

Euco® 456S Mortar

Master Format #: 03 01 30.71

Iron aggregate epoxy repair mortar kit. Exceptionally high strength with excellent impact and abrasion resistance. Intended as repair mortar for floors with extra heavy duty traffic.

UNDERWATER

Aquaseal™ Epoxy System

Master Format #: 35 01 00

Underwater epoxy coating and repair systems. Available in multiple viscosities.

EPOXY JOINT FILLERS

Euco® 700

Master Format #: 07 92 16

Semi-rigid epoxy joint filler with Shore A hardness >100.

Dural™ 340 NS, Dural™ 340 SL

Master Format #: 07 92 16

Semi-rigid epoxy joint filler and traffic loop sealant with Shore A hardness of 80 to 90. Available in non-sag and self-leveling versions.

MOISTURE MITIGATION COATINGS

Dural™ Aquatight 100 PLUS

Master Format #: 09 05 61.13

Two component, 100% solids, modified epoxy moisture mitigation system for use under finished flooring systems in areas where concrete is up to 100% RH.

Dural™ Aquatight WB

Master Format #: 09 05 61.13

Two component, low viscosity, penetrating, water-based epoxy moisture mitigation primer for use with epoxy coatings.

EPOXY COATING PRIMERS

Dural™ Epoxy Primer

Master Format #: 09 96 00

Two component, 100% solids, penetrating epoxy primer.

Duraprime™ WB

Master Format #: 09 96 00

Two component, fast drying, penetrating, water-based epoxy primer.

REBAR COATING

Tammsbar™

Master Format #: 03 21 16

Two component epoxy coating to repair scrapes, scars, damage, or imperfections of fusion bonded epoxy powder coatings.

ASTM D3963 as a patch compound

DECORATIVE EPOXY FLOOR COATINGS

Duraltex™/Duraltex™ Fast

Master Format #: 09 96 56

Two component, 100% solids, low modulus, chemical resistant epoxy coating for neat, broadcast, vinyl chip, slurry, and trowel-down applications. Available as Duraltex Fast for rapid turnaround applications.

Eucopoly™ Tufcoat™ DBS

Master Format #: 09 96 56

Three component, 100% solids epoxy and colored quartz aggregate kit for creating a seamless floor that is a chemical and abrasion resistant alternative to trowel-down systems.

INDUSTRIAL FLOOR COATINGS

Duralkote™ 240

Master Format #: 09 96 56

Two component, 100% solids, high build, flexible, high-performance epoxy coating system which exhibits good chemical and abrasion resistance. Can be tinted with Euclid Universal Color Packs for a variety of color options.

NSF/ANSI Standard 61

Duralkote™ 500

Master Format #: 07 18 16

Two component, 100% solids, very high build, low odor, chemically resistant epoxy liner system. Resistant to sulfuric acid up to a concentration of 75%.

Duraltex™ 1705, Duraltex™ 1707

Master Format #: 09 96 35

Two component, 100% solids epoxy systems exhibiting excellent chemical resistance to a broad range of solvents, salts, caustics and acids.

Duraltex™ 1805, Duraltex™ 1807

Master Format #: 09 96 35

Two component, 100% epoxy novolacs exhibiting the utmost chemical resistance to aggressive chemicals such as 98% sulfuric acid and 37% hydrochloric acid.

Eucopoly™ Tufcoat™

Master Format #: 09 96 56

Two component, solvent-based, high-performance floor coating system with excellent wear resistance.

Eucopoly™ Tufcoat™ VOX®

Master Format #: 09 96 56

Two component, water-based, low odor, epoxy-polyamide coating with good abrasion resistance.

LATEX BONDING AGENTS AND ADHESIVES

EucoWeld™ 2.0

Master Format #: 03 05 00

New generation of high-performing, easy-to-use latex for use as a bonding agent for cement-based repair mortars and concrete.

Akkro-7T™/Flex-Con™

Master Format #: 03 05 00

Water-based, high solids acrylic polymer emulsions for use as liquid bonding admixtures to produce polymer modified concrete and mortar.

ASTM C1059 Type II

SBR™ Latex

Master Format #: 03 05 00

Styrene butadiene copolymer latex admixture that is designed as an integral adhesive for cement bond coats, mortars, and concrete to improve bond strength and chemical resistance.

ASTM C1059 Type II

URETHANE HORIZONTAL CRACK REPAIR

Euco® QWIKstitch™

Master Format #: 03 01 30.71

Low viscosity rapid-setting urethane for crack and spall repair. Can be gravity fed or injected into cracks, or mixed with sand for use as a repair mortar.

TRAFFIC DECK COATINGS

Dural™ 335

Master Format #: 03 64 23

Two component, 100% solids, high modulus, ultra-low viscosity epoxy penetrating healer/sealer for concrete surfaces.

ASTM C881 Type I, IV, Grade 1

Dural™ 50 LM

Master Format #: 07 18 16

Two component, 100% solids, low modulus, ultra-low viscosity, acrylated epoxy resin crack healer/sealer for concrete surfaces.

Dural™ HFS

Master Format #: 07 18 16

Two component, 100% solids, low modulus epoxy binder used to bond a surface applied aggregate to an asphalt or concrete pavement, increasing the skid resistance.

ASTM C881 Type III, Grade 1 Class B, C

Flexolith™/Flexolith™ FS/Flexolith™ Summer Grade

Master Format #: 07 18 16

Two component, 100% solids, low modulus, epoxy binder for broadcast overlay or polymer concrete. Available as Flexolith FS for rapid turnaround applications, or Flexolith Summer Grade for longer working time.

Flexolith: ASTM C881 Type III, Grade 1, Class B, C

Flexolith FS: ASTM C881 Type III, Grade 1

Flexolith Summer Grade: ASTM C881 Type III, Grade 1, Class A, B

Flexdeck™ System

Master Format #: 07 18 16

Elastomeric, multilayer, fluid applied urethane/epoxy waterproofing system for protecting surfaces subject to pedestrian or vehicular traffic.

Tammsdeck™ System

Master Format #: 07 18 13

Elastomeric, fluid applied urethane waterproofing system for protecting surfaces subject to pedestrian traffic.

Dural™ MMA Healer/Sealer

Master Format #: 07 18 16

Rapid curing, 100% reactive, ultra-low viscosity methyl methacrylate resin penetrating healer/sealer for concrete surfaces.

DECORATIVE URETHANE FLOOR COATING

Euco® Tammoshield™

Master Format #: 09 96 35

Two component, non-yellowing, water-based aliphatic polyurethane topcoat with good abrasion resistance.

POLYUREA JOINT FILLERS

Euco® QWIKjoint™ UVR

Master Format #: 07 92 16

Fast setting, UV resistant, moisture-insensitive, semi-rigid polyurea joint filler with Shore A hardness 85.

USGBC LEED Version 4, BD&C, ID&C

Euco® QWIKjoint™ UVR 65

Master Format #: 07 92 16

Fast setting, UV resistant, moisture-insensitive, lower hardness polyurea joint filler with Shore A hardness 65 for pedestrian and light cart traffic.

Euco® QWIKjoint™ UVR 95

Master Format #: 07 92 16

Fast setting, UV resistant, moisture-insensitive, lower hardness polyurea joint filler with Shore A hardness 95 for heavy traffic.

Euco® QWIKjoint™ 200

Master Format #: 07 92 16

Fast setting, semi-rigid, not moisture-sensitive polyurea control and construction joint filler.