

Standard Guidelines for Product Review

Bonding Agents - Epoxy;

Section 02070.10

July 30, 2002

02070.10 – Epoxy Bonding Agents

Process - Submit the following:

- Preliminary Information for Product Evaluation Form.
- Independent Test Results showing compliance with Specs listed below.
- Legible copy of the MSDS.
- Spec Data Sheet.
- Detailed installation instructions.
- List of Limitations and Precautions.

Specifications:

1. **ASTM C 881-90** (AASHTO M 235) specifications for “Epoxy Resin Adhesives” are used as the basis for review. Type II is adequate for most bridge applications. Type I should be used for injection crack repairs, and Type VI should be used to bond segmental precast elements.
2. **Working Time (Gel Time or Pot Life):** At least 25 minutes for all test temperatures listed below (except 5-minute minimum when automatic mixing and dispensing is used).

<u>CLASS</u>	<u>TEMPERATURE RANGE</u>	<u>TEST TEMPERATURE</u>	
A	Below 4.5° C (40° F)	0 ± 1° C	(32 ± 1.8° F)
B	4.5 C – 15.5° C (40° - 60° F)	10 ± 1° C	(50 ± 1.8° F)
C	Above 15.5° C (60° F)	23 ± 1° C	(73 ± 1.8° F)

3. **Moisture Insensitivity:** Products must be able to be used on a damp surface.
4. **Bond Strength (ASTM C 882-91):** 6.9 MPa (1,000 psi) @ 2 days moist cure,
10.3 MPa (1,500 psi) @ 14 days moist cure
5. **Linear Coefficient of Shrinkage on Cure (ASTM D 2566-91):** 0.005 or less
6. **Compressive Strength (ASTM D 695-91):** 55.2 MPa (8,000 psi) @ 7 days
7. **Tensile Strength:** 13.8 Mpa (2,000 psi) @ 7 days (**ASTM D 638**)
8. **Elongation at Break (min.):** 1%

NOTE: AASHTO M 235 requires a minimum gel time of 30 minutes. “Gel time” is approximately equivalent to “pot life.” The 25-minute pot life limit was chosen because it was the lowest pot life of products commonly available.

REFERENCES

CLASIFICATIONS:

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Types – There are seven types of systems:

- Type I – For use in non-load bearing applications for bonding hardened concrete to hardened concrete and other materials, and as a binder in epoxy mortars or epoxy concretes.
- Type II – For use in non-load bearing applications for bonding freshly mixed concrete to hardened concrete.
- Type III – For use in bonding skid-resistant materials to hardened concrete, and as a binder in epoxy mortars or epoxy concretes used on traffic bearing surfaces (or surfaces subject to thermal or mechanical movements).
- Type IV – For use in load bearing applications for bonding hardened concrete to hardened concrete and other materials and as a binder for epoxy mortars and concretes.
- Type V – For use in load bearing applications for bonding freshly mixed concrete to hardened concrete.
- Type VI – For bonding and sealing segmental pre-cast elements with internal tendons and for span-by-span erection when temporary post tensioning is applied.
- Type VII – For use as a non-stress carrying sealer for segmental pre-cast elements when temporary post tensioning is not applied as in span-by-span erection.

Grades – Three grades of systems are defined according to their flow characteristics and are distinguished by viscosity and consistency.

- Grade 1 – Low Viscosity
- Grade 2 – Medium Viscosity
- Grade 3 – Non-Sagging Consistency

Classes – There are six classes are defined according to the range of temperatures for which they are suitable:

<u>CLASS</u>	<u>TEMPERATURE RANGE</u>	
A	Below 4.5° C (40° F)	(For Types I to V)
B	4.5° C – 15.5° C (40° - 60° F)	(For Types I to V)
C	Above 15.5° C (60° F)	(For Types I to V)
D	From 4.5° C – 18.0° C (40° - 65° F)	(for types VI and VII)
E	From 15.5° C – 26.5° C (60° - 80° F)	(for types VI and VII)
F	From 24.0° C – 32.0° C (75° - 90° F)	(for types VI and VII)

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SPECIFICATIONS FOR MATERIALS

M 235

TABLE 1 Physical Requirements of Bonding Systems

Property	Type						
	I	II	III	IV	V	VI	VII
Viscosity Pa-s (P):							
Grade 1, maximum	2.0 (20)	2.0 (20)	2.0 (20)	2.0 (20)	2.0 (20)	—	—
Grade 2, minimum	2.0 (20)	2.0 (20)	2.0 (20)	2.0 (20)	2.0 (20)	—	—
Maximum	10 (100)	10 (100)	10 (100)	10 (100)	10 (100)	—	—
Consistency mm (in.):							
Grade 3, types I, II, III, IV, V, maximum	6.4 (1/4)	6.4 (1/4)	6.4 (1/4)	6.4 (1/4)	6.4 (1/4)	—	—
Grade 3, types VI, VII	—	—	—	—	—	—	—
Thickness 1.6 mm (1/16 in.) maximum	—	—	—	—	—	1.6 mm (1/16 in.)	1.6 mm (1/16 in.)
Gel time, minutes, minimum	30	30	30	30	30	30	30
Bond strength, minimum 5 MPa (psi):							
2 days (moist cure)	6.9 (1000)	—	—	6.9 (1000)	—	6.9 (1000)	—
14 days (moist cure)	10.3 (1500)	10.3 (1500)	10.3 (1500)	10.3 (1500)	10.3 (1500)	—	6.9 (1000)
Absorption, 24-h max	1	1	1	1	1	—	—
Heat deflection: Temperature, minimum °C (°F):							
7 days	—	—	—	49 (120)	49 (120)	—	—
14 days	—	—	—	—	—	49 (120)	49 (120)
Thermal compatibility	—	—	passes test	—	—	—	—
Linear coefficient of shrinkage on cure, maximum	0.005	0.005	—	0.005	0.005	—	—
Effective shrinkage	—	—	passes test	—	—	—	—
Compressive yield strength, minimum, MPa (psi):							
24 h	—	—	—	—	—	13.8 (2000)	—
36 h	—	—	—	—	—	—	6.9 (1000)
48 h	—	—	—	—	—	41.4 (6000)	—
72 h	—	—	—	—	—	—	13.8 (2000)
7 days	55.2 (8000)	34.5 (5000)	—	69 (10000)	55.2 (8000)	—	—
Compressive Modulus, MPa (psi):							
Minimum	1034 (150000)	612 (90000)	—	1379 (200000)	1034 (150000)	—	—
Maximum	—	—	896 (130000)	—	—	—	—
Tensile strength, 7 days minimum, MPa (psi) ^A	34.5 (5000)	13.8 (2000)	—	48.3 (7000)	41.4 (6000)	—	—
Elongation at break, percent minimum	1	1	30	1	1	—	—
Contact strength, MPa (psi) minimum:							
2 days	—	—	—	—	—	6.9 (1000)	—
14 days	—	—	—	—	—	—	6.9 (1000)

^A Not required for Viscosity Grade 3 Systems.