



STRUCTURAL CONCRETE® ES-60

High Strength, 60-Minute Working Time for Elevated Temperatures Permanent Repair Material

PRODUCT DESCRIPTION

Five Star Structural Concrete® ES-60 is a high early strength, single component, permanent concrete repair material for elevated temperatures that provides a 60-minute working time at 90°F (32°C). The extended working times facilitate deep/large volume pours and applications in hot weather. Five Star Structural Concrete® ES-60 produces a repair which is dimensionally stable, develops an integral bond to existing concrete, and restores structural integrity within hours of placement. Five Star Structural Concrete® ES-60 provides increased corrosion protection of steel reinforced structures with migrating corrosion inhibitor technology and very low chloride ion permeability.

ADVANTAGES

- 60 minute working time at 90°F (32°C)
- Deep, large volume pours
- High six-hour strengths
- Coarse aggregate extension up to 80% with Five Star® 3/8 Coarse Aggregate
- Excellent freeze/thaw resistance with high bond strength
- Can apply cement/epoxy grouts and epoxy coatings as early as 8 hours after placement in elevated temperatures
- Pumpable
- Provides permanent concrete and equipment/machinery foundation repair
- Facilitates equipment rebuilds as early as 12 hours in very high temperatures
- Outstanding corrosion resistance for protection and rehabilitation

USES

- Deep, large-volume repair of concrete structures and machinery foundations
- Hot weather concrete repair
- Boiler/furnace rooms
- Heavy industrial repairs and retrofits
- Bulk mixing/handling

PACKAGING AND YIELD

Five Star Structural Concrete® ES-60 is packaged in heavy-duty polyethylene lined bags or plastic pails and is available in 50 lb. (22.7 kg) units yielding approximately 0.42 cubic feet (11.9 liters) at maximum water, or 0.60 cubic feet (17.0 liters) with a 60% extension using 3/8" pea gravel. Five Star Structural Concrete® ES-60 is also available in 800 lb. (364 kg), 1000 lb. (454 kg) and 3000 lb. (1362 kg) bulk bags.

SHELF LIFE

One year (packaged in bags) or two years (packaged in pails) in original unopened packaging when stored in dry conditions; high relative humidity will reduce shelf life.

TYPICAL PROPERTIES at 90°F (32°C)

Compressive Strength, ASTM C 109

6 Hours	3,000 psi (20.7 MPa)
1 Day	4,500 psi (31.0 MPa)
7 Days	6,000 psi (41.4 MPa)
28 Days	7,700 psi (53.1 MPa)

Bond Strength, ASTM C 882

1 Day	2,000 psi (13.8 MPa)
7 Days	2,500 psi (17.3 MPa)

Length Change, extended with pea gravel, ASTM C 157

28 Days Wet	+0.05%
28 Days Dry	-0.09%

Thermal Coefficient of Expansion, ASTM C 531

	6.0 x 10 ⁻⁶ in/in/°F (10.8 x 10 ⁻⁶ mm/mm/°C)
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Scaling Resistance, ASTM C 672, 50 cycles

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Chloride Ion Permeability, ASTM C 1202, 28 Days

	Very Low (<1,000 Coulombs)
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Working Time

	60 minutes
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*The data shown above reflects typical results based on laboratory testing under controlled conditions. Reasonable variations from the data shown above may result. Test methods are modified where applicable.

Use Five Star Structural Concrete® ES-60 in hot weather applications -- 90°F+ (32°C+). For applications below 90°F (32°C) use Five Star Structural Concrete® or Five Star Structural Concrete® ES.

APPLICATION INFORMATION

Mixing Ratio	2½ to 3 qts (2.4 to 2.8 L) potable water per 50 lb. bag	Maximum In-Service Temperature	400°F (204°C)
		Placement Depth	> 2 in (50 mm), contact Five Star

PLACEMENT GUIDELINES

The material can be installed at an ambient temperature range from 35°F – 95°F (2°C – 35°C), however it is engineered for hot weather applications. For ideal placement the material, environment, mixing equipment, and all surfaces in contact with the material should be at temperatures between 70°F - 95°F (21°C and 35°C). After installation, maintain material and substrate temperatures above 35°F (2°C) until material reaches a minimum of 1,000 psi (6.9 MPa) compressive strength. **Flowability and strength gain are affected by lower and higher temperatures.** Refer to Five Star® Technical Bulletin (TB) 300 and 301 *Concrete Repair Cold and Hot Weather* for installation temperatures outside recommended ranges.

- SURFACE PREPARATION:** All horizontal and vertical concrete surfaces in contact with Five Star Structural Concrete® ES-60 shall be clean and free of oil, grease, laitance, and other bond-inhibiting contaminants. To maximize bond, concrete surfaces shall be prepared by acceptable means to remove the top surface to coarse aggregate exposure. A minimum 1/2 inch (12 mm) peak to valley surface profile is recommended. Remove all oxidation from exposed reinforcing steel. A perimeter edge and minimum depth of 1/2 inch (12 mm) should be provided. Featheredging is not recommended. Presoak concrete surfaces with potable water for a minimum of 4 - 8 hours (optimum presoak 24 hours), continuously and consistently, via wet rags, wet burlap, ponding, or similar method to obtain a Saturated Surface Dry (SSD) condition. Presoak times are temperature dependent. In some applications an epoxy bonding adhesive may be utilized, contact Five Star Products. Any existing cracks shall be brought to the project engineer's attention prior to material installation.
- FORMWORK:** Formwork should be constructed and sealed 24-hours prior to the pour. Formwork shall be constructed of rigid non-absorbent materials, securely anchored, liquid-tight, and strong enough to resist forces developed during placement. Liquid tight forms should also allow for pre-soaking of the substrate and avoid material leakage. Formwork and areas where bond is not desired shall be treated with form release oil, paste wax, or similar material. Isolation/construction joints may be necessary depending on pour dimensions. Any existing joints within the repair area should be maintained. Air relief ports, installation ports, and quick acting isolation valves may also be necessary. Refer to ACI Committee 347 *Guide to Formwork for Concrete* [ACI 347-14(21)] for additional information.
- MIXING:** Use of a mortar mixer (stationary barrel with moving blades) is required to completely mix the material. For single bag mixes, refer to TB416 *Single Unit Mixing Instructions*. Start with approximately 2 ½ quarts (2.4 L) potable water per 50 lb. bag (22.7 kg). Add Five Star Structural Concrete® ES-60 and mix for approximately 3 minutes to a uniform consistency. To achieve desired consistency, add additional potable water and mix for an additional 2 minutes. Do not exceed the maximum recommended amount of potable mixing water as directed. Do not allow the material to segregate. Addition of coarse aggregate, meeting ASTM C33, should be used for pours greater than 2 inches (50 mm) in depth. A concrete mixer may be used if the material is extended with coarse aggregate; refer to TB302 *Aggregate Extension Guidelines* and TB405 *Mixing Bulk Bags in a Ready Mix Truck* for details. For further mixing details refer to TB305 *Cementitious Mortars Mixing Guidelines*.
- PLACEMENT PROCEDURES:** Five Star Structural Concrete® ES-60 shall be poured or pumped into place. If possible, firmly work the material into substrate and place at full depth from one side of the repair to the other. Placement should be continuous to prevent cold joints between pours. Finish as necessary. For pumping procedures, contact Five Star Products.
- POST-PLACEMENT PROCEDURES:** Five Star Structural Concrete® ES-60 shall be continuously wet cured for a minimum of 4 hours. Wet curing of exposed surfaces shall begin as soon as the material reaches final set (surface changes from dark to light), and if applicable, forms may be removed at this time. Continuously wet cure all exposed material surfaces using wet rags, burlap, or burlene saturated with potable water/ice. Place plastic sheeting over material used for wet cure to protect against evaporation. Monitor condition of material used for wet cure (i.e. rags) to ensure drying does not occur. During the curing process, protect the material from direct sun and wind exposure. A curing agent (meeting the requirements of ASTM C309, Type 1 or 2, Class B) may be applied after wet cure. The curing agent manufacturer's installation instructions should be followed to apply the material correctly. The project engineer should approve the curing method. Protect the new concrete from traffic, vibration, damage, wind/sun/rain exposure, and temperature extremes (< 40°F [5°C] and >90°F [32°C]) while the material is developing the desired strength.

For additional Five Star® Technical Bulletins, visit FiveStarProducts.com. For further questions, or if additional information is required, contact your local Five Star® Technical Sales Representative at 1-800-243-2206.

CAUTION

Contains cementitious material and crystalline silica. International Agency for Research on Cancer has determined that there is sufficient evidence for the carcinogenicity of inhaled crystalline silica to humans. Take appropriate measures to avoid breathing dust. Avoid contact with eyes and contact with skin. In case of contact with eyes, immediately flush with plenty of water for at least 15 minutes. Immediately call a physician. Wash skin thoroughly after handling. Keep product out of reach of children. **PRIOR TO USE, REFER TO SAFETY DATA SHEET.**

SKU/PRODUCT CODE	DESCRIPTION	#UNITS/PALLET	UNIT SIZE
29800	Five Star Structural Concrete® ES-60	56	50 lb. (22.7 kg) Bag
29700	Five Star Structural Concrete® ES-60	36	50 lb. (22.7 kg) Pail
29104	Five Star Structural Concrete® ES-60	2	800 lb. (364 kg) Bulk Bag
29101	Five Star Structural Concrete® ES-60	2	1,000 lb. (454 kg) Bulk Bag
29103	Five Star Structural Concrete® ES-60	1	3,000 lb. (1,362 kg) Bulk Bag

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Five Star Products, Inc.
Corporate Headquarters
2 Enterprise Drive, Suite 303
Shelton, CT 06484 USA
Tel: +1 203-336-7900 • Fax: +1 203-336-7930
FiveStarProducts.com

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