STRUCTURAL CONCRETE HTR ES

Repair for High Temperature Exposure

PRODUCT DESCRIPTION

Five Star Structural Concrete® HTR ES is a unique high temperature resistant concrete repair material which can be pumped or poured into place. Five Star Structural Concrete® HTR ES can be exposed to 1,000°F (538°C) in twenty-four hours and up to 2,400°F (1,316°C) after a 7-day curing procedure. Due to its 90-minute working time and bulk bag capability, Five Star Structural Concrete® HTR ES allows for larger / deeper volume placements.

ADVANTAGES

- Thermal shock resistant
- High temperature resistance; pourable fire brick equivalent
- Bulk bag capability for easier mixing of larger volume pours
- 90-minute working time allowing for larger volume, distance placement
- Easily pumpable at long distances
- Coarse aggregate extension up to 80% with Five Star® 3/8 Basalt Coarse Aggregate
- Resistant to sulfates
- Excellent freeze/thaw resistance

USES

- Areas of high temperature exposure
- Thermal cycling up to 2,400°F (1316°C)[1]
- Rapid repairs during shutdowns
- Coker, kiln, and foundry repairs

PACKAGING AND YIELD

Five Star Structural Concrete® HTR ES is packaged in heavy-duty polyethylene lined bags and is available in 50 lb (22.7 kg) units yielding approximately 0.40 cubic feet (11.3 liters) at maximum water. Also available in 3000 lb. (1362 kg) bulk bags.

SHELF LIFE

One year in original unopened packaging when stored in dry conditions; high relative humidity will reduce shelf life.

TYPICAL PROPERTIES AT 70°F (21°C)			
Compressive Strength, ASTM C 109 [2]			
1 Day	4,500 psi (31.1 MPa)		
7 Days	5,500 psi (38.0 MPa)		
28 Days	7,000 psi (48.3 MPa)	5,000 psi (34.5 MPa) at 1,000°F (538°C)	2,000 psi (13.8 MPa) at 2,400°F (1316°C)
Bond Strength, ASTM C 882			
1 Day	1,500 psi (10.4 MPa)		
7 Days	2,500 psi (17.3 MPa)		
Thermal Coefficient of Expansion, ASTM C 531	5.0 x 10^{-6} in/in/°F (9.0 x 10^{-6} mm/mm/°C)		
Working Time at 70°F (21°C) May be affected by colder & warmer temperatures [3]	90 minutes		

[1] Higher temperature exposure results in lower operating strength and requires additional curing time.

[2] The ultimate compressive strength of a material is affected by elevated operating temperatures and thermal cycling.

[3] Refer to Five Star® Technical Bulletins: *Concrete Repair in Cold Weather*; *Concrete Repair in Hot Weather*

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

APPLICATION INFORMATION

Mixing Ratio	2.5 to 3 qts. (2.4 L to 2.8 L) potable water per 50lb bag
Maximum In-Service Temperature	2400°F (1316°C)

Minimum Placement Thickness	2 in. (50 mm)[4]
Placement Depth	>2 in. (50 mm) requires coarse aggregate extension, contact Five Star Products

[4] This is the minimum recommended depth for placement purposes. The required depth of Five Star Structural Concrete® HTR ES should be based on the operating temperature of the material and how much heat can be transferred to the substrate. Higher operating temperatures usually require deeper placements. Contact Five Star Products for additional details.

PLACEMENT GUIDELINES

For optimum performance, install at temperatures between 40°F and 90°F (4°C and 32°C). Maintain material, substrate, and equipment temperatures above 40°F (4°C) until material reaches required compressive strength. Flowability and strength gain are adversely affected by lower temperatures. For hot or cold weather repair refer to Five Star® Technical Bulletins: *Concrete Repair in Cold Weather*; *Concrete Repair in Hot Weather*.

1. **SURFACE PREPARATION:** All horizontal and vertical surfaces in contact with Five Star Structural Concrete® HTR ES shall be free of oil, grease, laitance, and other contaminants. All horizontal and vertical concrete surfaces must be clean, sound and rough to ensure a good bond. To maximize bond, concrete surfaces should be prepared by acceptable means to coarse aggregate exposure with a recommended 1/2 inch (13 mm) peak to valley surface profile. Remove all oxidation from exposed reinforcing steel. A perimeter edge and minimum depth of two inches (50 mm) should be provided for a durable repair. Featheredging is not desirable. Soak concrete surfaces prior to application with liberal quantities of potable water, leaving the concrete saturated and free of standing water.
2. **FORMWORK:** Formwork shall be constructed of rigid non-absorbent materials, securely anchored, liquid-tight and strong enough to resist forces developed during placement. Areas where bond is not desired must be treated with form oil, paste wax or similar material. Joints may be necessary depending on pour dimensions. Any existing joints within the repair area should be maintained. Contact Five Star Products for further information.
3. **MIXING:** Mix Five Star Structural Concrete® HTR ES thoroughly for four to five minutes to a uniform consistency with a mortar mixer (stationary barrel with moving blades). A drill and paddle mixer is acceptable for single bag mixes. For optimum performance, condition between 60°F and 80°F (16°C and 27°C). Mix Five Star Structural Concrete® HTR ES with 2.5 to 3 quarts (2.4 L - 2.8 L) potable water per 50 lb. (22.7 kg) unit. Adjust consistency if necessary, but do not exceed maximum water content or an amount that will cause segregation. Addition of coarse aggregate, meeting ASTM C33, should be used for large volume pours. A kiln dried granite or basalt aggregate must be used to minimize the potential of moisture in the pores of the aggregate which creates issues at elevated temperatures. Refer to Five Star® Technical Bulletin *Concrete Repair Aggregate Extension*. Always add mixing water first to mixer followed by repair material. For bulk mixing applications refer to Five Star® Technical Bulletin *Bulk Mixing in a Ready Mix Truck*.
4. **PLACEMENT PROCEDURES:** Whenever possible, place Five Star Structural Concrete® HTR ES full depth from one side of the repair to the other. To ensure optimal bond development, firmly work material into substrate. Placement should be continuous to prevent cold joints between pours. For placements thinner than 2 inches (50 mm) or greater than 4 inches (102 mm), and a volume exceeding two cubic feet (56.6 liters) contact Five Star Products. Finish as necessary.
5. **POST-PLACEMENT PROCEDURES:** Five Star Structural Concrete® HTR ES shall be kept wet for a minimum of one to four hours immediately after hardening depending on the volume and depth of the placement. Wet curing shall begin at final set (surface changes from dark to light). 24-hours after placement, material can be brought up to an operating temperature of 1,000°F (538°C). For operating temperatures up to 2,400°F (1,316°C), wet cure for 3 days followed by dry cure for 4 days. Then slowly apply heat up to 2,400°F (1,316°C).

PRIOR TO APPLICATION, READ ALL PRODUCT PACKAGING THOROUGHLY. *more detailed information 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
28805	Five Star Structural Concrete® HTR ES	56	50 lb. (22.7 kg) Bag
28840	Five Star Structural Concrete® HTR ES	1	3000 lb. (1362 kg) Bulk Bag

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Specifications Subject to Change.
For most current version of datasheet, go to FiveStarProducts.com

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