

**FIVE STAR****STRUCTURAL CONCRETE HTR SHOTCRETE**

Rapid Strength, Dry Process for High Temperature Exposure

**PRODUCT DESCRIPTION**

Five Star Structural Concrete® HTR Shotcrete is a unique high temperature resistant concrete repair material which is applied by dry process shotcrete. Five Star Structural Concrete HTR Shotcrete gains strength rapidly and can be exposed to 1000°F (538°C) in three hours and up to 2400°F (1316°C) after a 7-day curing procedure.

**ADVANTAGES**

- Thermal shock resistant
- High temperature resistance
- Rapid strength gain
- Resistant to sulfates
- Dry process shotcrete application
- Excellent freeze/thaw resistance

**USES**

- Areas of high temperature exposure
- Thermal cycling up to 2400°F (1316°C)
- Rapid repairs during shutdowns
- Coker, kiln and foundry repairs

**PACKAGING AND YIELD**

Five Star Structural Concrete HTR Shotcrete is packaged in heavy-duty polyethylene lined bags and is available in 50 lb (22.7 kg) units yielding approximately 0.39 cubic feet (11.0 liters) at maximum water.

**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**

3 Hours	2500 psi (17.3 MPa)
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1 Day	4500 psi (31.1 MPa)
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28 Days	7000 psi (48.3 MPa)
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**Compressive Strength, ASTM C 42 in accordance with ACI 506R-90**

3 Days	5000 psi (34.5 MPa)
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7 Days	5700 psi (39.3 MPa)
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28 Days	7000 psi (48.3 MPa)
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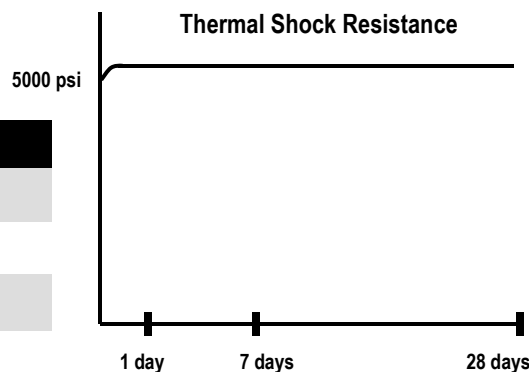
**Bond Strength, ASTM C 882**

1 Day	1500 psi (10.4 MPa)
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7 Days	2500 psi (17.3 MPa)
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<b>Thermal Coefficient of Expansion, ASTM C 531</b>	5.0 x 10 <sup>-6</sup> in/in/°F (9.0 x 10 <sup>-6</sup> mm/mm/°C)
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<b>Working Time at 70°F (21°C)</b>	20 minutes
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# CYCLE	AGE	STRENGTH
3 hour cycle	6 hours	5000 psi
1 1/2 cycles	1 day	5300 psi
5 1/2 cycles	7 days	5300 psi
20 1/2 cycles	28 days	5300 psi
Samples cured at 70°F (21°C) for 3 hours, then exposed to 1000°F (538°C) in 24 hour cycles		

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.

## **PLACEMENT GUIDELINES**

1. **SURFACE PREPARATION:** All horizontal and vertical concrete surfaces in contact with Five Star Structural Concrete HTR Shotcrete 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. Remove all oxidation from exposed reinforcing steel and for additional protection coat reinforcing steel with Five Star® AC Coat. 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. Surfaces shall be conditioned to between 40°F and 90°F (4°C and 32°C) at time of placement.
2. **MIXING:** The mixing equipment should be capable of maintaining continuous placement and equipped with a screen to avoid plug-ups.  
**DRY MIX PROCESS:** Pre-dampen Five Star Structural Concrete HTR Shotcrete either in a mortar mixer (stationary barrel with moving blades) prior to placement into gun or with a pre-hydration water ring equipped with a screen to avoid plug-ups. Avoid over dampening material. Do not pre-dampen more material than can be placed within 20 minutes. Adjust consistency at nozzle.
3. **METHODS OF PLACEMENT:** Apply Five Star Structural Concrete HTR Shotcrete to full design thickness whenever possible. Overhead placement is applied in layers just thick enough to prevent sagging. Direct nozzle perpendicular to surface and rotate in a series of circular patterns, filling all inside corners first. Five Star Structural Concrete HTR Shotcrete should emerge from the nozzle in a uniform, uninterrupted flow. Finish to desired texture with screed, float, trowel, or brush. For more detailed application procedures, refer to ACI 506R-90, Guide to Shotcrete Report.
4. **POST-PLACEMENT PROCEDURES:** Five Star Structural Concrete HTR Shotcrete shall be kept wet for a minimum of 30 minutes, depending on the volume and depth of the placement. Wet curing shall begin as soon as the material is thumb-print hard. Approximately three hours after placement, material can be brought up to an operating temperature of 1000°F (538°C). For operating temperatures up to 2400°F (1316°C), wet cure for 3 days followed by dry cure for 4 days. Then slowly apply heat up to 2400°F (1316°C).

**NOTE: PRIOR TO APPLICATION, READ ALL PRODUCT PACKAGING THOROUGHLY.** For more detailed placement procedures, refer to Design-A-Spec™ installation guidelines or call the Five Star Engineering and Technical Service Center at (800) 243-2206.

## **CONSIDERATIONS**

- Never exceed the maximum water content as stated on the package.
- If temperatures of equipment and surfaces are not between 40°F and 90°F (4°C and 32°C) at time of placement, refer to Design-A-Spec™, or call the Five Star Engineering and Technical Service Center at (800) 243-2206.
- For placements thinner than two inches (50 mm) or greater than four inches (102 mm), call the Five Star Engineering and Technical Service Center at (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 MATERIAL SAFETY DATA SHEET.**

For worldwide availability, additional product information and technical support, contact your local Five Star distributor, local sales representative, or you may call Five Star's Engineering and Technical Service Center at (800) 243-2206.

**WARRANTY:** "FIVE STAR PRODUCTS INC. (FSP) PRODUCTS ARE MANUFACTURED TO BE FREE OF MANUFACTURING DEFECTS AND TO MEET FSP'S CURRENT PUBLISHED PHYSICAL PROPERTIES WHEN APPLIED IN ACCORDANCE WITH FSP'S DIRECTIONS AND TESTED IN ACCORDANCE WITH ASTM AND FSP STANDARDS. HOWEVER, SHOULD THERE BE DEFECTS OF MANUFACTURING OF ANY KIND, THE SOLE RIGHT OF THE USER WILL BE TO RETURN ALL MATERIALS ALLEGED TO BE DEFECTIVE, FREIGHT PREPAID TO FSP, FOR REPLACEMENT. THERE ARE NO OTHER WARRANTIES BY FSP OF ANY NATURE WHATSOEVER, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE IN CONNECTION WITH THIS PRODUCT. FSP SHALL NOT BE LIABLE FOR DAMAGES OF ANY SORT, INCLUDING PUNITIVE, ACTUAL, REMOTE, OR CONSEQUENTIAL DAMAGES, RESULTING FROM ANY CLAIMS OF BREACH OF CONTRACT, BREACH OF ANY WARRANTY, WHETHER EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR FROM ANY OTHER CAUSE WHATSOEVER. FSP SHALL ALSO NOT BE RESPONSIBLE FOR USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT HELD BY OTHERS."

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