Technical Bulletin 307

Repair/New Concrete Curing



CONCRETE REPAIR CURING

This Technical Bulletin has been written to cover most TYPICAL concrete repair applications.

Five Star® concrete repair materials are often used in conjunction with Five Star® grouts and coatings, as well as other manufacturers' materials to rebuild equipment foundations where the speed at which the equipment can be returned to service is critical.

If the curing times required in this document impose an unacceptable delay in completing the repair material installation, contact Five Star Products for potential alternate curing options.

Most Five Star Structural Concrete® products are specially formulated to develop strength rapidly. As such, they hydrate quickly, consuming water rapidly and generating significant heat as they set. If this heat is not managed appropriately, it can result in surface cracking and other issues. This is why curing is one of the most critical steps in any structural concrete repair or new installation. Curing is also critical in mitigating dry shrinkage for both rapid and normal setting concretes. For Five Star Structural Concrete® products, curing involves applying a wet cure for a minimum amount of time. Once this minimum wet curing period has elapsed, concerns about protection, temperature, and evaporation are significantly reduced.

A. What is Wet Curing?

As the name suggests, wet curing involves keeping the surface of the repaired concrete wet and/or protected for a designated period. **NOTE: Wet curing must be continually monitored to ensure that the surface remains wet.**

Wet Curing serves two primary functions:

1. **Moisture Retention**: It prevents excessive surface evaporation and minimizes the probability of surface cracking. It can provide additional surface moisture to ensure the concrete retains enough water to complete the hydration process which is essential in its strength development and durability.

2. **Heat Control**: Hydration is the chemical reaction that causes the combination of cement and water to harden and, along with the aggregates, form the composite concrete. During hydration, the water in the mixture is consumed and heat is generated. Curing helps reduce the temperature of the material as it hydrates which mitigates surface cracking and other issues.

B. Protection Considerations

Five Star Structural Concrete® products must be protected from temperature extremes, direct sunlight, drying winds, precipitation, and vibration during the setting and curing period to ensure proper strength development and durability.

- For outdoor applications, if conditions warrant, Five Star recommends erecting a temporary enclosure or protective structure around the new/repair area. This enclosure should shield the product from excessive heat, wind, and precipitation.
- In cold environments, a temporary enclosure/protective structure may be heated to maintain the new/repaired concrete and ambient temperatures within the ranges recommended by ACI 306R – *Guide to Cold Weather Concreting*, thereby preventing freezing and promoting proper curing.
- In hot weather, shading and cooling should be considered to limit rapid moisture loss, in accordance with ACI 305R – *Guide to Hot Weather Concreting*. Five Star recommends using chilled/iced water or placing bags of loose ice cubes on the curing surface to help dissipate heat.
- Vibration from adjacent equipment or operations must be minimized until the new/repaired concrete has achieved sufficient early strength to resist cracking, loss of bond, or segregation. Excessive vibration can adversely affect the integrity of the installation. Isolation from vibration should be maintained for at least the period required to reach initial set and

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adequate early strength.

C. **Common Wet Curing Methods**

- **Flooding or Ponding:** This is the most effective method. This does, however, require a means of holding the water in place. If forms are properly constructed and left in place, they can help retain water on the surface.
- **Spraying or Misting:** Spraying or misting the surface with water and keeping it wet is another wet cure method.
- **Saturated Coverings:** Materials such as burlap, rags, or specialized curing blankets soaked in water can also be used. NOTE: The saturated coverings must be kept wet for the entire duration of the wet curing process.

NOTE: Best practice recommends covering the area/saturated coverings with plastic sheeting to prevent evaporation. This may not be required when flooding or ponding.



SPRAYING COVERINGS TO MAINTAIN SATURATION

D. Wet Curing Duration

Wet curing for longer than the minimum required time (as stated on the product's Technical Data Sheet) is encouraged because the heat of hydration and the conditions that cause shrinkage will be managed for longer, lowering the risk of surface cracking and other issues. Five Star recommends wet curing for a minimum of 4 hours*, however continuing to cure for 24 hours is optimal. There is no risk of "over-curing" with water. Covering the new/repair area with plastic sheeting after the minimum wet cure duration can allow wet curing to continue unmonitored until the next shift or the next day.

***Lower Curing Time Scenarios:** Curing times for smaller repairs, repairs with minimal exposed surface, repairs that will be coated, foundation rebuilds, or repairs using a curing compound (refer to Section F) may have shorter curing requirements. Contact Five Star Products.



HYDRATION PROCESS VISIBLY UNDERWAY - COLOR CHANGE OF THE MATERIAL FROM DARK TO LIGHT

E. Wet Curing Guidelines

Wet curing should begin once the hydration process is visibly underway. This is indicated by a color change of the new material from dark to light. Do not start wet curing before the product has hydrated adequately. Premature wetting (before the color change) may "overwater" the surface and cause issues such as cracking or spalling.

Only surfaces exposed to air need to be wet cured. Areas under/within formwork do not require wet curing.

- In cold weather, the water used for curing and the concrete repair/new surface must be kept above 32°F (0°C) for the full wet curing duration.
- If applying a grout or coating on top of a new concrete foundation, consult the manufacturer's specifications to confirm the appropriate curing procedures.

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F. Curing Compounds

If project specifications require that a curing compound be used, Five Star recommends that a curing compound meeting the requirements of ASTM C309, Type 2, Class B shall be selected. Follow the curing compound manufacturer's installation instructions to apply the material correctly.

The curing compound shall be applied after the minimum wet cure requirements have been met. For volumes 1 cu.ft. or less wet cure for 30 minutes then follow with a curing compound.

Five Star Structural Concrete® products that have been developed for vertical and overhead applications, without requiring formwork to install, may allow using a curing compound instead of wet curing. Follow the recommended curing procedure for these products detailed on their Five Star® Technical Data Sheet.

For additional information, contact your Five Star® Technical Sales Representative.

References:

ACI PRC-308-16 *Guide to External Curing of Concrete*

ACI 306R – *Guide to Cold Weather Concreting*

ACI 305R – *Guide to Hot Weather Concreting*

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