CEMSTONE®

HOT WEATHER CONCRETE

@cemstone_1927 @cemstonesupply

HOT WEATHER CONCRETING

ACI (American Concrete Institute) 305

Hot weather* is any combination of the following conditions that tend to impair the quality of freshly mixed concrete by accelerating the rate of moisture loss and rate of cement hydration or otherwise causing detrimental results. Conditions that cause moisture loss include:

- High ambient temperature
- High concrete temperature
- Low relative humidity
- High wind speed
- Solar radiation

*Hot weather conditions can occur during any season, not just summer.

The following is a list of practices and measures designed to reduce or avoid the potential problems of hot weather concreting:

- Schedule a pre placement meeting to discuss the requirements of hot weather concreting.
- Select concrete materials and proportions with satisfactory records in hot weather conditions.
- Reduce and control the temperature of fresh concrete.
- Use a concrete consistency (slump) that permits rapid placement and effective consolidation.
- Minimize the time to transport, place, consolidate, and finish the concrete.
- Plan concrete placement to avoid adverse exposure of the concrete to the environment; schedule placing operations during times of the day or night when weather conditions are favorable.

Potential hot weather problems for concrete in the freshly mixed state include:

- Increased water demand.
- Increased rate of slump loss and corresponding tendency to add water at the project site.
- Increased rate of setting, resulting in greater difficulty with handling, compacting and finishing, and a greater risk of cold joints.
- Increased tendency for plastic shrinkage and thermal cracking.
- Increased difficulty in controlling air-entrained content.

Potential hot weather problems for concrete in the hardened state include:

- Decreased strength results from higher water demand.
- Increased tendency for drying shrinkage and differential thermal cracking from either cooling of the overall structure or from temperature differentials within the cross-section of the member.
- Decreased durability resulting from cracking.
- Greater variability of surface appearance, such as cold joints or color difference due to different rates of hydration or different water cementitious material ratios (w/cm).

HYDRATION STABILIZING ADMIXTURE USE AT HIGH TEMPERATURES

Hydration stabilizing admixtures delay the setting time of concrete by controlling the hydration of Portland cement and other cementitious materials while facilitating placing and finishing operations. Use this chart as a guideline during hot weather conditions.

RECOMMENDED HYDRATION STABILIZING ADMIXTURE DOSAGE CHART								
Concrete Temperature	Hours of Additional Working Time							
	0.5 - 1 Hours	1 - 1.5 Hours	1.5 - 2 Hours	2 - 2.5 Hours	2.5 - 3 Hours	3 - 3.5 Hours	3.5 - 4 Hours	4 - 4.5 Hours
100°F - 109°F	5 oz/cwt	6 oz/cwt	7 oz/cwt	8 oz/cwt	9 oz/cwt	10 oz/cwt	11 oz/cwt	12 oz/cwt
90°F - 99°F	4 oz/cwt	5 oz/cwt	6 oz/cwt	7 oz/cwt	8 oz/cwt	9 oz/cwt	10 oz/cwt	11 oz/cwt
80°F - 89°F	3 oz/cwt	4 oz/cwt	5 oz/cwt	6 oz/cwt	7 oz/cwt	8 oz/cwt	9 oz/cwt	10 oz/cwt
70°F - 79°F	2 oz/cwt	3 oz/cwt	4 oz/cwt	5 oz/cwt	6 oz/cwt	7 oz/cwt	8 oz/cwt	9 oz/cwt
60°F - 69°F	1 oz/cwt	2 oz/cwt	3 oz/cwt	4 oz/cwt	5 oz/cwt	6 oz/cwt	7 oz/cwt	8 oz/cwt

For extended finishing time, contact Cemstone Engineering Services.

cwt - 100 lbs of cementitious material

RESOURCES

- **Aggregate and Ready Mix Association of Minnesota** | armofmn.com
- **Wisconsin Ready Mixed Concrete Association** | wrmca.com
- **Iowa Ready Mixed Concrete Association** | concretestate.org
- **Concrete Network** | concretenetwork.com
- **American Concrete Institute ACI-305 Hot Weather Concreting** | concrete.org
- **CIP12 – Hot Weather Concreting** | nrmca.org
- **Portland Cement Association** | cement.org

HOT WEATHER CONCRETING

Hot weather conditions can impact mixing, placing, finishing and curing of ready-mix concrete. This guide offers some best practices to minimize those effects when faced with a combination of high temperatures, low humidity, and high winds.

RATE OF EVAPORATION

Surface drying and plastic-shrinkage cracking are frequently associated with hot weather concreting. It occurs in exposed concrete, primarily in flatwork, when the evaporation rate is greater than the rate at which water rises to the surface (bleed water) of recently placed concrete.

Lerch, W. (1957) states, "If the rate of evaporation approaches 0.2 lbs/ft^2/hr, precautions against plastic shrinkage cracking are necessary". Knowing these four factors, one can effectively estimate the rate of evaporation by using the following chart. It should be noted that the chart estimates the rate of evaporation provided the surface of the concrete is covered with bleed water.

One or a combination of the following factors can lead to this condition:

- High air temperature
- High concrete temperature
- High wind velocity
- Low humidity
- The probability of surface drying and plastic-shrinkage cracking may be increased if the setting time of the concrete is delayed.

To determine the rate of evaporation, use the chart on the next page. →

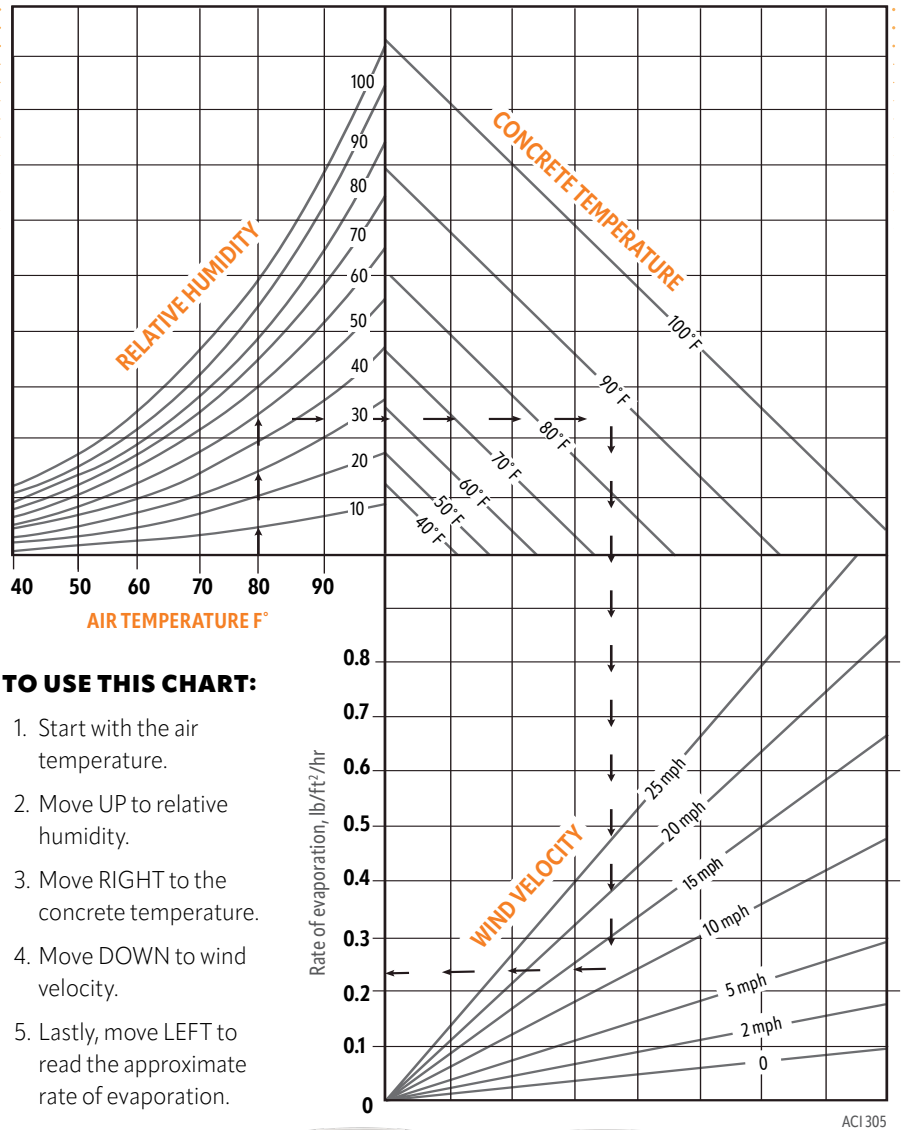
CONCRETE EVAPORATION PROTECTION

If the evaporation rate approaches 0.2 lbs/ft^2/hr, provide the following concrete evaporation protection:

1. Take special precautions to ensure that the forms and subgrade are sufficiently moist or protected to avoid lowering the water content at the pavement/form/subgrade interface. In hot weather conditions, moisten the subgrade prior to placing the concrete. There should be no puddles or standing water.
2. Minimize solar heat by shading or wetting concrete chutes or other equipment that comes in contact with the plastic concrete.
3. Use a fog spray to increase the relative humidity of the ambient air above the freshly placed concrete if there is a delay in immediately starting the curing process.
4. Ensure that the time between placing and curing is minimized.
5. Immediately apply an approved evaporation retarder to the concrete or increase the surface cure application to 1.5 times the standard specified rate. If an evaporation retarder is used, follow the manufacturer's instructions on usage. DO NOT finish the evaporation retarder into the surface of the concrete.
6. Use micro-synthetic fibers to reduce the potential for plastic shrinkage cracking.

⚠ **If the evaporation rate is 0.2 lbs/ft^2/hr or greater, TAKE EXTREME CAUTION.**

RATE OF EVAPORATION CHART



TO USE THIS CHART:

1. Start with the air temperature.
2. Move UP to relative humidity.
3. Move RIGHT to the concrete temperature.
4. Move DOWN to wind velocity.
5. Lastly, move LEFT to read the approximate rate of evaporation.

TENON® EVAPORATION REDUCERS

Trowel Ice Concentrate

Trowel Ice Ready to Use

X-Tender

CONCRETE CURING MATTERS

CURING IS CRITICAL

Curing is a critical procedure aimed at enhancing the surface durability and lifespan of concrete flatwork. ACI 308, Guide to External Curing of Concrete, describes curing as an action taken to maintain moisture and temperature conditions of freshly placed concrete.

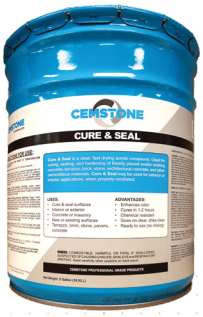
Proper curing techniques are essential to shield freshly finished concrete from adverse environmental factors such as low humidity, drying winds, and drastic temperature fluctuations. Improper curing may cause shrinkage cracking, scaling, mortar flaking, and other surface defects.

There are numerous methods of curing concrete. Wet curing and the application of curing compounds are two predominant methods. Select the most suitable curing method for the specific application and intended use of the concrete.

THE BENEFITS OF PROPERLY CURED CONCRETE ARE SIGNIFICANT

- **Maximized Hydration Process:** Proper curing leads to improved strength and abrasion resistance. Adequate moisture retention during curing ensures optimal cement hydration, resulting in a denser and stronger concrete matrix.
- **Enhanced Durability and Service Life:** By maintaining adequate moisture levels, curing minimizes the risk of surface deterioration and surface degradation over time. This results in concrete that withstands environmental stresses.
- **Decreased Permeability**: Curing is crucial for enhancing concretes resistance to water penetration and chemical ingress.
- **Surface Defect Prevention:** By preventing rapid moisture loss and temperature differentials, proper curing significantly reduces the potential for surface defects such as scaling and mortar flaking.

CURING COMPOUND RECOMMENDATIONS



Cure & Seal

Dissipating Cure 1315 WB

Cure & Seal WB 1315

Ultimate Barrier

TYPES OF CURING

Liquid membrane-forming compounds are the most practical method of curing when job conditions are not favorable for wet curing. When applied to concrete, these compounds form a membrane that prevents the internal moisture from evaporating, allowing the cement hydration to continue.

Cemstone recommends the following when curing concrete with liquid membrane-forming curing compounds:

- **Curing compounds** should meet ASTM C309 or C1315 and be used per the manufacturer's instructions to prevent surface moisture loss and continue the cement hydration process.
- **Curing compounds** should not be used on any surface of which additional concrete or other materials are to be bonded.
- **Application** of the curing compound should immediately follow the final finishing pass.
- **Position clean spray nozzle(s)** sufficiently close to the surface to ensure a consistent film application and proper application rate per the manufacturer's instructions.

OTHER CURING METHODS

- **Ponding:** This involves creating a shallow pond or reservoir of water on the concrete surface, maintaining continuous moisture contact to facilitate proper cement hydration.
- **Wet Burlap or Mats:** Covering the concrete with impermeable sheeting or fabric mats, which are kept consistently wet, helps retain moisture and promotes thorough curing.
- **Sprinkling or Fog Spraying:** Continuously sprinkle water on the concrete surface to sustain moisture levels.
- **Reinforced Paper or Plastic Film:** This method minimizes moisture loss from the surface due to evaporation (discoloration/motteling warning).

CURE & SEAL PLUS IS DESIGNED TO REDUCE THE POTENTIAL OF ASR SAND POP-OUTS.

ASR (alkali-silica reactivity) occurs when alkalis (potassium and sodium) from Portland cement react with certain siliceous aggregates. When this reaction occurs, a gel is formed. In the presence of moisture, the gel expands, causing internal pressure which often leads to surficial sand pop-outs. These sand pop-outs predominantly occur in high evaporation rate conditions. When ACI 305 hot weather conditions exist, and there is the possibility of ASR sand pop-outs, apply Cemstone Cure & Seal Plus "ASR Sand Pop-Out Minimizer" immediately after final finishing is completed.

Cure & Seal Plus

SEALING CONCRETE

28 DAYS AFTER YOUR CONCRETE IS CURED, WE RECOMMEND SEALING.

Properly sealed concrete helps maintain the appearance and durability of the concrete after it has had adequate time to cure, which is a minimum of 28 days after placement. Sealing is designed to keep moisture and contaminants, like deicing chemicals, from penetrating into the concrete. Since sealers eventually degrade from wear and environmental exposure and no longer function as intended, concrete should be sealed regularly following the sealer manufacturer's instructions or as needed.

Cemstone recommends the following when sealing your concrete:

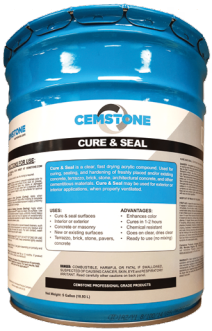
- Always follow the manufacturer's installation instructions.
- Prior to sealing or resealing, an aggressive power wash or power brooming may be required to remove any dirt, stains, or dissipating curing compounds from the concrete surface.
- Allow the concrete to adequately dry before applying sealer.
- For stubborn stains that are difficult to remove, contact your Cemstone Account Representative for assistance. They can provide a list of specialized products and methods tailored to effectively remove stains without damaging the surface.

Call or visit Cemstone Supply to learn more about sealing compounds. Find location details on the back cover.

CARING FOR AND MAINTAINING YOUR INVESTMENT

Acrylic Based Sealers

The recommended acrylic-based concrete sealers (below) form a barrier, are solvent-based, non-yellowing, and fast drying. Easy to apply with a sprayer and a roller, each product offers a different finish and surface effect.



Cure & Seal

Super Clear Coat

Super Diamond Glaze LV

Cemstone Chapin Sprayer

Penetrating Sealers

Penetrating sealers create a barrier on the concrete. These sealers saturate and absorb into the surface, providing lasting protection against moisture and deicing chemicals. The recommended penetrating sealers (below) are breathable, result in a non-yellowing, natural finish, and are easy to apply with a sprayer and a roller. **Penetrating sealers are not to be used when an acrylic liquid membrane-forming curing compound or sealer is still present on the concrete surface.**

Siloxane

Siloxane Final Seal

Salt Barrier

100% Silane

EXPOSURE TO WET CONCRETE CAN LEAD TO SERIOUS INJURIES

Working with concrete without the proper use of the appropriate Personal Protective Equipment (PPE) can damage the skin. "Cement burns" range from minor redness or irritation to serious chemical burns.

ALKALI BURNS FROM WET CEMENT/CONCRETE

When water is added to Portland cement, calcium hydroxide is formed. This wet cement/concrete is caustic, has a pH as high as 12.9, and can produce third-degree alkali burns after 2 hours of contact. An inexperienced finisher may be unaware of this danger and may stand or kneel in the wet cement/concrete for long periods, resulting in burns. General physicians may not recognize the seriousness of the injury in its early stages or the significance of a history of prolonged contact with wet cement/concrete. All people working with wet cement/concrete should be warned about its dangers and advised to immediately wash and dry their skin properly if contact does occur.

PERSONAL PROTECTIVE EQUIPMENT

Minimize contact with wet Portland cement/concrete. Compliance with OSHA's requirements for provision of personal protective equipment washing facilities, hazard communication, and safety training, along with good skin hygiene and work practices listed below, will aid in protecting against hazardous contact with wet cement/concrete. Wear the following protective gear when working with concrete: safety glasses or face shield, hard hat, protective over-boots, long pants, long sleeves, and gloves.

GLOVES

Anyone who may encounter wet caustic materials, such as Portland cement/concrete, should wear proper gloves.

- The recommended glove type for use with materials such as Portland cement is well-fitting butyl or nitrile gloves, rather than cotton or leather gloves.
- Loose-fitting gloves can let wet cement/concrete in. Use glove liners for added comfort.
- Wash and dry hands thoroughly before and after each use of gloves.
- Follow proper procedures for removing gloves, whether reusing or disposing them.
- Protect your arms and hands by wearing rubber gloves duct-taped to a long-sleeved shirt.

SKIN CARE AND TREATMENT

- Wash areas of the skin exposed to wet cement/concrete in clean, cool water and a pH-neutral or slightly acidic soap.
- You can neutralize caustic residues of cement/concrete on the skin by using a mildly acidic solution such as diluted vinegar or a buffering solution.
- We recommend not using abrasives or waterless hand cleaners, such as alcohol-based gels or citrus cleaners, when working with cement/concrete.
- Avoid wearing watches and rings as wet cement/concrete can collect under them.
- Do not use lanolin, petroleum jelly, or other skin softening products. These substances can seal cement/concrete residue to the skin, increase the skin's ability to absorb contaminants, and irritate the skin.
- Do not use skin softening products to treat cement/concrete burns.

SHOP FOR SAFETY PROTECTION AT CEMSTONE SUPPLY

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CEMSTONE
CONCRETE - HARDSCAPES - MASONRY
SUPPLY

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