

CONCRETE RESTORATION SYSTEMS

Installing repair materials in cold weather

Cold temperatures can significantly impact the performance of repair materials. As a result, one needs to be acutely familiar with how lower ambient and substrate temperatures can negatively affect product performance. As well, it is important to know how to take precautions against and mitigate cold temperatures before and during product applications.

As published in our products' Technical Data Sheets, the lowest allowable installation temperature for cement-based mortars is generally 45°F (7°C). As these lower substrate and ambient temperatures are approached, steps should be taken to mitigate the negative impact of coldness. This document defines a wide range of helpful options for coping with such conditions.

How cold can impact the effectiveness and durability of repair materials

- Retarded initial and final set times as well as impaired strength
- Suspended or incomplete cement hydration
- Possible freezing of mixing water within matrix during the critical cure cycle
- Suspended or incomplete coalescence of polymers used in modified repair mortars
- Compromised physical properties (such as lower compressive strength, lower density and compromised modulus of elasticity)
- Excessive "bleed," which weakens the repair surface and increases vulnerability to accelerated freeze/thaw degradation
- Deeper carbonation zones, precipitating corrosion cell development

Recommended precautions and procedures for cold-weather installations

General recommendations

- Use an infrared thermometer to accurately determine the substrate and ambient temperatures.
- Never apply repair products over frozen or frosted surfaces.
- Use recognized methods supported by industry standards to bring substrate and ambient temperatures to well above the recommended installation threshold of 45°F (7°C).
- Provide enough heat so that the substrate temperature remains above the minimum temperature until the repair material has reached at least 25% of its 28-day compressive strength. Maintain enough heat while placing

the repair product as well as during finishing and throughout the curing period. To identify the strength gain for individual cement-based products, consult the products' Technical Data Sheets or contact MAPEI's Technical Services.

- Use a non-chloride, liquid, accelerating admixture for high-early-strength and reduced setting times. Make sure the accelerating admixture is compatible with the repair mortar you are applying.
- The rule of thumb for the accelerating admixture is that when the temperature is 23°F (-5°C) and rising, two 5.07-oz. (150 mL) bottles can be added to all the products listed in the table below. If the temperature is 32°F (0°C) and rising, only one bottle is to be added.

Product	Minimum Temperature and Rising
<i>Mapecem® 102</i>	32°F (0°C)
<i>Mapecem 202</i>	32°F (0°C)
<i>Planigrout® 712</i>	32°F (0°C)
<i>Planitop® 11</i>	32°F (0°C)
<i>Planitop 11 SCC</i>	32°F (0°C)
<i>Planitop 12 SR</i>	32°F (0°C)
<i>Planitop 15</i>	32°F (0°C)
<i>Planitop 18</i>	23°F (-5°C)
<i>Planitop 18 ES</i>	32°F (0°C)
<i>Planitop 18 TG</i>	32°F (0°C)
<i>Planitop 23</i>	32°F (0°C)
<i>Planitop 25</i>	32°F (0°C)
<i>Planitop FD</i>	32°F (0°C)
<i>Planitop X</i>	32°F (0°C)
<i>Planitop XS</i>	32°F (0°C)

Please use this as a guide for recommending the proper dosage of the accelerating admixture and, if needed, perform a test before the application.

When using heat to achieve recommended installation conditions

- In addition to meeting or exceeding the minimum recommended substrate and ambient temperatures, whenever possible the substrate should be conditioned for 24 hours before work begins.
- Route carbon dioxide exhaust gas from temporary heaters to the exterior of the jobsite, thereby preventing damage to the work (that is, carbonation).
- For isolated areas, such as highway and bridge patching, propane torches may be used. Care must be taken to not contaminate the surface (as with carbon black) nor micro-fracture the repair area due to thermal shock.

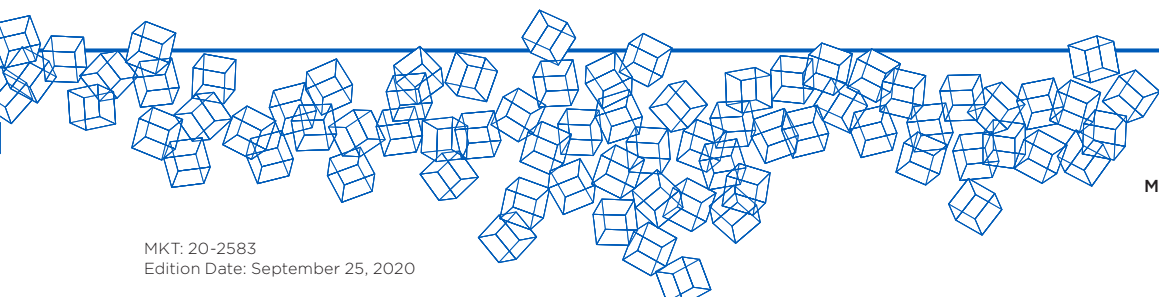
- Hot-air jets can also be used to remove frost, snow and ice from forms, reinforcements and other embedments. Unless the work area is housed or tented, the subsequent repair should be done immediately to ensure that the minimum temperature limit is maintained.
- Structural suspended slabs may be effectively heated from below and covered with insulating blankets placed above the slabs.
- When necessary, build a temporary shelter and use indirect auxiliary electric or propane heaters to maintain an adequate temperature level in the working environment. Electric heating blankets can also be used.
- Direct heat should never be applied to the repaired area to “flash-dry” a repair mortar.
- Use low-water mixing ratios in cold weather to accelerate initial drying, minimize the bleed and optimize the required curing time.
- Pre-condition repair materials to 70°F (21°C) for at least 24 hours to help offset the effects of a cooler substrate and jobsite ambient temperature conditions.
- Use warm water (65°F to 85°F [18°C to 29°C]) as opposed to cold water. Ensure that the latex component of a two-component mortar is warmed to similar temperatures.

About self-leveling underlayments and toppings

- Follow the final two procedural tips in the previous section regarding material/water temperatures for successful self-leveling underlayments and topping installations.
- If aggregates are used to extend the repair, ensure they are stored in a heated temperature-controlled area and away from frost.
- In order to avoid temperature loss, mixing should take place in a warm area in close proximity to the repair.
- Once a repair material is applied, protect the installation area from wind chill, frost and cold by covering it with insulating blankets as soon as the material has begun to set.
- Conduct work only while the ambient temperature is maintained or rising, to allow sufficient drying and curing time.
- If no heating procedures are used, complete all winter work early in the day to allow adequate curing before the start of declining temperatures in the afternoon and evening. In any case, do not proceed if the temperature is expected to fall below 39°F (4°C) within 24 hours of the application.
- In general, the time interval for returning a floor to service doubles for every 10 degrees F (5 degrees C) lower than 70°F (21°C). For example, if the estimated return-to-service time is listed at 6 hours, and both the ambient

and slab temperatures are 50°F (10°C), then the repair product should be allowed to cure for 24 hours (70°F minus 50°F is a 20°F difference, or 21°C minus 10°C is a difference of 10°C). With this doubling factor of two (2), the estimated delay time in the example would be from 6 hours to 24 hours (6 x 2 x 2).

Utilizing these practices will help to ensure successful and durable repairs under adverse temperature conditions. For additional or the most up-to-date information, visit www.mapei.com. You can also contact MAPEI's Technical Services Department by calling 1-888-365-0614 (U.S. and Puerto Rico) or 1-800-361-9309 (Canada), or e-mailing CRS@mapei.com.



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MAPEI Headquarters of North America
1144 East Newport Center Drive
Deerfield Beach, Florida 33442
1-888-US-MAPEI (1-888-876-2734) /
(954) 246-8888