



# Construction Site Shutdown and Restart: High Temperatures

## *Authors:*

Chris Kahanek, PE, SE, AIA  
Cade Osborne

## *Abstract:*

During the early months of 2020, governments across the world began restricting the movements of citizens and mandating business closures in response to the COVID-19 (SARS-CoV-2) pandemic. Construction sites were shut down due to government mandate or in response to myriad difficulties presented by the circumstances. Building materials left on-site with direct weather exposure may deteriorate significantly in a short span of time. In this series, we will examine the most corrosive weather conditions for unused materials and assemblies and identify those materials most vulnerable to deterioration during a construction site shutdown that lasts weeks or months.



## Building Material Storage

Building materials deteriorate naturally, through both daily use and regular exposure. Building materials are susceptible to degradation during installation and service, but also from improper storage. Manufacturers understand the natural rate of deterioration of their particular materials while in storage, based upon historical performance and standardized testing protocol. So, in order to guide suppliers and installers to properly handle their materials, manufacturers set storage requirements within their technical material data sheets. These may include environmental factors like: specified temperatures, humidity ranges, ultraviolet (UV) light exposure time, maximum shelf lives, or orientation for storage.

In this paper, we will summarize storage requirements of building materials and issues they encounter when unintentionally stored in high temperature environments. We will look at: roofing systems, weather-resistive barriers, cold fluid-applied waterproofing membranes, and traffic coatings.

As a rule, building materials need to be stored in areas that are cool, dry, well ventilated, and with minimal direct UV exposure. If building materials are exposed to these environmental conditions, there is significant potential that their chemical compositions may be negatively affected, impairing long-term performance and durability.

In many parts of the US, some building materials require conditioned storage, with controlled temperature regulation, during the summer months. Once the construction phase begins, owners and contractors do not always plan to have on- or off-site conditioned storage for building materials, especially when these items were intended for installation in the cooler spring months. When construction slows or stops, contractors should push to order building materials only for the work areas that are active, while delaying any other purchases for lack of proper storage.

If building materials experience conditions beyond the manufacturer's guidelines, their local representative should be contacted to weigh in on the material's health. The manufacturer may also provide insight during mock-up phases by helping contractors spot defects in their materials. Typically, if the manufacturer's requirements are not upheld, they have the option to void warranties.

## Roofing Systems

Single-ply roofing is a common product for many buildings, and Thermoplastic Polyolefin (TPO) and Polyvinyl Chloride (PVC) are the most common single-ply roof membranes. These materials are produced and delivered to the site in rolls. Some single-ply materials have pre-applied adhesive on the back side of the membrane, increasing their sensitivity and requiring temperature-controlled storage between 60°F and 80°F to prevent the adhesive from activating. In instances where the single-ply roofing is not pre-applied with adhesive, the membrane can be stored at much higher ranges of temperature because the membrane itself is designed to withstand wide temperature ranges. However, the separate material adhesive still needs to be maintained or stored in a temperature window of around 40°F to 100°F. As a side note, other adhesive materials for other building applications may have strict temperature tolerances as well.

Like single-ply, modified bitumen styrene butadiene styrene (SBS) and atactic polypropylene (APP) roofing also contains multiple redundant layers. This category can come in torch-applied and self-adhered varieties. Similarly, extra attention should be given to ensure self-adhered versions of modified bitumen roofing are properly stored—temperature tolerance varies across these products, so communication with the manufacturer is critical.

Some other adhesives associated with modified bitumen roofing may have a flash point of less than 110°F, a low tolerance for unconditioned storage spaces. Flash point is a characteristic of volatile materials which describes the lowest temperature at which the material's vapors may ignite. Every site team should recognize greater fire protection measures when materials on site have low flash points. Setting aside the adhesives, the modified bitumen roofing membranes can remain stable at temperatures well over 200°F.

## Weather-Resistive Barriers

Weather-resistive air barriers can come in the form of self-adhered sheets, fluid-applied systems, and mechanically fastened wraps like Tyvek. Similar to self-adhered roofing, self-adhered sheet air barriers may have adhesive that is activated by moderately high storage temperatures, inhibiting proper adhesion to the substrate during installation and leading to blisters or delamination. Incomplete adhesion allows moisture to move along the substrate and under of the membrane. Repairing subsequent water intrusion is more difficult under these circumstances because the location of water entry is less likely to correspond to the location where water was observed on the interior.

When evaluating a material's technical data sheet, it is important to distinguish between a material's service temperature and storage temperature requirements. Installation typically requires temperature-dependent chemical reactions, meaning storage temperatures are usually much lower and more rigid than service temperatures. Some Silyl-Terminated-Polymer (STP) fluid-applied air barriers must be stored below 80°F. If storage temperatures are not followed, these air barriers may be activated, possibly diminishing the performance of the building material and resulting in material waste. In the case of two-component fluid-applied air barriers, the two chemical components may not properly kick off during the mixing process if stored beyond the temperature threshold.

It is worth noting that all materials have a maximum shelf life. Some fluid applied systems have a maximum factory-sealed shelf life of six months, regardless of storage temperature, which can quickly expire when construction is delayed or halted. Contractors and owners should weigh their options when considering early material purchases, given the probability that the materials will be defective if a delay occurs.

## Cold Fluid-Applied Waterproofing

Cold fluid-applied waterproofing is comprised of one or two components. Each component should be checked for its individual storage requirements as many vary significantly, though they tend to be lower than 100°F. Inadequate storage conditions could impact bond strength, long-term durability, and chemical curing. Cold fluid-applied materials have more restrictive storage requirements compared to hot rubberized asphalt materials which are much more stable and have a much higher flash point of approximately 500°F.

## Traffic Coatings

Traffic coatings are installed at pedestrian walkways or areas with vehicular traffic to prevent concrete wear and water intrusion, which leads to more rapid corrosion. Traffic coatings may consist of modified polyurethane, polymethyl methacrylate (PMMA), or polyurethane methacrylate (PUMA). They are often composed of multiple layers, including a primer, base coat, intermediate coat, and a top wearing course. Depending on the chemistry and the traffic coating layer, we see flash points ranging from 55°F to 100°F. When construction shuts down, the team should accommodate for increased fire safety in the storage location, considering that storage of the traffic coating components will likely exceed well beyond 55°F. However, some manufacturers do not provide flash points and simply specify to store dry at 40–95°F.

Like previously discussed materials, the effects of inadequate storage conditions could impact adhesion between layers and to the substrate, as well as long-term durability and serviceability. Site teams should document unusual signs of delayed curing, blistering, and delamination. It is also worth noting that some traffic coating materials must be conditioned to 65°F to 85°F immediately prior to installation, which could require temporary indoor storage.



*Figure 1: Traffic coating membrane blistering example*

### Image Sources:

<https://www.buildsite.com/pdf/neogard/Neogard-Waterproofing-Roofing-Flooring-Cause-Repair-Prevention-1366815.pdf>

<https://iibec.org/issues-encountered-with-barriers/>

## Conclusion

After building materials are installed owners and property managers may notice signs of improper installation. Conditions such as membrane blistering or delaminating are key signals that the material is not performing to its full capacity and will not survive its intended service life. When additional layers in the assembly are quickly installed potential problems with underlying materials are concealed. The underlying materials may not perform as expected and may deteriorate rapidly, obscuring the building material applications that actually caused the failure.

Very soon after noticing an issue, owners should engage experts to determine the impact of potential short- and long-term issues. When problems like these are ignored or patched quickly, property owners can incur major renovation costs down the line as their asset continues to deteriorate from within.

Roofing systems, weather-resistive barriers, cold fluid-applied waterproofing, and traffic coatings are only a few of the building materials that are susceptible to extended storage in high temperatures. All building materials and raw materials must be stored properly to ensure long-term performance and prevent material waste. Architects, engineers, and owners should ensure that contractors have a plan to properly protect and store materials. If materials are not stored properly, they must be reviewed thoroughly before they have been installed.

Further investigation would likely include perspectives from the technical representative of the material's manufacturer and the project's enclosure consultant to determine if material testing or mock-ups are needed to verify performance. Following any additional testing, the manufacturer and consultant may advise material disposal/recycling or they may authorize the material for installation.

## Appendix

Type	Product	Storage Temp °F
<b>Roofing Systems</b>		
PVC Roofing Membrane adhesive	Sarnacol-2121	<a href="#">40 - 99</a>
TPO Self Adhered Membrane	JM TPO SA- 60 mil	<a href="#">60 - 90</a>
TPO Roofing Membrane Adhesive	JM TPO Water Based Membrane Adhesive	<a href="#">60 - 80</a>
APP Modified bitumen Roofing Membrane adhesive	Firestone building products; Multi-Purpose MB Flashing Cement	<a href="#">60 - 80</a>
<b>Weather Restrictive Barrier</b>		
Fluid applied air barrier membrane	PERM-A-BARRIER Detail Membrane	<a href="#">&lt; 90</a>
Self-adhered air barrier	Henry Blueskin® VP160	<a href="#">&lt; 120</a>
STP Fluid applied air barrier	Henry Air-Bloc® All Weather STPE	<a href="#">32 - 100</a>
STP Fluid applied air barrier	Prosoco R. Guard Cat 5	<a href="#">&lt; 80</a>
Mechanically fastened Wrap	DuPont™ Tyvek® Fluid Applied WB+™	<a href="#">50 - 80</a>
<b>Cold Fluid Applied Waterproofing</b>		
Liquid applied polyurethane membrane	Sikalastic®-320 NS	<a href="#">65 - 85</a>
Liquid applied urethane membrane	CIM 1000	<a href="#">70 - 95</a>
Liquid applied polyurethane membrane	TREMProof® 250GC	<a href="#">40 - 100</a>
<b>Traffic Coating</b>		
Modified polyurethane base coat	Sikalastic®-720 Base	<a href="#">40 - 95</a>
PMMA traffic coating membrane	Terapro VTS Resin	<a href="#">32 - 77</a>
PUMA waterproofing membrane	Henry Pumadeq™ Flex 30SL	<a href="#">50 - 75</a>