Technical Information Bulletin (TIB):

Mixing Guide

GENERAL OVERVIEW

Mixing polymer (resinous) materials properly is critical for a successful installation. A properly mixed material will behave as expected, while a poorly mixed material will yield unexpected results. Un-reacted material (wet), soft spots, wrinkling, and delamination are very obvious problems, but they are not the only undesirable results caused by improper mixing techniques.

Polymer materials are designed to have certain performance characteristics. Improper mixing will most likely result in a material whose characteristics are vastly different than expected; sometimes with disastrous consequences. While an improperly mixed material may develop some acceptable degree of hardness (which is the first property an owner and/or applicator notices), other important physical properties like chemical resistance, wear resistance, and color retention may be severely compromised. These deficient properties may not become evident for quite some time and often blame is shifted away from the actual cause.

This guide is designed to present considerations and techniques recommended for the elimination of mixing problems. Anyone who has mixed large amounts of polymer materials will attest to improper mixing being one of the most dreaded problems on a jobsite. Communication and execution of proper mixing technique would have likely eliminated those problems.

ADDITIONAL RESOURCES

Wolverine Coatings Corporation (WCC) has developed this bulletin along with other technical information to help all interested parties, from specifiers to applicators to owners, have a better understanding of the considerations, materials, and techniques required for proper installation. Consult all relevant information before using WCC materials.

WCC Videos
Video: Mixing Tutorial - Resinous Material

WCC Technical Detail Drawings
TDD: N/A

WCC Technical Data Sheets
TDS: N/A

WCC Safety Data Sheets
SDS: N/A

SAFETY

Prior to commencing work, carefully read and follow all SDS (formerly MSDS), Technical Data Sheets, and any Instruction Manuals for products and equipment used during installation. Following the safety regulations of jobsite, local, state, and federal authorities is the responsibility of the installation company, general contractor, and/or facility owner.

DISCLAIMER

This Document does not purport to address all applicability and safety concerns, if any, associated with its use. It is the responsibility of the user to determine applicability of the information and to establish appropriate safety practices.

DEFINITIONS

- Mix Ratio by Volume – The designed mix ratio of a polymer material given in terms of volume. Normally indicated as 2 Parts A:1 Part B, any unit of volume measure will work, from similar buckets to Dixie cups to thimbles full. As long as the volume unit is the same for each part, using a volume ratio will be applicable. (Do not confuse with Mix Ratio by Weight)
- Mix Ratio by Weight – The designed mix ratio of a polymer material given in terms of weight. Normally the units are indicated as pounds or grams (e.g. 2.2lbs Part A: 1lb Part B), but any like unit of weight will work. (Do not confuse with Mix Ratio by Volume)
- Off-Ratio Material – Material not mixed at the designed mix ratio. Resulting material's characteristics will be indeterminate without extensive testing.
- Soft Spots – Sticky or mushy areas within otherwise properly cured material. Barring some localized environmental cause, soft spots are always indicators of improper mixing technique, typically from scraping material out of a mixing bucket for immediate use rather than transferring to a transport container, then mixing further. Never scrape material out of a mixing bucket onto the work surface or into a paint tray! Always use the transport bucket method as prescribed in this TIB.
- Pot Life – Amount of time after mixing for the viscosity of a mixed material to double. Pot Life may be indicated on the material's TDS. Any value indicated will be for a specific temperature (typically 77°F) and small mix volume. Please note that Pot Life is highly affected by temperature and volume, with higher temperature and volume reducing it, sometimes dramatically. Pot Life will always be less than Gel Time.
- Gel Time – Amount of time after mixing for the viscosity of a mixed material to rise to the point of stopping a stirring paddle in a standard testing apparatus. Gel Time may be indicated on the material's TDS. Any value indicated will be for a specific temperature (typically 77°F) and small mix volume. Please note that Gel Time is highly affected by temperature and volume, with higher temperature and volume reducing it, sometimes dramatically. Gel Time will always be greater than Pot Life.

DEFINITIONS (CONTINUED)

- Working Time– Amount of time a mixed material may be applied without adversely affecting viscosity, substrate penetration, inter-coat bonding, etc. It is always less than Pot Life. As with Pot Life and Gel Time, Working Time is highly affected by temperature and humidity. Working Time is a very project specific amount. It can be estimated through application experience with the product coupled with test data extrapolated to fit the application conditions. Unless the project's environmental conditions precisely reflect lab conditions, Pot Life, Gel Time, and other cure time related properties will require extrapolation in order to be usable. Please note that a material's viscosity may be low enough for application past the Working Time, but some material properties may be compromised.
- Exothermic Reaction – A chemical reaction which produces heat. Most polymer materials react exothermically and will normally experience an associated temperature increase unless the reaction's heat is removed through increased contact with cool surfaces. In addition, material mixed in large volume is more chemically active because of more freedom of movement of the molecules in the mix (more molecular mobility.) Lower surface area to volume and higher molecular mobility of larger mix volumes combine to reduce Working Time, sometimes dramatically.
- Temperature – A measure of the heat content of polymer material, its environment, and surface to which it is applied. Speed of reaction (loosely read 'curing') is usually temperature dependant. A warm material will normally cure much faster than a cool one, and will generally have less working time. This is an important consideration when using materials in extreme temperatures as well as mixing materials in mass (see 'Exothermic Reaction').
- Induction Period (Sweat-In Time) – A time period when some mixed materials need to react in the mixing bucket before final mixing and application. Not all materials require an Induction Period. Consult the material's mixing requirements on its TDS. An Induction Period is normally required in order for the material components to compatiblize. Failure to allow an Induction Period, if required, may result in a coating with poor film properties, low gloss, blushing, off-colors, etc. Follow the mixing instructions on the material's TDS closely. Prepare for this 'down-time' during installation and stage your mixing schedule accordingly. As with other material properties, Induction Period is affected by environmental conditions such as temperature and humidity.

GENERAL CONSIDERATIONS

- Off-ratio material may or may not develop expected hardness, but will absolutely not perform as designed since its final, reacted composition is different than designed.
- While effective in some products, adding more hardener to speed up cure time will typically result in off-ratio material that will not perform as expected. The material may in fact cure more slowly than normal. Closely follow the mix ratio indicated on the material's TDS.
- Every ounce, drop, or molecule of each component of a polymer material must come into contact with each other for proper cure. For example, if Part A is splashed up on the wall of a mixing bucket, it will be very difficult to thoroughly incorporate those drops with Part B. The likely result will be a soft spot somewhere in the finished work unless proper mixing procedure is followed (i.e. transferring to a transport bucket which is then mixed further).
- A soft spot is almost always an indicator of poor mixing technique, typically from scraping unmixed material onto the work surface from a mixing bucket. Always transfer material from the mixing bucket to a transport container and mix further.
- If temperature and humidity are within allowable limits, material that will not cure or is slow to cure is most likely an indicator of poor mixing technique.
- Scrape all material out of measuring containers into the mixing container to ensure more accurate measuring of components.
- While mixing, it is always good practice to scrape around the mixing container's walls and edges with a stir stick or spatula.
- Do not scrape material out of the mixing bucket directly onto the surface to be coated. The only safe time to scrape material out of a mixing bucket is when transferring material from a mixing bucket into a transport container which will be mixed further.
- Some heavy ingredients in polymer material may settle during shipment or from storage on a shelf for an extended period. Higher temperature and vibration may increase the likelihood of settling. Settled materials must be reincorporated for material to perform as designed. Individually pre-mix all components to ensure proper performance.
- Other ingredients such as color packs and texture additives must be thoroughly incorporated for color and performance consistency.

GENERAL CONSIDERATIONS (CONTINUED)

- Color may vary slightly from batch to batch. To minimize color differences, use material from the same batch to coat adjacent areas. Different batches may be blended together to ensure color consistency, but extreme care must be taken to maintain proper mix ratio.
- Consult and closely follow the material's TDS for equipment requirements as well as mixing recommendations.
- Mechanical agitation is required to properly blend viscous material. But mixing too aggressively can whip air into the material, possibly trapping air bubbles in the material.
- There is a risk of inadequate mixing when mix time is reduced, while mixing too long will reduce working time.
- Unless an Induction Period is specified, use mixed materials as soon as possible or make smaller mixes if work time becomes an issue. Since most materials react exothermically, they may heat up during cure. If left in mass, the mix will have lower surface area in relation to its volume and higher molecular mobility. Its temperature and molecular mobility will rise, which will increase the speed of reaction, which increases the amount of heat produced, which increases the temperature, which increases the speed of reaction, and on and on. The material will 'go off', or cure very quickly, and become unusable. Note also, material that goes off in mass may produce a large amount of smoke and heat (possibly enough to burn flesh and melt plastic buckets).
- Do not mix more material than can be used well within estimated Working Time of the mixed material. Take temperature and mix volume into consideration when estimating the working time of your mix. Published curing times, including Gel Time or Pot Life, are based upon standard laboratory conditions (typically 77°F) and small mix volumes. Estimated Working Time will vary, sometimes dramatically.

SETTING UP A PROPER MIXING AREA

A proper mixing area is critical for error-free mixing. Not only will a well thought out mixing area yield higher quality mixes, it will also contribute to a cleaner work area and increased productivity.

It is extremely important to keep a clean and organized mixing area. Soft spots are very likely to occur when drips and spills of unmixed materials in the mix area get on shoes, hands, containers, clean up rags, etc., then get tracked or carried into the work area. Keep plenty of rags and solvent for clean up. Use them often.

MIXING AREA ITEM LIST

- Plastic sheeting (4mil minimum) to protect surface under mixing area
- Corrugated cardboard (enough for double layer)
- Thick tipped, permanent marker
- Duct tape
- Wooden stir sticks and/or solvent-resistant spatulas
- Measuring containers
- Mixing containers
- Transport containers
- Heavy-Duty drill motor or other suitable power mixer (preferably with a back up)
- Extension cords
- Mixing paddles (Spiral Mixing Arm) as indicated on material's TDS (one for each component and one for mixing)
- Plenty of lint-free rags for cleanup
- Solvent for clean up, including a bucket for easy cleaning of mixing paddles
- Plenty of disposable gloves

MIXING AREA SETUP STEPS

1. Choose a location near the work area and with enough room for mixing, material staging, and empty containers. If mixing area cannot adjoin the work area, protect the area between the work and the mix area. Also ensure proper power availability and ease of connection.
2. Lay down a sheet of plastic sheeting with edges extending beyond the area required. Duct tape pieces together if required. If desired, tape the plastic sheeting to the surface, but ensure tape will not harm the surface.
3. Lay down a layer of heavy corrugated cardboard and tape together if in pieces. Tape over any holes, slits, etc. if necessary. Then tape cardboard to the plastic sheeting.

SETTING UP A PROPER MIXING AREA (CONTINUED)

MIXING AREA SETUP STEPS (CONT)

4. Lay down a 2nd layer of heavy corrugated cardboard and tape together if in pieces. Tape over any holes, slits, etc. if necessary. Then tape cardboard to the first layer.
5. To better control drips and spills, cut additional pieces of cardboard to place under dripping mixing paddles, stir sticks, buckets, etc. You may also place a larger piece under your mixing container for easy cleanup in case of spills.
6. Stage each component of the material in their own, marked area, preferably away from each other, but in easy reach of the mix area. Also stage only materials to be used in this session of application. This will reduce confusion during mixing as well as increase productivity. Carefully check every label while staging to ensure proper sorting. Make note of the batch numbers to ensure consistency and as a record of the exact batch of material mixed, for future reference.
7. Make useful notes on the cardboard with a permanent marker. For instance, if a mix ratio requires 2 Part A's, boldly write that in front of the Part A's and the same with the Part B's. If multiple mix sizes are required, it may be useful to write that information on the cardboard, e.g. '3/4gal mix = 1/2gal Part A to 1 quart Part B'. You may want to keep a tally of the mixes on the cardboard as well. Mixing can be very stressful in the heat of battle. Informative notes can reduce the likelihood of error and keep mixing personnel on task.
8. Stage aggregate, color packs, texture additives, other components so as to maximize productivity, minimize congestion, minimize confusion, etc.

PROPER MIXING PROCEDURE

- Consult the Safety Data Sheet (SDS) of each material for required personal protective equipment (PPE) required for mixing personnel.
- If using the same container multiple times, pour material from the same side of the containers to minimize mess.
- Drips and spills should be cleaned up immediately to avoid cross-contamination and/or getting unmixed material on the bottom of containers and shoes, then tracking unmixed material off the mixing area onto the work areas, resulting in soft spots.
- Pre-mix all components. Use a dedicated mixing paddle for each component to avoid contamination. Place mixing paddles on their respective cardboard pieces to minimize mess.
- Some material require agitation when poured together. Consult the material's TDS.

FOR MIXING FROM BULK CONTAINERS AND/OR SMALLER THAN PREPACKAGED KIT BATCHES

- Precisely measure each component into measuring containers. Wipe the lip of the material containers to minimize drips. Each component should have a dedicated measuring container placed near that component's staging area on a piece of cardboard. It is good practice to mark the measuring container with a permanent marker to avoid confusion.
- After all components are measured out, pour the components into a mixing container per the mixing instructions on the material's TDS or label, without getting material on the mixing container's walls. Neatly pour material from the same side of the measuring container.
- Scrape out the measuring containers in order to ensure precise measuring.
- Wipe off excess material from the lip of the measuring containers and place them back on their respective cardboard pieces. (All components will now be in the mixing container, ready for mixing.)
- Proceed with step 1.

FOR PREPACKAGED KIT BATCHES (NOTE: MIXING CONTAINER WILL TYPICALLY BE THE LARGEST PART OF THE KIT)

- Pour all components into the prepackaged mixing container per the mixing instructions on the material's TDS or label, without getting material on the container's walls.
- Scrape out the component containers in order to ensure more precise measuring.
- Wipe off excess material from the lip of the component containers and discard appropriately. (All components will now be in the prepackaged mixing container, ready for mixing.)

1. With the designated mixing paddle, start mixing slowly to avoid splashing material onto the mixing container's side. Slowly increase speed and mix for half the time required on the material's TDS.

PROPER MIXING PROCEDURE (CONTINUED)

2. Remove the mixing paddle and place it on its own piece of cardboard.
3. Scrape the sides, bottom, and corners of the mixing container with mixing stick or spatula to incorporate material on container walls and corners.
4. Resume mixing with the mixing paddle for a quarter of the time required on the material's TDS. Remove the mixing paddle and place it on its own piece of cardboard.
5. Pour the mostly mixed material into the transport container, without getting material on the transport container's walls. Neatly pour material from the same side of the mixing container.
6. Carefully scrape out the mixing container then wipe off excess material from the lip of the measuring container and place it back on its respective piece of cardboard, without getting material on the transport container's wall.
7. In the transport container, mix material the remaining quarter of the total mix time required.
8. Transport the mixed material to the application area. If pouring material into paint trays, spray equipment, or onto the work surface, neatly pour material from the same side of the transport container. Wipe excess material off of the lip of the transport container to minimize drips.

CONSIDERATIONS FOR MIXING MORTARS AND OTHER AGGREGATE-FILLED POLYMER MATERIALS

This TIB is primarily concerned with mixing the resinous portion of polymer materials. Generally, these concepts and procedures should be followed when mixing mortars and other aggregate-filled polymer materials. Unless indicated differently on the material's Technical Data Sheet (TDS), the resinous portion of these materials is normally thoroughly mixed before adding aggregates or fillers, since the aggregate or filler may physically interfere with thorough mixing.

Consult the material's TDS for specific instructions and equipment requirements for mixing mortars and other aggregate-filled polymer materials.

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SAFETY

For your safety, all required personal protection equipment should be used when operating machinery or handling chemicals. Concrete dust is a source of silica particles and other hazardous materials that can cause silicosis and other illnesses. Proper safety equipment and methods are the responsibility of the installation company, general contractor, and/or facility owner.

WARRANTY

Wolverine Coatings Corporation warrants its products to be free from defects in material and workmanship. Wolverine Coatings Corporation's sole obligation and Buyer's exclusive remedy in connection with the products shall be limited, at Wolverine Coatings option, to either replacement of products not conforming to this Warranty or credit to the Buyer's account in the invoiced amount of the nonconforming products. Any claim under this warranty must be made by the Buyer to Wolverine Coatings in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or one year from the ship date, whichever is earlier. Buyer's failure to notify Wolverine Coatings of such nonconformance as required herein shall bar Buyer from recovery under this warranty.

Wolverine Coatings makes no other warranties about the product. No other warranties, whether expressed, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply.

Any recommendation or suggestion relating to the use of the products made by Wolverine Coatings, whether in its technical literature, or in response to specific inquiry or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for the Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedure of use, or extrapolation of data may cause unsatisfactory results.

LIMITATION OF LIABILITY

Wolverine Coatings Corporation's liability on any claims based upon Wolverine Coatings Corporation's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allocable to the products or parts thereof which give rise to the claim. In no event shall Wolverine Coatings Corporation be liable for consequential or incidental damages.

LITERATURE REVISION

Published literature is subject to change without notice. Wolverine Coatings Corporation is constantly formulating innovative products, new technologies, and practices. Please check www.wolverinecoatings.com for the latest product data sheets.

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