

Series 436 Perma-Shield FR

Surface Preparation & Application Guide



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1.0 INTRODUCTION

The purpose of this guide is to acquaint contractors and applicators with the basic information necessary for properly ordering and installing Tnemec's Perma-Shield FR epoxy wastewater system. Prior to starting work, please read this entire guide carefully. If you have questions, contact your Tnemec representative or call 1-800-TNEMEC1. It is important that you obtain answers to any questions before work begins.

Please review all pertinent Product Data Sheets as well as Perma-Shield Standard Details Guide. (See Section 6.0)

Also, reference the project specifications and compare them with this guide and the Product Data Sheets. Resolve any inconsistencies prior to starting work.

This application guide cannot cover every issue that may be encountered in the field. If issues arise that are not addressed in this guide or the Product Data Sheets, please contact your Tnemec representative or call 1-800-TNEMEC1 for assistance.

2.0 SURFACE PREPARATION

2.1 PREPERATION OF EMBEDDED MISCELLANEOUS METALS

When encountering miscellaneous metals embedded into concrete, the surface must be prepared in accordance with SSPC-SP5/NACE 1 White Metal Blast Cleaning with a 3.0 mil minimum anchor profile.

2.2 PREPARATION OF CONCRETE

Allow new concrete to cure a minimum of 28 days. Verify dryness by testing for moisture with a "plastic film tape-down test" (Reference ASTM D 4263). If necessary for testing horizontal surfaces, perform "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (Reference ASTM F 1869). Moisture content not to exceed three pounds per 1,000 sq. ft. in a 24 hour period. Abrasive blast or equivalent to remove laitance,

form release agents, curing compounds, sealers and other contaminants and to provide surface profile (Reference SSPC-SP13/NACE 6, > ICRI CSP5). Large voids, bugholes and other cavities should be filled with recommended resurfacing or patching materials.

All surfaces must be prepared in accordance with SSPC-SP13/NACE 6 standards prior to applying coating materials. All poor or weak concrete must be removed to provide a sound substrate. After preparation, the surface should exhibit a texture equal to or greater than International Concrete Repair Institute (ICRI) - Concrete Surface Profile (CSP) 5.

2.3 EXPOSED REBAR

When rebar is exposed through the surface preparation or due to construction oversights, the rebar must be properly cleaned and primed. Exposed rebar must be cleaned as per SSPC-SP10/NACE 2 "Near-White Metal Blast Cleaning" and primed using an epoxy primer such as Tnemec Series 1, N69, or Tnemec's VOC compliant epoxy primer. The area around the rebar may then be rebuilt using Series 218 MortarClad, or in more extreme cases, Series 219 MortarCast. (Refer to Section 6.0 for more information)

2.4 OUTGASSING

Outgassing must always be considered a possibility with any concrete substrate. A number of means exist to either eliminate or reduce outgassing. First, application should be accomplished in indirect sunlight and during times when the surface temperature of the concrete is stable or in a descending pattern. In addition, use of primers and resurfacing agents can help reduce outgassing. Series 218 MortarClad was specifically designed and is the preferred method to minimize this problem. Outgassing may also be minimized when using Series 436 Perma-Shield FR direct to concrete by spray applying a "mist coat" and allowing the concrete to out-gas for several minutes. This should be followed by another light tack coat.

2.5 TERMINATIONS

When the coating system is not scheduled to provide a monolithic surface, terminations must be built into the system. For example, when the system is scheduled to terminate, sawcuts must be installed so the system may be trowelled or brushed into these areas. Please refer to the Tnemec Standard Lining Details Guide and Section 6.0 of this guide.

3.0 RESURFACING /PATCHING

3.1 SERIES 218 MORTARCLAD

Series 218 MortarClad is a hybrid, cement-based, aggregate-reinforced waterborne epoxy for surfacing, patching and filling voids and bugholes up to 1/4" deep in concrete substrates. In addition, it also serves as a means to diminish outgassing problems typically associated with coating concrete when used as a resurfer at 1/16" thickness. The surface should be "pre-wet" or dampened with potable water to a Saturated Surface Dry (SSD) condition; the concrete is darkened by water but there is no pooling of water on the concrete. This can be done using a Hudson pump-up sprayer or heavy nap roller cover dampened with potable water. Note: Do not over-saturate the surface. Material can be transferred to the surface by utilizing hydraulic spray equipment (i.e. 11:1 Grover grout pump or 9:1 WIWA 410 pump) followed by trowelling to close the material. No special ACI 308 curing requirements - ambient cure only. Refer to the Series 218 MortarClad product data sheet for further information.

PACKAGING - SERIES 218

	PART A (Liquid)	PART B (Liquid)	PART C (Cement-Sand)	When Mixed
Small Kit	1 qt. plastic jug	1 pt. plastic jar	2 gal. pail with 10.7 lb. bag premeasured aggregate	0.7 gal. (2.6 L)
Large Kit	1 gal. plastic jug	1 qt. plastic jar	42.75 lb. bag with premeasured aggregate	2.8 gal. (10.6 L)

SUGGESTED COVERAGE RATES - SERIES 218*

	Small Kit	Large Kit
At 1/16"	18.0 sq. ft.	72.0 sq. ft.
(1.6 mm)	(1.7 m ²)	(6.7 m ²)
	theoretical	theoretical

*Refer to Series 218 Product Data Sheet for additional coverage rates

3.2 SERIES 219 MORTARCAST

Series 219 MortarCast is a hybrid, cement-based, aggregate-reinforced waterborne epoxy for patching and filling voids and bugholes from 1/4" to 1-1/2" deep in concrete substrates (multiple vertical passes will be required to achieve 1-1/2"). The surface should be "pre-wet" or dampened with potable water to a Saturated Surface Dry (SSD) condition; the concrete is darkened by water but there is no pooling of water on the concrete. This can be done using a Hudson pump-up sprayer or heavy nap roller cover dampened with potable water. Note: Do not over-saturate the surface. Refer to the Series 219 MortarCast product data sheet for further information.

PACKAGING - SERIES 219

	PART A (Liquid)	PART B (Liquid)	PART C (Cement-Sand)	When Mixed
Small Kit	1 qt. plastic jug	1 pt. plastic jar	2 gal. pail with 14 lb. bag premeasured aggregate	0.855 gal. (3.2 L)
Large Kit	1 gal. plastic jug	1 qt. plastic jar	56.7 lb. bag with premeasured aggregate	3.4 gal. (12.9 L)

SUGGESTED COVERAGE RATES - SERIES 219**

	Small Kit	Large Kit
At 1/4"	5.5 sq. ft.	21.8 sq. ft.
(6.4 mm)	(0.51 m ²)	(2.0 m ²)
	theoretical	theoretical
At 1 1/2"	0.91 sq. ft.	3.6 sq. ft.
(38.1 mm)	(0.084 m ²)	(0.34 m ²)
	theoretical	theoretical

**Refer to Series 219 Product Data Sheet for additional coverage rates.

3.3 MIXING & APPLICATION - SERIES 218 AND SERIES 219

Mix entire kits of all products as supplied. For smaller applications, smaller kits are available. Note: Mixing less than a full kit can result in mis-catalization, improper film build and variant cure times. The aggregate for Series 218 and

Series 219 is supplied by weight, not by volume, so determining proper portions can be extremely difficult. Kit splitting is not recommended and Tnemec shall not be liable nor warrant such an application.

Mortar mixers, Kol mixers, or mixing paddles such as a M-713 H style mixing paddle with a minimum 10 amp, 3/4" heavy-duty drill motor are recommended for mixing mortar products herein.

Pour liquid Part A into a container large enough to hold all components. Under agitation slowly add liquid Part B. When blended, slowly sift powder, Part C, while continuing agitation. Do not dump all of the Part C into the liquids at one time. Mix for two minutes or until the cement-sand is thoroughly wetted and a smooth consistency is obtained.

3.4 APPLICATION EQUIPMENT - SERIES 218

Steel, stiff, concrete finishing trowels, broad knives and rubber floats are recommended. Note: Set times for this product are quicker than a standard cement mortar.

For trowelling inside and outside corners, the use of a radiused or margin trowel is recommended.

Material can be transferred to the surface by utilizing hydraulic spray equipment (i.e. 11:1 Grover grout pump or 9:1 WIWA 410 pump) followed by troweling to seal the material.

For a smoother finished appearance, trowel licks may be reduced by using water to lightly dampen a 1/4" nap roller cover over the sealed Series 218 material. Note: If white liquid is brought to the surface during this process, the Series 218 material is being overworked and/or oversaturated. Overworking or oversaturating the surface may have an adverse effect on the adhesion of subsequent coatings applied.

3.5 APPLICATION EQUIPMENT - SERIES 219

Mortar brushes, Hawk, metal trowels, stiff straight edge.

Vertical: Material can be applied as either a patch or resurfacer by hawk and trowel up to 1-1/2 inches. The material may be placed at thicknesses above 1-1/2 inches if forms are used.

Horizontal: Can be trowel applied to fill, grade and smooth concrete surfaces.

3.6 CURING - SERIES 218 & SERIES 219

Ambient cure only. No special ACI 308 curing requirements. Refer to the Series 218 and 219 product data sheets for additional information.

4.0 SERIES 436 PERMA-SHIELD FR

Series 436 Perma-Shield FR is a fiber-reinforced, Modified Polyamine Epoxy. A thick film, 100% solids, spray-applied, abrasion-resistant coating designed for wastewater immersion and fume environments. Product provides excellent resistance to severe wastewater environments. The fiber-reinforcement provides superior physical strength and higher film build. Series 435 Perma-Glaze may be used as an optional topcoat.

4.1 PACKAGING - SERIES 436

	PART A (partially filled)	PART B (partially filled)	MIXED YIELD
Small Kit	1-1 gallon can	1-1 gallon can	1 gallon
Medium Kit	1-6 gallon pail	1-3 gallon pail	5 gallons



4.2 COVERAGE RATES

	Dry Mils (Microns)	Wet Mils (Microns)	Sq. Ft./Gal. (m ² /gal.)
Minimum	50.0 (1270)	50.0 (1270)	32 (3.0)
Maximum	125.0 (3175)	125.0 (3175)	13 (1.2)

4.3 STORAGE - SERIES 436

Minimum storage temperature is 40°F (4°C) and maximum is 110°F (43°C). Prior to application, the material temperature should be between 70°F to 80°F (21°C to 27°C).

4.4 MATERIAL TEMPERATURE - SERIES 436

For optimum application, handling and performance, the material temperature during application should be between 70°F and 90°F (21°C and 32°C). Temperature will affect the workability. Cool temperatures increase viscosity and decrease workability. Warm temperatures will decrease viscosity and shorten pot life.

4.4 MIXING - SERIES 436

Mix the entire contents of Part A and Part B separately. Scrape all of the Part A and the Part B into a suitable container by using a flexible spatula. Use a variable speed drill with a PS Jiffy blade and mix the blended components for a minimum of two minutes. During the mixing process, scrape the sides and bottom of the container to ensure all of Parts A and B are blended together. Apply the mixed material within pot life limits after agitation.

CAUTION: Do not reseal mixed material. An explosion hazard may be created.

4.5 POT LIFE/SPRAY LIFE- SERIES 436

POT LIFE - SERIES 436

25 - 30 minutes	70°F (21°C)
15 - 20 minutes	80°F (27°C)
8 - 10 minutes	90°F (32°C)

Material temperatures above 90°F (32°C) will significantly reduce the spray and pot life.

SPRAY LIFE - SERIES 436

15 - 20 minutes	70°F (21°C)
5 - 10 minutes	80°F (27°C)

4.6 SPRAY APPLICATION & EQUIPMENT

Application of Series 436 Perma-Shield FR is as follows:

The spray application equipment includes a Graco "Xtreme-King" 45:1 airless spray pump or other airless spray equipment of equal or greater configuration and capability. Configuration of the pump can have a significant effect on the quality of the products application. Contact Tnemec Technical Services for specific pump configuration recommendations. Pump assembly should include a moisture trap and oiler, air regulator with gauge, fluid outlet drain (dump) valve and outfitted with an attached gravity fed material hopper. Use a 1/2" I.D. material hose (maximum 50 ft. and minimum 5,000 psi working pressure rating). For better control, use a 6' to 10' of 3/8" whip line. A WIWA 500F, a Graco XTR-7, or a Graco Pistol Grip Mastic Flo-Gun (Model 207-945) with a Graco H.D. RAC Housing/Guard assembly and H.D. tip sizes ranging from 0.035" - 0.047".

AIRLESS SPRAY

Pump Size	45:1 or greater
Gun	Graco XTR-7, Graco Pistol Grip Mastic Flo-Gun, WIWA 500F
Tip Orifice	0.035" - 0.047" H.D.
Atomizing Pressure	3000 - 4500 psi
Mat'l Hose ID	1/2" (50 ft. maximum)
Whip Line ID	3/8" (6' - 10' length)
Manifold Filter	N/A

NOTE: Remove all filters. Material needs to be gravity fed through an attached material hopper. Material will not feed through a suction tube. If further information is needed, contact Tnemec Technical Service.

4.7 PUMP MAINTENANCE

After every 20 to 25 gallons, the pump should be flushed with MEK. This is accomplished in two stages. First, MEK (either new or filtered) is recirculated through the pump for five minutes through a filter bag. Then, a second flush is done, again for five minutes, this time using only fresh MEK. (This MEK can be used for the first flush of the next flush cycle). This cycle is repeated every 20 to 25 gallons, or as needed. It should be noted that the

amount of flushing needed is dependent on temperatures and extended spray times.

After the end of a work shift, the pump is flushed as stated above. This time, after the second flush, the lower end of the pump is disassembled and thoroughly cleaned to remove all traces of coating material.

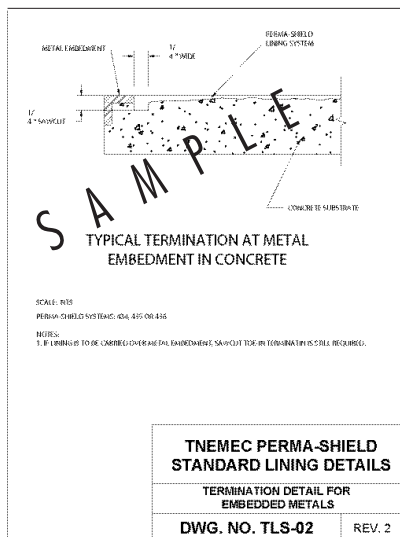
It should be noted that the amount of flushing needed is dependent on temperatures and extended spray times.

5.0 SERIES 435 PERMA-GLAZE (OPTIONAL TOPCOAT)

Series 435 Perma-Glaze is a 100% solids, modified polyamine epoxy designed for outstanding H₂S permeation resistance and is used as a glaze coat to prolong the service life of the Perma-Shield FR system. It is applied with a 3/8" - 1/2" high quality, synthetic, woven nap roller to a finished thickness of approximately 15 to 20 mils DFT. Refer to the Tnemec Series 435 Surface Preparation and Application Guide and Product Data Sheet for further instructions.

6.0 TNEMEC STANDARD LINING DETAILS

When the coating system is not scheduled to provide a monolithic surface, terminations must be built into the system. For example, when the system is scheduled to terminate, sawcuts must be installed so the Perma-Shield system may be trowelled into these areas. For a complete list of termination details, refer to Perma-Shield Standard Lining Details Guide at www.tnemec.com.



7.0 HIGH VOLTAGE DISCONTINUITY (SPARK) TESTING

High voltage discontinuity (spark) testing is recommended to determine the presence and number of discontinuities in the nonconductive Series 436 Perma-Shield FR or Series 435 Perma-Glaze applied to a conductive surface.

All high voltage discontinuity (spark) testing shall be performed in accordance with NACE RP0188 and the procedures outlined herein.

Series 436 Perma-Shield FR and Series 435 Perma-Glaze (if applicable) shall be applied and allowed to cure within the parameters of the corresponding Product Data Sheets. Sufficient curing time of the coating system shall be allowed prior to conducting a holiday test, as indicated by the "To Place in Service" duration on the Product Data Sheets. Curing time will vary with surface temperature, air movement, humidity, and film thickness.

If the substrate is incompatible or if thickness constraints are not applicable for a non-destructive dry film thickness gauge, measurements of the coating system thickness are to be performed during application of each system component using a wet film gauge, feeler gauge, or other measurement device that can accurately measure the coating wet film thickness. These coating measurements are to be tabulated to determine the total system thickness.

All high voltage discontinuity (spark) testing shall be performed using a Tinker & Rasor model AP/W Holiday Detector. Refer to the following chart for appropriate voltage based on coating system thickness.

To perform holiday testing attach a ground wire from the instrument ground output terminal to the conductive substrate and ensure proper electrical contact. Test conductivity by attaching the instrument ground wire to rebar or other metallic ground permanently installed in the concrete and touch the electrode to the bare concrete. If metallic ground is not visible, the ground wire can be placed directly against a bare concrete surface and weighted with a damp cloth and sand-filled bag. Make contact with the exploring electrode on the conductive substrate to verify the instrument is properly grounded. If the test proves negative, determining discontinuities with a high voltage spark test will be ineffective. Under no circumstances shall the voltage be increased above the recommended voltage potential.

RECOMMENDED VOLTAGES FOR HIGH VOLTAGE SPARK TESTING WITH TINKER & RASOR MODEL AP/W

Total Dry Film Thickness (mils)	Voltages (V)
20-24	2,500
25-29	3,000
30-39	3,500
40-47	5,000
48-59	6,000
60-69	7,500
70-79	8,500
80-99	10,000
100-124	12,500
125-134	15,000
135-159	16,000
160-174	17,500
175-214	20,000
215-269	27,000
270-299	31,000
300-350	35,000

Holiday testing of repaired areas shall be performed using same testing procedures as outlined above.

If utilizing alternate high voltage DC holiday detectors, never exceed the recommended 100-125 volts DC per mil or contact Tnemec Technical Services for recommended voltage settings. Excessive voltage may produce a holiday in the coating film.