SURFACE PREPARATION AND APPLICATION GUIDE

PROPOLYMER & VINESTER MEDIUM BUILD (MB) SYSTEMS (MB-5.0 and MB-6.0)

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1.0 INTRODUCTION

The purpose of this guide is to acquaint applicators with the basic information necessary for properly ordering, storing and installing Tnemec's ProPolymer & Vinester Medium Build (MB) vinyl ester systems.

Prior to starting work, please read this entire guide carefully. If you have questions, contact your Tnemec representative. It is important that you obtain answers to any questions before work begins. Please review all pertinent product data sheets, as well as all referenced standards and technical bulletins. 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 sheet, please contact your Tnemec representative or call +1-816-483-3400 or e-mail techsvcs@tnemec.com for technical assistance.

This application guide gives information for two primary medium build (MB) systems; MB 5.0 and MB 6.0. System 5.0 uses Series 1430 and Series 1415 liquids and System 6.0 uses Series 1436 and Series 1416 liquids. Both systems use the same primer Series 1407 and 1.5-ounce chopped strand mat reinforcement, Series 211-226/227. It should be noted that at times a MB 6.0 may be adjusted by a specifier to use Series 1438 and Series 1418 liquids for special chemical services. All pertinent data concerning these alternate liquids are exactly the same as standard 1436/1416. Further, at times an alternate finish coat may be suggested for both MB systems that is more desirable for the intended service such a silica free or higher abrasion resistance. Consult appropriate data sheet if an alternate finish coat is specified.

2.0 MEDIUM BUILD (MB) PRODUCT & PACKAGING

2.1 MB PRODUCTS: SERIES 1407, 1415, 1416, 1430, 1436

The medium build (MB) systems of vinyl ester products are brand named either Vinester or ProPolymer. They have unique compositional ingredients specific to their number. This includes, but is not limited to, being an epoxy or a novolac epoxy-based vinyl ester coating and/or lining. Consult each product data sheet for further specifics and use selection. The specific system was selected for performance in the chemical service environment.

2.2 MB PRODUCT PACKAGING: SERIES 1407, 1415, 1416, 1430, 1436

KIT SIZE	PART A (BASE)	PART B (CATALYST)	YIELD (MIXED)
Medium Kit †	5 gallon pails	Pint bottle	5.0 gallons (18.9 L)
Small Kit	1 gallon can	4 oz bottle	1.0 gallons (3.7 L)

Note: A special order for 1 gallon containers of 1402-0REDB are available for use with catalyst injection equipment. This product requires precise metering of 3.2 fluid ounces (94.6 mL) 1402-0REDB catalyst to each gallon of Part A material. One gallon of 1402-0REDB will theoretically be sufficient to catalyze 40-gallons of Part A vinyl ester material. This red catalyst is **not** approved for, and is **not** to be used in, direct food grade lining applications.

3.0 GENERAL REQUIREMENTS FOR THE WORK SITE

3.1 CLEANLINESS

Prior to and during surface preparation and the lining application, cleanliness must be maintained to avoid contaminants compromising the performance of the lining system. To prevent contamination from being tracked into the work area, establish a clean area around the entrance of the tank where clean footwear, or disposable overshoes, can be put on prior to entering the tank.

3.2 MATERIAL STORAGE

Storage of all materials including powders and aggregates, if used in the system, shall be indoors and in a conditioned environment. Ideally, storage conditions shall be no less than 40°F (5°C) to no more than 80°F (27°C). Temperature will greatly affect the workability of the products. Cooler temperatures increase viscosity and lengthen pot life of mixed materials. Warmer temperatures will reduce viscosity and shorten pot life of mixed materials. **Note:** This applies to aggregates and dry powders that may be used on the project.

3.3 DEHUMIDIFICATION

The surface should be clean, dry, and contaminant free, and be at least 5°F (3°C) above the dew point. Do not apply when humidity exceeds 80%. For tanks, dehumidification equipment is recommended if humidity exceeds 80%. Relative humidity conditions above 75% can retard the cure of vinyl ester products, therefore dehumidification equipment will be required if conditions are prone to go over 75% during the application and cure process.

If dehumidification equipment is not used, the surface to be coated should be abrasive blasted within twenty four (24) hours of the application of the lining material.

3.4 VENTILATION

When used as a tank lining or in enclosed areas, provide adequate ventilation during application and cure.

3.5 HEATING

The vinyl ester products listed in this application guide may be installed when temperatures of steel or concrete are above the minimum temperatures listed on the individual product data sheets. Necessary heating as specified, should be by means of an indirect fire into the heat exchange system that is incorporated into the dehumidified air supply. Air admitted into the tank should not pass directly through a combustion chamber.

Additional information concerning heating for cure, and if specified, post cure of these linings can be found in section 7.0 Curing Time.

3.6 LIGHTING

Reference SSPC-Guide 12 for more information.

4.0 STEEL SURFACE PREPARATION

4.1 PRIOR TO BLASTING STEEL

Before work can commence on tanks previously in service, it is vital that all internal tank surfaces are clean, dry and in suitable condition for surface preparation and lining system application. The following minimum requirements apply:

- Tanks must be structurally sound and free of chemical fumes (gas-free).
- Mill scale or other debris attached to the tank's surfaces must be removed. For heavily scaled or contaminated surfaces, sweep blasting may be required.
- If hydrostatic testing is carried out using salt or brackish water in the tank, then the test must be followed by fresh water washing. The maximum allowed total soluble salt contamination before application of MB vinyl esters is 3 µg (cm-2).
- The surface should be clean, dry, and contaminant free, and be at least 5°F (3°C) above the dew point. Do not apply when humidity exceeds 80%. For tanks, dehumidification equipment is recommended if humidity exceeds 80%.
- If dehumidification equipment is not used, the surface to be coated should be abrasive blasted within twenty four (24) hours of the application of the lining material and before flash rusting occurs.

4.2 WELDS

Remove weld spatter, burrs, or protrusions; remove and/or round sharp edges. Smooth rough welds and gouges prior to abrasive blasting. Welds should be ground to remove any irregularities and are considered ready for painting when a minimum finishing level of a C designation, as defined by the latest revision of NACE SP0178 has been achieved.

4.3 CONTAMINATED SURFACES

Unlined tanks or previously-lined tanks require checking for contaminant presence that require complete removal prior to abrasive blasting. Water soluble contaminants such as chlorides, sulfates, acids, alkalies, etc. are not present and small quantities are not readily visible on the surface of the metal. These surface contaminants can be embedded into blast profile if not removed and cause extensive, persistent corrosion, and blistering under the protective coating system.

For a successful lining application, no more than the following amounts of detectable contaminants should be present on the surface:

CONTAMINANT	MAXIMUM DETECTABLE AMOUNT
Chlorides	30 mg/m^2 / 3 ppm (µg/cm^2)
Sulfates	100 mg/m^2 / 10 ppm (µg/cm^2)
Nitrates	50 mg/m^2 / 5 ppm (µg/cm^2)

4.4 PREPARATION OF STEEL - ABRASIVE CLEANING

All steel surfaces to receive the MB systems materials should be abrasive blasted to a white metal cleanliness in accordance with SSPC-SP 5/NACE 1 White Metal Blast Cleaning or ISO Sa 3 Blast Cleaning to Visually Clean Steel with a minimum angular anchor profile of 3.0 mils (75 microns).

The abrasive used should be clean, dry, bagged material that has a hard, angular cutting surface, such as aluminum oxide. Abrasive materials should be selected to produce the required 3.0 mils (75 microns) minimum angular anchor pattern and no evidence of a polished or peened surface will be accepted. Depth of anchor pattern is suggested to be measured by using HT Testex-Replica profile tape prior to the application of the prime coat. Profile readings should be recorded on HT Testex-Replica tape and retained by the applicator for verification as part of the Quality Assurance file (reference NACE SP0287 and ASTM D4417).

The compressed air used for blasting should be free of water and oil. Adequate traps and separators should be used to ensure elimination of all contaminants. Cleanliness of the air supply may be checked by operating the line without abrasive media through a clean white cloth for 20 seconds. If oil or water appear on the cloth, the traps and separators should be cleaned until subsequent 20 second tests prove satisfactory (reference ASTM D4285).

Blasting should not be performed when the surface temperature is less than 5°F above the dew point to prevent the formation of rust bloom. Dew point and surface temperature readings should be taken prior to blasting to ensure this condition. In addition, application of the prime coat should be scheduled so as to immediately follow blasting and cleaning operations. Painting over flash rust or other contaminants is not acceptable. Care should be exercised by all personnel to avoid hand or clothing contamination of the freshly-blasted surface.

All dust and blasting debris must be removed by vacuuming. Cloths should not be permitted for cleaning blasted surfaces because of possible lint contamination. Brushing or blowing the surface should not be permitted as these methods will not dislodge all particles embedded in the surface profile. Styrene or other solvents should not be used to wipe clean steel or in between coats of vinyl ester materials.

4.5 SURFACE IMPERFECTIONS

Abrasive blasting may expose surface imperfections in steel surfaces that may previously have gone unnoticed. If practical, these imperfections must be repaired immediately and blasted to duplicate the surrounding area. If immediate repair is not feasible (due to loss of blast), the affected area is to be masked off and repaired following application of the first coat. If welding is involved in the repair procedure, the masked area must measure 6 inches (15.2 cm) in any direction from the weld. The edges of all masked repair areas should be feathered using an abrasive cloth or wheel. Prepare the repaired area for coating using the surface preparation procedures for steel outlined previously in Sections 3 and 4. Any contamination resulting from the repair must be removed by solvent wiping prior to abrasive blasting.

A record should be kept of all repaired areas using a coordinate system. The repaired area must be spot-blasted and remain free of voids, undercutting and weld spatter and exhibit a minimum 3.0 mil (75 micron) anchor pattern.

All outside corners or edges must have a 1/8" (3 mm) minimum radius. All inside corners should be filled to a minimum of 1" (2.5 cm) radium with putty made from the resin. See section 5.0 for additional information.

5.0 CONCRETE SURFACE PREPARATION

All new concrete should be allowed to cure 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 Measure Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (reference ASTM F 1869). Moisture content is 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 to provide profile per NACE 6/SSPC-SP13, greater

than an ICRI-CSP5. Blasting must be performed sufficiently close to the surface to open up surface voids, bug holes, air pockets and other subsurface irregularities. Dry, oil-free air must be used for the blasting operation (reference ASTM D 4285).

If concrete surfaces are severely deteriorated and a Medium Build (MB) system is being applied, the substrate must be resurfaced using an appropriate material such as Series 215 Surfacing Epoxy, Series 217 MortarCrete or Series 1415/1416/1418 Vinester with the addition of Series 9111 Bulking Additive. Small patches, bugholes, and coving can be repaired using Series 1407 Vinester, Series 1402 ProPolymer, or Series 201 Epoxoprime with the addition of 211-0211 Fumed Silica or Series 9111 Bulking Additive. Refer to the appropriate data sheet and Application Guide for more specific information or Tnemec Technical Services for more extensive repairs and additional information.

If installing a Reinforced System (RS), in most cases of new construction or marginal deterioration of the concrete surface the specified basecoat mortar is sufficient to fill and smooth up the concrete substrate for subsequent applications. For severe deterioration consider the use of previously mentioned materials for patching and resurfacing.

All dust and blasting debris dust shall be removed by vacuuming or washing prior to application. Cloths shall not be permitted for cleaning blasted surfaces because of possible lint contamination. Brushing or blowing the surface shall not be permitted, as these methods will not dislodge all particles embedded in the surface profile. All surfaces must be clean, dry, free of oil, grease and other contaminants.

5.1 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 out of direct sunlight and during times when the surface temperature of the concrete is stable or descending. In addition, coating systems may have an exothermic reaction during their cure generating heat on the concrete surface promoting outgassing. The use of primers or resurfacers can help reduce outgassing.

5.2 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 Cleaning or SSPC-SP11 Power Tool Cleaning to Bare Metal, and primed using an epoxy primer such as Tnemec Series N69 Hi-Build Epoxoline II or equal. The area around the rebar may then be rebuilt using Series 215 Surfacing Epoxy or, in more extreme cases, Series 217 MortarCrete.

5.3 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 three feet up the wall, 1/4" x 1/4" saw cuts must be installed so the system may be keyed into these termination points. Refer to the "Secondary Containment Construction Details Guide" for more information.

5.4 PREPARATION OF CMU

Allow new mortar to cure 28 days. Surfaces much be clean, dry, sound and free of all contaminants (Ref. SSPC-SP13/NACE No. 6). Level all protrusions and mortar spatter.

6.0 MIXING

The MB vinyl ester products have limited pot life and workable spray conditions once the Part A and the Part B are mixed together. Prior to starting work, review each MB vinyl ester product data sheet associated with the project.

6.1 MIXING

Power mix the contents of Part A (base) thoroughly making sure no pigment remains in the bottom of the can. Add the Part B (catalyst) to the Part A (base) while under agitation. Ensure that all Part B is blended into Part A by scraping the sidewalls of the pail using a flexible spatula or similar instrument. Care should be taken to not entrap air into the mixed material. **Note:** This mixing procedure does not apply if materials are to be applied by catalyst injection spray equipment.

Caution: Unused mixed material in the pail will greatly exotherm at the end of pot life which can generate dangerous heat and a possible explosion or fire hazard may occur. Containers should be moved to a safe exterior location. Unused material should immediately have gravel or sand added to the liquid to help absorb and dissipate the heat buildup. Do not close or cover the pail until all liquids have solidified and cooled down to an ambient temperature.

7.0 APPLICATION & EQUIPMENT

7.1 APPLICATION RECOMMENDATION

The MB lining systems all utilize vinyl ester products that can be applied with a roller, single-leg equipment or catalyst injected plural component equipment. Linings should always be spray applied to achieve appropriate film build, ensure continuity, and to create a pinhole-free and smooth finish. From a commercial standpoint, the spray method and equipment vendor may be selected by the applicator.

Projects of up to 50 gallons of spray per day would be candidates for single-leg airless equipment. Projects larger than 50 gallons per day are highly encouraged to utilize high production catalyst injection (CI) pumps designed for flake-filled vinyl ester coatings. With CI equipment and application, the production is vastly increased, product has minimal waste, increases mixing accuracy, dramatically reduces cleaning time.

7.2 AIRLESS SPRAY EQUIPMENT OR EQUAL

Airless spray equipment is for use with the following MB system products: Series 1407, 1430, 1432, 1436, 1438, 1439, 1448, 1450, 1451.

PUMPS	Graco X60 with 220cc fluid section without filter housing or Graco XL70 with 290cc fluid section without filter housing.
HOPPER	10-gallon SS hopper / 1½" id with mounting hardware
ANCILLARY	- Dump valve – high pressure ½" T with a high pressure ½" ball valve - ½" male x ½" male hose fitting / ½" male x 3/8" male hose fitting
PACKINGS	PTFE
SPRAY GUNS	- Graco XHF Spray Gun - WIWA 500F Spray Gun - Graco gun swivel ½"f x 3/8" npsm
SPRAY TIPS	0.029 - 0.037 reverse clean

MATERIAL LINES	- ½"f x 3/8" npsm ½" x 50' x 6000 psi hose (maximum 50' length) - 3/8" x 6' x 6000 psi whip

7.3 CATALYST INJECTION EQUIPMENT OR EQUAL

The catalyst injection equipment is for use with the following MB system products: Series 1407, 1430, 1432, 1436, 1438, 1439, 1448, 1450, 1451. Refer to 2.1 of this Application Guide for ordering 1402-0REDB tinted catalyst for use with catalyst injection equipment.

PUMP	Spray-Quip 398-575 High Production Catalyst Injection Pump For Application of Flake Filled Vinyl Ester Coatings
MOTOR	Graco Extreme XL6500 50:1 resin ratio pump
CATALYST DELIVERY	Binks Super Slave catalyst pump package; 0.5% - 3.5% (.25 increments) Catalyst flow meter with 2.5-gallon supply cannister with overflow catch
HOPPER	7.5-gallon to 10-gallon stainless gravity feed hopper with in-line filter
HEATER	Graco Viscon HP 120V in-line heater with HD recirculation valve and return to hopper kit. Normal required spray temperature 90°F for MB Series vinyl ester products
HOSE BUNDLE	50' to 200' insulated assembly to contain, resin, catalyst and air atomizing hoses
SPRAY GUN	Binks Century Air-Assisted Airless gun with tungsten carbide needle and seat tip fitted with external catalyst injector nozzle.
CATALYST INJECTOR	Orifice size: 0.031 Gel/resin tip sizes: 0.026 to 0.044 Fits all recommended tips for specific MB Series vinyl ester products

7.4 AIRLESS SPRAY TIPS FOR CATALYST INJECTION CARRIER

	SERIES 1430	SERIES 1436	SERIES 1438	SERIES 1439	SERIES 1448
TIP SELECTION	0.026 to 0.031	0.041 to 0.044	0.041 to 0.044	0.026 to 0.031	0.031 to 0.036
TIP ID No.:	(2609) (3109)	(4109) (4409)	(4109) (4409)	(2609) (3509)	(3109) (3609)
MAIN PROPORTIONER	50 to 60 psi	60 psi	60 psi	60 psi	45 to 50 psi
ATOMIZING PRESSURE	60 psi	60 psi	60 psi	65 psi	60 psi

8.0 APPLICATION CONDITIONS

8.1 MATERIAL TEMPERATURE

Vinyl ester products require surface, ambient and material exposure to the temperatures of 60°F (16°C) for no less than 6 hours, 70°F (21°C) for no less than 4 hours, and 80°F (27°C) for no less than 2 hours to complete polymerization. If noted temperatures are not at least 60°F (16°C) and on the rise, they are not favorable to meet these parameters, it is recommended to wait until environmental conditions improve. If application is at an interior protected space or a covered tank, appropriate conditions can be created with conditioned air. Once exposed to these temperatures, the products will cure sufficiently if mixed and applied properly provided temperatures do not fall below 50°F (10°C) during this initial cure phase. See 14.0 CURING for additional details.

8.2 MOISTURE AND RELATIVE HUMIDITY

The presence of moisture and damp surfaces will severely retard or completely stop the cure of vinyl ester materials. All steel and concrete conditions must be no less than 5°F (3°C) above the dew point condition. During application it is recommended that relative humidity generally stays below 80%. No standing or visible water is allowed on steel or concrete prior to application.

9.0 SHELF LIFE

All Part A components of ProPolymer vinyl ester and Vinester products have a very short shelf life, and they should only be ordered once the purchaser is assured the project is viable and will not be delayed. It is recommended that materials be ordered no more than thirty (30) days in advance of application date.

Proper storage temperature conditions of vinyl ester products is not only important for optimum application properties but also to meet the shelf life profile in chart below.

ProPolymer vinyl ester and Vinester products are made to order (MTO), and they are not acceptable for return to Tnemec once the order is placed.

9.1 SHELF LIFE OF MB SYSTEM PRODUCTS

STORAGE TEMPERATURE	SHELF LIFE
35°F to 49°F (2°C to 9°C)	3 MONTHS
50°F to 79°F (10°C to 26°C)	2 MONTHS
80°F to 90°F (27°C to 32°C)	1 MONTH

Note: Do not store products at temperatures below 35°F (2°C) or above 90°F (32°C).

10.0 SPRAY LIFE

10.1 MB PRODUCT SPRAY LIFE

TEMPERATURE	POT LIFE
65°F (18°C)	1-2 HOURS
75°F (24°C)†	45-MINUTES TO 1 HOUR

†At higher temperatures, pot life will decrease; use caution in spray equipment. In hot weather, material should be cooled to 65°F to 80°F prior to mixing and application to avoid shortened pot life and improve workability.

10.2 SPRAY LIFE

Reference the applicable product data sheets for spray life limits.

10.3 CAUTION

Caution: Unused mixed material in the pail will greatly exotherm at the end of pot life generating dangerous heat and a possible explosion or fire hazard. Containers should be moved to a safe exterior location. Unused material should immediately have gravel or sand added to the liquid to help absorb and dissipate the heat buildup. Do not close or cover the pail until all liquids have solidified and cooled down to an ambient temperature.

11.0 MB APPLICATION

The following are the application guidelines for the medium build (MB) product systems.

11.1 MB SYSTEMS

Below is a breakdown of MB systems 5.0 and 6.0:

SYSTEM NUMBER	PRIMER	INTERMEDIATE COAT	REINFORCEMENT & SATURANT	FINISH
MB-5.0	Series 1407	Series 1430	211-226/227 Fiberglass Mat & Series 1415-900	Series 1430
MB-6.0	Series 1407	Series 1436	211-226/227 Fiberglass Mat & Series 1416-900	Series 1436

11.2 SERIES 1407 PRIMER

Series 1407 is the primer selected for use under the MB system finish coats, and it is acceptable for use on steel or concrete. In some cases, the primer may be omitted due to temperature service levels and other conditions.

11.3 SERIES 1407 CURING TIME

TEMPERATURE	TO RECOAT
90°F (32°C)	2 hours min. 24 hours max
70°F (21°C)	2 hours min. 72 hours max

11.4 SERIES 1407 COVERAGE RATES

KIT	DRY MILS	WET MILS	SQ FT/KIT
MEDIUM KIT	5	6	1,375
SMALL KIT	5	6	275

11.5 SERIES 1415, 1416, 1430, 1436 COVERAGE RATES

The thicknesses and theoretical coverage rates below for MB systems MB-5.0 and MB-6.0 are for one coat.

KIT	DRY MILS	WET MILS	SQ FT/KIT
MEDIUM KIT	20	24	325
SMALL KIT	20	24	65

11.6 MB-5.0 AND MB-6.0 SYSTEMS

MB-5.0 and MB-6.0 Series systems consist of one prime coat, a base coat, chopped strand mat reinforcement with a saturation coat, and a final finish coat. See **Figure 11.6** for more information.

11.7 MB-5.0 AND MB-6.0 BASE COAT AND REINFORCEMENT

The following steps all occur in one application sequence.

1. After application and cure of the prime coat, apply either Series 1430 (MB-5.0) or Series 1436 (MB-6.0) as the base coat to achieve a film thickness of 20.0 - 25.0 mils (510 - 635 microns). Spray application preferred.
2. While base coat is still fluid, embed 211-0226/0227 1.5-ounce chopped strand mat and press into the base coat using trowels or steel ribbed rollers.
3. Immediately apply Series 1415-900 (MB-5.0) or 1416-900 (MB-6.0) saturant on to the front of the mat, wetting out all surfaces to insure intimate contact with the base coat and remove all air pockets or bubbles. If desired to assist in build or for spraying, 211-0211 fumed silica may be added starting at one quart of dry to one gallon of 1416-900, up to and not exceeding one full gallon of 211-0211 to one gallon of resin.
4. When laying additional sheets of fiberglass mat a minimum of a 1-inch overlap should be placed between “drops” using ample saturant to wet and bind the edges.
5. Once laid, allow the system to cure, usually overnight.

FIGURE 11.6 – MB-5.0 AND MB-6.0 SYSTEMS

MB SYSTEM NUMBER	PRIMER DRY FILM THICKNESS	BASE COAT	REINFORCEMENT & SATURANT	FINISH	TARGET MILS DRY THICKNESS FINAL
MB-5.0	Series 1407 5.0 mils (125 microns)	Series 1430 20.0 - 25.0 mils (510 - 635 microns)	211-226/227 Fiberglass Mat & Series 1415-900 20.0 mils (510 microns)	Series 1430 20.0 - 25.0 mils (510 - 635 microns)	65.0 mils (1,650 microns)
MB-6.0	Series 1407 5.0 mils (125 microns)	Series 1436 20.0 - 25.0 mils (510 - 635 microns)	211-226/227 Fiberglass Mat & Series 1416-900 20.0 mils (510 microns)	Series 1436 20.0 - 25.0 mils (510 - 635 microns)	65.0 mils (1,650 microns)

11.8 MB-5.0 AND MB-6.0 FINISH COAT

Before applying finish coat, the hardened glass mat saturant should be lightly sanded to dull the surface and knock down any wicking stray glass strands. After abrading, use clean dry cloths or vacuum to remove detritus created. Do not use solvent or styrene. Apply either Series 1430 (MB-5.0) or Series 1436 (MB-6.0) at 20.0 - 25.0 mils (510 - 635 microns) DFT preferably by spray application over prepared glass mat.

11.9 NOTES ON THICKNESS AND COVERAGE RATES

Individual product data sheets list a range of acceptable dry film thicknesses. The charts above list the standard specified film thickness for each product in the MB system specification, or if a range is given, highest dry film thickness listed. Exception are Series 1407 primer at 5-mils (130 microns) dry for concrete or steel.

Vinyl ester coatings have reactive monomers and some shrinkage between wet to dry application occurs.

For calculation purposes, 15% has been found as a generally accepted delta between wet to dry, therefore, calculations are based upon a theoretical 85% solids material. Expect exceptions between product types and for waste, as this is theoretically calculated.

12.0 CURING TIME

12.1 ALL MB SYSTEM MATERIALS

Check primer product data sheets for recommended "to recoat" times for Series 1407 Vinester.

TEMPERATURE	TO RECOAT	IMMERSION	MAXIMUM RECOAT
90°F (32°C)	3-hours	24-hours	3-days
70°F (21°C)	4-hours	48-hours	5-days
50°F (25°C)*	12-hours	4-days	7-days

*After the initial minimum temperature application conditions have been met, as per APPLICATION CONDITIONS 8.1.

12.2 MAXIMUM RECOAT WINDOW EXTENSION

If the maximum recoat window has been exceeded by less than 25-hours at the noted maximum temperature, it may be possible to still overcoat the lining. Follow Acetone or Styrene Sensitivity to check for acceptable secondary bonding is still present per Tnemec Technical Bulletin No. 22-119. Note: This test is not to be used to check for early recoat window for subsequent material coats of linings or earlier prior to published immersion time to service.

12.3 POST CURING (PC) GUIDANCE

Post curing **may** be required of an MB-Series system. Some chemical services will require post cure for optimum performance of the lining system. If not specifically noted as **not** required, it is best to re-check with Tnemec Technical Services or your Tnemec Coating Specialist prior project pricing and/or start of the project.

Allow 24-hours of cure at 70°F (21°C) and no less than 8-hour at higher ambient temperatures with good air movement in the tank or vessel prior to post curing. Inject via appropriate hot air make-up equipment warm air, raising the temperature 30-degrees Fahrenheit every 30-minutes, until a temperature of 150°F (66°C) is achieved and hold this temperature with good air exchange for a minimum of 4-hours.

12.4 DIRECT FOOD CONTACT GUIDANCE

All food, beverage and pharmaceutical lining services using ProPolymer Series vinyl ester products under 21 CFR 175.300 Direct Food Contact must be post cured by method herein described. Tank or vessel should be sanitized after post cure. For taste and odor sensitivity protocols the end user of the vessel should be consulted for any other additional conditions that my be required from their industrial hygienist or other competent persons and brought to the attention of the installing contractor in advance of project start. Dry food articles and pharmaceuticals do not require a post cure.

The following ProPolymer vinyl ester products are the only allowable linings for use in direct food contact vessels and tanks: Series 1402, 1420, 1422, 1430, and 1432.

12.5 BARCOL HARDNESS TESTING

Barcol hardness testing is an indication of complete cure in advance of placing the lining in immersion service. A minimum dry film thickness of no less than 30 mils dried is required to perform this test. Additional cure information, including Barcol hardness can be found in Tnemec Technical Bulletin No. 22-119. Following details outlined under ASTM D2583-13 the following are desired readings:

SERIES NUMBER	MINIMUM BARCOL HARDNESS
1444, 1448	20
1402, 1407, 1415, 1420, 1422, 1430, 1432	30
1416, 1418, 1428, 1436, 1438, 1439	40

13.0 INSPECTION & DISCONTINUITY TESTING

13.1 BLAST PROFILE (STEEL)

Refer to section 4.4 Preparation of Steel for more information.

13.2 WET & DRY FILM THICKNESS MEASUREMENT

Wet and dry film thickness readings for successive coats should be taken as soon as possible at a frequency of at least one per 100 sq. ft. and should be taken so as to avoid surface irregularities that could distort the readings. Readings on corners and in areas of intricate geometry should be taken every 10 sq. ft. to ensure proper wet coverage.

Certain ProPolymer and Vinester products may have fillers that can distort wet film thickness readings such as abrasion resistant additives or large glass flake filled trowel applied linings. It is recommended that a good practice is to identify and mark a specific location inside the tank or on the project substrate and determine how many gallons are required to be applied in the area to achieve the specified film thickness.

For example, use chalk to mark a 10' x 20' (200-sq. ft.). area and spray apply Series 1439 Vinester to achieve specified 25 mils (635 microns). With no loss, a 5-gallon kit (MK) will cover a 275 square foot area. With a 20% practical loss, a 5-gallon kit (MK) will allow for adequate material to cover the chalked 200-sq. ft. area.

13.3 FINAL INSPECTION - HIGH VOLTAGE DISCONTINUITY (SPARK) TESTING

If required by the contract specifications, high voltage discontinuity (spark) testing may be used to determine the presence and number

of discontinuities in the nonconductive MB Series coating systems applied to a conductive surface.

All high voltage discontinuity (spark) testing should be performed in accordance with NACE SP0188 and the procedures outlined herein. NACE SP0188 recommends AGAINST spark testing liners that have been placed in service.

The MB coating systems should be applied and allowed to cure within the parameters of the corresponding information herein. Sufficient curing time of the coating system should allowed prior to conducting a holiday test, as indicated by the, "Immersion" duration on the Product Data Sheets. Curing time will vary with surface temperature, air movement, humidity and film thickness.

It is acceptable if preferred, to perform discontinuity and holiday testing on some lining systems prior to the last coat/lift(s). After high-voltage inspection, make any repairs before proceeding and do not perform a second high-voltage testing on the complete lining system. Consult Tnemec Technical Services for additional direction if not doing full inspection until last topcoat. The following are few examples:

- MB-5.0/6.0, after the application of the saturant and before application of the finish coat.
- SS-1.2, between the first and second trowel glass flake applications.
- RS-5.0/6.0, after the application of the saturant over the glass roving and before the application of the abrasion resistant mortar coat.

Note: Series 1448 Vinester **cannot** be high voltage tested.

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.

The high voltage discontinuity (spark) testing voltage can be calculated using the tabulated total coating system thickness (in mils) multiplied by 100 volts DC. Never exceed the recommended 100 volts DC per mil, for excessive voltage may produce a holiday in the coating film. All high voltage discontinuity (spark) testing should be performed using a Tinker & Rasor model AP/W Holiday Detector.

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 bare concrete surface and weighted with a damp cloth and paper 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 should the voltage be increased above the recommended voltage potential.

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

TOTAL DRY FILM THICKNESS (MILS)	VOLTAGE (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 should be performed using the 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.

14.0 REPAIR

Consult with Tnemec Technical Services concerning repair procedures for specific MB, RS, or SS systems. In general, where imperfections, discontinuities or surface defects are present, or if a coating is damaged during inspection, the area in question should be masked and mechanically abraded to provide a consistent finish. Application of an additional brush coat may be necessary.

If immediate repair is not feasible (due to loss of blast), the affected area is to be masked off and repaired following application of the first coat. If welding is involved in the repair procedure, the masked area must measure 6" in any direction from the weld. The edges of all masked repair areas should be feathered using an abrasive cloth or wheel. Prepare the repaired area for coating using the surface preparation procedures for steel previously outlined in section 4.4. Any contamination resulting from the repair must be removed by solvent wiping prior to abrasive blasting.

A record should be kept of all repaired areas using a coordinate system. The repaired area must be spot-blasted and remain free of voids, undercutting and weld spatter and exhibit a minimum 3.0 mils (75 microns) angular anchor profile pattern.

If film defects are suspected to involve a significant void or holiday, or if the film has been damaged to the substrate,

contact your Tnemec representative or call Tnemec Technical Service at +1-816-483-3400 for specific recommendations.

15.0 HEALTH & SAFETY

ProPolymer and Vinester products are for industrial use only and must be installed by qualified coating and lining application specialists only. Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. Keep out of the reach of children.

More detailed health and safety requirements are available in the Material Safety Data Sheet. Contact your local Tnemec representative for more information.