SURFACE PREPARATION AND APPLICATION GUIDE

SERIES 391 TANK ARMOR

TABLE OF CONTENTS

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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 Tank Armor. 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 the Tank Armor Plural Component Equipment Recommendation Guide prior to starting. 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 PRODUCTS AND PACKAGING

2.1 SERIES 391 TANK ARMOR

An internal epoxy lining formulated for aggressive chemical immersion and corrosion control of chemical tanks. Contains micro-fiber reinforcement for improved film integrity. Series 391 exhibits superior resistance to a wide range of chemicals, acids, and fractionation blends with excellent physical properties for long term durability and service life of transport and storage tanks.

2.2 SERIES 391 PACKAGING

KIT SIZE	PART A (PARTIALLY FILLED)	PART B (PARTIALLY FILLED)	YIELD (MIXED)
Large Kit †	3 - 55 gallon drums	1 - 55 gallon drum	200 gallons (757.0 L)
Medium Kit †	3 - 6 gallon pails	1 - 6 gallon pail	20 gallons (75.7 L)

† Configured for plural-component applications only.
Note: Series G312-1234 TK can be used for repair or touch-up. Reference the Series 312 product data sheet for packaging and mixing information.

2.3 SERIES 391 COVERAGE RATES (THEORETICAL)

	DRY MILS (MICRONS)	WET MILS (MICRONS)	SQ.FT./GAL (M^2/GAL)
Suggested	30.0 (762)	30.0 (762)	53 (5.0)
Minimum	20.0 (508)	20.0 (508)	80 (7.5)
Maximum	40.0 (1015)	40.0 (1015)	40 (3.7)

Note: Series 391 can be applied to an optional high build thickness of 50 mils (1270 microns) in a single coat to meet specific industry requirements. Allow for overspray and surface irregularities. Application of coating below minimum or above maximum recommended dry film thickness may adversely affect coating performance.

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

Minimum storage temperature for the product is 20°F (-7°C) and maximum is 110°F (43°C). Prior to application, the material temperature will need to be between 70°F and 80°F (21°C and 27°C). It is suggested that the material be stored at the aforementioned temperatures at least 48 hours prior to use.

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%.

If dehumidification equipment is not used, the surface to be coated should be abrasive blasted within twenty four (24) hours prior to 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

Series 391 may be installed only when steel temperatures reach above the minimum temperature that is indicated on the Series 391 product data sheet. Necessary heating, as specified, should be by means of a heat exchange system that is incorporated into the dehumidified air supply. Air admitted into the tank should not pass directly through a combustion chamber.

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 this test must be followed by fresh water washing. The maximum allowed total soluble salt contamination before application of Series 391 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 prior to 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; and 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 NACE SP0178 latest revision, 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 readily visible when present in small quantities 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.

4.4 PREPARATION OF STEEL - ABRASIVE CLEANING

All steel surfaces to receive Tnemec's Tank Armor materials should be abrasive blasted to a white metal cleanliness in accordance with SSPC-SP5/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.

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″ 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 anchor pattern.

5.0 MIXING

Do not mix part A with part B. **CAUTION: Do not reseal mixed material**. Exothermic temperature can reach in excess of 250°F (121°C). An explosion hazard may be created.

5.1 DRUM SETS

Place blanket heaters on drums and set to medium heat. Recirculate the material through the primary heaters set to the highest setting back into the drums. Remove the center 2" bung on the drum and insert the drum agitator. The material should be 80°-90°F (27°-32°C) before the drum agitator is turned on. Agitate the material for 30-60 minutes before use or until the material in the drums reaches 110°-120°F (43°-49°C).

5.2 MEDIUM KITS

To aid in mixing this material, place it in a 70°F to 80°F (21°C to 27°C) heated area for 48 hours prior to its use. Then mechanically mix the entire contents of Part A and Part B separately. Use a minimum 10 amp, 3/4" heavy-duty drill with a PS Jiffy blade and mix the components for a minimum of two minutes. **Note:** Product must be heated to 110°-120°F (43°-49°C) prior to and during application.

5.3 SERIES 312 TOUCH-UP KIT

Series G312-1234-TK can be used for touch-up or repair of the Series 391 Tank Armor lining. The Series 312 touch-up kit consists of four (4) tubes along with six (6) static mixers.

Equipment: A dual cartridge applicator with a 26:1 thrust is required and can be ordered separately (F100-TKAP2).

Usage: Material tube must be used in conjunction with provided static mixer in order to ensure proper mixing. Unscrew retaining ring and remove both plugs. Save plugs in case entire tube is not used. Install static mixing element, replace retaining screw ring, and place tube in applicator. Pump handle until the material is of uniform color. This results in approximately 1 fluid ounce of waste material that cannot be used and should be discarded. Use a putty

knife or spatula to ensure adequate coverage and mixing.

For more information regarding repair, please reference section 9.0 of this guide.

6.0 APPLICATION & EQUIPMENT

6.1 APPLICATION CONDITIONS

The minimum surface temperature is 60°F (16°C) and maximum is 120°F (49°C).

The surface should be dry and 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%.

Under certain environmental conditions, this coating may develop an amine blush during cure. While this condition will not adversely affect the performance of this coating, amine blush must first be removed and then the coating aggressively sweep blasted prior to applying additional coating. Please contact Tnemec Technical Services for more information.

6.2 STRIPE COATING (WET ON WET)

Welds, seams and repaired areas should be given an initial brush coat of Series 391 prior to a full spray application to work the material into the surface. This should also apply to all areas inaccessible by spray gun and as necessary to achieve the specified dry film thickness and a surface free of imperfections.

6.3 TANK ARMOR - PLURAL COMPONENT EQUIPMENT RECOMMENDATION

Tank Armor is applied using a Graco XP70 heated plural component airless spray unit or equivalent. Contact Tnemec Technical Services for recommended equipment modifications.

GRACO XP70 HEATED PLURAL COMPONENT AIRLESS SPRAY

PUMP SIZE	Graco XP70
GUN	Graco XTR-7
TIP ORIFICE	0.021" - 0.029"
ATOMIZING PRESSURE	4500 - 5000 PSI (DYNAMIC)
PAINT LINE	50' - 3/8" (9.5 mm)
STATIC MIXERS	Two - 3/8" x 12 Fold SST Static Mixers One - 1/4" x 6 Fold SST Static Mixer
WHIP LINES	6' - 10' X 1/4"
PRIMARY HEAT (PRT A)	120°F - 130°F
PRIMARY HEAT (PRT B)	110°F - 120°F
HOSE HEAT	140°F - 160°F
MATERIAL TEMP AT GUN	115°F - 120°F
FILTERS	30 MESH WYE
PURGE TIME	Less than one minute
COMPONENT RATIO	3 (Epoxy) to 1 (Amine)

6.4 PUMP MAINTENANCE

Clean up and purge lines immediately after use with No. 4 Thinner or MEK.

7.0 CURING TIME

TEMPERATURE	TO HANDLE	MAX. RECOAT	IMMERSION
75°F (24°C)	8 Hours	24 Hours	5 Days

Note: If more than 24 hours elapsed between coats, the Series 391 coated surface must be mechanically abraded before topcoating. **Note:** For high temperature service (>90°F, 35°C) consult your Tnemec representative or Tnemec Technical Services. Curing time will vary with surface temperature, air movement, humidity and film thickness.

8.0 INSPECTION

8.1 BLAST PROFILE (STEEL)

Refer to section 4.4-Preparation of Steel for more information.

8.2 WET FILM THICKNESS MEASUREMENT

Wet 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.

8.3 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 Tank Armor coating system 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 Series 391 coating system should be applied and allowed to cure within the parameters of the corresponding Product Data Sheet. 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.

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.

8.4 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.

9.0 REPAIR

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. 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, repairs may be made using Series 312 touch-up and repair. Please refer to the Series 312 product data sheet for details.

10.0 HEALTH & SAFETY

Tank Armor is 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 for Series 391 are available in the Material Safety Data Sheet. Contact your local Tnemec representative for more information.