

# **PROPER METHODS OF SURFACE PREPARATION AND INSTALLATION OF AMERICAN SAFETY TECHNOLOGIES NON-SKID COATINGS**

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## **NON-SKID COATING SYSTEMS AND MIL-SPEC TESTING**

The non-skid products that are manufactured by American Safety Technologies are two component epoxy coatings. They are formulated, tested and qualified under the United States Navy Military Specification MIL-PRF-24667A. Within the matrix of this specification and other controlling documents these coatings shall be installed as a system. System simply means the primer; non-skid and color topping must all be purchased from the same manufacturer. Co-mingling of competing products is strictly prohibited and any deviation from this procedure will result in decertification of the flight deck.

Our non-skid coating systems may be installed onto aluminum, glass reinforced plastic (GRP), steel or wood. To achieve a successful installation and receive the expected longevity provided by these coatings proper surface preparation is required. Ninety percent of the failures associated with these coatings are a direct result of inadequate or improper surface preparation.

Due to the aggressive abrasion of the general-purpose non-skid coating (Comp G) we are required to manufacture a limited use coating (Comp L). This limited use coating formula is modified to contain aluminum as opposed to the aluminum oxide that is part of the general-purpose coating. The limited use coating system is installed within the tail hook impact and arresting gear purchase cable run out area on Aircraft Carriers. The sole purpose of the limited use coating is to sacrifice itself and decrease the abrasion of the arresting gear purchase cable. On U. S. Navy Fixed Wing Aircraft Carriers this equates to approximately 60,000 square feet/5,574 square meters of surface that receives the limited use non-skid.

After all laboratory testing is completed the products that comprise these coating systems must be installed on a Fixed Wing Aircraft Carrier for in- service testing. The actual test requirements are:

### **TYPE I**

Composition L  
10,000 Arrested Landings  
Composition G  
12 Months In-Service Test

### **TYPE II**

Composition L  
5,000 Arrested Landings  
Composition G  
6 Months In-Service Test

### **TYPE III**

Composition G  
6 Months In-Service Test

### **TYPE IV**

Composition G  
6 Months In-Service Test

After those milestones are achieved the final inspection is performed by, a NACE (National Association of Corrosion Engineers) Certified Coating Inspector, from the Carderock Division of Naval Surface Warfare Center. The coating systems are inspected for bonding, resistance to corrosion, profile retention and coefficient of friction under dry, wet, and oily conditions. At this point a Qualified Products List (QPL) is generated and transmitted to all commands within the Department of the Navy and Marine Corps. Our Safety Non-Skid Coatings Systems appear on the Qualified Products List for MIL-PRF-24667A as:

**TYPE I, COMP G**

MS-400G Non-Skid  
MS-400G (LT) Non-Skid  
MS-400G LSA Non-Skid  
MS-440G Non-Skid  
MS-7CZ Metal Primer  
MS-180 Color Topping  
MS-200 Color Topping

**TYPE I, COMP L**

MS-400L Non-Skid  
MS-400L (LT) non-Skid  
MS-7CZ Metal Primer  
MS-180 Color Topping  
MS-200 Color Topping

**TYPE II, COMP G**

MS-375G Non-Skid  
MS-440G Non-Skid  
MS-660G UV/LSA Non-Skid  
MS-7CZ Metal Primer  
MS-180 Color Topping  
MS-200 Color Topping

**TYPE II, COMP L**

MS-375L Non-Skid  
MS-7CZ Metal Primer  
MS-180 Color Topping  
MS-200 Color Topping

**TYPE III, COMP G**

MS-660G UV/LSA Non-Skid  
MS-880G Flexible Non-Skid  
MS-1600 Flexible Membrane  
MS-7CZ Metal Primer  
MS-180 Color Topping  
MS-200 Color Topping

**TYPE IV, COMP G**

MS-375G Spray On Non-Skid  
MS-2000G Spray On Non-Skid  
MS-7CZ Metal Primer  
MS-180 Color Topping  
MS-200 Color Topping

Prior to beginning the surface preparation and installation procedure there are some lessons learned by the U.S. Navy that are noteworthy. Normal flight operations will contaminate the non-skid coatings with jet fuel, hydraulic fluid, oil and seawater. If these contaminants are not removed prior to resurfacing the flight deck the vacu-blast machine will drive them onto the blasted substrate. This has generated a requirement by (COMNAVAIRPAC/COMNAVAIRLANT) via a mandatory instruction. The instruction requires that all ships entering port for non-skid resurfacing shall scrub the entire flight deck with a cleaner degreaser. The flight deck is then rinsed with fresh water while paying particular attention to salt removal from aircraft securing fittings, cracks, crevices, etc.

## ENVIRONMENTAL CONDITIONS

The following environmental conditions shall be met during removal of existing non-skid coatings and installation of the primer, non-skid and color topping.

<b><u>COMPONENT STORAGE</u></b>	<b><u>MINIMUM</u></b>	<b><u>MAXIMUM</u></b>
Long Term	55°F / 12 °C	100°F / 37°C
24 Hours Before Mixing	70 °F / 21 °C	80°F / 26°C
Ambient Air Temp	55 °F / 12 °C	100°F / 37°C
Substrate Temp (Primer)	40 °F / 4.4 °C	120°F / 48.8°C
Substrate Temp (Non-Skid)	40 °F / 4.4 °C	110°F / 43.3°C
Relative Humidity	Zero	85%
Dew Point	The substrate temperature must be at least 5 ° F/ 2.78 ° C above the dew point.	
Wind	15 MPH (24KPH)	

## SURFACE PREPARATION

The non-skid coating systems manufactured by AST are high performance, textured, polymer coatings that must withstand very abusive flight operations. This environment requires more extensive methods of surface preparation to ensure the coating system adheres to the substrate. Surface preparation methods required by AST are abrasive blast, hydro-blast and power tool cleaning. These methods are compiled by the National Association of Corrosion Engineers (NACE), Steel Structures Painting Council (SSPC) and Swedish Standards (SA).

All equipment fixed in place that may be damaged by the abrasive blasting process shall be protected. Plywood or net barriers must surround the non-skid job site to contain the stray steel shot. If netting material is used the size of the mesh must be small enough to ensure the rebounding shot will be contained. The ends of this material must be overlapped and anchored at the bottom to prevent the shot from being blown about.

### **SSPC-10/NACE NO.2 AND SA 2 \_ - Near White Metal**

Requires the use of steel shot centrifugal wheel vacuum-blast machines, which yield the highest degree of deck cleanliness. These machines save time in large open areas as the blast track is large, shot is contained and the shot is also recirculated. The metal substrate shall be free of oil, grease, dirt visible mill scale, rust, corrosion products, oxides, paint and other foreign particles. But 95% of each square inch/6.45 square centimeters shall appear as a surface that has been blast cleaned to near white metal. The depth of the metal profile is dependent upon the size of the blast media and the speed of the blast machine. The prepared surface metal anchor tooth profile shall be 3-4.5 mils/75-111.25 microns.

### **SSPC-11/SA 3- Very Thorough Power Tool Cleaning**

Requires the use of deck crawlers, power rotary brushes, scaling hammers, needle gun, scalers, sanders and grinders. This method is used for deck edges, around stanchions or any obstructions that will prevent the use of the vacuum blast machines. These tools shall remove all rust, loose mill scale and paint to bare metal. There may be slight residues of existing coatings and foreign particles left in pitted areas or crevices after cleaning is complete. A minimum of 1 mil/25 microns metal anchor tooth profile must be achieved.

After completing surface preparation the entire area should be blown clean using compressed air that is free of oil and water. Visually inspect the entire area for contaminants to ensure that the power tool-cleaning requirement has been met.

### **SSPC-12/NACE 5 WJ-2 Standard**

**IMPORTANT NOTE:** Current requirements during new construction dictate that vacu-blast machines are used to provide the required 3-4.5 mil/75-111.25 micron surface metal anchor tooth profile. Water Jet/Ultra-High Pressure water will not provide any type of surface metal anchor tooth profile.

The Water Jet/Ultra-High Pressure prepared surface will not have the appearance of a surface that has been cleaned via vacu-blast machines. In lieu of the near white metal appearance of vacu-blasted steel the WJ/UHP cleaned surface will have a matte finish. It will appear dull gray with occasional black spots known as inert carbon shadowing.

Surface shall be prepared to matte finish with a minimum of 95% of surface area free of previously existing residues. The remaining 5% of surface area shall only contain randomly dispersed rust stains, coatings and foreign matter.

### **MEASURING SURFACE PROFILE**

The metal anchor tooth profile must be measured to ensure the correct peak to valley ratio has been achieved. The most common method of measurement is to use Testex Press-O-Film replica tape and a micrometer. Ensure area to be tested is free of all dirt and debris which could alter the reading. For non-skid surface preparation it should be X-Coarse with a circular window in the center. Place the replica tape onto the substrate, use the round end of the plastic stick provided and move it in circular motions over the window. Lift the replica tape; insert into the micrometer between the measuring platens and lower the platens slowly onto the center of the window by lowering the lever. Take the reading, subtract the thickness of the tape, which should be 2 and record the measurement. Remove the protective cover from the adhesive backed tape and place tape onto the Quality Assurance record sheet/log.

## **MIXING NON-SKID SYSTEM PRODUCTS**

The metal primer, non-skid and color topping that comprise the complete non-skid system are all packaged as two-component epoxy kits. These products may be shipped in 1 U.S. gal/3.78 liter or 5 U.S. gallon/18.90 liter containers.

The 1 U.S. gallon/3.78 liter kit will be packaged by the case with the A and B component as separate containers within the carton. The base material will be in the A part container and the hardener or converter will be in the smaller B part container.

The 5 U.S. gallon/18.90 liter kit will actually be packaged in a 6 gallon/22.7 liter pail. The base material A part will be in the bottom of the container. The hardener or converter B part will be in a plastic bag, which lies in a plastic insert that hangs from the lip of the pail. The purpose of the six-gallon container is to permit the complete kit to be mixed within the shipping container.

In the U.S. we call the correct mixing device a "Jiffy" Mixing Blade. Any mixing apparatus that will blend heavy fluids using an upward spinning motion will suffice. All heavy fluids will settle and become somewhat compacted into the bottom of the container during the shipment. The settling will happen whether shipped as land, ocean or airfreight. DO NOT EVER ship the kit of non-skid by rail. The metal-to-metal vibration compacts the grit half way up the pail. It takes a lot of effort to break and blend the grit back with the existing solvent to become the original base material.

To comply with the Air Pollution Control rules for California, AST has to meet specific quantities of Volatile Organic Compounds (VOC). The result is a lower volume of solvent within the base material. After removing the lid from the container lift the plastic insert and bag of hardener only when ready to mix the entire kit.

Always refer to the environmental conditions listed earlier for storage 24 hours prior to mixing all of these coatings. As mentioned earlier the metal primer, non-skid and color topping are all two-component epoxy kits. This fact will allow you to use the same mixing procedure for all of the coatings.

Ensure the mixing blade is moved up and down, around pail edge and bottom throughout the mixing evolution. This method dislodges any lumps that may be clinging to the bottom or sides of the pail. Upon removing the lid and plastic insert thoroughly mix the base material A part for 3-5 minutes. Add the B part and mix again for 3-5 minutes. All these coatings once mixed have a varied pot life and you should always refer to the Technical Data Sheet or ASTM-F718 prior to mixing.

**(VERY IMPORTANT)** The non-skid coating systems manufactured by AST DO NOT require any induction or stand in time. Once mixed they can be applied immediately.

## **APPLICATION OF METAL PRIMER TO METAL SUBSTRATES**

All prepared metal surfaces shall be covered with primer not later than 6 hours after blasting or prior to the formation of flash rusting. If oxidation is visible the entire surface must be brush/speed blasted prior to primer application.

COMNAVSEASYSCOM has directed the application of a stripe coat to all weld beads in conjunction with the normal primer coat. There are variances with the methods used. Aircraft Carriers use one stripe coat and a single coat of primer. LHA/LHD vessels have one stripe coat, a coat of primer followed by a second coat of primer. Ensure that you refer to the ASTM-F718 Revision 12 for the proper application of the stripe coat.

Ensure that all security barriers are in place and clean the entire surface with dry, clean air, prior to applying the primer. All areas that are not to receive the primer or that could become contaminated with over spray should be covered. Perform a good visual inspection of the blasted metal surface looking for any oil, grease spot, rust or contaminants. After all parties responsible for the Quality Assurance inspection are in agreement you are ready to apply to the primer.

The primer may be applied using conventional or airless spray equipment or by roller. If applied by roller the primer coat must be applied then cross rolled to ensure there are no holidays in the coating. For large areas such as a flight deck the airless equipment is the preferred method. Apply the primer at 6-8 mils/150-200 microns wet film thickness (WFT). WFT readings shall be taken and recorded throughout the application of the primer coat. It is MANDATORY that the HIGHEST PEAK of the measured surface metal anchor tooth profile receives a MINIMUM of 2 mils/50 microns of primer during application.

The amount of time required for the primer to set "tack free" is dependent upon the environmental conditions at the job site. Please refer to the MS-7CZ ASTM-F718.

**IMPORTANT NOTE:** ALWAYS ensure all personnel walking onto primed metal surface wear some type of shoe covers similar to surgical boots.

## **ROLLER APPLICATION OF NON-SKID COATINGS**

The required readings listed under environmental conditions shall be taken and recorded every hour throughout the non-skid application. If it appears environmental conditions are diminishing readings should be taken every 15 minutes.

The non-skid coatings should be applied within 36 hours of the primer application. If that is not feasible and 36-72 hours have passed the entire area shall be wiped with clean fresh water or xylene. Use clean white lint free rags to wipe the surface and wipe up the cleaning agent with a new clean lint free rag. Should more than 7 days pass prior to non-skid application entire area must be speed blasted and another coat of primer applied.

A visual inspection should be performed of the primed metal surface. This inspection should ensure there are no contaminants on the primer. If rain or heavy dew has fallen after the primer has been applied the entire surface should be wiped down with clean fresh water or xylene. Use clean white lint free rags to wipe the surface and wipe up the cleaning agent with a new clean lint free rag.

Mask off all areas of the work site that is not going to receive the non-skid coatings. Care should be taken to ensure that the masking tape is applied in a manner that will leave a square or a circle. The more attention to detail that is applied to these areas the more aesthetically pleasing the finished product.

Take and record dry film thickness (DFT) readings of the primed surface in accordance with the local Quality Assurance Instructions. Any areas that do not read 2-4 mils/50-100 microns DFT shall be repaired as directed by the contract.

**(CAUTION)** The non-skid coating shrinks during the curing process, if it is applied too thick at the weld bead it will crack while curing. Consequently all weld beads shall be cross rolled to avoid excessive build up of coating in these areas.

Pour a ribbon approximately 6-10 inches/3.28 meters wide and 6-8 feet/3.2 meters long onto the primed surface. The non-skid should be rolled in a fore and aft direction or toward the bow and stern of the vessel. The installation crew should all work in a parallel line as they roll the coating aft onto the primed surface. All motions of the roller should be a pull stroke toward the person applying the coating. Excessive fore and aft strokes will over work the coating and balling or lumps will appear. On days of high ambient and metal surface temperatures these mistakes cannot be corrected and must be repaired.

The average spread rate for roller applied non-skid should be 150 square feet per 5 gallon kit or 13.9 square meters per 18.9 liter kit. Immediately after non-skid is applied ensure all security barriers are still in place. Allow the non-skid to cure as long as possible prior to permitting pedestrian or vehicle traffic.

The surface and substrate temperatures have the greatest impact on the initial cure process since the coatings cure from inside out. As the cure progresses the ambient air temperature becomes the controlling factor due to solvent bleed off. When the ambient temperature lowers the cure process slows down and it will take the coating longer to cure. This is especially true for AST's high solids coatings. The coatings should have a minimum of 36 hours cure at 70°F/21°C prior to pedestrian traffic and 72 hours before vehicle traffic is allowed. Complete cure of epoxy non-skid systems takes 7-10 days depending on the ambient and surface temperature.

When pedestrian traffic is feasible all masking tape previously applied should be removed. These areas should be wiped with xylene and the finish topcoat should be applied onto the primed surface.

### **SPRAY APPLICATION OF NON-SKID COATINGS**

A U.S. 5 gallon/18.9 liter heavy fluid bottom feed spray pot with an agitator should be used. The spray pot should contain a double regulator with a 1 inch/2.54 cm ID outlet pipe. A 25 foot/7.6 m of 3/8 inch/.95 cm hose that is    inch/1.9cm with    inch/1.9 cm female connectors at each end is needed. The 4 foot/1.2 m pole gun with    inch internal air cap is the preferred application equipment.

Air pressure of 20 CFM at 90 lbs, material pressure at 15-20 PSI and atomization set at 20-25 PSI are the normal settings. Atomization pressure should always be higher than the pot pressure. Weather conditions at the time of application will vary and these adjustments should not be considered mandatory.

ALWAYS prime the material feed lines with solvent prior to pouring the non-skid into the pot. During high temperatures and humidity these hoses should be flushed solvent every hour. Use an empty non-skid container to spray the non-skid into while adjusting pressure, then hold the pole gun 18-24 inches/46-60 cm above substrate. The spread rate of spray on non-skid should average 50 sq ft or 4.6 sq m per 3.7 liter per (1 U.S. gallon). Overlap each pass by 50% to ensure the application is always wet. Keep the pole gun moving to prevent excessive build up of material on the surface.

### **NON-SKID INSTALLATION ON GLASS REINFORCED PLASTIC (GRP)**

Prior to beginning surface preparation the entire GRP deck should be wiped clean using xylene. Care must be taken to ensure that the contamination is removed using clean lint free rags to apply and remove the xylene.

Vacuum blasting is neither required nor a good idea on Glass Reinforced Plastic (GRP). The most used method of surface preparation on GRP is via SSPC SP-11 Power Tool Cleaning.

Leave the security barriers in place for as long as possible. Since access in a shipyard is of primary concern allow pedestrian traffic after 36 hours and vehicle traffic after 72 hours.

### **APPLICATION OF COLOR TOPPING ONTO THE NON-SKID**

The Color Topping manufactured by AST is also a two component epoxy coating. When ordering this material consideration should be given to total area it will cover. This product is packaged in U.S. 1 gal/3.7 liter and U.S. 5 gal/18.9 liter containers. This is an ideal opportunity for mixing too much material which will result in money lost. If small areas of Safety Markings are to be painted the U.S. 1 gal/3.7 liter should be used.

Color Topping should only be applied to those areas that designate Safety Zones or Visual Landing Aids for aircraft. Using this coating for cosmetic purposes will decrease the co-efficient of friction the non-skid coating is formulated to provide.

This coating should be mixed in the same manner as the primer/non-skid. You should ensure that the environmental conditions applied to the storage 24 hours prior to mixing are applied here.

There have been several attempts to spray apply Color Topping onto the lines that have been masked off. Most shipyards are in areas where a constant sea breeze is blowing onto the vessel being repaired. To alleviate over spray the best method of application is via long nap roller. The purpose of the long nap roller is to ensure that the coating covers both peaks and valleys of the profile. The spread rate for MS-200 Color Topping should be approximately 320 square feet per U.S. gallon/7.84 square meters per 3.78 liter kit.

### **VISUAL QUALITY ASSURANCE INSPECTION**

Prior to expending the man hours required to mask off and apply the color topping for markings inspect the non-skid for:

Delamination- Normally found when the non-skid separates from the primer. Possible causes could be POL products on the primer, primer/non-skid not mixed properly or improper surface preparation.

Weld Beads- Ensure that the weld beads are cross rolled 3-6 in/7.62-15.24 cm on each side of weld beads. Check these areas specifically for cracking where nonskid is applied too thick.

Profile Irregularities- The non-skid profile should appear as a uniform peak to valley pattern. Areas where the coating has been over worked will appear as balled or flat.

Discoloring- If inclement weather is expected installation of the on-skid should be delayed. If the coating is rained on or subjected to heavy dew before cure process has adequate time the color will become light gray. The non-skid will continue to reach complete cure and will be serviceable. However, it will not be dark gray and will become an immediate concern of the vessel owner.

### **QUALITY ASURANCE THROUGHOUT RESURFACING PROCESS**

Each individual shipyard will have their own methods and rules for performing QA Inspections. They will also have a variety of different forms for recording these inspections. All QA Inspection records should be kept on file until the warranty for work performed has expired.

C. J. Heard  
National Account Manager  
Military/Marine Market  
[astcv@pacbell.net](mailto:astcv@pacbell.net)