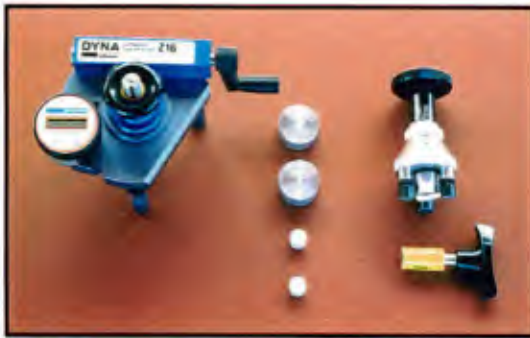




NAVAL FACILITIES ENGINEERING SERVICE CENTER
Port Hueneme, California 93043-4370

SPECIAL PUBLICATION SP-2057-SHR

HANGAR FLOOR COATING SPECIFICATIONS: THIN FILM, THICK FILM, AND OVERCOATING SOUND COATING SYSTEMS



by

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October 1999

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EXECUTIVE SUMMARY

The Special Publication was developed for use with the Naval Facilities Engineering Service Center's (NFESC) Users Guide titled "Condition Assessment and Coating Recommendations for Aircraft Maintenance Hangars (UG – 2036 – SHR)." A condition assessment in accordance to the Users Guide is required prior to specifying one of three, non-conductive, hangar floor coating systems: 1) Thin film coating system (≥ 16 mils: 1 mil = 0.001"), 2) Thick film coating system (≥ 250 mils), and 3) Overcoating sound coating systems. Coating specifications based upon the above coating systems are enclosed in the Appendices. Presented within the publication are the following sections: A) Coating system requirements, B) Quality control, C) Chemical resistance of topcoat, D) Cleaning coating systems, and E) Conductive coating system.

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INTRODUCTION

The Special Publication was developed for use with the Naval Facilities Engineering Service Center's (NFESC) Users Guide titled "Condition Assessment and Coating Recommendations for Aircraft Maintenance Hangars: UG – 2036 – SHR." A condition assessment in accordance to the Users Guide is required prior to specifying one of three, non-conductive, hangar floor coating systems: 1) Thin film coating system (≥ 16 mils: 1 mil = 0.001"), 2) Thick film coating system (≥ 250 mils), and 3) Overcoating sound coating systems. Coating specifications based upon the above coating systems are enclosed in the Appendices. Presented below are the following sections: A) Coating system requirements, B) Quality control, C) Chemical resistance of topcoat, D) Cleaning coating systems, and E) Conductive coating system.

COATING SYSTEM REQUIREMENTS

THIN FILM COATING SYSTEM

A thin film coating system is for use on hangar floors with the following condition assessment results: 1) "Smooth" concrete surface texture, 2) Average moisture vapor emission rate ≤ 3.0 lbs/24 hours, 1000 ft², 3) Average concrete surface strength ≥ 200 psi, and 4) Average surface depth of hydrocarbon contamination $\leq 1/4"$. A thin film coating system may be applied to floors with a coarse surface texture, however the concrete's surface texture may mirror through the coating system to decrease aesthetics. Installation costs: \$3.00 - \$4.25 ft². Thickness: ≥ 16 mils. Approximate service life: *Overcoating at 4 years*. Benefits: *Low cost, fast installation, and average applicator skill*. The "Thin Film Coating System" specification is enclosed in Appendix A.

THICK FILM COATING SYSTEM

A thick film coating system is for use on hangar floors with the following condition assessment results: 1) Either "Smooth" or "Coarse" concrete surface textures, 2) Average moisture vapor emission rate ≤ 5.0 lbs/24 hours, 1000 ft², 3) Average concrete surface strength ≥ 200 psi, and 4) Average surface depth of hydrocarbon contamination $\leq 1/4"$. Installation costs: \$5.50 - \$8.00 ft². Thickness: ≥ 250 mils. Approximate service life: *Overcoating at 4 years*. Benefits: *Tolerates high moisture vapor emission rates, produces a level surface over coarse concrete, high impact resistance, and may provide a suitable topcoat base for ≥ 10 years service*. The "Thick Film Coating System" specification is enclosed in Appendix B.

OVERCOATING SOUND COATING SYSTEMS

Overcoating sound coating systems is to be used over either epoxy or urethane coating systems with the following condition assessment results: 1) Average moisture vapor emission rate ≤ 3.0 lbs/24 hours, 1000 ft², 2) Average coating system adhesive strength ≥ 250 psi or ≥ 200 psi with coating system producing cohesive failures within the concrete, and 3) Coating system failures total ≤ 7 % of floor surface. Installation costs: \$1.25 - \$2.50 ft². Thickness: ≥ 5 mils. Approximate service life: *At 4 years, either overcoating or complete coating system removal*. Benefits: *Increases service life of existing coating system*. The "Overcoating Sound Coating Systems" specification is enclosed in Appendix C.

QUALITY CONTROL



Relative humidity and temperature measuring equipment.



Adhesion tester, air-cooled core drill, core bit, and pull-off coupons.

Temperature and relative humidity requirements are provided in the specifications and are to be followed during the application of coatings and sealant. The specifications also detail coating adhesion requirements. Adhesion testing is to be performed at various stages throughout the application of coatings.

CHEMICAL RESISTANCE OF TOPCOAT

During the first two-weeks of service and without full chemical resistance, several urethane topcoats continue to cure. During this period, chemical spills and drips should be immediately removed from floor surfaces.

When performing maintenance on aircraft with new tires, place either cardboard or a plastic sheet under each tire until new tires become slightly worn (approximately three or more take-offs and subsequent landings). New tires under warm conditions may produce dark-colored tire imprints in the specified topcoat. Without affecting the topcoat's performance, the resulting imprint permanently stains the topcoat.

CLEANING COATING SYSTEMS

Either mopping or light scrubbing using a pH neutral detergent followed by rinsing under low pressure (≤ 500 psi) may be used to clean coating systems. Scrub brushes are to be made from soft nylon fibers. Detergents containing bleach, acids (low pH), alkali (high pH), abrasive particles (cleansers), and organic solvents are not recommended. Do not wax or polish coated surfaces.

CONDUCTIVE COATING SYSTEM

Each of the enclosed coating systems may be specified as a conductive coating system. Conductive coating systems reduce the build-up of static electricity on floor surfaces and may be required on hangar floors where flammable liquids, flammable gases, and munitions are either used or stored.

APPENDIX A

THIN FILM COATING SYSTEM

PART 1 GENERAL

1.1 **Background (Place condition assessment results here).**

1.2 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM C 307 1994 Test Method for Tensile Strength of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing
- ASTM C 579 1996 Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- ASTM D 412 1998 Test Method for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers - Tension
- ASTM D 638 1996 Test Method for Tensile Properties of Plastics
- ASTM D 1308 1993 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- ASTM D 2240 1997 Test Method for Rubber Property-Durometer Hardness
- ASTM D 4541 1995 Test Method for the Pull-off Strength of Coatings Using Portable Adhesion Testers
- ASTM E 11 1995 Standard Specification for Wire Cloth and Sieves for Testing Purposes
- ASTM E 831 1993 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis

FEDERAL STANDARDS

Federal Standard 595B: Colors

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.59 Hazard Communication

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI Technical Guideline No. 03732: "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays".

1.3 Submittals

All submittals shall be submitted to the Government for approval and records.

- a. Two Component Epoxy Polyamine Grout Primer
- b. Three Component Sand Filled Epoxy Grout
- c. Four Component Sand and Pea Gravel Filled Epoxy Grout
- d. Two Component Polysulfide Sealant
- e. Two Component Epoxy Polyamide Primer
- f. Two Component Urethane Topcoat
- g. White Aluminum Oxide Non-Skid Grit (#50, #60)
- h. Degreaser(s)
- i. Material Certificates (Section 1.3.2)
- j. Contractor Qualifications (Section 1.3.3a)
- k. Coating System Performance (Section 1.3.3b)
- l. Sealant Performance (Section 1.3.3c)
- m. Procedural Variation(s) (Section 1.3.4)
- n. Scheduling (Section 1.3.5)
- o. Warranty (Section 1.3.6)
- p. Certified Coating and Sealant Applicator (1.3.2h)

1.3.1 Instruction

For materials a. – h., submit formulator's printed instructions to include brand name, catalog numbers, and name of manufacturer. Include in the instructions (if applicable) date material was manufactured, shelf-life, detailed mixing and application procedures, quantity of material to be used on job, minimum and maximum application temperatures, and curing procedures. Include copies of Material Safety Data Sheets (MSDS) for all materials to be used at the job site. All coatings shall be manufactured by one coating vendor. Each material shall contain less than 350 g/l of Volatile Organic Compounds (VOC).

1.3.2 Certificates

- a. *Two Component Epoxy Polyamine Grout Primer*
Submit certified conformance to the requirements set forth in Section 2.1.1.
- b. *Three Component Sand Filled Epoxy Grout*
Submit certified conformance to the requirements set forth in Section 2.2.1.
- c. *Four Component Sand and Pea Gravel Filled Epoxy Grout*
Submit certified conformance to the requirements set forth in Section 2.3.1.
- d. *Two Component Polysulfide Sealant*
Submit certified conformance to the requirements set forth in Section 2.4.1.
- e. *Two Component Epoxy Polyamide Primer*
Submit Certified conformance to the requirements set forth in Section 2.5.1.
- f. *Two Component Urethane Topcoat*
Submit certified conformance to the requirements set forth in Section 2.6.1.
- g. *White Aluminum Oxide Non-Skid Material*
Submit certified conformance to the requirements set forth in Section 2.7.1.
- h. *Certified Installation Contractor*
Installation contractor shall be certified by both the coating and sealant manufacturer in the correct handling, mixing and application of their materials. Submit copy of certificates.

1.3.3 Statements

a. Contractor Qualifications

Minimum requirements for installation contractor are as follows: Installation contractor shall have completed three or more jobs within the past two years applying the materials listed in Section 1.3.1 (a – h) exclusively to concrete surfaces in which the total area exceeds 200,000 square feet. Contractor shall submit documentation listing location of work, point of contact at job site, total square footage of applied materials, listing of both materials and equipment used, and validation from coating manufacturer documenting quantity of materials purchased per job for work totaling 200,000 ft² and within the past two-years. Customers referenced by contractor shall be contacted by Government to confirm contractor's work is acceptable.

b. Coating System Performance

The manufacturer of the coating system shall submit literature documenting the past performance of the coating system's use in aircraft maintenance hangars. Minimum requirements are two or more aircraft maintenance hangars totaling 34,000 ft² whereby the coating system has performed for two years with less than 1 % combined premature coating failures, material defects and surface discoloration (≤ 0.5 % discoloration due to aviation chemicals, tire plasticizers, and UV exposure). In addition, coating system shall exhibit greater than 85 % non-skid grit retention within the above time frame. Coating manufacturer shall list location of hangars, total coated area per hangar, hangar point of contact, date coating system was applied, and the names of the installed coating materials. Government shall contact each hangar to confirm performance of coating system.

c. Sealant Performance

The manufacturer of the sealant shall submit literature documenting the past performance of the sealant's use in aircraft maintenance hangars. Minimum requirements are two or more aircraft maintenance hangars with joint work totaling 10,000 linear feet whereby the sealant has performed for two years with less than 1 % combined sealant failures and defects. Sealant manufacturer shall list location of hangars, total linear feet of sealant applied per hangar, hangar point of contact, date sealant was applied, and the name of the installed sealant material. Government shall contact each hangar to confirm performance of sealant system.

1.3.4 Work Procedure

Contractor shall submit all procedural variations different than those outlined in Part 3 titled Execution.

1.3.5 Scheduling

Contractor shall submit procedural scheduling, for Government approval, to complete work within twelve (12) consecutive days (weekends and evenings may be included). Contractor shall assign one supervisor to the job who is to remain on site throughout all phases of work who, in addition, is to act as the primary point of contact between Government and contractor. This person shall be identified in the submitted schedule. All work shall be performed in a manner as to cause the least interference with the normal functions of the Government activity.

1.3.6 Warranty: Installation and Materials

Materials and workmanship used to perform spall repairs, crack repairs, coating work, and sealant work shall be warranted by the "Installation Contractor" for a minimum of one-year following material application. Materials and workmanship shall be subjected to the terms and conditions defined as follows. The entire floor coating system shall be removed and replaced at the expense of the installation contractor (cost includes materials plus application) if $\geq 1.0\%$ of the total coated surface becomes either blistered (chemical), checked, soft, or lifts within one-year following application. Within the warranty period, failures greater than 3/8" diameter (of the above type) totaling less than 1.0 % of coated surfaces (including spall repairs) shall be identified and repaired at contractor's expense. Cosmetic imperfections due to scratching and gouging are excluded from the warranty. If the coating system's adhesion is in question, one adhesion test (ASTM-D-4541) shall be performed per 100 ft². Each adhesion test shall produce cohesive failures within the concrete above 200 psi with concrete chunks attached to each pull-off coupon. All areas tested for adhesion that do not produce cohesive failures within the concrete and, in addition, exhibit adhesion values below 200 psi shall require removal and replacement at installation contractor's expense. There shall be 0 % sealant failures within one year. All sealant material within the warranty period displaying either chemically attacked surfaces or lifting from joint walls shall be removed and reinstalled at the expense of the installation contractor.

1.4 Materials: Condition, Storage, Disposal

Materials on site shall be inspected for damage prior to use. Packaged materials in dented, rusty, or leaking containers and, in addition, materials with an expired shelf life shall be returned to manufacturer. Packaged materials shall be unloaded and stored out of sun and weather, preferably in air-conditioned spaces. All unused material, whether in its' cured or uncured state, shall be removed from the job site by contractor.

1.5 Safety

Throughout all phases of work, contractor shall follow the requirements of the Occupational Safety and Health Administration (OSHA), 29 CFR 1926.59, and safety procedures as recommended by the material manufacturers. Safety procedures may include employing the use of respirators, impervious clothing, gloves, face shields, and ear plugs. Prior to use and per material, contractor shall understand the information contained in Material Safety Data Sheets (MSDS).

1.6 Demonstration of Coating System

Prior to the approval of the coating system, contractor shall apply the complete coating system to a ten-foot square section of concrete. Materials and procedures outlined in Parts 2 & 3, including full broadcasts of non-skid grit, shall be used in the application of the test patch. One week following the final topcoat application, three adhesion tests in accordance to ASTM-D-4541 shall be performed. Each adhesion test shall produce cohesive failures within the concrete above 200 psi with concrete chunks attached to each pull-off coupon. If cohesive failures are not produced within the concrete, either coating system is unacceptable or concrete surface preparation was insufficient. If coating system is unacceptable, contractor shall submit a new coating system manufactured by a different coating vendor and re-perform the above testing. If concrete surface preparation was insufficient, contractor shall apply an additional coating system patch to properly prepared concrete followed by the

above testing. Immediately following adhesion testing, patch shall be sanded flush with surrounding concrete.

PART 2 PRODUCTS

2.1 Two Component Epoxy Polyamine Grout Primer

Two component, 100 % solids, epoxy polyamine primer for use in repairing spalled concrete prior to the application of epoxy grouts.

2.1.1 Epoxy Polyamine Primer

The epoxy polyamine primer shall be formulated to exhibit the following properties as listed in Table 1.

Table 1: Properties of Epoxy Polyamine Primer

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Color	Clear to Amber
Application Thickness	5 to 30 mils Dry Film Thickness per coat
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate.

2.2 Three Component Sand Filled Epoxy Grout

Three component, 100 % solids, sand filled epoxy grout for use in the repair of spalled/chipped concrete with an inner depth less than 1.0”.

2.2.1 Sand Filled Epoxy Grout

The sand filled epoxy grout shall be formulated to exhibit the following properties as listed in Table 2.

Table 2: Properties of Sand Filled Epoxy Grout

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Compressive Strength (ASTM-C-579)	7,600 psi ± 1000 psi
Tensile Strength (ASTM-C-307)	1,800 psi ± 300 psi
Hardness (ASTM-D-2240: Shore D)	80 – 92

Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 11.5 x 10 ⁻⁶ in/in°F
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the grout shall not contain blisters, checks, or lift from substrate.

2.3 Four Component Sand and Pea Gravel Filled Epoxy Grout

Four component, 100 % solids, sand and pea gravel filled epoxy grout for use in the repair of spalled/chipped concrete with an inner depth greater than 1".

2.3.1 Sand and Pea Gravel Filled Epoxy Grout

The sand and pea gravel filled epoxy grout shall be formulated to exhibit the following properties as listed in Table 3.

Table 3: Properties of Sand and Pea Gravel Filled Epoxy Grout

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Compressive Strength (ASTM-C-579)	7,600 psi ± 1000 psi
Tensile Strength (ASTM-C-307)	1,400 psi ± 300 psi
Hardness (ASTM-D-2240: Shore D)	80 – 92
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 11.5 x 10 ⁻⁶ in/in°F
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the grout shall not contain blisters, checks, or lift from substrate.

2.4 Two Component Self-leveling Polysulfide Sealant

Two component, 100 % solids, self-leveling polysulfide sealant formulated with high chemical resistance and capable of withstanding ± 25 % joint movement.

2.4.1 Sealant

The two component polysulfide sealant shall be formulated to exhibit the following properties as listed in Table 4.

Table 4: Properties of Sealant

Sealant System	Polysulfide: Manganese Cure (MnO ₂)
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume

Hardness (ASTM-D-2240: Shore A)	20 – 30
Tensile Strength (ASTM-D-412)	150 – 200 psi
Percent Elongation (ASTM-D-638)	≥ 500 %
Adhesion to Concrete	≥ 130 psi
Tack Free @ 65°F	12 hours maximum
Full Cure @ 65°F	24 hours: Full Chemical Resistance
Adhesion of Epoxy Polyamide (paintable sealant)	≥ 130 psi (chemically compatible)

¹A 2" x 1/2" x 1/2" section of cured sealant shall be immersed and tested.

2.5 Two Component Epoxy Polyamide Coating System Primer

Two component, solvent based, epoxy polyamide penetrating primer for use on properly prepared concrete.

2.5.1 Primer Coat

The two component primer coat shall be formulated to exhibit the following properties as listed in Table 5.

Table 5: Properties of Primer Coat

Resin System	Epoxy Polyamide
Percent Volume Solids	≥ 62 %
Color: White (Fed. Std. 595B)	17925
Application Thickness	2 to 20 mils Dry Film Thickness per coat
Specular Gloss at 60°	≥ 70
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Adhesion @ 6 hrs cure, 75°F (ASTM-D-4541)	≥ 200 psi
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi
Softening Point (ASTM-E-831)	≥ 175°F
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 60.0 x 10 ⁻⁶ in/in°F

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate.

2.6 Two Component Urethane Topcoat

Two component, urethane topcoat formulated to increase chemical and abrasion resistance.

2.6.1 Urethane Topcoat

The two component urethane topcoat shall be formulated to exhibit the following properties as listed in Table 6.

Table 6: Properties of Topcoat

Resin System	Urethane
Percent Volume Solids	≥ 52 %

First Topcoat Color: White (Fed. Std. 595B)	17925
Second Topcoat Color: Clear	0 % pigments
Walkway Strip Color: Red/Orange, Semi-gloss (Fed. Std. 595B)	22197
Hiding Power: Red/Orange	Complete hiding of white coatings at 2.5 -3.0 mils DFT (one coat).
Application Thickness	Up to 4 mils Dry Film Thickness
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Service @ 48 hours cure, 65°F	Heavy Traffic, Full Chemical Resistance
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi
Adhesion to Epoxy Polyamide @ 48 hrs cure, 75°F	≥ 350 psi
Softening Point (ASTM-E-831)	≥ 175°F

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate. Slight staining is unacceptable.

2.7 White Aluminum Oxide Non-Skid Material

Dust free (washed and dry), white aluminum oxide non-skid material.

2.7.1 Aluminum Oxide

a. Size #50

Size #50 white aluminum oxide shall exhibit the following size gradations and formulation as listed in Table 7.

Table 7: Properties of White #50 Aluminum Oxide

Percent White Al ₂ O ₃	≥ 99 %
Sieve No. 30 (ASTM-E-11)	100 % Passing
Sieve No. 40 (ASTM-E-11)	10 – 25 % Retained
Sieve No. 50 (ASTM-E-11)	75 – 90 % Retained
Sieve No. 60 (ASTM-E-11)	0 – 15 % Retained

b. Size #60

Size #60 white aluminum oxide shall exhibit the following size gradations and formulation as listed in Table 8.

Table 8: Properties of White #60 Aluminum Oxide

Percent White Al ₂ O ₃	≥ 99 %
Sieve No. 40 (ASTM-E-11)	100 % Passing
Sieve No. 50 (ASTM-E-11)	15 – 30 % Retained
Sieve No. 60 (ASTM-E-11)	70 – 85 % Retained
Sieve No. 70 (ASTM-E-11)	0 – 15 % Retained

PART 3 EXECUTION

Notes A – E shall be treated as part of the specification.

NOTES A - E

Note A: Protection shall be provided by contractor to prevent damage to adjacent areas, equipment, fixtures, finishes, electrical utilities, mechanical services, “Grounding Rods”, and existing work. Damage to the above items while performing work shall be either repaired or replaced with new items at no additional cost to Government.

Note B: Care shall be taken to reduce the spread of dust and debris to office spaces within the hangar. Dust, waste, and debris resulting from work shall be cleaned and removed “daily” from the Activity.

Note C: Minor materials and work not specifically mentioned herein but necessary for the proper completion of the specified work shall be furnished without additional cost to Government.

Note D: Should deteriorated materials of a major nature be uncovered during the course of work, it shall be brought to the attention of the Contracting Officer. Repairs as directed by Government (in writing) shall be made with an adjustment, reflecting the terms of the modification(s), to contract price.

Note E: All work that is not performed in accordance to either the specification or manufacturer’s recommended procedures shall be replaced and reworked at contractor’s expense. If a dispute exists between specification and manufacturer’s procedures, the procedure which offers the greatest degree of prudence shall supercede.

“The following procedures are sequential and have been presented in the order in which the work shall proceed starting with Section 3.1.”

3.1 Removal of Material in Joints and Re-saw Cutting

Remove 100 % of the existing material in all expansion and contraction joints including material bonded to joint walls and base. Rigid material may require the use of saw cutting equipment to remove. Saw Cutting equipment shall be capable of producing straight lines with sporadic joint spalls less than 1/16". All joints that were not originally saw cut to a minimum depth of 1" or were previously filled with coating material shall be re-saw cut open to a depth of 1". Joints may be widened by up to 1/8" when re-saw cutting.

3.2 Material Application

A minimum period of 36 hours following degreasing and 48 hours following heavy rain shall be used to allow concrete surfaces a chance to dry prior to the application of concrete repair materials, coatings, and sealant.

3.2.1 Temperature and Humidity Requirements

Coatings and sealant shall be applied when the relative humidity is below 80 % with temperatures between 55°F to 90°F (concrete and air). Temperatures shall also be a minimum of 5°F above the dew point temperature. If temperatures and relative humidity exceed the above ranges, work shall stop until either acceptable temperatures and relative humidity or material manufacturers approve application under existing conditions.

3.2.2 Mixing and Application of Materials

Mix and apply all materials in accordance to manufacturer's requirements. The use of spray equipment to apply materials is prohibited. Epoxy and urethane coatings, once mixed and prior to application, may require time to initiate their chemical reaction (induction period). The epoxy primer and sealant shall be applied in the late afternoon after the heat of the day when both the air and concrete temperatures are decreasing and prior to the dew point temperature. It is recommended that representatives from the material manufacturers be on site to view both the mixing and application of their materials.

3.3 Treatment of Cracks and Spall Repair

3.3.1 Treatment of Cracks

Cracks with widths greater than 1/8" may be treated and repaired as moving joints. Cracks containing a crack width between 1/8" to 1.25" may be chased by either saw cutting or power grinding to a minimum depth of 5/8". Where crack spalling exceeds a width of 1.25", crack spalls shall be repaired according to the procedures outlined in Section 3.3.2. Resulting crack surfaces shall contain smooth vertical walls of uniform depth.

3.3.2 Spall Repair

Saw cut, in square to rectangular geometries, 0.5 – 2 inches away from the perimeter of each spall using a depth of 0.5 – 2.0 inches (depth is spall dependant). Concrete within the repair area shall be broken out using a chipping hammer and contain a minimum depth of 0.5 inch or until sound concrete is exposed. The repair cavity shall be inspected for unsound concrete by tapping with a hammer or steel rod. In areas where tapping indicates unsound concrete, additional concrete shall be removed. Resulting surfaces shall contain sound concrete, smooth vertical walls, and a repair base of uniform depth. Sweep and vacuum all dust from repair area.

3.3.2.1 Prime Repair Areas

Prime all concrete surfaces that are to receive either of the two types of epoxy grout using the "Two Component Epoxy Polyamine Grout Primer" specified in Section 2.1. Primer shall be applied at 10 mils wet. Prime saw cuts outside the repair geometry.

3.3.2.2 Epoxy Grout Application

Immediately following primer application, apply the appropriate epoxy grout directly into the wet primer per repair area (see Sections 2.2 & 2.3 to determine which grout is appropriate per specific area). Fill and trowel in the epoxy grout into both the concrete repair and the adjacent saw cuts. Epoxy grout shall be worked towards the perimeter of the patch to establish contact and enhance bonding to the existing slab. Make at least two passes with the trowel to ensure a smooth repair surface that is level with the surface of the floor slab. Resulting repair shall be dense, homogenous and finished to the same surface slope as the existing concrete slab. When cured, remove trowel marks and blend grout into adjacent concrete by sanding.

3.3.2.3 Grout Coat Application

Approximately 8 – 24 hours following application of epoxy grout, seal the surface of the grout repair by applying a grout coat at 10 mils wet to the epoxy grout's surface. Either the

“Two Component Epoxy Polyamine Grout Primer” or the “Two Component Epoxy Polyamide Coating System Primer” shall be used (see Sections 2.1 & 2.5).

3.3.2.4 Saw Cutting Repaired Joint Spalls and Spalled Cracks

Less than 8 hours following application of grout coat, saw cut through the repair and directly above either the existing joint or crack (if applicable). Saw cuts shall be 1/4” wide and at a depth 1/4” greater than the base of the repair. The placement of the saw cut is to enable the repaired area to expand/contract in relation to and in the same pattern as either the underlying joint or crack. The resulting saw cut shall be treated as a joint and filled using backer rod and sealant.

3.4 Surface Preparation

3.4.1 Coated Hangar Floors

3.4.1.1 Degrease Coating System

Degrease entire floor by scrubbing (manual and power) using a solution of hot potable water (120°F – 170°F) and a concentrated aqueous-based caustic degreaser (water-based alkaline degreaser). Solution shall be allowed to soak into surfaces prior to scrubbing and removed using hot potable water under a minimum of 4,000 psi pressure. Rinsing shall be complete when rinse water appears clear. Two complete degreasing cycles shall be performed on entire floor surface and, in addition, one additional cycle of spot degreasing shall be performed on all areas where either the existing coating system or existing joint sealant has failed. If the industrial detergent is not biodegradable, all rinse water shall be collected and disposed of as hazardous waste. Use of industrial degreasers containing either phosphates or organic solvents is prohibited. Squeegees and shop vacuums may be used to collect pooling rinse water. Fans may be used to aid drying of floor surfaces.

3.4.1.2 Coating System Removal

Remove 100 % of the existing coating system employing a combination of one or more of the following techniques: shot blasting, chipping, scraping, sanding, scarification, high pressure water blasting, and various hand tools. The use of impact tools (such as scabblers) shall not be used to remove the existing coating system. Shot blasting equipment shall produce a 20” minimum blast path width. Prior to blasting, old shot shall be removed and replaced with new shot. Shot blasting to remove existing coatings shall stop when the concrete’s surface resembles an ICRI CSP 5 profile. If contractor produces concrete surfaces with a level of coarseness greater than an ICRI CSP 5 profile, contractor shall resurface these areas using the materials and procedures outlined in Section 3.6 at contractor’s expense.

3.4.1.3 Concrete Surface Preparation

Surface preparation techniques employing acid, organic solvents, extreme heat (flame), impact tools (scabblers) and scarification is prohibited. After degreasing and when concrete is dry, shot blast entire floor to produce a surface profile between ICRI CSP 3 and ICRI CSP 5 (excluding ICRI CSP 4). Shot blasting equipment shall produce a 20” minimum blast path width and, in addition, each pass shall be slightly overlapped (1/4” – 1/2” overlap). New shot shall be added to shot blasting equipment prior to blasting. Shot blasting shall stop when the concrete’s surface resembles an ICRI CSP 5 profile. If contractor produces concrete surfaces with a level of coarseness greater than an ICRI CSP 5 profile, contractor shall resurface these areas using the materials and procedures outlined in Section 3.6 at contractor’s expense.

Concrete surfaces inaccessible to shot blasting (base of perimeter walls and under secured equipment) shall be prepared using diamond disk grinding to produce an ICRI CSP 2 profile. Resulting surfaces shall appear visually clean and contain the appropriate level of surface profile. If the resulting level of cleanliness can not be determined, adhesion testing in accordance to ASTM-D-4541 shall be conducting on the dirtiest areas of concrete. Each adhesion test shall produce cohesive failures within the concrete above 200 psi with concrete chunks attached to each pull-off coupon. If the above adhesion results are not produced, then up to two additional degreasing cycles shall be performed using the materials and procedures outlined in Section 3.4.1.1. Sweep, vacuum, and run a high powered magnet over the above areas.

3.4.2 Uncoated Hangar Floors

3.4.2.1 Degrease Concrete

Two complete degreasing cycles shall be performed on entire floor surface and one additional cycle of spot degreasing shall be performed on all areas that appear visually oily/greasy. The materials and techniques outlined in Section 3.4.1.1 shall be used.

3.4.2.2 Concrete Surface Preparation

The procedures and resulting profiles outlined in Section 3.4.1.3 shall be used.

3.5 Treatment of Joints Greater Than 2" in Width

Wide joints shall be examined for the presence of hydrocarbons (fuels, oils) and, if detected, spot cleaned in accordance to Section 3.4.1.1. Sweep and vacuum up residual dust from within joints.

3.5.1 Install Bondbreaker

Apply solvent resistant bond breaker tape with an adhesive backing to the base of each joint. Resulting tape application shall cover each joint's horizontal base and span its' total length. Application of tape facilitates movement of repair material and prevents repair material from rigidly fusing joint. Bond breaker tape shall contain a thickness less than or equal to 6 mils.

3.5.2 Repair Joints Greater Than 2" in Width

Repair joints greater than 2" in width using the procedures outlined in Sections 3.3.2.1 – 3.3.2.4, respectively. Less than 8 hours following application of grout coat, saw cut directly in the middle of the joint the entire joint length. Saw cuts shall be 1/4" wide and at a depth 1/4" greater than the base of the joint. The resulting saw cut shall be treated as a joint and filled using backer rod and sealant.

3.6 Resurfacing Coarse Concrete and Repair of Surface Voids

3.6.1 Resurfacing Coarse Concrete

Coarse concrete may be resurfaced using the following materials and procedures.

3.6.1.1 Key Perimeter of Each Area Identified for Resurfacing

Key the entire perimeter surrounding each area identified for resurfacing. Resulting key shall contain one vertical wall at a depth between 3/8" to 5/8" with a 1.5" to 2" sloped surface

leading down to the resulting vertical depth. A hand held concrete saw may be used to cut the correct vertical depth followed by power tool grinding to attain the above sloped surface.

3.6.1.2 Prime Coarse Concrete

Sweep and vacuum resulting repair areas. Prime each area using the epoxy grout primer specified in Section 2.1 at 10 mils wet.

3.6.1.3 Resurfacing Grout Application

Immediately following primer application, apply the epoxy grout specified in Section 2.2 directly into the wet primer at 3/16" thickness or until concrete surface appears smooth (minimum thickness shall be 1/8"). Resulting surface shall be finished flush with perimeter key using either a steel trowel or steel power trowel.

3.6.1.4 Sand Resurfacing Grout

When grout has sufficiently cured, all trowel marks shall be removed by sanding. Resulting surface shall appear smooth and flush with adjacent surfaces.

3.6.1.5 Grout Coat Application

Following grout sanding, seal the surface of each resurfaced area using either the "Two Component Epoxy Polyamine Grout Primer" or the "Two Component Epoxy Polyamide Coating System Primer" (Sections 2.1 & 2.5). Apply the grout coat at 10 mils wet. When sufficiently cured, grout coat shall be sanded to a dull appearance with visible scratches.

3.6.2 Repair of Surface Voids

Surface voids (bugholes and popouts) with an inner diameter between 1/4" to 1" may be repaired using the following materials and procedures.

3.6.2.1 Prime Surface Voids

Prime each surface void using the epoxy grout primer specified in Section 2.1 to produce a surface that appears wet.

3.6.2.2 Repair Surface Voids

Fill each surface void with the repair material specified in Section 2.2 directly into the wet primer. A steel trowel may be used to pack repair material into each surface void. Resulting surface shall appear smooth and flush with adjacent concrete. Surface void repairs shall be allowed to cure to a semi-rigid state prior to the full application of the coating system primer.

3.7 Application of Sealant

Prior to sealant work, joints shall be examined for the presence of hydrocarbons (fuels, oils) and, if detected, spot cleaned in accordance to Section 3.4.1.1. Sweep and vacuum up residual dust from floor surface and within joints.

3.7.1 Install Bondbreaker

Install, using a backer rod tool, round closed cell polyethylene backer rod into joints and cracks designated for repair. Backer rod shall be a minimum of 1/8" larger diameter than the width of the joint. Backer rod shall fit tight between joint walls (30 % compression) with a

minimum depth of 3/8" below surface of joint. For 1/2", 3/8", and 1/4" wide joints use a joint depth of 3/8" above backer rod (3/8" below joint surface to highest point on backer rod). For joint widths greater than 3/4" but less than 2", use a joint depth of 5/8" above backer rod (joints greater than 2" in width require special treatment). All backer rod that is installed using either the incorrect size (loose fit) or at the incorrect depth shall be removed and reinstalled. After backer rod is installed, apply painter's tape to both sides of joint to protect adjacent surfaces from sealant.

3.7.2 Sealant Application

Mix and apply the sealant material specified in Section 2.4 to joints and cracks designated for repair. Although the joint sealant is self-leveling, it is best applied using a bulk caulking gun. Resulting sealant finish shall exhibit a recess of 1/8" – 1/32" below the surface of each joint. All sealant which remains either flush or greater shall be removed and reapply by contractor at contractor's expense. Immediately following sealant application, remove painter's tape and sealant drips from concrete. Sealant shall be allowed to cure a minimum of 24 hours following application and prior to coating. If temperatures remain below 60°F, sealant shall cure a minimum of 36 hours prior to the application of coatings.

3.8 Application of Coatings

Sweep, vacuum, and run a high powered magnet over all areas that are to receive the coating system. To ensure coating materials are applied at the specified thickness, contractor may wish to grid the floor into 600 ft² areas. Coating batches may be mixed for complete use per area at the specified thickness. Sealant surfaces may be lightly coated.

3.8.1 Primer Application

A minimum of 24 hours following sealant application (temperature dependant), primer shall be applied late in the afternoon following the heat of the day when both the air and concrete temperatures are cooling (this practice minimizes the off-gassing of water-vapor from concrete). *When it appears that the concrete temperature may be decreasing, apply the mixed primer at 10 mils Dry Film Thickness (DFT) to a 9 ft² section of extremely coarse and porous concrete.* For a minimum of 20 minutes, monitor patch for fisheyes, paint separations, and the new formation of bubbles. If either fisheyes or paint separations occur and the concrete is cooling, concrete contains hydrocarbon contamination (fuels, oils, skydrol) and requires additional degreasing in accordance to Section 3.4.2.1. If none of the aforementioned occurs within 20 minutes, concrete is cooling and a full coat of the primer may be applied. *Apply a full coat of the epoxy primer specified in Section 2.5 at a spreading rate of 10.0 mils DFT.* Stripe coat perimeter edges and around equipment footings using the specified primer. Contractor shall monitor and report a minimum of one Wet Film Thickness (WFT) reading to Government every 600 ft² of floor surface. Care shall be taken to not allow primer to pool over sealant. Wet primer in excess of 3 mils shall be removed from the surfaces of all joint sealant. In areas where primer has cured and completely filled recess above sealant flush with joint surfaces, sealant shall be removed and reapplied at contractor's expense. *The adhesion of the primer shall be tested in accordance to Section 4.1.1.*

3.8.2 Application of Topcoats

Two coats of the urethane topcoat (Section 2.6) shall be applied with non-skid grit (Section 2.7). The first topcoat of urethane shall be white followed by a second topcoat of clear

urethane. White aluminum oxide non-skid grit shall be broadcast into the topcoat(s) at the *Customer's desired rate and size* specified in Section 3.8.2.1.

3.8.2.1 Non-skid Grit

a. Light Broadcast of Non-skid Grit

Number 60 white aluminum oxide shall be broadcast at a rate of 1.0 lbs per 100 ft² into the second topcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

b. Medium Broadcast of Non-skid Grit

Number 50 white aluminum oxide grit shall be broadcast at a rate of 1.0 lbs per 100 ft² into the first topcoat of white urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6.0 lbs of #50 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section. Number 60 white aluminum oxide shall be broadcast at a rate of 1.0 lbs per 100 ft² into the second topcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

c. Heavy Broadcast of Non-skid Grit

Number 50 white aluminum oxide grit shall be broadcast at a rate of 1.0 lbs per 100 ft² into the first topcoat of white urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6.0 lbs of #50 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section. Number 60 white aluminum oxide shall be broadcast at a rate of 2.0 lbs per 100 ft² into the second topcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 12 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

3.8.2.2 First Coat

When the primer is well within the coating manufacturer's recoat window, apply a full coat of the white urethane topcoat specified in Section 2.6 at a spreading rate of 3.0 mils Dry Film Thickness (DFT). Contractor shall monitor and report a minimum of one WFT reading to Government per 600 ft² section of floor surface prior to broadcasting #50 grit. Stripe coat perimeter edges and around equipment footings. When the correct WFT has been applied per 600 ft² area, immediately and evenly broadcast the desired quantity of #50 white aluminum oxide grit into the urethane topcoat and backroll in two directions (medium and heavy broadcast only). Wet urethane in excess of 3 mils on sealant surfaces shall be removed by light brushing. If bubbles appear in the topcoat (solvent popping) and create fisheyes (small paint separations) that cannot be rolled out, either application temperature is too warm or topcoat application is too thick and work shall stop until contractor demonstrates application at the correct thickness or temperature decreases. If fisheyes appear without the presence of bubbles, primer coat has been contaminated and topcoat application shall stop. To remove contamination, contractor shall degrease entire floor using a pH neutral degreaser (water-based) followed by potable water rinsing and light sanding.

3.8.2.3 Second Coat

When the first coat of urethane is well within the coating manufacturer's recommended recoat window, apply a second topcoat of the "clear" urethane specified in Section 2.6 at a spreading rate of 3.0 mils DFT. Contractor shall monitor and report a minimum of one WFT reading to Government per 600 ft² section of floor surface prior to broadcasting #60 grit. Stripe coat perimeter edges and around equipment footings. When the correct WFT has been applied per 600 ft² area, immediately and evenly broadcast the desired quantity of #60 white aluminum oxide grit into the second topcoat of urethane and backroll in two directions. Wet urethane in excess of 3 mils on sealant surfaces shall be removed by light brushing. In areas where topcoat has cured and completely filled recess above sealant flush with joint surfaces, sealant shall be removed and reapplied at contractor's expense. *The adhesion of the topcoats shall be tested in accordance to Section 4.1.2.*

3.8.2.4 Walkway Stripe

Less than 24 hours following the clear topcoat application, apply a stripe of the red/orange topcoat specified in Section 2.6 at 3.0 mils DFT with #60 white aluminum oxide broadcast into the stripe. The walkway stripe shall be placed 10 feet from the base of the three interior perimeter walls and form one continuous line with two connecting right angles. The stripe shall start and end on the interior side of the drain gate. Tape shall be used to protect the floor coating against stripe coat bleed. Government shall provide a map detailing the exact size and location of the walkway stripes. The red/orange topcoat shall completely hide, in one coat, the white topcoat color. If insufficient hiding occurs, contractor shall apply one additional coat of walkway stripe coating at no charge to Government

3.9 Curing

All materials shall cure in accordance to manufacturer's requirements. Improperly cured material shall be removed and reapplied by contractor at contractor's expense. It is recommended that a material representative(s) sign off on the contractor's finished product.

3.10 Final Cleanup

Following completion of work, remove debris, equipment, and materials from the site. Remove temporary connections to Government furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

PART 4 QUALITY CONTROL

It is recommended that either a Navy Coating Specialist or a National Association of Corrosion Engineers (NACE) Certified Coating Inspector be on site prior to and during all coating operations. The Coating Inspector's role will be to enforce the specification by documenting and reporting on the quality of workmanship. Differences between coating specification and contractor's work shall be immediately reported to either Public Works or the Resident Officer In Charge of Construction. *Mixed material samples shall be taken during the application of each material and stored in labeled plastic containers.* Clean plastic bottle caps may be used for sampling materials. Fill one bottle cap per mixed material sample (liquid) to an approximate thickness of 1/8". If the coating system prematurely fails, the above samples will be used in the failure analysis.

4.1 Adhesion of Coating System

Either the Government or a third party coating inspector shall perform the below adhesion testing.

4.1.1 Primer Adhesion

A minimum of six hours following primer application and prior to topcoat applications, three adhesion tests (ATSM-D-4541) shall be performed on the primer (left side, center, right side). Each adhesion value shall be greater than or equal to 200 psi (this value is time/temperature dependent and may vary). Contractor shall feather sand the tested areas back into the adjacent coating and spot prime prior to topcoat applications. If adhesion values are below 200 psi, contractor shall remove 100 % of the primer to bare concrete and correctly re-apply the primer (Section 3.8.1) at contractor's expense.

4.1.2 Topcoat Adhesion

Forty-eight hours following topcoat application, three adhesion tests (ASTM-D-4541) shall be performed on the topcoat (left side, center, right side). If each adhesion value is greater than or equal to 200 psi, coating system is acceptable and ready for service. If adhesion values are below 200 psi and do not produce cohesive failures within the concrete (removal of concrete chunks), contractor shall remove topcoats, sand primer to a dull appearance with visible scratches, degrease entire floor (use a pH neutral degreaser with warm water followed by potable water rinsing), and re-apply the topcoats (Section 3.8.2) at contractor's expense. Contractor shall repaint the tested areas using the specified white topcoat (Section 2.6) and #60 grit (Section 2.7). Resulting repairs shall be flush with adjacent coatings.

APPENDIX B

THICK FILM COATING SYSTEM

PART 1 GENERAL

1.1 **Background (Place condition assessment results here).**

1.2 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM C 307 1994 Test Method for Tensile Strength of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing
- ASTM C 579 1996 Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- ASTM D 412 1998 Test Method for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers - Tension
- ASTM D 638 1996 Test Method for Tensile Properties of Plastics
- ASTM D 1308 1993 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- ASTM D 2240 1997 Test Method for Rubber Property-Durometer Hardness
- ASTM D 4541 1995 Test Method for the Pull-off Strength of Coatings Using Portable Adhesion Testers
- ASTM E 11 1995 Standard Specification for Wire Cloth and Sieves for Testing Purposes
- ASTM E 831 1993 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis

FEDERAL STANDARDS

Federal Standard 595B: Colors

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.59 Hazard Communication

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI Technical Guideline No. 03732: "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays".

1.3 Submittals

All submittals shall be submitted to the Government for approval and records.

- a. Two Component Epoxy Polyamine Grout Primer
- b. Three Component Sand Filled Epoxy Grout
- c. Four Component Sand and Pea Gravel Filled Epoxy Grout
- d. Two Component Polysulfide Sealant
- e. Two Component Epoxy Polyamine Coating System Primer
- f. Three Component Epoxy Polyamine Intermediate Coat
- g. Two Component Epoxy Polyamine Grout Coat
- h. Two Component Urethane Topcoat
- i. White Aluminum Oxide Non-Skid Grit (#50, #60)
- j. Degreaser(s)
- k. Material Certificates (Section 1.3.2)
- l. Contractor Qualifications (Section 1.3.3a)
- m. Coating System Performance (Section 1.3.3b)
- n. Sealant Performance (Section 1.3.3c)
- o. Procedural Variation(s) (Section 1.3.4)
- p. Scheduling (Section 1.3.5)
- q. Warranty (Section 1.3.6)
- r. Certified Coating and Sealant Applicator (1.3.2j)

1.3.1 Instruction

For materials a. – j., submit formulator's printed instructions to include brand name, catalog numbers, and name of manufacturer. Include in the instructions (if applicable) date material was manufactured, shelf-life, detailed mixing and application procedures, quantity of material to be used on job, minimum and maximum application temperatures, and curing procedures. Include copies of Material Safety Data Sheets (MSDS) for all materials to be used at the job site. All coatings shall be manufactured by one coating vendor. Each material shall contain less than 350 g/l of Volatile Organic Compounds (VOC).

1.3.2 Certificates

- a. *Two Component Epoxy Polyamine Grout Primer*
Submit certified conformance to the requirements set forth in Section 2.1.1.
- b. *Three Component Sand Filled Epoxy Grout*
Submit certified conformance to the requirements set forth in Section 2.2.1.
- c. *Four Component Sand and Pea Gravel Filled Epoxy Grout*
Submit certified conformance to the requirements set forth in Section 2.3.1.
- d. *Two Component Polysulfide Sealant*
Submit certified conformance to the requirements set forth in Section 2.4.1.
- e. *Two Component Epoxy Polyamine Coating System Primer*
Submit certified conformance to the requirements set forth in Section 2.5.1.
- f. *Three Component Sand Filled Epoxy Intermediate Coat*
Submit certified conformance to the requirements set forth in Section 2.6.1.
- g. *Two Component Epoxy Polyamine Grout Coat*
Submit certified conformance to the requirements set forth in Section 2.7.1.
- h. *Two Component Urethane Topcoat*
Submit certified conformance to the requirements set forth in Section 2.8.1.

i. *White Aluminum Oxide Non-Skid Material*

Submit certified conformance to the requirements set forth in Section 2.9.1.

j. *Certified Installation Contractor*

Installation contractor shall be certified by both the coating and sealant manufacturer in the correct handling, mixing and application of their materials. Submit copy of certificates.

1.3.3 Statements

a. *Contractor Qualifications*

Minimum requirements for installation contractor are as follows: Installation contractor shall have completed three or more jobs within the past two years applying the materials listed in Section 1.3.1 (a. – j.) exclusively to concrete surfaces in which the total area exceeds 200,000 square feet. Contractor shall submit documentation listing location of work, point of contact at job site, total square footage of applied materials, listing of both materials and equipment used, and validation from coating manufacturer documenting quantity of materials purchased per job for work totaling 200,000 ft² and within the past two-years. Customers referenced by contractor shall be contacted by Government to confirm contractor's work is acceptable.

b. *Coating System Performance*

The manufacturer of the coating system shall submit literature documenting the past performance of the coating system's use in aircraft maintenance hangars. Minimum requirements are two or more aircraft maintenance hangars totaling 34,000 ft² whereby the coating system has performed for two years with less than 1 % combined premature coating failures, material defects and surface discoloration (≤ 0.5 % discoloration due to aviation chemicals, tire plasticizers, and UV exposure). In addition, coating system shall exhibit greater than 85 % non-skid grit retention within the above time frame. Coating manufacturer shall list location of hangars, total coated area per hangar, hangar point of contact, date coating system was applied, and the names of the installed coating materials. Government shall contact each hangar to confirm performance of coating system.

c. *Sealant Performance*

The manufacturer of the sealant shall submit literature documenting the past performance of the sealant's use in aircraft maintenance hangars. Minimum requirements are two or more aircraft maintenance hangars with joint work totaling 10,000 linear feet whereby the sealant has performed for two years with less than 1 % combined sealant failures and defects. Sealant manufacturer shall list location of hangars, total linear feet of sealant applied per hangar, hangar point of contact, date sealant was applied, and the name of the installed sealant material. Government shall contact each hangar to confirm performance of sealant system.

1.3.4 Work Procedure

Contractor shall submit all procedural variations different than those outlined in Part 3 titled Execution.

1.3.5 Scheduling

Contractor shall submit procedural scheduling, for Government approval, to complete work within twelve (12) consecutive days (weekends and evenings may be included). Contractor shall assign one supervisor to the job who is to remain on site throughout all phases of work

who, in addition, is to act as the primary point of contact between Government and contractor. This person shall be identified in the submitted schedule. All work shall be performed in a manner as to cause the least interference with the normal functions of the Government activity.

1.3.6 Warranty: Installation and Materials

Materials and workmanship used to perform spall repairs, crack repairs, coating work, and sealant work shall be warranted by the "Installation Contractor" for a minimum of one-year following material application. Materials and workmanship shall be subjected to the terms and conditions defined as follows. The entire floor coating system shall be removed and replaced at the expense of the installation contractor (cost includes materials plus application) if $\geq 1.0\%$ of the total coated surface becomes either blistered (chemical), checked, soft, or lifts within one-year following application. Within the warranty period, failures greater than $3/8"$ diameter (of the above type) totaling less than 1.0% of coated surfaces (including spall repairs) shall be identified and repaired at contractor's expense. Cosmetic imperfections due to scratching and gouging are excluded from the warranty. If the coating system's adhesion is in question, one adhesion test (ASTM-D-4541) shall be performed per 100 ft^2 . Each adhesion test shall produce cohesive failures within the concrete above 200 psi with concrete chunks attached to each pull-off coupon. All areas tested for adhesion that do not produce cohesive failures within the concrete and, in addition, exhibit adhesion values below 200 psi shall require removal and replacement at installation contractor's expense. There shall be 0% sealant failures within one year. All sealant material within the warranty period displaying either chemically attacked surfaces or lifting from joint walls shall be removed and reinstalled at the expense of the installation contractor.

1.4 Materials: Condition, Storage, Disposal

Materials on site shall be inspected for damage prior to use. Packaged materials in dented, rusty, or leaking containers and, in addition, materials with an expired shelf life shall be returned to manufacturer. Packaged materials shall be unloaded and stored out of sun and weather, preferably in air-conditioned spaces. All unused material, whether in its' cured or uncured state, shall be removed from the job site by contractor.

1.5 Safety

Throughout all phases of work, contractor shall follow the requirements of the Occupational Safety and Health Administration (OSHA), 29 CFR 1926.59, and safety procedures as recommended by the material manufacturers. Safety procedures may include employing the use of respirators, impervious clothing, gloves, face shields, and ear plugs. Prior to use and per material, contractor shall understand the information contained in Material Safety Data Sheets (MSDS).

1.6 Demonstration of Coating System

Prior to the coating system's approval, contractor shall apply the complete coating system to a ten-foot square section of concrete. Materials and procedures outlined in Parts 2 & 3, including full broadcasts of non-skid grit, shall be used in the application of the test patch. Three adhesion tests shall be performed 24 hours following the grout coat application and in accordance to Section 4.1.1. Three additional adhesion tests shall be performed 48 hours following topcoat application and in accordance to Section 4.1.2. The coating system shall be approved if the requirements of Sections 4.1.1 & 4.1.2 are satisfied. If concrete surface

preparation was insufficient, contractor shall apply an additional coating system patch to properly prepared concrete followed by the above adhesion testing. If adhesion results are unacceptable for both the topcoat and the coatings below the grout coat, contractor shall submit a new coating system manufactured by a different coating vendor. Prior to approval, a patch of the new coating system shall be applied and subjected to the above requirements for adhesion. Immediately following adhesion testing, patch shall be sanded flush with surrounding concrete.

PART 2 PRODUCTS

2.1 Two Component Epoxy Polyamine Grout Primer

Two component, 100 % solids, epoxy polyamine primer for use in repairing spalled concrete prior to the application of epoxy grouts.

2.1.1 Epoxy Polyamine Grout Primer

The epoxy polyamine grout primer shall be formulated to exhibit the following properties as listed in Table 1.

Table 1: Properties of Epoxy Polyamine Grout Primer

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Color	Clear to Amber
Application Thickness	5 to 30 mils Dry Film Thickness per coat
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate.

2.2 Three Component Sand Filled Epoxy Grout

Three component, 100 % solids, sand filled epoxy grout for use in the repair of spalled/chipped concrete with an inner depth less than 1.0”.

2.2.1 Sand Filled Epoxy Grout

The sand filled epoxy grout shall be formulated to exhibit the following properties as listed in Table 2.

Table 2: Properties of Sand Filled Epoxy Grout

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness

Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Compressive Strength (ASTM-C-579)	7,600 psi ± 1000 psi
Tensile Strength (ASTM-C-307)	1,800 psi ± 300 psi
Hardness (ASTM-D-2240: Shore D)	80 – 92
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 11.5 x 10 ⁻⁶ in/in°F
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the grout shall not contain blisters, checks, or lift from substrate.

2.3 Four Component Sand and Pea Gravel Filled Epoxy Grout

Four component, 100 % solids, sand and pea gravel filled epoxy grout for use in the repair of spalled/chipped concrete with an inner depth greater than 1".

2.3.1 Sand and Pea Gravel Filled Epoxy Grout

The sand and pea gravel filled epoxy grout shall be formulated to exhibit the following properties as listed in Table 3.

Table 3: Properties of Sand and Pea Gravel Filled Epoxy Grout

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Compressive Strength (ASTM-C-579)	7,600 psi ± 1000 psi
Tensile Strength (ASTM-C-307)	1,400 psi ± 300 psi
Hardness (ASTM-D-2240: Shore D)	80 – 92
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 11.5 x 10 ⁻⁶ in/in°F
Adhesion to Concrete	≥ 400 psi

¹After immersion, the grout shall not contain blisters, checks, or lift from substrate.

2.4 Two Component Self-leveling Polysulfide Sealant

Two component, 100 % solids, self-leveling polysulfide sealant formulated with high chemical resistance and capable of withstanding ± 25 % joint movement.

2.4.1 Sealant

The two component polysulfide sealant shall be formulated to exhibit the following properties as listed in Table 4.

Table 4: Properties of Sealant

Sealant System	Polysulfide: Manganese Cure (MnO ₂)
Percent Volume Solids	100 %

Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Hardness (ASTM-D-2240: Shore A)	20 – 30
Tensile Strength (ASTM-D-412)	150 – 200 psi
Percent Elongation (ASTM-D-638)	≥ 500%
Tack Free @ 65°F	12 hours maximum
Full Cure @ 65°F	24 hours: Full Chemical Resistance
Adhesion to Sand Filled Epoxy Polyamine	≥ 130 psi
Adhesion of Solvent-based Urethane Topcoats (paintable sealant)	≥ 130 psi (chemically compatible)

¹A 2" x 1/2" x 1/2" section of cured sealant shall be immersed and tested.

2.5 Two Component Epoxy Polyamine Coating System Primer

Two component, 100 % solids, epoxy polyamine penetrating primer for use on properly prepared concrete.

2.5.1 Primer Coat

The two component primer coat shall be formulated to exhibit the following properties as listed in Table 5.

Table 5: Properties of Primer Coat

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Color	Clear to Amber
Application Thickness	5 to 30 mils Dry Film Thickness per coat
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi
Softening Point (ASTM-E-831)	≥ 175°F
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 60.0 x 10 ⁻⁶ in/in°F

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate.

2.6 Three Component Sand Filled Epoxy Polyamine Intermediate Coat

Three component, 100 % solids, sand filled epoxy polyamine intermediate coat.

2.6.1 Intermediate Coat

The three component epoxy intermediate coat shall be formulated to exhibit the following properties as listed in Table 6.

Table 6: Properties of Sand Filled Epoxy Intermediate Coat

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Color	Clear to amber
Application Thickness	125 to 400 mils Dry Film Thickness per coat
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Compressive Strength (ASTM-C-579)	7,600 psi ± 1000 psi
Tensile Strength (ASTM-C-307)	1,800 psi ± 300 psi
Hardness (ASTM-D-2240: Shore D)	80 – 92
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 11.5 x 10 ⁻⁶ in/in°F
Adhesion to Epoxy Polyamine (ASTM-D-4541)	≥ 400 psi
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate.

2.7 Two Component Epoxy Polyamine Grout Coat

Two component, 100 % solids, epoxy polyamine grout coat for use in filling the surface voids of three component sand filled intermediate coats.

2.7.1 Grout Coat

The two component grout coat shall be formulated to exhibit the following properties as listed in Table 7.

Table 7: Properties of Grout Coat

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Color: White (Fed. Std. 595B)	17925
Application Thickness	5 to 30 mils Dry Film Thickness per coat
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi
Adhesion to Epoxy Polyamine (ASTM-D-4541)	≥ 400 psi
Softening Point (ASTM-E-831)	≥ 175°F
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 60.0 x 10 ⁻⁶ in/in°F

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate. Slight staining is unacceptable.

2.8 Two Component Urethane Topcoat

Two component, urethane topcoat formulated to increase chemical and abrasion resistance.

2.8.1 Urethane Topcoat

The two component urethane topcoat shall be formulated to exhibit the following properties as listed in Table 8.

Table 8: Properties of Topcoat

Resin System	Urethane
Percent Volume Solids	≥ 52 %
First Topcoat Color: White (Fed. Std. 595B)	17925
Second Topcoat Color: Clear	0 % pigments
Walkway Strip Color: Red/Orange, Semi-gloss (Fed. Std. 595B)	22197
Hiding Power: Red/Orange	Complete hiding of white coatings at 2.5 -3.0 mils DFT (one coat).
Application Thickness	Up to 4 mils Dry Film Thickness
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Service @ 48 hours cure, 65°F	Heavy Traffic, Full Chemical Resistance
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi
Adhesion to Epoxy Polyamine @ 48 hrs cure, 75°F	≥ 350 psi
Softening Point (ASTM-E-831)	≥ 175°F

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate. Slight staining is unacceptable.

2.9 White Aluminum Oxide Non-Skid Material

Dust free (washed and dry), white aluminum oxide non-skid material.

2.9.1 Aluminum Oxide

a. Size #50

Size #50 white aluminum oxide shall exhibit the following size gradations and formulation as listed in Table 9.

Table 9: Properties of White #50 Aluminum Oxide

Percent White Al ₂ O ₃	≥ 99 %
Sieve No. 30 (ASTM-E-11)	100 % Passing
Sieve No. 40 (ASTM-E-11)	10 – 25 % Retained
Sieve No. 50 (ASTM-E-11)	75 – 90 % Retained
Sieve No. 60 (ASTM-E-11)	0 – 15 % Retained

b. Size #60

Size #60 white aluminum oxide shall exhibit the following size gradations and formulation as listed in Table 10.

Table 10: Properties of White #60 Aluminum Oxide

Percent White Al ₂ O ₃	≥ 99 %
Sieve No. 40 (ASTM-E-11)	100 % Passing
Sieve No. 50 (ASTM-E-11)	15 – 30 % Retained
Sieve No. 60 (ASTM-E-11)	70 – 85 % Retained
Sieve No. 70 (ASTM-E-11)	0 – 15 % Retained

PART 3 EXECUTION

Notes A – E shall be treated as part of the specification.

NOTES A - E

Note A: Protection shall be provided by contractor to prevent damage to adjacent areas, equipment, fixtures, finishes, electrical utilities, mechanical services, “Grounding Rods”, and existing work. Damage to the above items while performing work shall be either repaired or replaced with new items at no additional cost to Government.

Note B: Care shall be taken to reduce the spread of dust and debris to office spaces within the hangar. Dust, waste, and debris resulting from work shall be cleaned and removed “daily” from the Activity.

Note C: Minor materials and work not specifically mentioned herein but necessary for the proper completion of the specified work shall be furnished without additional cost to Government.

Note D: Should deteriorated materials of a major nature be uncovered during the course of work, it shall be brought to the attention of the Contracting Officer. Repairs as directed by Government (in writing) shall be made with an adjustment, reflecting the terms of the modification(s), to contract price.

Note E: All work that is not performed in accordance to either the specification or manufacturer’s recommended procedures shall be replaced and reworked at contractor’s expense. If a dispute exists between specification and manufacturer’s procedures, the procedure which offers the greatest degree of prudence shall supercede.

“The following procedures are sequential and have been presented in the order in which the work shall proceed starting with Section 3.1.”

3.1 Removal of Material in Joints and Re-saw Cutting

Remove 100 % of the existing material in all expansion and contraction joints including material bonded to joint walls and base. Rigid material may require the use of saw cutting equipment to remove. Saw Cutting equipment shall be capable of producing straight lines with sporadic joint spalls less than 1/16". All joints that were not originally saw cut to a minimum depth of 1" or were previously filled with coating material shall be re-saw cut open to a depth of 1". Joints may be widened by up to 1/8" when re-saw cutting.

3.2 Material Application

A minimum period of 36 hours following degreasing and 48 hours following heavy rain shall be used to allow concrete surfaces a chance to dry prior to the application of concrete repair material, coatings, and sealant.

3.2.1 Temperature and Humidity Requirements

Coatings and sealant shall be applied when the relative humidity is below 80 % with temperatures between 55°F to 90°F (concrete and air). Temperatures shall also be a minimum of 5°F above the dew point temperature. If temperatures and relative humidity exceed the above ranges, work shall stop until either acceptable temperatures and relative humidity or material manufacturers approve application under existing conditions.

3.2.2 Mixing and Application of Materials

Mix and apply all materials in accordance to manufacturer's requirements. The use of spray equipment to apply materials is prohibited. Epoxy and urethane coatings, once mixed and prior to application, may require time to initiate their chemical reaction (induction period). The epoxy primer shall be applied in the late afternoon after the heat of the day when both the air and concrete temperatures are decreasing and prior to the dew point temperature. It is recommended that representatives from the material manufacturers be on site to view both the mixing and application of their materials.

3.3 Spall Repair

Saw cut, in square to rectangular geometries, 0.5 – 2 inches away from the perimeter of each spall using a depth of 0.5 – 2.0 inches (depth is spall dependant). Concrete within the repair area shall be broken out using a chipping hammer and contain a minimum depth of 0.5 inch or until sound concrete is exposed. The repair cavity shall be inspected for unsound concrete by tapping with a hammer or steel rod. In areas where tapping indicates unsound concrete, additional concrete shall be removed. Resulting surfaces shall contain sound concrete, smooth vertical walls, and a repair base of uniform depth. Sweep and vacuum all dust from repair area.

3.3.1 Prime Repair Areas

Prime all concrete surfaces that are to receive either of the two types of epoxy grout using the "Two Component Epoxy Polyamine Grout Primer" specified in Section 2.1. Primer shall be applied at 10 mils wet. Prime saw cuts outside the repair geometry.

3.3.2 Epoxy Grout Application

Immediately following primer application, apply the appropriate epoxy grout directly into the wet primer per repair area (see Sections 2.2 & 2.3 to determine which grout is appropriate per specific area). Fill and trowel in the epoxy grout into both the concrete repair and the adjacent saw cuts. Epoxy grout shall be worked towards the perimeter of the patch to establish contact and enhance bonding to the existing slab. Make at least two passes with the trowel to ensure a smooth repair surface that is level with the surface of the floor slab. Resulting repair shall be dense, homogenous and finished to the same surface slope as the existing concrete slab. When cured, remove trowel marks and blend grout into adjacent concrete by sanding.

3.3.3 Grout Coat Application

Approximately 8 – 24 hours following application of epoxy grout, seal the surface of the repair by applying the grout coat specified in Section 2.7 at 10 mils wet.

3.4 Surface Preparation

3.4.1 Coated Hangar Floors

3.4.1.1 Degrease Coating System

Degrease entire floor by scrubbing (manual and power) using a solution of hot potable water (120°F – 170°F) and a concentrated aqueous-based caustic degreaser (water-based alkaline degreaser). Solution shall be allowed to soak into surfaces prior to scrubbing and removed using hot potable water under a minimum of 4,000 psi pressure. Rinsing shall be complete when rinse water appears clear. Two complete degreasing cycles shall be performed on entire floor surface and, in addition, one additional cycle of spot degreasing shall be performed on all areas where either the existing coating system or existing joint sealant has failed. If the industrial detergent is not biodegradable, all rinse water shall be collected and disposed of as hazardous waste. Use of industrial degreasers containing either phosphates or organic solvents is prohibited. Squeegees and shop vacuums may be used to collect pooling rinse water. Fans may be used to aid drying of floor surfaces.

3.4.1.2 Coating System Removal

Remove 100 % of the existing coating system employing a combination of one or more of the following techniques: shot blasting, chipping, scraping, sanding, scarification, high pressure water blasting, and various hand tools. The use of impact tools (such as scabblers) shall not be used to remove the existing coating system. Shot blasting equipment shall produce a 20" minimum blast path width. Prior to blasting, old shot shall be removed and replaced with new shot. Shot blasting to remove existing coatings shall stop when the concrete's surface resembles an ICRI CSP 5 profile.

3.4.1.3 Concrete Surface Preparation

Surface preparation techniques employing acid, organic solvents, extreme heat (flame), impact tools (scabblers) and scarification is prohibited. After degreasing and when concrete is dry, shot blast entire floor to produce a surface profile between ICRI CSP 3 and ICRI CSP 5 (excluding ICRI CSP 4). Shot blasting equipment shall produce a 20" minimum blast path width and, in addition, each pass shall be slightly overlapped (1/4" – 1/2" overlap). New shot shall be added to shot blasting equipment prior to blasting. Shot blasting shall stop when the concrete's surface resembles an ICRI CSP 5 profile. Concrete surfaces inaccessible to shot blasting (base of perimeter walls and under secured equipment) shall be prepared using diamond disk grinding to produce an ICRI CSP 2 profile. Resulting surfaces shall appear visually clean and contain the appropriate level of surface profile. If the resulting level of cleanliness can not be determined, adhesion testing in accordance to ASTM-D-4541 shall be conducting on the dirtiest areas of concrete. Each adhesion test shall produce cohesive failures within the concrete above 200 psi with concrete chunks attached to each pull-off coupon. If the above adhesion results are not produced, then up to two additional degreasing cycles shall be performed using the materials and procedures outlined in Section 3.4.1.1. Sweep, vacuum, and run a high powered magnet over the above areas.

3.4.2 Uncoated Hangar Floors

3.4.2.1 Degrease Concrete

Two complete degreasing cycles shall be performed on entire floor surface and one additional cycle of spot degreasing shall be performed on all areas that appear visually oily/greasy. The materials and techniques outlined in Section 3.4.1.1 shall be used.

3.4.2.2 Concrete Surface Preparation

The procedures and resulting profiles outlined in Section 3.4.1.3 shall be used.

3.5 Key Hangar Entrance and Exits

Key the entire length adjacent to the interior side of the primary drain gate located at the hangar's entrance. Key all surfaces directly below doorways and in exit areas with high traffic. Resulting key shall contain one vertical wall at a depth between 3/8" to 5/8" with a 1.5" to 2" sloped surface leading down to the resulting vertical depth. A hand held concrete saw may be used to cut the correct vertical depth followed by power tool grinding to attain the above sloped surface.

3.6 Application of Primer, Intermediate Coat, and Grout Coat

Sweep, vacuum, and run a high powered magnet over all areas that are to receive the coating system. *Prior to coating, mark all joints using either nails or other appropriate devices.* Concrete joints are to be filled using the coating system and re-saw cut open after the application of the grout coat and prior to topcoating. If contractor fails to mark joints and applies coating system, destructive testing shall be performed to determine the location of each joint and repaired at contractor's expense.

3.6.1 Primer Application

The primer shall be applied late in the afternoon following the heat of the day when both the air and concrete temperatures are cooling (this practice minimizes the off-gassing of water-vapor from concrete). *When it appears that the concrete temperature may be decreasing, add a manufacturer approved pigment to a pint of the primer, mix with the correct portion of catalyst, and apply the pigmented primer at 10 mils wet to a 9 ft² section of extremely coarse and porous concrete.* Monitor patch for fisheyes, paint separations, and the new formation of bubbles for a minimum of 20 minutes. If either fisheyes or paint separations occur and the concrete is cooling, concrete contains hydrocarbon contamination (fuels, oils, skydrol) and requires additional degreasing in accordance to Section 3.4.2.1. If none of the aforementioned occurs within 20 minutes, concrete is cooling and a full coat of the primer may be applied. *Apply a full coat of the epoxy primer specified in Section 2.5 at 10.0 mils wet.*

3.6.2 Sand Filled Intermediate Coat Application

Apply the intermediate coat specified in Section 2.6 directly into the wet primer at 250 mils wet. The sand filled intermediate coat is best applied by screed application and finished using a steel power trowel. Directly above areas previously keyed and at a distance of 1.0" to 1.5" away from the coating's outer edge, slope the intermediate coating down and flush with the concrete's surface. The resulting angle shall terminate flush with vertical cut of the previously keyed groove. Perimeter edges and adjacent equipment footings may require

finishing by steel hand trowel. When cured, sand entire floor surface. Resulting surface shall appear level, contain uniform thickness, and be free of surface imperfections including trowel marks.

3.6.3 Grout Coat Application

Sweep and vacuum up residual dust from intermediate coat sanding. Apply the grout coat specified in Section 2.7 at 10 mils wet to the intermediate coat. If the resulting cured grout coat feels oily/greasy, an amine blush has occurred which requires removal. The coating manufacturer shall be consulted to recommend an appropriate amine blush removal procedure. Epoxy amines may blush during cool temperatures with high humidity which, in effect, interferes with topcoat adhesion. *A minimum of 24 hours following grout coat application, the coating system's adhesion shall be tested in accordance to Section 4.1.1.*

3.7 Saw Cut Joints

Place saw cuts directly above and in the middle of each existing joint. Saw cuts shall be 1/4" wide, placed to a minimum depth of 1.5", and span the joint's entire length. Care shall be taken to reduce grease and oil contamination from saw cutting equipment and foot traffic. Floor access shall be limited to essential contractor personnel. When performing joint work, it is recommended that clean rolled cardboard be placed adjacent joint surfaces. This practice may decrease coating system contamination. Air-cooled saw cutting equipment is preferred.

3.8 Sand Grout Coat

Lightly sand grout coat to a dull appearance with visible scratches. Resulting surface shall be 100 % absent of gloss with zero shinny spots. Perimeter edges and around equipment footings shall also be lightly sanded. Care shall be taken to minimize the removal of coatings when sanding.

3.9 Application of Sealant

Sweep and vacuum up dust from floor surface and within joints.

3.9.1 Install Bondbreaker

Install using a backer rod tool round closed cell polyethylene backer rod into each new saw cut. For 1/4" wide saw cuts, backer rod shall be either 5/16" or 3/8" diameter and placed at a depth of 3/8" below the joint's surface (depth equals the distance from the joint's surface to the highest spot on the backer rod). Backer rod shall fit tight between joint walls (30 % compression). All backer rod that is installed using either the incorrect size (loose fit) or at the incorrect depth shall be removed and reinstalled. After backer rod is installed, apply painter's tape to both sides of joint to protect adjacent surfaces from sealant.

3.9.2 Sealant Application

Mix and apply the sealant material specified in Section 2.4 to joints. Although the joint sealant is self-leveling, it is best applied using a bulk caulking gun. Resulting sealant finish shall exhibit a recess between 1/8" – 1/32" below the surface of each joint. All sealant which remains either flush or greater shall be removed and reapply by contractor at contractor's expense. Immediately following sealant application, remove painter's tape and sealant drips on surface of grout coat. Sealant shall be allowed to cure a minimum of 24 hours following

application and prior to topcoating. If temperatures remain below 60°F, sealant shall cure a minimum of 36 hours prior to the application of topcoats.

3.10 Application of Topcoats

Sweep and vacuum up all residual dirt and dust prior to the topcoat application. Inspect floor for shiny grease spots and, if detected, spot degrease using a pH neutral degreaser followed by potable water rinsing. Two coats of the urethane topcoat (Section 2.8) shall be applied with non-skid grit (Section 2.9). The first topcoat of urethane shall be white followed by a second topcoat of clear urethane. White aluminum oxide non-skid grit shall be broadcast into the topcoat(s) at the *Customer's desired rate and size* specified in Section 3.10.1. Sealant surfaces may be lightly topcoated.

3.10.1 Non-skid Grit

a. Light Broadcast of Non-skid Grit

Number 60 white aluminum oxide shall be broadcast at a rate of 1.0 lbs per 100 ft² into the second topcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

b. Medium Broadcast of Non-skid Grit

Number 50 white aluminum oxide grit shall be broadcast at a rate of 1.0 lbs per 100 ft² into the first topcoat of white urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6.0 lbs of #50 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section. Number 60 white aluminum oxide shall be broadcast at a rate of 1.0 lbs per 100 ft² into the second topcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

c. Heavy Broadcast of Non-skid Grit

Number 50 white aluminum oxide grit shall be broadcast at a rate of 1.0 lbs per 100 ft² into the first topcoat of white urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6.0 lbs of #50 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section. Number 60 white aluminum oxide shall be broadcast at a rate of 2.0 lbs per 100 ft² into the second topcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 12 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

3.10.2 Topcoat Applications

3.10.2.1 First Coat

A minimum of 24 hours following sealant application (temperature dependant) apply a full coat of the white urethane topcoat specified in Section 2.8 at a spreading rate of 3.0 mils Dry Film Thickness (DFT). Contractor shall monitor and report a minimum of one WFT reading to Government per 600 ft² section of floor surface prior to broadcasting #50 grit. Stripe coat perimeter edges and around equipment footings. When the correct WFT has been applied per 600 ft² area, immediately and evenly broadcast the desired quantity of #50 white aluminum

oxide grit into the urethane topcoat and backroll in two directions (medium and heavy broadcast only). Wet urethane in excess of 3 mils on sealant surfaces shall be removed by light brushing. If bubbles appear in the topcoat (solvent popping) and create fisheyes (small paint separations) that cannot be rolled out, either application temperature is too warm or topcoat application is too thick and work shall stop until contractor demonstrates application at the correct thickness or temperature decreases. If fisheyes appear without the presence of bubbles, grout coat has been contaminated and topcoat application shall stop. To remove contamination, contractor shall degrease entire floor using a pH neutral degreaser (water-based) followed by warm potable water rinsing.

3.10.2.2 Second Coat

When the first coat of urethane is well within the coating manufacturer's recommended recoat window, apply a second topcoat of the "clear" urethane specified in Section 2.8 at a spreading rate of 3.0 mils DFT. Contractor shall monitor and report a minimum of one WFT reading to Government per 600 ft² section of floor surface prior to broadcasting #60 grit. Stripe coat perimeter edges and around equipment footings. When the correct WFT has been applied per 600 ft² area, immediately and evenly broadcast the desired quantity of #60 white aluminum oxide grit into the second topcoat of urethane and backroll in two directions. Wet urethane in excess of 3 mils on sealant surfaces shall be removed by light brushing. In areas where topcoat has cured and completely filled recess above sealant flush with joint surfaces, sealant shall be removed and reapplied at contractor's expense. *The adhesion of the topcoats shall be tested in accordance to Section 4.1.2.*

3.10.3 Walkway Stripe

Less than 24 hours following the clear topcoat application, apply a stripe of the red/orange topcoat specified in Section 2.8 at 3.0 mils DFT with #60 white aluminum oxide broadcast into the stripe. The walkway stripe shall be placed 10 feet from the base of the three interior perimeter walls and form one continuous line with two connecting right angles. The stripe shall start and end on the interior side of the drain gate. Tape shall be used to protect the floor coating against stripe coat bleed. Government shall provide a map detailing the exact size and location of the walkway stripes. The red/orange topcoat shall completely hide, in one coat, the white topcoat color. If insufficient hiding occurs, contractor shall apply one additional coat of the walkway stripe coating at contractor's expense.

3.11 Curing

All materials shall cure in accordance to manufacturer's requirements. Improperly cured material shall be removed and reapplied by contractor at contractor's expense. It is recommended that a material representative(s) sign off on the contractor's finished product.

3.12 Final Cleanup

Following completion of work, remove debris, equipment, and materials from the site. Remove temporary connections to Government furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

PART 4 QUALITY CONTROL

It is recommended that either a Navy Coating Specialist or a National Association of Corrosion Engineers (NACE) Certified Coating Inspector be on site prior to and during all coating operations. The Coating Inspector's role will be to enforce the specification by documenting and reporting on the quality of workmanship. Differences between coating specification and contractor's work shall be immediately reported to either Public Works or the Resident Officer In Charge of Construction. *Mixed material samples shall be taken during the application of each material and stored in labeled plastic containers.* Clean plastic bottle caps may be used for sampling materials. Fill one bottle cap per mixed material sample (liquid) to an approximate thickness of 1/8". If the coating system prematurely fails, the above samples will be used in the failure analysis.

4.1 Adhesion of Coating System

Either the Government or a third party coating inspector shall perform the below adhesion testing.

4.1.1 Adhesion of Grout Coat/Intermediate Coat/Primer Coat

Three modified adhesion tests (ASTM-D-4541) shall be performed on the coating system twenty-four hours following grout coat application (left side, center, right side). The coating system shall be completely cored through and 1/4" into the concrete using a 1" diameter core bit. 3/4" pull-off coupons shall be used and attached directly to the middle of each cored surface (coating surface shall be sanded prior to attaching pull-off coupons). If adhesion values are either greater than 200 psi or produce cohesive failures within the concrete (removal of concrete chunks), coating system is acceptable for topcoat application. If the above requirements are not satisfied, then one adhesion test per 100 ft² section shall be performed using the above procedures. Adhesion results per area shall meet the above requirements or coating system shall be 100 % removed to bare concrete and reapplied at contractor's expense. Contractor shall repair each area tested for adhesion. Core holes shall be filled using the specified primer (Section 2.5) followed by a white, sand filled intermediate coat (Section 2.6). Resulting repairs shall be flush with adjacent coatings.

4.1.2 Topcoat Adhesion

Forty-eight hours following topcoat application, three adhesion tests (ASTM-D-4541) shall be performed on the topcoat (left side, center, right side). Each adhesion test shall be performed without coring through the coating system and into the concrete. Lightly score the circumference of each pull-off coupon to depth where the white grout coat becomes visible. If each adhesion value is greater than or equal to 250 psi, then coating system is acceptable and ready for service. If adhesion values are below 250 psi, contractor shall remove topcoats, re-sand grout coat, degrease entire floor (use a pH neutral degreaser with warm water followed by potable water rinsing), and re-apply the topcoats at contractor's expense. Contractor shall repaint the tested areas using the specified white topcoat (Section 2.8) and #60 grit (Section 2.9). Resulting repairs shall be flush with adjacent coatings.

APPENDIX C

OVERCOATING SOUND COATING SYSTEMS

PART 1 GENERAL

1.1 **Background (Place condition assessment results here).**

1.2 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM C 307 1994 Test Method for Tensile Strength of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing
- ASTM C 579 1996 Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- ASTM D 412 1998 Test Method for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers - Tension
- ASTM D 638 1996 Test Method for Tensile Properties of Plastics
- ASTM D 1308 1993 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- ASTM D 2240 1997 Test Method for Rubber Property-Durometer Hardness
- ASTM D 4541 1995 Test Method for the Pull-off Strength of Coatings Using Portable Adhesion Testers
- ASTM E 11 1995 Standard Specification for Wire Cloth and Sieves for Testing Purposes
- ASTM E 831 1993 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis

FEDERAL STANDARDS

Federal Standard 595B: Colors

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.59 Hazard Communication

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI Technical Guideline No. 03732: "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays".

1.3 Submittals

All submittals shall be submitted to the Government for approval and records.

- a. Two Component Epoxy Polyamine Grout Primer
- b. Three Component Sand Filled Epoxy Grout
- c. Four Component Sand and Pea Gravel Filled Epoxy Grout
- d. Two Component Polysulfide Sealant
- e. Two Component Epoxy Polyamide Primer
- f. Two Component Urethane Topcoat
- g. White Aluminum Oxide Non-Skid Grit (#50, #60)
- h. Degreaser(s)
- i. Material Certificates (Section 1.3.2)
- j. Contractor Qualifications (Section 1.3.3a)
- k. Coating System Performance (Section 1.3.3b)
- l. Sealant Performance (Section 1.3.3c)
- m. Procedural Variation(s) (Section 1.3.4)
- n. Scheduling (Section 1.3.5)
- o. Warranty (Section 1.3.6)
- p. Certified Coating and Sealant Applicator (1.3.2h)

1.3.1 Instruction

For materials a. – h., submit formulator's printed instructions to include brand name, catalog numbers, and name of manufacturer. Include in the instructions (if applicable) date material was manufactured, shelf-life, detailed mixing and application procedures, quantity of material to be used on job, minimum and maximum application temperatures, and curing procedures. Include copies of Material Safety Data Sheets (MSDS) for all materials to be used at the job site. All coatings shall be manufactured by one coating vendor. Each material shall contain less than 350 g/l of Volatile Organic Compounds (VOC).

1.3.2 Certificates

- a. *Two Component Epoxy Polyamine Grout Primer*
Submit certified conformance to the requirements set forth in Section 2.1.1.
- b. *Three Component Sand Filled Epoxy Grout*
Submit certified conformance to the requirements set forth in Section 2.2.1.
- c. *Four Component Sand and Pea Gravel Filled Epoxy Grout*
Submit certified conformance to the requirements set forth in Section 2.3.1.
- d. *Two Component Polysulfide Sealant*
Submit certified conformance to the requirements set forth in Section 2.4.1.
- e. *Two Component Epoxy Polyamide Primer*
Submit Certified conformance to the requirements set forth in Section 2.5.1.
- f. *Two Component Urethane Topcoat*
Submit certified conformance to the requirements set forth in Section 2.6.1.
- g. *White Aluminum Oxide Non-Skid Material*
Submit certified conformance to the requirements set forth in Section 2.7.1.
- h. *Certified Installation Contractor*
Installation contractor shall be certified by both the coating and sealant manufacturer in the correct handling, mixing and application of their materials. Submit copy of certificates.

1.3.3 Statements

a. Contractor Qualifications

Minimum requirements for installation contractor are as follows: Installation contractor shall have completed three or more jobs within the past two years applying the materials listed in Section 1.3.1 (a. – h.) exclusively to concrete surfaces in which the total area exceeds 200,000 square feet. Contractor shall submit documentation listing location of work, point of contact at job site, total square footage of applied materials, listing of both materials and equipment used, and validation from coating manufacturer documenting quantity of materials purchased per job for work totaling 200,000 ft² and within the past two-years. Customers referenced by contractor shall be contacted by Government to confirm contractor's work is acceptable.

b. Coating System Performance

The manufacturer of the coating system shall submit literature documenting the past performance of the coating system's use in aircraft maintenance hangars. Minimum requirements are two or more aircraft maintenance hangars totaling 34,000 ft² whereby the coating system has performed for two years with less than 1 % combined premature coating failures, material defects and surface discoloration (≤ 0.5 % discoloration due to aviation chemicals, tire plasticizers, and UV exposure). In addition, coating system shall exhibit greater than 85 % non-skid grit retention within the above time frame. Coating manufacturer shall list location of hangars, total coated area per hangar, hangar point of contact, date coating system was applied, and the names of the installed coating materials. Government shall contact each hangar to confirm performance of coating system.

c. Sealant Performance

The manufacturer of the sealant shall submit literature documenting the past performance of the sealant's use in aircraft maintenance hangars. Minimum requirements are two or more aircraft maintenance hangars with joint work totaling 10,000 linear feet whereby the sealant has performed for two years with less than 1 % combined sealant failures and defects. Sealant manufacturer shall list location of hangars, total linear feet of sealant applied per hangar, hangar point of contact, date sealant was applied, and the name of the installed sealant material. Government shall contact each hangar to confirm performance of sealant system.

1.3.4 Work Procedure

Contractor shall submit all procedural variations different than those outlined in Part 3 titled Execution.

1.3.5 Scheduling

Contractor shall submit procedural scheduling, for Government approval, to complete work within eleven (11) consecutive days (weekends and evenings may be included). Contractor shall assign one supervisor to the job who is to remain on site throughout all phases of work who, in addition, is to act as the primary point of contact between Government and contractor. This person shall be identified in the submitted schedule. All work shall be performed in a manner as to cause the least interference with the normal functions of the Government activity.

1.3.6 Warranty: Installation and Materials

Materials and workmanship used to perform spall repairs, crack repairs, coating work, and sealant work shall be warranted by the "Installation Contractor" for a minimum of one-year following material application. Materials and workmanship shall be subjected to the terms and conditions defined as follows. The entire floor coating system shall be removed and replaced at the expense of the installation contractor (cost includes materials plus application) if $\geq 1.0\%$ of the total coated surface becomes either blistered (chemical), checked, soft, or lifts within one-year following application. Within the warranty period, failures greater than $3/8"$ diameter (of the above type) totaling less than 1.0% of coated surfaces (including spall repairs) shall be identified and repaired at contractor's expense. Cosmetic imperfections due to scratching and gouging are excluded from the warranty. If the coating system's adhesion is in question, one adhesion test (ASTM-D-4541) shall be performed per 100 ft^2 . Each adhesion test shall produce cohesive failures within the concrete above 250 psi with concrete chunks attached to each pull-off coupon. All areas tested for adhesion that do not produce cohesive failures within the concrete and, in addition, exhibit adhesion values below 250 psi shall require removal and replacement at installation contractor's expense. There shall be 0% sealant failures within one year. All sealant material within the warranty period displaying either chemically attacked surfaces or lifting from joint walls shall be removed and reinstalled at the expense of the installation contractor.

1.4 Materials: Condition, Storage, Disposal

Materials on site shall be inspected for damage prior to use. Packaged materials in dented, rusty, or leaking containers and, in addition, materials with an expired shelf life shall be returned to manufacturer. Packaged materials shall be unloaded and stored out of sun and weather, preferably in air-conditioned spaces. All unused material, whether in its' cured or uncured state, shall be removed from the job site by contractor.

1.5 Safety

Throughout all phases of work, contractor shall follow the requirements of the Occupational Safety and Health Administration (OSHA), 29 CFR 1926.59, and safety procedures as recommended by the material manufacturers. Safety procedures may include employing the use of respirators, impervious clothing, gloves, face shields, and ear plugs. Prior to use and per material, contractor shall understand the information contained in Material Safety Data Sheets (MSDS).

1.6 Demonstration of Coating System

Prior to the approval of the coating system, contractor shall apply the complete coating system over a ten-foot square section of previously coated concrete. Materials and procedures outlined in Parts 2 & 3, including full broadcasts of non-skid grit, shall be used in the application of the test patch. One week following the final topcoat application, a minimum of three adhesion tests shall be performed (ASTM-D-4541). Each adhesion test shall produce cohesive failures within the concrete above 250 psi with concrete chunks attached to each pull-off coupon. If cohesive failures are not produced within the concrete, either the coating system is chemically incompatible (solvent-based urethane over water-based urethane) or surface preparation was insufficient. If coating system is chemically incompatible, contractor shall submit a chemically compatible coating system and re-perform the above testing. If surface preparation was insufficient, contractor shall apply an additional coating system patch over properly prepared existing coatings followed by the above testing.

Immediately following adhesion testing, patch shall be sanded flush with surrounding coatings.

PART 2 PRODUCTS

2.1 Two Component Epoxy Polyamine Grout Primer

Two component, 100 % solids, epoxy polyamine primer for use in repairing spalled concrete prior to the application of epoxy grouts.

2.1.1 Epoxy Polyamine Primer

The epoxy polyamine primer shall be formulated to exhibit the following properties as listed in Table 1.

Table 1: Properties of Epoxy Polyamine Primer

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Color	Clear to Amber
Application Thickness	5 to 30 mils Dry Film Thickness per coat
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate.

2.2 Three Component Sand Filled Epoxy Grout

Three component, 100 % solids, sand filled epoxy grout for use in the repair of spalled/chipped concrete with an inner depth less than 1.0".

2.2.1 Sand Filled Epoxy Grout

The sand filled epoxy grout shall be formulated to exhibit the following properties as listed in Table 2.

Table 2: Properties of Sand Filled Epoxy Grout

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Compressive Strength (ASTM-C-579)	7,600 psi ± 1000 psi
Tensile Strength (ASTM-C-307)	1,800 psi ± 300 psi
Hardness (ASTM-D-2240: Shore D)	80 – 92
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 11.5 x 10 ⁻⁶ in/in°F

Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi
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¹After immersion, the grout shall not contain blisters, checks, or lift from substrate.

2.3 Four Component Sand and Pea Gravel Filled Epoxy Grout

Four component, 100 % solids, sand and pea gravel filled epoxy grout for use in the repair of spalled/chipped concrete with an inner depth greater than 1”.

2.3.1 Sand and Pea Gravel Filled Epoxy Grout

The sand and pea gravel filled epoxy grout shall be formulated to exhibit the following properties as listed in Table 3.

Table 3: Properties of Sand and Pea Gravel Filled Epoxy Grout

Resin System	Epoxy Polyamine
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Compressive Strength (ASTM-C-579)	7,600 psi ± 1000 psi
Tensile Strength (ASTM-C-307)	1,400 psi ± 300 psi
Hardness (ASTM-D-2240: Shore D)	80 – 92
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 11.5 x 10 ⁻⁶ in/in°F
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi

¹After immersion, the grout shall not contain blisters, checks, or lift from substrate.

2.4 Two Component Self-leveling Polysulfide Sealant

Two component, 100 % solids, self-leveling polysulfide sealant formulated with high chemical resistance and capable of withstanding ± 25 % joint movement.

2.4.1 Sealant

The two component polysulfide sealant shall be formulated to exhibit the following properties as listed in Table 4.

Table 4: Properties of Sealant

Sealant System	Polysulfide: Manganese Cure (MnO ₂)
Percent Volume Solids	100 %
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 5.0 % increase in volume
Hardness (ASTM-D-2240: Shore A)	20 – 30
Tensile Strength (ASTM-D-412)	150 – 200 psi

Percent Elongation (ASTM-D-638)	≥ 500 %
Adhesion to Concrete	≥ 130 psi
Tack Free @ 65°F	12 hours maximum
Full Cure @ 65°F	24 hours: Full Chemical Resistance
Adhesion of Solvent-based Urethane Topcoats (paintable sealant)	≥ 130 psi (chemically compatible)

¹A 2" x 1/2" x 1/2" section of cured sealant shall be immersed and tested.

2.5 Two Component Epoxy Polyamide Repaired Spall and Uncoated Concrete Primer

Two component, solvent based, epoxy polyamide penetrating primer for use over spall repairs and areas with failed coatings (uncoated concrete).

2.5.1 Primer Coat

The two component primer coat shall be formulated to exhibit the following properties as listed in Table 5.

Table 5: Properties of Primer Coat

Resin System	Epoxy Polyamide
Percent Volume Solids	≥ 62 %
Color: White (Fed. Std. 595B)	17925
Application Thickness	2 to 20 mils Dry Film Thickness per coat
Specular Gloss at 60°	≥ 70
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Adhesion @ 6 hrs cure, 75°F (ASTM-D-4541)	≥ 200 psi
Adhesion to Concrete (ASTM-D-4541)	≥ 400 psi
Softening Point (ASTM-E-831)	≥ 175°F
Mean Coefficient of Thermal Expansion, 0°F – 120°F (ASTM-E-831)	3.0 – 60.0 x 10 ⁻⁶ in/in°F

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate.

2.6 Two Component Urethane Overcoat

Two component, urethane overcoat formulated to increase chemical and abrasion resistance.

2.6.1 Urethane Overcoat

The two component urethane overcoat shall be formulated to exhibit the following properties as listed in Table 6.

Table 6: Properties of Overcoat

Resin System	Urethane
Percent Volume Solids	≥ 52 %
Application Thickness	Up to 4 mils Dry Film Thickness
First Topcoat Color: White (Fed. Std. 595B)	17925

Second Topcoat Color: Clear	0 % pigments
Walkway Strip Color: Red/Orange, Semi-gloss (Fed. Std. 595B)	22197
Hiding Power: Red/Orange	Complete hiding of white coatings at 2.5 -3.0 mils DFT (one coat).
Chemical Resistance to JP-8 Fuel @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Motor Oils @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Chemical Resistance to Skydrols @ 70°F (ASTM-D-1308)	48 hours immersion ¹ : ≤ 2.0 % increase in weight, ≤ 2.0 % increase in thickness
Service @ 48 hours cure, 65°F	Heavy Traffic, Full Chemical Resistance
Adhesion to Epoxies (ASTM-D-4541)	≥ 400 psi
Adhesion to Urethanes @ 48 hrs cure, 75°F (ASTM-D-4541)	≥ 350 psi
Softening Point (ASTM-E-831)	≥ 175°F

¹After immersion, the coating shall not contain blisters, checks, or lift from substrate. Slight staining is unacceptable.

2.7 White Aluminum Oxide Non-Skid Material

Dust free (washed and dry), white aluminum oxide non-skid material.

2.7.1 Aluminum Oxide

a. Size #50

Size #50 white aluminum oxide shall exhibit the following size gradations and formulation as listed in Table 7.

Table 7: Properties of White #50 Aluminum Oxide

Percent White Al ₂ O ₃	≥ 99 %
Sieve No. 30 (ASTM-E-11)	100 % Passing
Sieve No. 40 (ASTM-E-11)	10 – 25 % Retained
Sieve No. 50 (ASTM-E-11)	75 – 90 % Retained
Sieve No. 60 (ASTM-E-11)	0 – 15 % Retained

b. Size #60

Size #60 white aluminum oxide shall exhibit the following size gradations and formulation as listed in Table 8.

Table 8: Properties of White #60 Aluminum Oxide

Percent White Al ₂ O ₃	≥ 99 %
Sieve No. 40 (ASTM-E-11)	100 % Passing
Sieve No. 50 (ASTM-E-11)	15 – 30 % Retained
Sieve No. 60 (ASTM-E-11)	70 – 85 % Retained
Sieve No. 70 (ASTM-E-11)	0 – 15 % Retained

PART 3 EXECUTION

Notes A – E shall be treated as part of the specification.

NOTES A - E

Note A: Protection shall be provided by contractor to prevent damage to adjacent areas, equipment, fixtures, finishes, electrical utilities, mechanical services, “Grounding Rods”, and existing work. Damage to the above items while performing work shall be either repaired or replaced with new items at no additional cost to Government.

Note B: Care shall be taken to reduce the spread of dust and debris to office spaces within the hangar. Dust, waste, and debris resulting from work shall be cleaned and removed “daily” from the Activity.

Note C: Minor materials and work not specifically mentioned herein but necessary for the proper completion of the specified work shall be furnished without additional cost to Government.

Note D: Should deteriorated materials of a major nature be uncovered during the course of work, it shall be brought to the attention of the Contracting Officer. Repairs as directed by Government (in writing) shall be made with an adjustment, reflecting the terms of the modification(s), to contract price.

Note E: All work that is not performed in accordance to either the specification or manufacturer’s recommended procedures shall be replaced and reworked at contractor’s expense. If a dispute exists between specification and manufacturer’s procedures, the procedure which offers the greatest degree of prudence shall supercede.

“The following procedures are sequential and have been presented in the order in which the work shall proceed starting with Section 3.1.”

3.1 Removal of Material in Joints and Re-saw Cutting

If unsound, remove 100 % of the existing material in all expansion and contraction joints including material bonded to joint walls and base. Rigid material may require the use of saw cutting equipment to remove. Saw Cutting equipment shall be capable of producing straight lines with sporadic joint spalls less than 1/16". All joints that were not originally saw cut to a minimum depth of 1" or have been filled with coating material shall be re-saw cut open to a depth of 1". Joints may be widened by up to 1/8" when re-saw cutting.

3.2 Material Application

A minimum period of 36 hours following degreasing and 48 hours following heavy rain shall be used to allow concrete surfaces a chance to dry prior to the application of spall repair materials, coatings, and sealant.

3.2.1 Temperature and Humidity Requirements

Coatings and sealant shall be applied when the relative humidity is below 80 % with temperatures between 55°F to 90°F (concrete and air). Temperatures shall also be a minimum of 5°F above the dew point temperature. If temperatures and relative humidity exceed the above ranges, work shall stop until either acceptable temperatures and relative humidity or material manufacturers approve application under existing conditions.

3.2.2 Mixing and Application of Materials

Mix and apply all materials in accordance to manufacturer's requirements. The use of spray equipment to apply materials is prohibited. Epoxy and urethane coatings, once mixed and prior to application, may require time to initiate their chemical reaction (induction period). The sealant shall be applied in the late afternoon after the heat of the day when both the air and concrete temperatures are decreasing and prior to the dew point temperature. It is recommended that representatives from the material manufacturers be on site to view both the mixing and application of their materials.

3.3 Spall Repair

Saw cut, in square to rectangular geometries, 0.5 – 2 inches away from the perimeter of each spall to a depth of 0.5 – 2.0 inches (depth is spall dependant). Concrete within the repair area shall be broken out using a chipping hammer and contain a minimum depth of 0.5 inch or until sound concrete is exposed. The repair cavity shall be inspected for unsound concrete by tapping with a hammer or steel rod. In areas where tapping indicates unsound concrete, additional concrete shall be removed. Resulting surfaces shall contain sound concrete, smooth vertical walls, and a repair base of uniform depth. Sweep and vacuum all dust from repair area.

3.3.1 Prime Repair Areas

Prime all concrete surfaces that are to receive either of the two types of epoxy grout using the "Two Component Epoxy Polyamine Grout Primer" specified in Section 2.1. Primer shall be applied at 10 mils wet. Prime saw cuts outside the repair geometry.

3.3.2 Epoxy Grout Application

Immediately following primer application, apply the appropriate epoxy grout directly into the wet primer per repair area (see Sections 2.2 & 2.3 to determine which grout is appropriate per specific area). Fill and trowel in the epoxy grout into both the concrete repair and the adjacent saw cuts. Epoxy grout shall be worked towards the perimeter of the patch to establish contact and enhance bonding to the existing slab. Make at least two passes with the trowel to ensure a smooth repair surface that is level with the surface of the floor slab. Resulting repair shall be dense, homogenous and finished to the same surface slope as the existing concrete slab. When cured, remove trowel marks and blend grout into adjacent surfaces by sanding.

3.3.3 Grout Coat Application

Approximately 8 – 24 hours following application of grout, seal the surface of the repair by applying a grout coat at 10 mils wet. The "Two Component Epoxy Polyamide Primer" shall be used as the grout coat (Section 2.5).

3.3.4 Saw Cut Spall Repairs

Less than 8 hours following application of grout coat, saw cut through the repair and directly above either the existing joint or crack (if applicable). Saw cuts shall be 1/4" wide and at a depth 1/4" greater than the base of the repair. The placement of the saw cut is to enable the repaired area to expand/contract in relation to and in the same pattern as either the underlying joint or crack. The resulting saw cut shall be treated as a joint and filled using backer rod and sealant.

3.4 Degrease Coatings and Concrete

Degrease entire floor by scrubbing (manual and power) using a pH neutral industrial degreaser (water-based) and warm potable water (100°F – 130°F). Solution shall be allowed to soak into surfaces prior to scrubbing and removed using warm potable water under low pressure (≤ 750 psi). Rinsing shall be complete when rinse water appears clear. Two complete degreasing cycles shall be performed on entire floor surface and, in addition, one additional cycle of spot degreasing shall be performed on all areas where coating system has failed. If the industrial degreaser is not biodegradable, all rinse water shall be collected and disposed of as hazardous waste. Use of industrial degreasers containing either phosphates or organic solvents is prohibited. Squeegees and shop vacuums may be used to collect pooling rinse water. Fans may be used to aid drying of floor surfaces.

3.5 Treatment of Joints Greater Than 2" in Width

Wide joints shall be examined for the presence of hydrocarbons (fuels, oils) and, if detected, spot cleaned in accordance to Section 3.4. Sweep and vacuum up residual dust within wide joints.

3.5.1 Install Bondbreaker

Apply solvent resistant bond breaker tape with an adhesive backing to the base of each joint. Resulting tape application shall cover each joint's horizontal base and span its' total length. Application of tape facilitates movement of repair material and prevents repair material from rigidly fusing joint. Bond breaker tape shall contain a thickness less than or equal to 6 mils.

3.5.2 Repair Joints Greater Than 2" in Width

Repair joints greater than 2" in width using the procedures outlined in Sections 3.3.1 – 3.3.4, respectively. Less than 8 hours following application of grout coat, saw cut directly in the middle of the joint the entire joint length. Saw cuts shall be 1/4" wide and at a depth 1/4" greater than the base of the joint. The resulting saw cut shall be treated as a joint and filled using backer rod and sealant.

3.6 Sand Existing Coating System, Repaired Spalls, and Uncoated Concrete

Power sand 100 % of the existing coating system to produce a surface that has a dull appearance (0 % shiny spots) with visible scratches (100 grit). Power sand repaired spalls and uncoated concrete to an ICRI CSP 2 profile. Power sanding equipment employing either sanding belts or circular disks is acceptable whereas light shot blasting is prohibited. Hand tool sand under secure equipment and at the base of perimeter walls. Unsound coatings may require removal to existing sound coatings. Sweep and vacuum resulting surfaces.

3.7 Application of Sealant

Floor access shall be limited to essential contractor personnel. When performing joint work, it is recommended that clean rolled cardboard be placed adjacent joint surfaces. This practice may decrease coating system contamination. Prior to sealant work, joints shall be examined for the presence of hydrocarbons (fuels, oils) and, if detected, spot cleaned in accordance to Section 3.4. Sweep and vacuum up residual dust from within joints.

3.7.1 Install Bondbreaker

Install using a backer rod tool round closed cell polyethylene backer rod into joints. Backer rod shall be a minimum of 1/8" larger diameter than the width of the joint. Backer rod shall

fit tight between joint walls (30 % compression) with a minimum depth of 3/8" below surface of joint. For 1/2", 3/8", and 1/4" wide joints use a joint depth of 3/8" above backer rod (3/8" below joint surface to highest point on backer rod). For joint widths greater than 3/4" but less than 2", use a joint depth of 5/8" above backer rod (joints greater than 2" in width require special treatment). All backer rod that is installed using either the incorrect size (loose fit) or at the incorrect depth shall be removed and reinstalled. After backer rod is installed, apply painter's tape to both sides of joint to protect adjacent surfaces from sealant.

3.7.2 Sealant Application

Mix and apply the sealant material specified in Section 2.4 to joints. Although joint sealant is self-leveling, it is best applied using a bulk caulking gun. Resulting sealant finish shall exhibit a recess of 1/8" – 1/32" below the surface of each joint. All sealant which remains either flush or greater shall be removed and reapply by contractor at contractor's expense. Immediately following sealant application, remove painter's tape and sealant drips from adjacent surfaces. Sealant shall be allowed to cure a minimum of 24 hours following application and prior to overcoating. If temperatures remain below 60°F, sealant shall cure a minimum of 36 hours prior to the application of overcoats.

3.8 Application of Coatings

Sweep and vacuum all surfaces that are to receive the overcoat system. To ensure coating materials are applied at the specified thickness, contractor may wish to grid the floor into 600 ft² areas. Coating batches may be mixed for complete use per area at the specified thickness. White aluminum oxide non-skid grit shall be broadcast into the overcoats at the *Customer's desired rate and size* specified in Section 3.8.1. Sealant surfaces may be lightly overcoated.

3.8.1 Non-skid Grit

a. Light Broadcast of Non-skid Grit

Number 60 white aluminum oxide shall be broadcast at a rate of 1.0 lbs per 100 ft² into the second overcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

b. Medium Broadcast of Non-skid Grit

Number 50 white aluminum oxide grit shall be broadcast at a rate of 1.0 lbs per 100 ft² into the first overcoat of white urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6.0 lbs of #50 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section. Number 60 white aluminum oxide shall be broadcast at a rate of 1.0 lbs per 100 ft² into the second overcoat of clear urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

c. Heavy Broadcast of Non-skid Grit

Number 50 white aluminum oxide grit shall be broadcast at a rate of 1.0 lbs per 100 ft² into the first overcoat of white urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 6.0 lbs of #50 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section. Number 60 white aluminum oxide shall be broadcast at a rate of 2.0 lbs per 100 ft² into the second overcoat of clear

urethane and backrolled. The hangar floor shall be broken down into 600 ft² sections where 12 lbs of #60 non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 ft² section.

3.8.2 Application of Primer for Repaired Spalls and Uncoated Concrete

Prior to the application of the urethane overcoats, prime the surfaces of repaired spalls and uncoated concrete (areas with coating failures to bare concrete). Apply the epoxy polyamide primer specified in Section 2.5 at 10 mils Dry Film Thickness (DFT) exclusively to the above areas. *All surfaces containing existing urethane coatings (topcoats) shall not be primed.*

3.8.3 Application of Overcoats

3.8.3.1 First Coat

A minimum of 24 hours following sealant application and while primer applied to spalls and uncoated concrete is within manufacturer's recoat window, apply a full coat of the white urethane overcoat specified in Section 2.6 at a spreading rate of 3.0 mils Dry Film Thickness (DFT). Contractor shall monitor and report a minimum of one WFT reading to Government per 600 ft² section of floor surface prior to broadcasting #50 grit. Stripe coat perimeter edges and around equipment footings. When the correct WFT has been applied per 600 ft² area, immediately and evenly broadcast the desired quantity of #50 white aluminum oxide grit into the urethane overcoat and backroll in two directions (medium and heavy broadcast only). Wet urethane in excess of 3 mils on sealant surfaces shall be removed by light brushing. If bubbles appear in the topcoat (solvent popping) and create fisheyes (small paint separations) that cannot be rolled out, either application temperature is too warm or topcoat application is too thick and work shall stop until contractor demonstrates application at the correct thickness or temperature decreases. If fisheyes appear without the presence of bubbles, existing coating system has been contaminated and overcoat application shall stop. To remove contamination, contractor shall degrease entire floor using the procedures outlined in Section 3.4.

3.8.3.2 Second Coat

When the first overcoat of urethane is well within the coating manufacturer's recommended recoat window, apply a second overcoat of the "clear" urethane specified in Section 2.6 at a spreading rate of 3.0 mils DFT. Contractor shall monitor and report a minimum of one WFT reading to Government per 600 ft² section of floor surface prior to broadcasting #60 grit. Stripe coat perimeter edges and around equipment footings. When the correct WFT has been applied per 600 ft² area, immediately and evenly broadcast the desired quantity of #60 white aluminum oxide grit into the second overcoat of urethane and backroll in two directions. Wet urethane in excess of 3 mils on sealant surfaces shall be removed by light brushing. In areas where overcoat has cured and completely filled recess above sealant flush with joint surfaces, sealant shall be removed and reapplied at contractor's expense. *The adhesion of the overcoats shall be tested in accordance to Section 4.1.1.*

3.8.4 Walkway Stripe

Less than 24 hours following the clear overcoat application, apply a stripe of the red/orange coating specified in Section 2.6 at 3.0 mils DFT with #60 white aluminum oxide broadcast into the stripe. The walkway stripe shall be placed 10 feet from the base of the three interior perimeter walls and form one continuous line with two connecting right angles. The stripe shall start and end on the interior side of the drain gate. Tape shall be used to protect the

overcoats against stripe coat bleed. Government shall provide a map detailing the exact size and location of the walkway stripes. The red/orange coating shall completely hide, in one coat, the white overcoat color. If insufficient hiding occurs, contractor shall apply one additional coat of walkway stripe coating at no charge to Government

3.9 Curing

All materials shall cure in accordance to manufacturer's requirements. Improperly cured material shall be removed and reapplied by contractor at contractor's expense. It is recommended that a material representative(s) sign off on the contractor's finished product.

3.10 Final Cleanup

Following completion of work, remove debris, equipment, and materials from the site. Remove temporary connections to Government furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

PART 4 QUALITY CONTROL

It is recommended that either a Navy Coating Specialist or a National Association of Corrosion Engineers (NACE) Certified Coating Inspector be on site prior to and during all coating operations. The Coating Inspector's role will be to enforce the specification by documenting and reporting on the quality of workmanship. Differences between coating specification and contractor's work shall be immediately reported to either Public Works or the Resident Officer In Charge of Construction. *Mixed material samples shall be taken during the application of each material and stored in labeled plastic containers.* Clean plastic bottle caps may be used for sampling materials. Fill one bottle cap per mixed material sample (liquid) to an approximate thickness of 1/8". If the coating system prematurely fails, the above samples will be used in the failure analysis.

4.1 Adhesion of Overcoat System

Either the Government or a third party coating inspector shall perform the below adhesion testing.

4.1.1 Overcoat Adhesion

Forty-eight hours following overcoat application, three adhesion tests (ASTM-D-4541) shall be performed on the overcoats (left side, center, right side). If each adhesion value is greater than or equal to 250 psi, then overcoat system is acceptable and ready for service. If adhesion values are below 250 psi and do not produce cohesive failures within the concrete (removal of concrete chunks), contractor shall remove overcoats (100 % removal), re-sand the existing topcoat (Section 3.6), degrease entire floor (Section 3.4), and re-apply the overcoats (Section 3.8.3) at contractor's expense. Contractor shall repaint the tested areas using the specified white overcoat (Section 2.6) and #60 grit (Section 2.7). Resulting repairs shall be flush with adjacent coatings.