



SPECIFICATION FOR PLANT APPLICATION OF NAP-GARD® NON-SLIP DUAL POWDER SYSTEM ON LINE PIPE

Revised: 16 September 2013

1.0 SYSTEM: NAP-GARD® NON-SLIP DUAL POWDER SYSTEM

2.0 GENERAL

2.1 The following definitions are used to explain the major terms used in this specification.

- 2.1.1 Applicator - The organization responsible for the application of the coating
- 2.1.2 Manufacturer - The Producer and Distributor of the Coating Material
- 2.1.3 Coating Material - Any specified coating material prior to application to the pipe
- 2.1.4 S.S.P.C. - Steel Structures Painting Council
- 2.1.5 NACE - National Association of Corrosion Engineers
- 2.1.6 A.P.I. - American Petroleum Institute
- 2.1.7 Holiday - A discontinuity of coating that exposes the metal surface to the environment
- 2.1.8 AAR – American Association of Railroads
- 2.1.9 CSA – Canadian Standards Association
- 2.1.10 ISO – International Standards Organization
- 2.1.11 SIS – Swedish Institute of Standards
- 2.1.12 D.P.S. – Dual Powder Systems

3.0 HANDLING OF BARE PIPE

- 3.1 Proper equipment for handling, unloading and temporary storage of bare pipe shall be used to avoid any damage to the bare pipe or pipe ends.
- 3.2 Care shall be taken to preclude damage to internal pipe identification markings and or internal coatings during all phases of operation covered by this specification.

4.0 HANDLING AND STORAGE OF COATING SYSTEM MATERIAL

- 4.1 The Nap-Gard® Fusion Bonded Epoxy powder coating material shall be packaged in containers adequate to keep the contents clean and dry during handling, shipping and storage. Handling and storage conditions and any temperature-time limitations for each of the coating system components shall be in accordance with Manufacturer's recommendations.
- 4.2 The repair material shall be packaged in containers to give adequate protection during handling, shipping and storage. Handling and storage conditions and any temperature-time limitations on repair materials shall be in accordance with Manufacturer's recommendations.
- 4.3 Adequate precautions shall be taken during handling, shipping and storage to prevent damage to the containers that would result in contamination of the coating material.

5.0 SURFACE PREPARATION

- 5.1 All pipes shall be supplied to the coating applicator externally bare and free of chlorides, grease or any type of oil and other contaminants detrimental to the coating's performance.
- 5.2 Applicator shall inspect the pipe surface and clean it according to SSPC Specification SSPC-SP1 to remove oil, grease and loosely adhering deposits. If identified, all foreign material remaining on the external surface of the pipe will be removed by use of a suitable method. If solvents are used, only client approved solvents which do not leave a residue shall be used. Neither gasoline nor kerosene shall be used for this purpose.
- 5.3 Pipe shall be checked for possible chloride contamination using proper test methods. If chloride level is above 2 milligrams/m², it shall be cleaned to remove all chloride or to bring it below 2 milligrams/m² (Ref: NACE RP0394-02).
- 5.4 Preheat is not required if pipe is visually free of moisture and is 3°C (37°F) above the dew point, otherwise pipe shall be heated in a uniform manner before the final blast cleaning to assure that all moisture is removed. Pipe temperature will be raised to at least 3°C (37°F) above the dew point during blast cleaning. (Ref: NACE RP0394-02).
- 5.5 All external pipe surfaces to be coated shall be cleaned by grit or grit/shot blasting to near-white metal finish in accordance with NACE #2/SSPC-SP10 or Sa 2½ as described in ISO 8501-1/SIS.SS.05 5900. NACE near-white, NACE #2/SSPC-SP10, is interpreted to mean that all metal surfaces shall be grit or grit/shot blasted to remove all dirt, mill scale, rust, corrosion products, oxides, paint and other foreign matter.

Very light shadows, very slight streaks or slight discoloration will be acceptable. However, at least 95% of the surface shall have the uniform gray appearance of a near-white metal blast cleaned surface.

Abrasive taken from the blast unit shall be checked for chloride. A minimum of one test per 8-hour shift is recommended. The concentration shall be below 20 ppm.

The abrasive used shall be continually cleaned and controlled as to particle size distribution by air wash separation. The anchor pattern profile shall have a minimum height of 50µm (2.0 mils) and a maximum height of 115µm (4.5 mils) as measured with X Course Press-o-Film Replication Tape or suitable profilometer.

- 5.6 Any slivers or bristles of steel remaining on a newly blasted surface shall be removed by the use of high speed wire brushes, sanders, files or other approved means. This shall be done after the grit or grit/shot blasting operation but prior to the coating application. Remaining surface imperfections such as slivers, scales, burrs, weld spatter, gouges, etc. shall be removed by grinding. If the grinding results in a surface profile below 50µm (2.0 mils), the surface shall be re-blasted to meet the criterion of 5.4.
- 5.7 Following the acceptance of the blast cleaning and immediately prior to heating, all shot, grit, sand, dust, or other foreign matter remaining on the external and internal surfaces of the pipe shall be thoroughly removed by air blast, or vacuum type cleaning.

- 5.7.1 If air is used for the cleaning, it shall be dry and free of contaminants and all metal particles removed from the surface shall be extracted or collected in such a manner as to not contaminate cleaned pipe.

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- 5.7.2 Should it be determined phosphoric acid washing is required, Applicator shall follow acid manufacturer's recommendations for concentration, application, dwell time, rinse water quality and disposal.
- 5.8 Blast-cleaned pipe surfaces shall be protected from conditions of high humidity, rainfall, or surface moisture. No pipe shall be allowed to flash rust before coating.
- 5.9 Residual products from blasting shall be suitably removed from the interior and exterior surface of the pipe.

6.0 HEATING PRIOR TO COATING APPLICATION

- 6.1 Pipe that has been blast cleaned, inspected and approved for coating shall be preheated in a continuous, uniform procedure to a temperature of 232°C (450°F) to 239°C (463°F) or in accordance with the TDS of the selected product (Nap-Gard® Non-Slip).
- 6.2 The heat source shall not leave a residue or contaminant on the pipe surface. Oxidation of the steel in the form of "blueing" or other apparent oxide formation is not acceptable.
- 6.3 Pre-heat temperatures shall be monitored, controlled and recorded. Templstiks® or roller contact pyrometers are acceptable methods. Care shall be exercised to minimize contamination of any surfaces to be coated by deposits left by the Templstiks®.

7.0 APPLICATION OF DUAL POWDER SYSTEM

7.1	<u>Base Coat</u>	<u>Top Coats</u>
	7-2500	7-2502NS
	7-2501	7-2608NS
	7-2508 STD or LG	
	7-2514EN Series	

Note: Nap-Gard® Non-Slip powder can also be applied over Nap-Gard® Gold 7-2504 with the appropriate base coat.

- 7.2 The Dual Powder System shall be applied over cleaned, preheated surface as covered by Sections 5.0 and 6.0 of this specification.
- 7.3 Both coatings are spray applied to the heated pipe using electrostatic spray guns. Apply the specified base coating followed by the Nap-Gard® Non-Slip in a continuous process providing the base coat enough time to gel but not fully cure. Ensure that interlayer bonding is taking place by carefully checking for lamination or interlayer bonding issues using the adhesion test method described in section C of the attached Appendix. Any sign of lamination or interlayer bonding problems will require shortening the distance between the base coat application and the Nap-Gard® Non-Slip application.
- 7.4 All air used to fluidize, transport, and apply the powder shall be dry and free of oil. It is recommended that the dry air system be capable of delivering air of at least -20°F (-30°C) dew point or lower.
- 7.5 The preferred equipment to apply the Dual Powder System is in separate powder systems for each coating material, with reclaim powder being applied as an intermediate layer between virgin base coat and virgin top coat. The intermediate layer can comprise 25% of total film thickness.
- 7.6 All reclaim will go to the top coat fluidized bed if a single powder recovery system is used.

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- 7.7 During the coating process, the Non-Slip powder can be turned off occasionally to check the stand alone thickness of the base coat and for possible surface irregularities. It should only require two or three pipe revolutions to provide enough area to perform this inspection.
- 7.8 Once the thickness of the respective layers (base / non-slip) are established and meet the specified requirements the magnetic gauge can be used for overall coating thickness readings
- 7.9 The non-slip material should be measured for surface roughness by using extra coarse Press-O-Film tape and a dial micrometer. These measured ranges should be between 62 μm (2 1/2 mils) to 112 μm (4 1/2 mils).

8.0 CURE

- 8.1 To insure proper cure, the D.P.S. shall be applied according to the time -temperature data provided by the manufacturer of the base coat.
- 8.2 Special care shall be taken in handling the pipe during the curing and cooling operations to assure against damage to the coating.
- 8.3 After the coating is completely cured, the pipe may be force cooled to facilitate coating inspection and repairs.

9.0 INSPECTION AND TESTING

- 9.1 The Applicator shall have the full responsibility for the coating application quality in accordance with this Specification. The Applicator's quality control inspector or the authorized Project Manager shall be responsible for stopping operations when conditions develop which could adversely affect the quality of the completed work.
- 9.2 Tests on the Dual Powder System, as detailed in the Appendix and Table 1 of this specification during the application process and on the finished coating, shall be performed by the authorized laboratory. The results of these tests will be used in the qualification of the finished job for acceptance.
- 9.3 Any coated pipe that does not conform to the criteria or test result limits specified herein shall be repaired in accordance with Section 10.0 of this Specification or re-coated.
- 9.4 Although the principal purpose of the external coating inspection by Applicator or other authorized inspector is to ensure full compliance of the external coating with this Specification, such inspections shall also include examination of previously undetected defects in the pipe or on the pipe ends. Pipe having such defects shall be set aside for subsequent repair or replacement by the pipe supplier and for any necessary repair.

Note: The coating has a tendency to hold surface moisture. This condition may indicate false discontinuity detection to the cutback areas.

10.0 Repairs

- 10.1 Any defects or damage to the external coating found during the inspection shall be repaired. Coating thickness shall be in accordance with the attached Table 1. If repairs are deemed impractical, the Applicator shall re-clean and re-coat the entire pipe joint containing the defects or damaged areas.

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10.2 Pinhole and Small Area Repair

- 10.2.1 Imperfections such as scales, slivers, burrs, weld spatter, etc. shall be removed by grinding prior to repairs.
- 10.2.2 All repairs shall conform to the requirements of the attached Table 1. Two part epoxy repairs will not be performed when ambient temperature is 13°C (50°F) or below.
- 10.2.3 Completely cured coating repairs shall be inspected with a holiday detector as outlined in the Appendix (Paragraph 2.D.) of this Specification.
- 10.2.4 The two part epoxy repair area shall be allowed to cure prior to handling as per manufacturer's specification.

10.3 Large Area Repair

For larger areas, the following procedures shall be followed:

- 10.3.1 The pipe to be repaired shall be cleaned to remove all dirt, scale, rust, damaged or disbanded coating and other foreign material. Areas repaired before surface oxidation or rusting occurs may be prepared by hand sanding, power tool grinding or other approved and suitable means. The edges of the original coating shall be "feathered out" around the area to be coated and all dust wiped off before applying the patch coating.
- 10.3.2 The material for two part epoxy repairs shall be in accordance with the attached Table 1.
- 10.3.3 Repair coating shall be applied to attain a uniform minimum thickness as required in the attached Table 1.
- 10.3.4 The two part repair material shall completely cover the repaired area.
- 10.3.5 The two part epoxy repair areas shall be allowed to completely cure prior to handling according to the manufacturer's specifications.
- 10.3.6 Completely cured coating repairs shall be inspected with the Applicator's holiday detector as outlined in Paragraph 2.D. of the Appendix of this Specification.

11.0 HANDLING, TEMPORARY STORAGE, AND LOADING OF COATED PIPE

11.1 Handling of Coated Pipe

- 11.1.1 The pipe, after being externally coated and cured, shall be sufficiently cooled for proper handling. Pipe temperature should be 88°C (190°F) or less before handling. All coated pipe shall be rolled or removed so as to prevent damage to the internal and external coating, or to the pipe.
- 11.1.2 When handling the pipe by hook line, only hooks fitted to the curvature of the pipe shall be used. All hooks shall be padded to prevent contact damage to the pipe. Use of brass or copper padding will not be allowed.

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11.2 Temporary Storage of Coated Pipe

- 11.2.1 Coated pipe to be temporarily stored shall be protected to avoid damage to the coating and the pipe. The coated pipe shall be stacked using separators to avoid contact between joints. The type and number of separators shall be agreed between Company and Applicator.

11.3 Loading for Transportation of Coated Pipe

- 11.3.1 All pipes to be shipped by truck, ship, barge, or rail shall be protected by padding, separators, and dividers before shipment. No protruding metal objects which could contact the coated pipe will be allowed.
- 11.3.2 Each 40 foot joint of pipe shall be separated from other pipe with a minimum of 4 separators. One separator shall be placed near each end and the remaining two separators placed at third points long the pipe.
- 11.3.3 On 80 foot double-jointed pipe, a minimum of 6 separators shall be used, spaced near each end and at fifth points along the double joint.
- 11.3.4 All pipe shipped by rail shall be loaded in accordance with AAR-2
- 11.3.5 All pipes shall be tied down to prevent damage to the coating resulting from movement or vibration during transportation.

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APPENDIX

1. CLEANING AND SURFACE PREPARATION

A. Visual Inspection of Surface Preparation

Tests for compliance with cleaning and surface preparation specifications shall be visual.

B. Tests for Blast Anchor Pattern

The anchor pattern attained with the particular abrasive and blasting conditions can be determined by any of the following methods:

(a) Method 1 – Extra Course Press-O-Film Replica Tape

The profile shall be measured by the Extra Course Press-O-Film Replica Tape followed by measurement using a micrometer.

(b) Method 3 - Profilometer

Subject to approval by the Company's inspector, a profilometer or other instrument designed for measuring surface profile may be used.

C. Use of Visual Standards

To assist in routine inspection of the surface preparation and anchor pattern, a set of visual standards may be used for comparison. Such a set of standards may be NACE (Visual Standard for Surface of New Steel Centrifugally Blast Cleaned with Steel Grit and Shot) or ISO 8501-1/SIS.SS.05 5900 (1988) – Pictorial Surface Preparation Standard for Painting Steel Structures

2. Dual Powder System

A. Applied Film Thickness

(a) Tests to determine the applied film thickness of the epoxy Dual Powder System shall be made with an approved magnetic type thickness instrument which shall be calibrated to certified coating thickness standards as frequently as necessary to ensure accuracy, but not less than once every four hours.

(b) Thickness tests shall be performed after the pipe has been cooled sufficiently to allow inspection.

(c) The finished applied film shall have an average nominal thickness and minimum thickness as specified in the attached Table 1 or the Purchase Order.

(d) Determination shall be made at random points on each joint.

B. Cured Coating

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- (a) Cured coating shall be essentially free of blisters, pinholes, fisheyes or sags.
 - (b) Determination of cure shall be by one or both of the following methods; which shall be agreed to during the pre-job meeting:
 - i) Method 1 - Bend Test
When directed by the inspector, an 18-inch ring shall be cut from a pipe joint. Two straps, one inch wide, cut from the ring shall be subjected to bend tests by the Applicator for cure verification. Test method and Pass/Fail shall be as per the attached Table 1 and NACE RP-0394-02.
 - ii) Method 2 - Thermal Analyzer
Complete cure may be verified by the use of a Thermal Analyzer (DSC). Shavings of the top coat shall be tested with a Thermal Analyzer (DSC) to determine degree of cure. For Non-Slip, remove the top coat and then take samples from the base coat. Test procedure is given in Table 1.
- C. Adhesion Test
- (a) The adhesion of the coating shall be verified periodically on at least one joint from each hour's production.
 - (b) Determination shall be made adjacent to the cutback when the pipe temperature is below 66°C (150°F).
 - (c) The knife test: Using a utility knife cut through coating to substrate, creating an X pattern. At the intersection of the X, insert the tip of the blade under the coating. Using a levering action, the coating should demonstrate a definite resistance. The coating shall be fully adhered and shall not strip or peel from the steel.
- D. Holiday Inspection
- (a) Complete holiday inspection shall be carried out on 100% of the coated pipe joint after the coating is cured and sufficiently cooled to allow inspection (below 88°C (190°F). Testing shall be in accordance with the attached Table 1 and NACE RP-0490-01.
 - (b) The audible signal initiated by a holiday in the coating shall be of sufficient volume to be detected above maximum background noise.
 - (c) Holiday detector voltage shall be calculated by the thickness of the base coat.

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TABLE 1: NAP-GARD® 7-2502NS & 7-2508NS (NON-SLIP)

TEST	METHOD	FREQUENCY	LIMITS
ANCHOR PROFILE (for Base Coat)	PRESS-O-FILM REPLICATION METHOD, X- COARSE GRADE TAPE	ONCE PER HOUR	50 µm (2.0 MILS) MINIMUM 115.0 µm (4.5 MILS) MAXIMUM
COATING THICKNESS	MAGNETIC THICKNESS GAUGE	EACH PIPE	<i>BASECOAT</i> 7-2500, 7-2501, 7-2508, 7- 2504, 7-251En Series PER CUSTOMER SPECIFICATION <i>TOPCOAT</i> 7-2502NS / 7-2508NS 50-75µm (2 MILS TO 3 MILS)
SURFACE ROUGHNESS	PRESS-O-FILM REPLICATON METHOD, X-COARS GRADE TAPE	TWICE/SHIFT	62-112 µm (2.5 TO 4.5 MILS)
DWELL TIME	STOP WATCH	AT START UP AND EACH LINE SPEED CHANGE	AS SPECIFIED IN SECTION 7.3
COATING REPAIR	1)7-1631 / 7-1677S "E-Z STICK" 2)7-1861 / 7-1868 PATCH COMPOUND	AS REQUIRED	1) PINHOLES ONLY- 15 MILS MIN 2) LARGE AREAS - 25 MILS MIN
HOLIDAY TEST	NACE RP 0490-01	EACH PIPE	125 VOLTS PER MIL (Not to exceed 4,000 volts)
ADHESION (DRY)	APPENDIX 2.C	ON PIPE/ONE/HOUR	APPENDIX SECTION 2.C
BEND TEST	CSA-CLAUSE 12.11	EACH RING SAMPLE	1.5/PD MINIMUM @-30°C WITH 30 MILS TOTAL THICKNESS
CATHODIC DISBONDMENT	CSA-CLAUSE 12.8 (24 HRS)	ONCE/SHIFT	6.5MM MAXIMUM (from the edge of holiday)
ADHESION	CSA-CLAUSE 12.14(24 HRS)	ONCE/SHIFT	RATING 3 MAXIMUM
IMPACT RESISTANCE	CSA-CLAUSE 12.12	ONCE/SHIFT	>1.5 JOULES
INTERFACE POROSITY	CSA-CLAUSE 12.10	ONCE/SHIFT	RATING 4 MAXIMUM
CROSS-SECTION POROSITY	CSA-CLAUSE 12.10	ONCE/SHIFT	RATING 4 MAXIMUM
INTERFACE CONTAMINATION	CSA-CLAUSE 12.15	ONCE/SHIFT	30% MAXIMUM
THERMAL ANALYSIS	CSA-CLAUSE 12.17	ONE PER 8 HOUR SHIFT	ΔTg. -5°C to 4°C

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