PPG Highway Waterproofing System Inspection and Testing Procedure

PART 1 - PRE-APPLICATION

1.1 SECTION INCLUDES

A. Inspection and testing procedures for Spray Applied Waterproofing Membrane, aka "Membrane Waterproofing (Cold Liquid Elastomeric)," "Cold Liquid Applied Elastomeric Waterproofing Membrane," "Cold Liquid-Applied Membrane (CLAM)," etc. with an asphalt or concrete wearing course.

1.2 REFERENCED PARTIES

A. Owner: The individual, company, or agency which owns the structure(s) under contract.

B. General Contractor: The contractor employed by the Owner to provide all labor, materials, tools, and equipment, either directly or through sub-contractors, to perform all operations necessary for the construction associated with the contract documents.

C. Installer: The installer of the waterproofing system. In the event the Installer is directly contracted by the Owner, the installer shall assume the responsibilities designated to the General Contractor listed herein.

D. Waterproofing Inspector: An individual with the dedicated role of performing field testing of the PPG Highway Waterproofing system as specified in the contract documents.

1.3 PRIOR TO PROJECT STARTUP

A. It is recommended that all parties meet prior to the start of the project to review and discuss all aspects of the waterproofing installation and field inspection and testing. This document (and other PPG documentation) contains commentary or clarification regarding specific procedures and/or tests.

1.4 PRIOR TO APPLICATION OF PRIMER

A. Waterproofing Inspector shall record environmental conditions readings into a daily log in accordance with the contract documents. If no such requirements are listed in the contract documents, the Waterproofing Inspector shall record the following information into a daily log:

1. Time of reading
2. Ambient temperature
3. Humidity
4. Wind velocity
5. Substrate temperature
6. Dew point

B. The frequency of recording environmental conditions readings shall be in accordance with the contract documents.

C. If no such requirements are listed in the contract documents, the Waterproofing Inspector shall perform a minimum of three (3) readings and record each reading in a daily log.

D. Waterproofing Inspector shall record substrate preparation methods and other information into a daily log in accordance with the contract documents.

E. If no such requirements are listed in the contract documents, the Waterproofing Inspector shall record the following information into a daily log:

1. Area (size) of prepared substrate (typically reported in square feet or square meters)

2. Surface preparation standard utilized (i.e., SSPC-SP13/NACE No. 6)

3. Substrate material (i.e., concrete, steel, etc.)

4. Surface preparation equipment utilized (i.e., shot blaster machine, open blast cleaning machine with nozzle, pressure washing machine, etc.)

5. Surface preparation media (i.e., steel shot, sand, water, etc.)

6. Surface profile achieved

F. Substrate moisture content shall be in accordance with the contract documents or less than 5.0% (whichever is more stringent) when tested with a non-destructive concrete moisture meter such as Tramex Concrete Moisture Encounter or DeFelsko PosiTest CMM.

G. Frequency of substrate moisture content testing shall be in accordance with the contract documents.

H. If no such requirements are listed in the contract documents, the frequency of testing shall be one (1) test per 1,000 ft² (100 m²) or a minimum of three (3) tests, whichever is greater.

I. ACCEPTANCE OF PREPARED SUBSTRATES

1. Concrete and Masonry Structures and Substrates

a. The acceptance criteria for prepared concrete and masonry structures and substrates should be specified in the contract documents.

b. If no such criteria are listed in the contract documents, SSPC-SP13/NACE No. 6 shall be used. Refer to Section 6 and Table 2. SSPC-SP13/NACE No. 6 provides minimum acceptance criteria for concrete surfaces after surface preparation. For reference only, a subset of the acceptance criteria listed in Table 2 is provided below.

Property	**Test Method**	**Severe Service**
Surface tensile strength	ASTM D7234 and/or ASTM C1583	2.1 MPa (300 psi) min.
Surface profile	ICRI No. 310.2	CSP 3 min.
Surface cleanliness	ASTM D4258 (Visible dust)	No significant dust
Residual contaminates	ASTM F21	Water droplets wet surface immediately forming a continuous uniform film

Property	Test Method	Severe Service
Moisture content	ASTM D4263[1]	No visible moisture

c. Concrete strength and soundness is the responsibility of the General Contractor. It is recommended that the General Contractor validate the concrete strength in accordance with ASTM C1583 and/or ASTM C856 prior to mobilization for waterproofing activities.

2. Metal Structures and Substrates

a. The acceptance criteria for prepared metal structures and substrates should be specified in the contract documents.

b. If no such criteria are listed in the contract documents, refer to SSPC-SP10/NACE No. 2.

PART 2 - WATERPROOFING SYSTEM APPLICATION

A. PRIMER APPLICATION

1. Waterproofing Inspector shall record product application information into a daily log as required in the contract documents.

2. If no such requirements are listed in the contract documents, the Waterproofing Inspector shall record the following information into a daily log:

a. Area (size) coated (typically reported in square feet or square meters)

b. Product name

c. Traceability, lot, or batch number(s)

d. Ambient temperature of product component(s)

e. Quantity of material used (typically reported in gallons)

f. Mixing method, application method, and equipment used

B. PPG BRIDGE DECK MEMBRANE (“BDM”) APPLICATION

1. Waterproofing Inspector shall record product application information into a daily log as required in the contract documents.

2. If no such requirements are listed in the contract documents, the Waterproofing Inspector shall record the following information into a daily log:

a. Area (size) coated (typically reported in square feet or square meters)

[1] It may not be practical to perform ASTM D4263 in some circumstances due to the cautions listed in Section 4 of the ASTM document. Section 4.1 states *“This test method shall be conducted when the surface temperature and ambient conditions are within the established parameters for application of the coating system.”* Section 4.2 states *“Avoid direct sunlight, direct heat, or damage to the plastic sheet, as such treatment affects the reliability of the results.”* In such circumstances, Owner, General Contractor, Installer, and Waterproofing Inspector shall discuss and approve an alternative method of evaluating substrate moisture content. It is recommended that such a contingency be discussed during the pre-construction meeting(s).

b. Product name

c. Traceability, lot, or batch number(s)

d. Ambient temperature of A and B components

e. Quantity of material used (typically reported in gallons)

f. Application equipment information

i. Pump make and model

ii. Spray gun make and model

iii. Spray module

iv. Set temperatures of A and B components (i.e., the equipment settings)

v. Actual temperatures of A and B components (i.e., the actual temperature readings, typically referred to as “dynamic temperature”)

vi. Set pressure (i.e., the equipment settings)

vii. Actual pressure (i.e., the actual pressure readings, typically referred to as “dynamic pressure”)

viii. Material inlet pressure

C. PPG BD TOP COAT (“BDTC”) APPLICATION

1. Waterproofing Inspector shall record product application information into a daily log as required in the contract documents.

2. If no such requirements are listed in the contract documents, the Waterproofing Inspector shall record the following information into a daily log:

a. Area (size) coated (typically reported in square feet or square meters)

b. Product name

c. Traceability, lot, or batch number(s)

d. Ambient temperature of A and B components

e. Quantity of material used (typically reported in gallons)

f. Application equipment information

i. Pump make and model

ii. Spray gun make and model

iii. Spray module

iv. Set temperatures of A and B components (i.e., the equipment settings)

v. Actual temperatures of A and B components (i.e., the actual temperature readings, typically referred to as “dynamic temperature”)

vi. Set pressure (i.e., the equipment settings)

vii. Actual pressure (i.e., the actual pressure readings, typically referred to as “dynamic pressure”)

viii. Material inlet pressure

PART 3 - FIELD TESTING OF WATERPROOFING SYSTEM

3.1 FILM THICKNESS

A. PPG BDM

1. Waterproofing Inspector shall perform thickness testing in accordance with the contract documents and record the results in a daily log.

2. If no such requirements are listed in the contract documents, the Waterproofing Inspector may perform thickness testing in accordance with SSPC-PA2 (magnetic), SSPC-PA9 (ultrasonic), and/or ASTM D1005 (destructive) and record the results in a daily log, noting the location where the test sample was taken.

3. If Waterproofing inspector uses a micrometer per ASTM D1005,

a. Remove a small amount of cured BDM from the substrate using a punch, knife, or scraper.

b. Measure three (3) points of the removed sample using a micrometer. Record each reading in a daily log, noting the location where the test sample was taken.

c. Installer shall repair any sample areas where BDM was cut out prior to proceeding to subsequent installation steps.

4. The frequency of testing shall be in accordance with the contract documents.

5. If no frequency of testing is specified in the contract documents, it is suggested that Waterproofing Inspector perform at least one (1) test per 500 ft².

B. PPG BDTC

1. Waterproofing Inspector shall perform thickness testing in accordance with the contract documents and record the results in a daily log[2].

2. If no such requirements are listed in the contract documents, the following theoretical thickness calculations[2] may be used to determine the quantity of material (gallons or liters) required to cover the area being coated.

[2] Magnetic, ultrasonic, and destructive test procedures are not possible due to the presence of aggregate in the membrane surface. Spray equipment is calibrated and tested to a stroke count per gallon of material sprayed. The quantity of material dispensed can be determined by recording the number of pump strokes the proportioning unit (i.e., the pump) performed.

Square Feet per Gallon

Square Footage ÷ (1,604 ÷ required thickness in mils) x 1.1 = **# of gallons required**

Example: 50,000 ÷ (1,604 ÷ 40) x 1.1 = ***1,372 gallons***

Square Meters per Liter

Square Footage ÷ (1,000 ÷ required mil thickness in µm) x 1.1 = **# of liters required**

Example: 5,000 ÷ (1,000 ÷ 1,000 µm) x 1.1 = ***5,500 liters required***

Explanations:

- 1,604: A 100% volume solids gallon of membrane will cover 1,604 ft² at 1 mil thick.
- 1,000: A 100% volume solids liter of membrane will cover 1,000 m² at 1 µm thick.
- 1.1: When determining theoretical coverage rates, an assumed 10% waste is included.

3.2 PULL-OFF ADHESION STRENGTH

A. Prior to Coating Application

1. Waterproofing Inspector shall perform pull-off adhesion strength testing to evaluate the substrate surface strength in accordance with contract documents and record the results in a daily log.

2. If no such requirements are listed in the contract documents, the Waterproofing Inspector shall perform pull-off adhesion strength testing in accordance with SSPC-SP13, Table 2 and as described below.

   a. Pull-off adhesion strength testing may be performed in accordance with ASTM D7234.

   b. The frequency of testing shall be in accordance with the contract documents.

   c. If no frequency of testing is specified in the contract documents, the frequency of testing shall be as follows:

      i. If Waterproofing Inspector utilizes, 50mm dollies, perform one (1) test per 5,000 ft² (500 m²) or fraction thereof, or a minimum of three (3) tests, whichever is greater.

      ii. If Waterproofing Inspector utilizes, 20mm dollies, perform three (3) tests per 5,000 ft² (500 m²) or fraction thereof, or a minimum of three (3) tests, whichever is greater. The three (3) tests shall be performed within the perimeter of a 12-inch (300mm) diameter area.

d. The minimum value is 300 psi (2 MPa). Values below 300 psi (2 MPa) may indicate unsound or bruised concrete. If adhesion values are below 300 psi (2 MPa), cease work and obtain further instruction from Owner[3].

B. Primer & BDM Adhesion

1. Waterproofing Inspector shall perform pull-off adhesion strength testing of primer and BDM in accordance with contract documents and record the results in a daily log.

2. If no such requirements are listed in the contract documents, the Waterproofing Inspector may perform pull-off adhesion strength testing as described below.

a. Concrete and Masonry Structures and Substrates

i. Pull-off adhesion strength testing may be performed in accordance with ASTM D7234.

ii. The location of each adhesion test should be randomly selected, and evenly distributed throughout the installation area.

iii. The minimum recommended value is 150 psi (1 MPa)[4].

iv. For each test, the Waterproofing Inspector should record the following information in a daily log:

1. Adhesion value

2. Mode of failure

3. Product tested

b. Metal Structures and Substrates

i. Pull-off adhesion strength testing may be performed in accordance with ASTM D4541.

ii. The location of each adhesion test should be randomly selected, and evenly distributed throughout the installation area.

iii. The minimum recommended value is 300 psi (1 MPa).

iv. For each test, the Waterproofing Inspector should record the following information in a daily log:

1. Adhesion value

[3] Refer to SSPC-SP13, Appendix A.8.5 for additional information. Appendix A.8.5 states *"Because of the variability in concrete, the surface preparation methods used and the choice and operation of the instruments, there is a large margin of error in the pull-off strength results obtained from these methods. Therefore, it is incumbent on all persons performing the testing and/or specifying the numeric results that equal attention is paid to the mode of failure and it is observed, interpreted, and the consequences understood."* If on site personnel (Owner, General Contractor, Installer, and/or Waterproofing Inspector) suspect a pull-off value is erroneous, additional testing should be performed in the general vicinity of this test location to validate the results.

[4] Each result should be evaluated based on duration of cure, mode of failure, and force at failure. Refer to ASTM D7234, Appendix X.1 for additional information regarding interpretation of results.

2. Mode of failure

3. Product tested

3. The frequency of testing shall be in accordance with the contract documents.

4. If no frequency of testing is specified in the contract documents, it is suggested that the Waterproofing Inspector perform at least one (1) test per 5,000 ft² (500 m²) or fraction thereof, or a minimum of three (3) tests, whichever is greater.

C. Membrane Tie-In or Overlap Adhesion

1. Waterproofing Inspector shall pull-off adhesion strength testing of new membrane (BDM or BDC) overlapped or tied into existing membrane (BDM or BDTC) in accordance with contract documents and record the results in a daily log.

2. If no such requirements are listed in the contract documents, the Waterproofing Inspector may pull-off adhesion strength testing as described below.

a. Concrete and Masonry Structures and Substrates

i. Tensile adhesion bond testing may be performed in accordance with ASTM D7234.

ii. The location of each adhesion test should be randomly selected, and evenly distributed throughout the overlap or tie-in area.

iii. The minimum recommended value is 150 psi (1 MPa)[4].

iv. For each test, the Waterproofing Inspector should record the following information in a daily log:

1. Adhesion value

2. Mode of failure

3. Product tested

b. Metal Structures and Substrates

i. Tensile adhesion bond testing may be performed in accordance with ASTM D4541.

ii. The location of each adhesion test should be randomly selected, and evenly distributed throughout the overlap or tie-in area.

iii. The minimum recommended value is 300 psi (1 MPa)

3. The frequency of testing shall be in accordance with the contract documents.

4. If no frequency of testing is specified in the contract documents, it is suggested that the Waterproofing Inspector perform at least one (1) test per 250 linear feet (75 linear meters) or fraction thereof, or a minimum of three (3) tests, whichever is greater.

3.3 HOLIDAY INSPECTION

A. Inspection of membrane surface for holidays shall be performed in accordance with contract documents[5].

B. If no such requirements are listed in the contract documents, it is recommended that the Waterproofing Inspector perform visual holiday inspections throughout the installation process. Waterproofing Inspector should indicate pin holes and areas of insufficient membrane thickness. Installer shall correct these areas.

[5] If high voltage spark testing is specified in contract documents for use on concrete substrates, refer to PPG Discontinuity Testing Memorandum for additional information.

Appendix A – Document Version Control

Version	Date	Author	Rationale	Approval
1.0d	8/31/2023	Jonathan Haydu	First draft	
1.0	9/6/2023	Jonathan Haydu	Issued	Jonathan Haydu James McCarthy
2.0d	11/22/2023	Jonathan Haydu	Draft; added additional requirements for concrete surface strength testing	
2.0	12/12/2023	Jonathan Haydu	Issued	Jonathan Haydu James McCarthy