



ABRASION

- METHOD:** ASTM D 4060-07 (CS-17 Wheel, 1,000 cycles, 1,000 gram load).
SYSTEM: Series 431 Perma-Shield PL cured seven days at 75°F (24°C).
REQUIREMENT: No more than 76 mg loss, average of three tests. (TR6176)
- METHOD:** BS EN 598: 2007+A1: 2009 (Rocking Abrasion).
SYSTEM: Series 431 Perma-Shield PL cured 30 days.
REQUIREMENT: No more than 0.01 mm (0.6 mils) thickness of coating loss after 50,000 cycles. (TR6207-A)
- METHOD:** BS EN 598: 2007+A1: 2009 (Rocking Abrasion).
SYSTEM: Series 431 Perma-Shield PL cured 30 days.
REQUIREMENT: No more than 0.14 mm (5.5 mils) thickness of coating loss after 1,000,000 cycles. (TR6206-A)

ADHESION

- METHOD:** ASTM D 4541-09 (Method E, Type V Tester, Scored).
SYSTEM: Series 431 Perma-Shield PL applied to ductile iron and cured seven days at 75°F (24°C).
REQUIREMENT: No less than 1,131 psi (7.8 MPa) pull, average of three tests. (TR6187)
- METHOD:** ASTM D 4541-09 (Method E, Type V Tester, Scored).
SYSTEM: Series 431 Perma-Shield PL applied to SSPC-SP5/NACE No. 1 White Metal Blast Cleaned steel and cured seven days at 75°F (24°C).
REQUIREMENT: No less than 1,770 psi (12.2 MPa) pull, average of three tests. (TR6195-A)

CATHODIC DISBONDMENT

- METHOD:** ASTM G 8-96 (2003) e1.
SYSTEM: Series 431 Perma-Shield PL applied at 37 mils average DFT and cured 14 days at 75°F (24°C).
REQUIREMENT: Classification Group A. No more than 0.00 inch (0.00 mm) disbonded equivalent circle diameter, average of two tests. (TR6210)

CHEMICAL IMMERSION

- METHOD:** NACE TM 0174-2002.
SYSTEM: Series 431 Perma-Shield PL applied to SSPC-SP5/NACE No. 1 White Metal Blast Cleaned steel and cured 30 days at 75°F (24°C).
REQUIREMENT: No blistering, cracking, checking, erosion or delamination of film after one year continuous immersion at 72°F (22°C). (TR6211)

Reagents:

Hydrochloric Acid 5%	Sulfuric Acid 5%
Hydrochloric Acid 10%	Sulfuric Acid 25%
Sodium Hypochlorite 13%	Sulfuric Acid 50%
Sodium Potassium Acetate 50%	Urea Liquid

CHEMICAL RESISTANCE

- METHOD:** BS EN 598: 2007+A1: 2009 (Chemical Resistance to Effluents).
SYSTEM: Series 431 Perma-Shield PL applied to ductile iron pipe and cured 14 days at 75°F (24°C).
REQUIREMENT: No blistering, checking, disbonding, softening, discoloration or loss of gloss following six months immersion, recirculated at 1.0 l/min and maintained at 64°F (18°C). (TR6217)

Reagents:

Sulfuric acid solution, pH 3
Sodium hydroxide solution, pH 13

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HARDNESS

METHOD:	ASTM D 2240-05.
SYSTEM:	Series 431 Perma-Shield PL cured 30 days at 75°F (24°C).
REQUIREMENT:	No less than a Shore Type D hardness of 78, average of five tests. (TR6185)

IMMERSION

METHOD:	ASTM D 870-09.
SYSTEM:	Series 431 Perma-Shield PL applied to ductile iron and cured 14 days.
REQUIREMENT:	No rusting, cracking, checking, or delamination of film after 4,000 hours continuous immersion in 140°F deionized water. (TR6209)

SALT SPRAY (FOG)

METHOD:	ASTM B 117-09.
SYSTEM:	Series 431 Perma-Shield PL applied to ductile iron and cured 14 days at 75°F (24°C).
REQUIREMENT:	No blistering, cracking or delamination of film after 5,000 hours exposure. (TR6219)

SEVERE WASTEWATER ANALYSIS TEST (S.W.A.T.)

METHOD:	Standard Practice for Rapid Evaluation of Coatings and Linings by Severe Wastewater Analysis Test: 65°C, 500 ppm H ₂ S, 4,000 ppm NaCl, 10% H ₂ SO ₄
SYSTEM:	Series 431 Perma-Shield PL applied at 50 mils to SSPC-SP5/NACE No. 1 White Metal Blast Cleaned steel and cured 30 days at 75°F (24°C).
REQUIREMENT:	Initial impedance of 11.2 (log-Z). No blistering, cracking, checking or loss of adhesion. Reduction in log-Z electrical impedance no more than 0.5 after 28 days exposure.

WATER ABSORPTION

METHOD:	ASTM C 413-01 (2006).
SYSTEM:	Series 431 Perma-Shield PL cured 14 days at 75°F (24°C).
REQUIREMENT:	No water absorption. (TR6188-B)

WATER VAPOR TRANSMISSION

METHOD:	ASTM D 1653-03 (2008) (Method B Wet Cup, Condition C).
SYSTEM:	Series 431 Perma-Shield PL cured 30 days at 75°F (24°C).
REQUIREMENT:	No more than 1.25 g/m ² per 24h water vapor transmission (WVT), and no more than 0.09 perms (0.06 metric perms) water vapor permeance (WVP), average of three tests. (TR6186-B)
METHOD:	ASTM E 96/E96M-05 (Procedure D).
SYSTEM:	Series 431 Perma-Shield PL cured 30 days at 75°F (24°C).
REQUIREMENT:	No more than 0.09 perms (0.06 metric perms) water vapor permeance (WVP), average of three tests. (TR6208)

This product will meet or exceed the above test requirements established for the coating systems listed. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating. Published technical data is subject to change without notice. The online catalog at www.tnemec.com should be referenced for the most current technical data and instructions. For additional performance criteria and specific test results, contact Tnemec Company or its representative.