PERMA-SHIELD® PL

ADVANCED PROTECTION FOR DUCTILE IRON AND STEEL PIPE

Tnemec Company's innovative Perma-Shield lining technology is now available for the interior and exterior of steel and ductile iron pipe and fittings. Specifically formulated and tested to withstand severe wastewater environments and corrosive soil conditions, Perma-Shield has protected millions of square feet in wastewater collection and treatment plants including manholes, lift stations, headworks, clarifiers, digesters and buried pipe.

THE PERFORMANCE

Wastewater coating technology has changed dramatically in the past several years, driven primarily by changes in wastewater that have lead to elevated levels of hydrogen sulfide gas (H_2S) and Microbiologically Induced Corrosion (MIC) that quickly corrode unprotected, or poorly protected, substrates. Tnemec recognized older coating technology no longer offered sufficient protection and launched a major research initiative to formulate a protective liner designed to resist the biological and chemical components found in wastewater streams and aggressive soils. The result was the Perma-Shield line of fluid-applied epoxy wastewater coatings. Extensively tested in accelerated laboratory environments, and backed by years of reliable field service, Perma-Shield has demonstrated performance superior to older coating technology and even newer lining products.

THE PRODUCT

Series 431 Perma-Shield® PL is a 100% solids, high-build epoxy liner derived from the successful Perma-Shield line and developed for the unique needs of steel and ductile iron pipe and fittings. A high loading (20% by volume) of high quality, ceramic microspheres adds exceptional abrasion resistance to an already durable epoxy film, and its low permeation rate provides an impenetrable barrier to H_2S and other sewer gases and chemicals. Series 431 applies quickly in one or two coats allowing for fast and efficient through-put of pipe and fittings.

THE SUPPORT

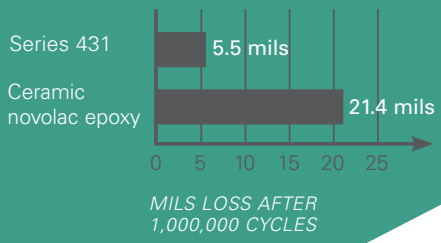
Tnemec products are backed by some of the most technical and knowledgeable coating consultants in the industry. With expertise extending to all facets of wastewater collection and treatment, Tnemec representatives provide solid support from specification to application, and on through placing the coating in service. Ensuring long-term performance is our key objective.

SERIES 431 BENEFITS

- 100% Solids Epoxy
- Excellent Adhesion
- Abrasion Resistant
- Chemical Resistant
- Ceramic Microsphere Modified
- H_2S Permeation Resistant

SIDE BY SIDE COMPARISON

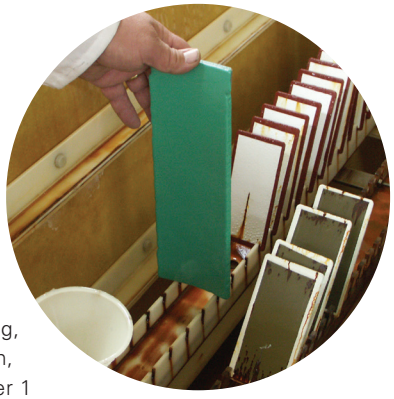
Series 431 Perma-Shield PL and a competitive liner were evaluated side by side in an internal test utilizing the British Standard rocking abrasion test EN 598:2007+A1:2009.



ABRASION RESISTANCE

Method: ASTM D 4060-07 (CS-17 Wheel, 1,000 gm load 1,000 cycles).
System: Series 431 Perma-Shield PL cured 30 days.
Requirement: No more than 41 mg loss, average of three tests.

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) loss, average 15 point readings along pipe invert after 1,000,000 cycles.



CHEMICAL RESISTANCE

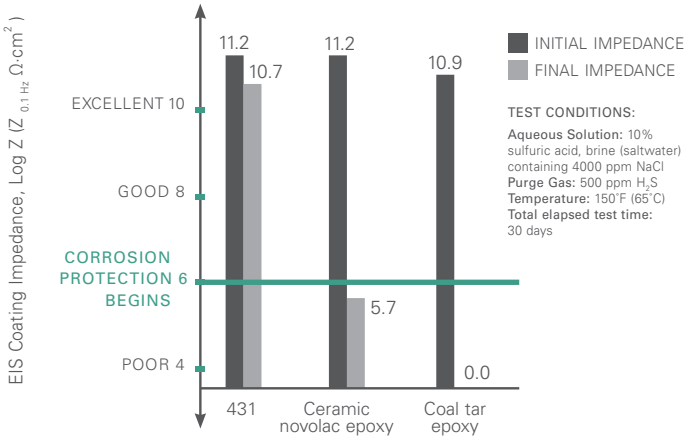
Method: NACE TM 01-74:2002.
System: Series 431 Perma-Shield PL cured 30 days.
Requirement: No blistering, cracking, checking, erosion, or delamination of film after 1 year continuous immersion at 72°F.
Reagents: Hydrochloric Acid 10%, Sulfuric Acid 50%, Sodium Hypochlorite 13%, Sodium Potassium Acetate 50%.

Method: BS EN 598:2007+A1:2009 (Chemical Resistance to Effluents).
System: Series 431 Perma-Shield PL cured 14 days.
Requirement: No blistering, checking, disbonding, softening, discoloration or loss of gloss following 6 months immersion, recirculated at 1.0 l/min and maintained at 64°F (18°C).
Reagents: Sulfuric acid solution, pH 3; and Sodium hydroxide solution, pH 13.

PERMEATION RESISTANCE

A component of the 28 day Standard Practice for Rapid Evaluation of Coatings and Linings by Severe Wastewater Analysis Test (S.W.A.T.), Electrochemical Impedance Spectroscopy (EIS) analysis is a method that uses electrical current to determine the level of coating degradation after exposure to a testing environment. Measuring a coating's resistance as impedance to an electrical current before and after provides a correlation to its overall performance. The higher the resistance, the lower its permeability to gases, liquids, chlorides and ions, thus the more protection it offers. As results from third party testing show below, the final impedance of Series 431 surpassed the competition, proving it to be the ultimate protection for steel and ductile iron pipe and fittings.

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



For complete testing results, contact your local Tnemec representative.

*An updated version of this test is now certified as ASTM G210-2013.

THE TEST

In order to evaluate coating performance, Series 431 Perma-Shield PL underwent exposure to the Severe Wastewater Analysis Test (S.W.A.T.). This accelerated wastewater corrosion testing program was developed by Tnemec, in conjunction with leading engineers, municipalities and testing laboratories to test a coating's resistance to sewer gas permeation, which is the leading cause of coating failure within wastewater environments. The Severe Wastewater Analysis Test has been modified and adopted by ASTM as G210-2013.

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