# Tnemec Series 431 Perma-Shield® PL
# Performance Data Comparison

| Test | 431 Perma-Shield® PL | Ceramic Novolac Epoxy |
|---|---|---|
| Solids / Volume | **100%** | 87% ± *2%* |
| Color | **Sewer Pipe Green** | Black |
| Abrasion Resistance<br>ASTM D 4060-10<br>CS-17 (1,000 g. load) | **76 mg loss** | 340 mg loss<br>(reported by third party) |
| Abrasion Resistance<br>ASTM 4060-10<br>H-22 (1000 g. load) | **3.2 mils depth of wear** | 11 mils depth of wear<br>(reported by manufacturer) |
| Rocking Abrasion<br>BS EN 598-2007 | **5.5 mils loss after 1,000,000 cycles** | 2 mils loss after 1,000,0000 cycles<br>(reported by manufacturer–1994 test version)<br>21.4 mils loss after 1,000,000 cycles<br>(tested by Tnemec on production lined pipe) |
| Chemical Immersion<br>20% $H_2S0_4$ half-filled in production lined pipe | **No blistering, cracking, checking, erosion or delamination after 30 days exposure** | Large blistering throughout film in immersion and vapor phase following 30 days exposure<br>(tested by Tnemec on production lined pipe) |
| Adhesion to Ductile<br>ASTM D 4541-09 | **Exceeds 1,131 psi**<br>***Glue Failure*** | 1,000 psi<br>*Cohesive Failure*<br>(reported by manufacturer– test method unknown) |
| Adhesion to Steel<br>ASTM D 4541-09 | **1,769 psi**<br>***Glue Failure*** | Not Tested |
| Tensile Strength<br>ASTM D 2370-98 | **3,400 psi** | 250–300 psi<br>(reported by manufacturer–test method or version unknown) |
| Cathodic Disbondment<br>ASTM G8-96 | **Group A Classification.**<br>**0.00 inch disbondment circle equivalent** | 0.17 mm<br>(reported by manufacturer–test version unknown) |

| | | |
|---|---|---|
| Deflection (5%)<br>8" diameter DIP | **Passed. No checking, cracking or other detectable damage.** | Failed. Checking and spider cracking<br>(tested by Tnemec on production pipe) |
| Impact<br>ASTM D 2794-93<br>(modified) | **160 inch-pounds on ductile iron and steel** | 72 inch-pounds on ductile iron<br>(reported by mfg–ASTM G14-88) |
| Dielectric Strength<br>ASTM D 149-09 | **618 volts/mil** | 448 volts/mil<br>(reported by manufacturer) |
| 28-Day Severe Wastewater Analysis Test (S.W.A.T.) | **Initial Impedance: 11.2 (Log $Z_{0.1\ Hz}$)**<br>**Final Impedance: 10.7 (Log $Z_{0.1\ Hz}$)**<br>(tested by independent lab) | Initial Impedance: 11.2 (Log $Z_{0.1\ Hz}$)<br>Final Impedance: 5.7 (Log $Z_{0.1\ Hz}$)<br>(tested by independent lab) |
| Coal Tar Containing | **No** | Yes |
| High Velocity Sewer Jet Cleaning (Hydrocleaning) Recommendations | **Conventional flushing nozzle, self-rotating or non-rotating**<br>**2,500 psi (172 bar) max. pressure at nozzle** | Not Recommended<br>Must use self-rotating nozzle with fan jets only<br>1,800 psi (124 bar) max. pressure at nozzle<br>(reported by manufacturer) |

For the most accurate and useable results, all testing should be completed using the most current test methods.