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TECHNICAL BULLETIN

ULTRAVIOLET (UV) RADIATION EXPOSURE OF PVC PIPE PRODUCTS

Polyvinyl Chloride (PVC) pipe is susceptible to UV exposure from the sun if not stored properly prior to installation. While the visible effects, such as discoloration, may seem severe, they do not compromise the pipe's performance. This technical bulletin aims to provide evidence of PVC pipe performance, guidelines for proper storage, and insight into Westlake's additional measures for pipe protection from UV exposure.

Standard 

Faded 

Burned 

Industry Research Summary

The Uni-Bell PVC Pipe Association provides extensive information on this subject in their Technical Report UNI-TR-5-03, *The Effects of Ultraviolet Radiation on PVC Pipe.* Data in this report shows that pipe made with standard PVC material and exposed to UV radiation from the sun for two years suffers no adverse effects on the tensile strength or modulus of elasticity of the pipe. The changes, although permanent, are local and superficial.

Source: Uni-Bell

Surface Discoloration

Colors can vary and range from chalky white (as shown on the right), to brown or black (shown above). Chalky surface discoloration of PVC pressure pipe stored outdoors, unprotected for 15 years shown on the right.

Key Takeaways

- There may be some product discoloration, but it is typically limited to a few thousandths of an inch on the exterior of the pipe. Once the pipe is installed and underground, there is no further effect of the sun on the pipe.
- There is some decrease in the impact resistance in the pipe, although on average, impact levels remained above minimum levels prescribed by industry standards.
- Be sure to inspect the gaskets to make sure they are smooth and pliable, not cracked and/or dried out.

Physical Property	Performance Characteristics	Effects of Sunlight Exposure	ASTM Test Method
Tensile Strength	Pressure Capacity	No Effect	ASTM D638
Modulus of Elasticity	Pipe Stiffness	No Effect	ASTM D790
Impact Strength	Impact Resistance	Decrease	ASTM D2444

Westlake Pipe & Fittings

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Westlake Pipe & Fittings Test Study

Westlake Pipe & Fittings analyzed an AWWA C900 IB CIOD 8" DR25 pipe affected by UV exposure. The pipe underwent four tests: Acetone, Heat Reversion, Flattening, and Pressure. See Figure 1 for details.

Figure 1: Sunburned AWWA C900 IB DR25 Pipe

ASTM Performed Tests

The pipe, though affected by sun exposure, was thoroughly tested according to ASTM standards to confirm if it continued to meet the necessary performance criteria. The test results show that the pipe, when subjected to UV exposure, performs just as well as a brand-new pipe and continues to adhere to the industry's required standards.

ASTM 1598 – Burst Pressure – Material must meet short term pressure capacity. Results for the AWWA C900 IB CIOD 8" DR25 PC135 pipe exceeded the 535 psi minimum short term pressure requirement.

ASTM D2152 – Acetone Immersion - Determines the adequacy of fusion of extruded PVC. The test results show that the PVC is fused properly, as evidenced by the absence of delamination referenced in Figure 2.

ASTM F1057 – Heat Reversion – Estimates the quality of PVC pipes by observing the reaction of pipe specimens after exposure to hot air in the oven at 180 degrees C for 30 minutes minimum time duration. The test results confirm that the PVC is extruded properly, as evidenced by the absence of delamination detailed in Figure 3.

ASTM D2142 – Flattening – Determines the stiffness and load deflection of the pipe. Test results indicate no evidence of splitting, cracking, or breaking was present. Reference Figure 4.

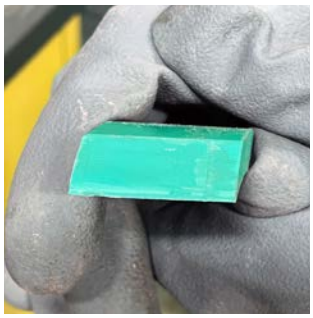

Figure 2: Acetone Immersion Results

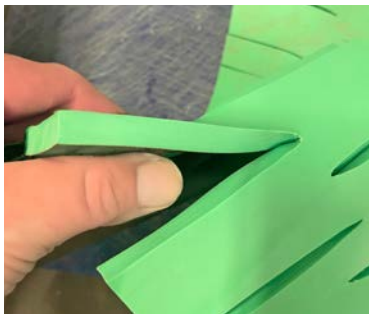

Figure 3: Heat Reversion Results

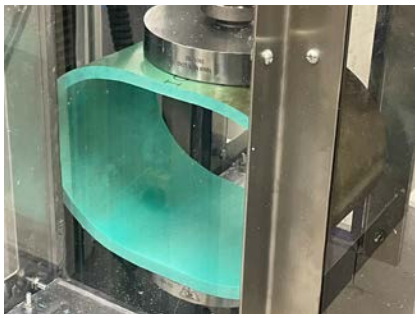

Figure 4: Flattening Process

Microscope Evaluation - Figure 5 shows the sunburned pipe under a microscope. It confirms that the burn is only on the surface and is even thinner than a hair strand.

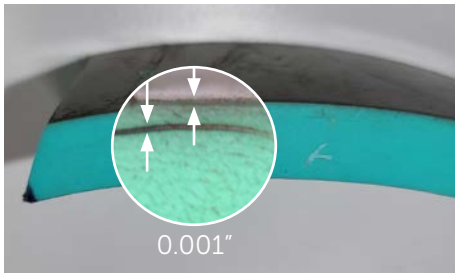

Figure 5:
Surface-Level Sunburn Compared to Hair Strand
Arrow Set 1: Hair strand thickness
Arrow Set 2: Sunburn thickness, 0.001"

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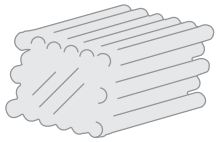
Standard PVC Pipe Material Products

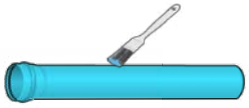
Westlake Pipe & Fittings standard PVC material products are formulated with titanium dioxide in the United States and Canada to limit damage from ultraviolet radiation. For proper protection from UV damage review *"How To Prevent UV Damage To PVC Pipe"* below.

It is important for the gaskets supplied with each product be checked for hardening or cracking prior to assembly and installation. If a gasket has become hardened or cracked, the product should not be used. In all cases, proper installation techniques must be followed.

How To Prevent UV Damage To PVC Pipe

The best way to prevent UV damage is to cover the pipe. These methods will help prevent sun rays from damaging the exterior of the pipe.





- **Tarp:** Cover with an opaque material that permits adequate air circulation around the PVC pipe products. Proper air circulation prevents excessive heat buildup that will damage the pipe.
- **Factory Wrap**: Contact your sales representative for request.
- **Soil:** Lay dirt over the pipe until it is completely covered.
- **Shed:** Roofing will block sun rays.
- **Paint:** Acrylic or latex (water-based) paint. Verify material compatibility with paint manufacturer.
  - **Preparation:** Clean the surface of the pipe, remove moisture, dirt, and oil with a clean dry cloth.
  - **Application:** Apply a thin layer of paint on the outside surface of the pipe.
  - **Do not use petroleum-based paint**, this will prevent bonding of paint to pipe and result in pipe damage.

Yelomine® PVC Pipe Products

Products made with our Yelomine material including, AWWA C900, ASTM D2241, and Certa-Set® have a specially formulated PVC compound that contains impact modifiers and UV inhibitors. These products include over five times more inhibitors than standard PVC pipes to ensure ultraviolet (UV) exposure does not affect the pipe during above ground installation methods.

Certa-Set®

Questions regarding UV exposed pipe, contact Technical Services:
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Phone: 484-435-7474

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