

## FILLERS USED IN POLY (VINYL CHLORIDE) (PVC) PIPE

---

Fillers are added to the PVC resin mix to lower material costs, provide coloring, Ultra Violet (UV) protection and lubrication. Fillers that are used to replace resin are generally calcium carbonate (limestone), diatomaceous earths, and clays.

Limestone is the most prevalent filler and can be added to the resin mix without restrictions per ASTM specifications. ASTM D 1784, "Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds", states the following:

"1.1 This specification covers rigid plastic compounds composed of poly (vinyl chloride), chlorinated poly (vinyl chloride), or vinyl chloride co-polymers, and the necessary compounding ingredients. The resin portion of copolymer compounds shall contain at least 80% vinyl chloride. The compounding ingredients may consist of lubricants, stabilizers, nonpoly (vinyl chloride) resin modifiers, and pigments essential for processing property control and coloring."

A quick reading of the above paragraph from ASTM D 1784 could suggest that 20% fillers are allowed since 80% of the compound shall be poly (vinyl chloride). **THIS IS NOT CORRECT!** A closer reading of paragraph 1.1 of ASTM D 1784 states that at least 80% OF THE RESIN MATERIAL must be poly (vinyl chloride) and the other 20% OF THE RESIN can be either chlorinated poly (vinyl chloride) or vinyl chloride copolymers, or a mixture of the resins. **NOTHING IS MENTIONED ABOUT THE AMOUNT OF FILLERS!** The pipe could have any combination of resins and fillers.

All specifications relating to PVC pipe should have a statement limiting the amount of fillers allowed. It is suggested that a maximum of 10 parts by weight of fillers to 100 parts of PVC resin (9%) is a reasonable amount. The AGC/APWA "Standard Specification for Public Works Construction" for Southern California (commonly called the "Green Book") requires the following:

"207-17.2.2 Additives and fillers, including but not limited to stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 10 parts by weight per 100 parts of PVC resin in the compound."

The European equivalent of ASTM does not allow fillers. The European standard, DIN 8016, states the following for Unplasticized Polyvinyl Chloride Pipes:

"2 PVC-U and PVC-HI, made from unplasticized PVC moulding material, SHALL NOT CONTAIN FILLERS!"

DIN 8061 does, however, allow processing additives such as lubricants and coloring pigments.

The reason limitations are placed on the amount of fillers is that while some initial mechanical properties are improved, such as tensile strength and modulus of elasticity, the addition of fillers may cause the long-term properties to decrease substantially. For example, calcium carbonate fillers, which are often used, may improve the short-term strength, but at the sacrifice of long-term pipe strength characteristics and environmental stress crack resistance.

An analysis of some recently produced plastic pipes showed fillers used in excess of 75% compared to 8% ± filler content used years ago.

The performance of plastic pipes that were produced in years past from materials having a low filler content should not be used to support future performance of pipes using greater amounts of fillers.

**Conclusion: Fillers should be limited to 10 parts by weight to 100 parts of resin (9%).**