

SAFETY FACTORS FOR AWWA PLASTIC PIPES: WHAT ENGINEERS SHOULD KNOW

The first AWWA plastic pipe standard was published in 1975. The standard was AWWA C900 for 4- through 12-inch PVC pipe. At that time, AWWA was a conservative organization which required a safety factor (SF) of 2.5 for the C900 standard – the highest for plastic water pipe in North America. Other organizations like ASTM and CSA used 2.0 for their standards.

SF REVISED FOR PVC PIPE ONLY AFTER DECADES OF PROVEN PERFORMANCE

In 2007, after 32 years of proven municipal usage at SF = 2.5, AWWA revised the C900 standard to a lower SF of 2.0. In addition, AWWA was able to rely on a 40+-year history of PVC pipe usage at SF = 2.0 (for more than 500,000 miles of pipe).

UNDERSTANDING "SF" AND OTHER TERMS AS APPLIED TO WATER PIPE

For an introduction to the concepts of safety factor (SF) and design factor (DF), [click here](#). The safety factors discussed in this document are against pressure pipe failure. The pipe's long-term ultimate pressure capacity is called the "Hydrostatic Design Basis" (HDB). HDB is roughly equivalent to the yield strength in iron/steel pipe. An SF is applied to the HDB to provide the stress used for pressure pipe design. The result is called the "Hydrostatic Design Stress" (HDS).

HDPE AWWA C906 PROPOSES SF OF LESS THAN 2.0: AN INDUSTRY DEPARTURE

The AWWA C906 standard for HDPE water transmission/distribution pipe was first published in 1990. That edition and three subsequent revisions all used SF = 2.0. The proposed C906 includes a new material for which there has been a substantial change proposed: the SF is only 1.6. While the standard uses the term "design factor" instead of safety factor, a quick review of the HDB and HDS provides the SF:

- HDB = 1600 psi
- HDS = 1000 psi
- SF = HDB/HDS = 1600/1000 = 1.6

This significantly lower SF (20% reduction) has been proposed for a material that does not have a 40+-year history of usage for municipal applications that existed for PVC pipe.

RECOMMENDATION: STAY WITH SF = 2.0

The 1.6 SF proposed for C906 falls outside the conservative tradition for AWWA standards for transmission/distribution pipe that has served North American utilities well. The PVC Pipe Association recommends that design engineers recognize this disparity and continue to use a SF = 2.0 for their projects.

The table below shows PVC and HDPE products that have equivalent pressure classes using SF = 2.0:

EQUIVALENT PRESSURE CLASSES			
PVC		HDPE	
Dimension Ratio	Pressure Class	Dimension Ratio	Pressure Class
DR 18	235 psi	DR 7.3	250 psi
DR 21	200 psi	DR 9	200 psi
DR 25	165 psi	DR 11	160 psi
DR 32.5	125 psi	DR 13.5	125 psi
DR 41	100 psi	DR 17	100 psi
DR 51	80 psi	DR 21	80 psi