

# ANSI/AWWA PE4710 Safety Factors Exceed 2.0

(Including information provided to AWWA Standards Council and AWWA Executive Committee)

For over 2 decades, high performance polyethylene pipe resins, equivalent to PE4710, have been designed and operated successfully in Europe at even higher allowable stresses than authorized by AWWA in the conservative N. American market. The recent adoption of ANSI/AWWA C906-15 likely will result in an even broader acceptance in the U.S and Canada. Polyethylene has become the primary material of choice for municipal water distribution pipe in Europe, and fear of a similar shift in the N. American market could be one reason the competitive interests are spreading misinformation about HDPE.

The AWWA 263 [HDPE] Committee, AWWA Standards Council, AWWA Executive Committee, ANSI, and the Hydrostatic Stress Board (the body that lists the HDB for both PVC and polyethylene), have repeatedly approved and demonstrated that the safety factors for long-term performance of PE4710 resins exceed 2.0 for all typical design conditions. The competitive interests held onto its commercial notion that the safety factor for polyethylene is simply the HDB divided by the HDS. This relationship is not relevant to an evaluation of the long-term performance of polyethylene pipe and intentionally misrepresents and confuses the users.

<b>Table 1: PE4710 Safety Factors Exceed 2.0</b>		<b>Safety Factor (SF)</b>
Ratio of Tensile Stress at Yield (TS= 3,625 psi) to Hydrostatic Design Stress (HDS= 1,000 psi)	TS/HDS	3.6
Ratio of predicted lifetime to desired service life (100 years)		>10
Ratio of Peak surge rupture stress (~4,350 psi) to allowable occasional surge stress (2,000 psi)		2.2
Ratio of peak surge rupture stress (~4,350 psi) to allowable recurring surge stress (1,500 psi)		2.9
Ratio of number of cycles to predicted failure under occasional surge cycles (2,000 psi, 1 occasional surge/day for 100 years)		11.6
Ratio of number of cycles to predicted failure under recurring surge cycles (1,500 psi, 55 recurrent surges/day for 100 years)		3.6 to 5.5
Ratio of Hydrostatic Design Basis (HDB= 1,600 psi) to Hydrostatic Design Stress (HDS=1,000 psi)	HDB/HDS	Not a Safety Factor

- The ratio of HDB/HDS is not a Safety Factor and is not applicable and not relevant to Safety Factor discussion:
  - The Hydrostatic Design Basis (HDB) is a rating for piping materials established based on testing conducted under ASTM D2837. PE4710 has an HDB of 1600 psi and is equal to the expected mean rupture stress at 11.4 years (100,000 hours).
  - By using the 0.63 DF, PE4710 is expected to last for 100 years at HDS = 1000 psi.
  - Tensile strength remains constant over time with a safety factor of 3.6 (nominal tensile/HDS = 3,625psi / 1,000 psi).
- As shown in Table 1, the ratios and Safety Factors exceed 2.0 and have been accepted and are globally approved for long-term pressure ratings, instantaneous surge pressures and fatigue cycles. As noted, the ratio of HDB/HDS is not a Safety Factor for HDPE and PE4710.