

FOUR THINGS TO KNOW BEFORE SPECIFYING POLYETHYLENE (PE) 4710 PIPE

The polyethylene pipe industry has redefined how the capabilities of their materials are determined. As a result, design engineers considering pipe made from PE4710 should be aware of the following:

1. NO IMPROVEMENT IN LONG-TERM TENSILE STRENGTH

The Hydrostatic Design Basis (HDB) of PE4710 is 1,600 psi, which is the same as that for previous-generation PE3608 pipe materials. The last two digits of the PE pipe material designation code equal the Hydrostatic Design Stress (HDS) divided by one hundred ($HDS \div 100$). Thus the “10” in “PE4710” is the result of lowering the safety factor to 1.6 rather than 2.0 (design factor of 0.63 rather than 0.50). When a safety factor of 2.0 is applied, the appropriate material designation is PE4708.

For both PE4710 and PE3608 pipe materials, the HDB is 1,600 psi per ASTM D2837 “Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.” When the HDB is divided by 2.0, the design stress (HDS) is 800 psi. A less conservative 1.6 safety factor raises the design stress to 1,000 psi ($1,600 \text{ psi} \div 1.6$). Thus the PE4710 material is “higher-strength” due to numerical manipulation rather than material improvement.

2. LOWER SAFETY FACTOR FOR OCCASIONAL SURGE

The safety factor for occasional surge is only 1.45. The total pressure allowed in AWWA C906 for an occasional surge event is equal to two times the pipe’s Pressure Class (PC). This provides a safety factor of only 1.45 for occasional surges.

For example, for occasional surges the allowable pressure for a PC 100 PE4710 pipe is 200 psi ($2 \times 100 \text{ psi}$). Per Section 4.3.7.1 of AWWA C906-21 “Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks,” the minimum quick-burst pressure for a PC 100 PE4710 pipe is 290 psi. The resulting safety factor is 1.45 ($290 \text{ psi} \div 200 \text{ psi}$).

3. THINNER PE PIPE = LOWER-STRENGTH PE PIPE

Contrary to the PE pipe industry’s assertions, the strength of new PE4710 pipe is substantially less than that of PE3608 pipe. For the same pressure class, the required minimum burst strength of PE4710 pipe is 20% less than for PE3608 pipe.

This is easily verifiable by comparing the quick-burst test requirements of AWWA C906-15, Sec. 4.3.7. For example, the quick-burst pressure for a PC 100 PE3608 pipe is 365 psi versus only 290 psi for PC 100 PE4710 pipe. The math is simple: $290 \text{ psi} / 365 \text{ psi} = 80\%$, a 20% reduction.

4. PE4710 IS THE LOWEST STRENGTH PRESSURE PIPE MATERIAL

All other pipe materials with AWWA standard designations are much stronger than PE4710 and have been in use longer.

The tensile strengths of other pipe materials found in AWWA standards are much greater than that of “high strength” PE4710: C150 (ductile iron), C200 (steel), C300/C302 (steel-reinforced concrete), C900 (PVC), C909 (PVCO), and C950 (FRP). Moreover, all of these stronger pipe materials provide safety factors greater than 1.6 for determining pressure classes and all have been in service much longer than PE4710.

DON’T COMPROMISE PIPE STRENGTH AND LIFE EXPECTANCY

The needs of municipalities and the public are not served when a safety factor of less than 2.0 is used to design pipe made from PE4710 – the material with the shortest in-service performance record. To minimize risk, always specify pipe that provides a safety factor of 2.0.

References: ASTM D2837; AWWA C150, C200, C300, C302, C900, C906, C909, C950; “Safety Factors for AWWA Plastic Pipes: What Engineers Should Know,” PVC Pipe Association.