



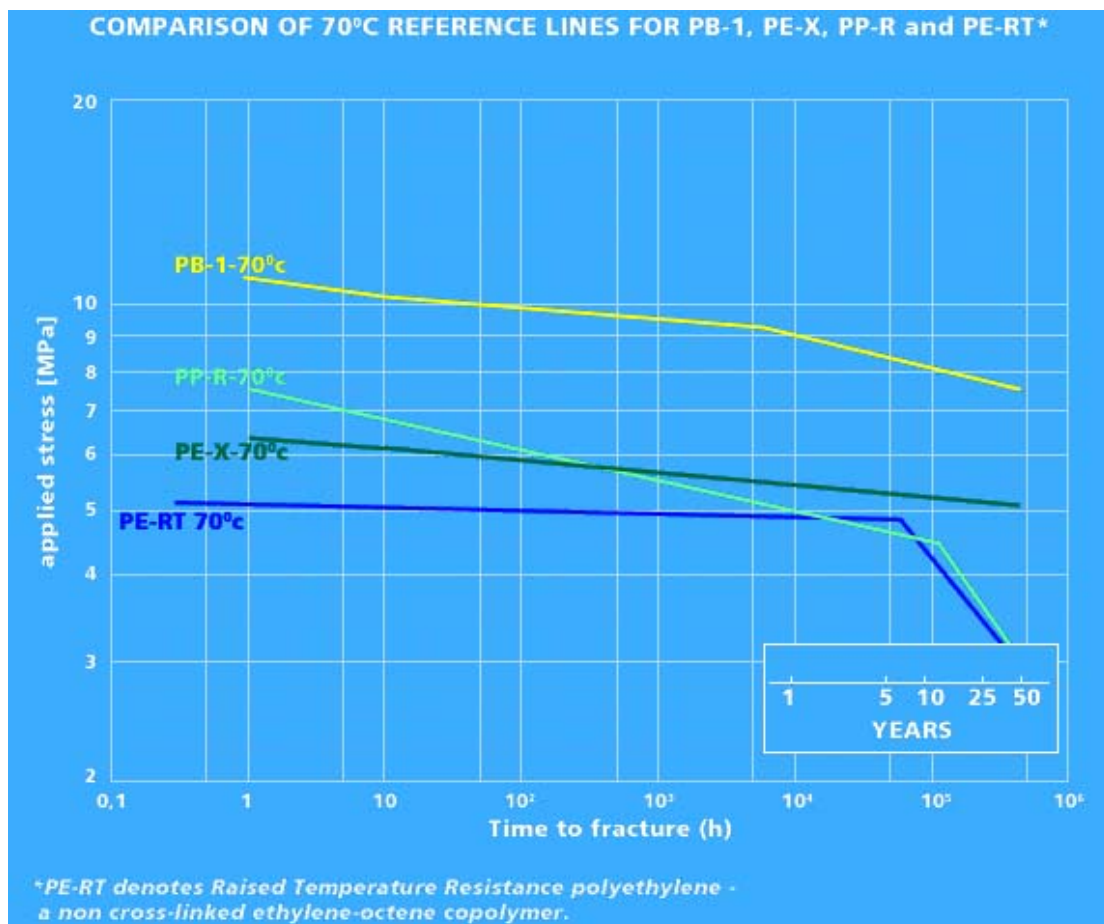
Pipe Performance Standards

The performance comparison of Polybutene-1 and alternative plastics materials

Internal pressure resistance

Parallel standards to ISO 12230 exist which present the effect of time and temperature on the expected strength of PE-X (ISO 10146) and PP-H, PP-R and PP-B (ISO 3213). These standards provide the basic data for the three respective piping systems standards, namely ISO 15876 for Polybutene-1, ISO 15875 for PE-X and ISO 15874 for the three types of polypropylene. The data presented in these standards provides a useful means of comparison of the performance of these three alternative plastic materials.

The following figure shows the performance reference lines for Polybutene-1, PE-X, PP-R and PE-RT (*) at 70°C on an equivalent scale. After 10 years' exposure to continuously applied stress, Polybutene-1 retains 40% more strength than PE-X and almost double that of PP-R and PE-RT(*). There is no ISO standard dealing with the expected strength of PE-RT(*). The data presented in this figure was obtained from a published ISO 9080 evaluation of PE-RT(*)



Design stress

By employing standardised dimensional criteria presented in ISO 10508 it is possible to calculate the maximum allowable hoop stress of these alternative polyolefin pipes for the various standardised applicational temperature classes. This calculation results in the comparisons presented in the table below where it is shown that the maximum allowable hoop stress for Polybutene-1 pipes is some 35% higher than for cross-linked polyethylene PE-X pipes, 45% higher than for polypropylene PP-R pipes and more than 50% higher than for non cross-linked PE-RT(*) pipes. This effectively means that at equivalent thickness, Polybutene-1 pipes offer a significant safety factor over these alternative plastic materials for installed systems.

Class	PB-1	PE-X	PP-R	PE-RT(*)
1	5.73	3.90	3.10	3.56
2	5.06	3.59	2.16	3.29
4(UFH)	5.46	4.04	3.30	3.64
5	4.31	3.28	1.90	2.89

From the maximum allowable hoop stress, we can calculate a minimum allowable wall thickness. It is clear from the calculation that Polybutene-1 pipes can be produced with a significantly reduced wall thickness when compared to other materials dependent on applicational standards limitations. Lower wall thickness also means a larger internal bore for a given external pipe diameter resulting in reduced head pressure loss and lower flow speeds to deliver a fixed volume of water.

(*) PE-RT denotes Raised Temperature Resistance polyethylene - a non cross-linked ethylene-octene copolymer