

## INFORMATION SHEET

### PEX Comparisons

## PEX-A vs. PEX-B vs. PEX-C

There are three (3) main manufacturing processes used to produce PEX tubing:

- Peroxide method (PEX-A pipe)
- Silane method (PEX-B pipe)
- Irradiation method (PEX-C pipe)

A, B and C are not grades of PEX. These letters are used to identify the manufacturing process and have nothing to do with quality or performance ratings of the end product. In fact, all PEX products have to adhere to the same standards — pressure and temperature ratings, minimum bending radius, pipe wall thickness and ID/OD dimensions (subject to manufacturing tolerances).\* All types of PEX (A, B, C) have to comply with the same ASTM F876 and ASTM F877 standards and SDR9 dimensional standard before they can be used anywhere in the US. Pipe which conforms to these standards carries a proper readable imprint. Apollo® carries PEX-A and PEX-B pipe, tools, and fittings.

### PEX-A (Apollo® Expansion PEX)

PEX-A tubing is produced using Peroxide (or, “Engel”) method, named after the inventor Tomas Engel. During the manufacturing process, free radicals are created when HDPE polymer is melted and cross-links between molecules occur at temperatures that exceed the decomposition temperature of the polymer.

### PEX-B (Apollo® PEX)

PEX-B is made using a “Silane” or “Moisture Cure” method of cross-linking, where links between the molecules of the HDPE polymer are formed after the extrusion process using a catalyst and by exposing PEX tubing to water (steam bath). This type of PEX is probably the most common and is manufactured by a large number of companies.

### PEX-C

PEX-C pipe is manufactured using “Electronic Irradiation” method of cross-linking, also known as “Cold” cross-linking. Here, cross-linking of the molecules is done after the process of extrusion by exposing the pipe to an electron radiation beam. The radiation emitted allows to break the existing links between molecules of the polymer and initiate cross-linking process.

Type	Pros	Cons
<b>PEX-A</b> (Apollo® Expansion PEX)	Highest flexibility (softness) among all PEX types. Kinks can be repaired with a heat gun. Highest degree of cross-linking. No coil memory.	Highest price (100-160% higher than PEX-B)(1). Lower bursting pressure than PEX-B. Possible residual or leaching chemicals from manufacturing process. Variation in wall thickness.
<b>PEX-B</b> (Apollo® PEX)	Highest chlorine and oxidative resistance(2) Highest bursting pressure. Lowest price vs. PEX-A and PEX-C(1). Lowest dimensional tolerances.	Stiffer than PEX-A. Lower cross-linking ratio than PEX-A. Noticeable coil memory. Kinks can only be repaired by splicing (using coupling).
<b>PEX-C</b>	Softer than PEX-B. More environmentally-friendly to manufacture. Little or no coil memory.	Prone to development of cracks. Least-uniform cross-linking. Least resistance to kinks, which are repairable only with a coupling.

## **Which PEX tubing to choose?**

**PEX-A** is the most flexible of all PEX tubing types, has little or no coil memory and gives installer an ability to repair kinks with a heat gun. It has been in use for over 50 years (which is longer than other types) with few publicly known issues (3), which is a good indicator of reliability. There are two important downsides to this type. First and foremost is a high rate of chemical leaching – from 50% to over 200% higher than PEX-B (2), which is a major concern for plumbing applications. Second is the price, which coupled with fittings and tools may become as much as 2-3 times higher than PEX-B or PEX-C options. While a leading PEX-A manufacturer claims that their tubing has highest resistance to crack propagation, independent testing (2) shows that PEX-B actually shows the same or higher resistance to long-term oxidation which appears to be the primary reason for crack formation in the pipes and their subsequent failure. A lower bending radius in PEX-A (6 times the OD vs. 8 times the OD for PEX-B & C) is helpful, but offers little practical advantage in most cases.

**PEX-B** is a clear winner in terms of price vs. both other types. It has been in use for over 40 years with no known issues, given that a typical warranty for any type of PEX is only 20-25 years. It also has a higher bursting pressure than PEX-A and a similar or better resistance to oxidation – a very important factor for plumbing installations. The major downside of PEX-B is its stiffness and coil memory (tendency to return to the original shape of coil). While there's little difference in smaller sizes such as 1/2", larger pipe diameters, especially 1", can be noticeably harder to bend. Any kinks (which are very rare in our experience, but still occur) made during the installation can only be repaired by installing a coupling and cannot be repaired with a heat gun like PEX-A.

**Oxygen Barrier PEX (PEX-B)** tubing has been designed to prevent diffusion of oxygen into hydronic radiant heating systems. A layer of polymer is laminated to the outside surface which is highly resistant to the passage of oxygen. Oxygen Barrier PEX tubing is good for hydronic radiant heating, cooling, and snow melting systems using water or water/glycol mix. The tubing may be installed in concrete, gypsum based lightweight concrete, sand, asphalt, in or under wood flooring, or behind wallboard or plaster. Oxygen Barrier PEX tubing may also be used as transfer lines for baseboard heating systems with a maximum operating temperature of 200° F @ 100 psi.

**PEX-C** was the hardest to evaluate, given the lack of testing data and publicly available information. In late 2013, a leading US manufacturer of PEX-C pipe became a subject of a class-action settlement which indicated that its PEX tubing is prone to development of cracks in the pipe as a result of early oxidation. For this reason therefore, we think that this type of PEX should be avoided altogether in plumbing applications. While PEX-C may be suitable for hydronic and radiant heating use, it offers little practical advantage over the other (2) types.

**For hot and cold water plumbing** as well as for open-loop heating systems, both PEX-A and PEX-B are evident choices, yet the latter offers a more attractive combination of better health safety, higher durability and lower price.

Apollo® Expansion PEX (PEX-A) pipe has the following approvals/certifications: PEX 3006-SDR9, cNSFus-PW, cUPC, ASTM F876/F877/F2023, ANSI/NSF 61 & 14, CSA B137.5. Apollo® PEX-B pipe has the following approvals/certifications: PEX 5006-SDR9, ASTM F876/F877, cNSFus-pw, cUPC, ANSI/NSF 61 & 14, CSA B137.5. Apollo® Oxygen Barrier PEX pipe has the following approvals/certifications: cNSFus-rfh, ASMT F876/F877, ASTM D2765, DIN 4726, ICBO ER #5287.

From <http://www.pexuniverse.com/content/types-of-pex-tubing>

\* Note that these only apply to brands sold in the US and mentioned below. There are many little-known or no-brand products out there which may or may not meet these criteria.

### References:

(1) Based on competitive research conducted for online and walk-in retail stores.

(2) "Contaminant Diffusion, Solubility, and Material Property Differences between HDPE and PEX Potable Water Pipes" from Journal of Environmental Engineering.

(3) i.e. "Defren v. Triform Homes"