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**PEX Piping Systems and
PB Piping Systems
- What is the Difference?
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FOREWORD

This technical note was developed and published with the technical help and financial support of the members of the PPI (Plastics Pipe Institute, Inc.). The members have shown their interest in quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

The purpose of this technical note is to provide important information available to PPI on the differences and similarities between PEX and PB piping systems.

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PEX (crosslinked polyethylene) Piping Systems and PB (polybutylene) Piping Systems – What is the difference?

Often end-users ask the question – how are PEX and PB different? The purpose of this paper is to outline the differences and similarities.

Background

During the 1980's and 1990's there were widespread reports of failures of polybutylene piping systems in water distribution applications. Ultimately, the sole manufacturer of polybutylene resin– the base material used in the manufacture of the pipe for the systems – halted sale of the resin in the United States. It should be noted that there remains in use today in both North America and around the world, thousands of polybutylene piping systems that have never experienced any problems.

There were a number of factors that contributed to the failure of some polybutylene piping systems and the move away from the polybutylene piping systems:

- Some polyacetal fittings used in the systems failed due to their exposure to chlorinated water or to improper design.
- Poor installation techniques – sometimes due the inexperience of installers not familiar with new (at the time) plastic piping systems, and sometimes due to the lack of consistent, detailed installation instructions from manufacturers.
- A wave of litigation prompted by widespread publicity encouraged even those without problems to join a class action lawsuit.

Also during the 1980's a new plastic piping material – PEX – was introduced in the United States. This material, which until then was widely used in Europe and elsewhere, offered many of the benefits of a flexible plastic piping system – easy installation, cost effectiveness, resistance to freeze damage – without the problems of PB.

• PEX and PB - Different Materials

Plastic is the generic term for a class of materials – just as metal and wood are generic terms. Within the class of plastics, there are materials with very different properties and some with very similar properties– just as with metal or wood. For example, there are very obvious differences between iron and aluminum: iron is heavy, and comparatively inexpensive; aluminum is lightweight and comparatively expensive. Their properties dictate the applications for which each material is used.

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Various types of plastic also differ from each other in very real ways. Polybutylene and PEX start out from polymerization of two different olefin monomers – butylene and ethylene. Polybutylene is directly synthesized from butylene. It gets its strength from the molecular bonding that is inherent in the raw material. Crosslinked polyethylene is first synthesized from ethylene to make polyethylene, and then crosslinked during the tube manufacturing process to obtain its exceptional properties.

PEX and PB Piping Systems – What’s Similar?

Both PEX and PB are hydrocarbons called polyolefins because they are synthesized from olefin monomers – ethylene and butylene. Because they are hydrocarbons, they have very similar chemical resistance. PEX and PB also have remarkable similarities in both physical and handling characteristics. These characteristics are what made both of them attractive for plumbing applications. The table below is by no means all inclusive, but is a comparison of relevant properties for plumbing applications:

Property	PEX	PB
Flexibility	Good	Good
Design Temperature and Pressure Rating	100 psig @ 180°F	100 psig at 180°F
Freeze Break Resistance	Yes	Yes
Allowable Bend Radius	8 x outside diameter	10 x outside diameter
Horizontal Spacing	32 “ (per ASTM F-877)	32 “ (per ASTM F-877)

PEX and PB Piping Systems – What’s Different?

As noted above, the raw material used for PEX is different from PB. Polymerization of the butylene monomer results in a fairly high molecular weight, which inherently provides high temperature resistance. Polyethylene must be crosslinked to achieve the desired higher molecular weight and resulting high temperature resistance. PB was pressure rated at 180°F; whereas, PEX has a pressure rating at both 180°F and 200°F.

The key difference between the two piping systems is the method of joining. History has shown that the vast majority of failures with polybutylene piping systems were due to failure of the polyacetal fittings. The chlorine in some water systems attacked these fitting. PEX piping systems do not use polyacetal fittings, and chlorine or other aspects of water chemistry do not affect the fittings used. PEX tubing is generally joined by mechanical fittings that are designed by the PEX tubing manufacturer. These fittings have been tested and found to be resistant to chlorine.

For more information on PEX piping systems, contact the Plastics Pipe Institute at 1-888-314-7664, or visit our website at www.plasticspipe.org.