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Differences Between PEX and PB Systems for Potable Water Applications

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Foreword

This technical note was developed and published with the technical help and financial support of the members of the Plastics Pipe Institute. The members have shown their interest in quality products by assisting independent standard-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.

This technical note has been prepared to provide those responsible for the maintenance of existing HDPE pipelines with suggested general guidelines for the repair of those lines that have been subjected to third party or other unforeseen damage. These guidelines constitute a set of basic operations that have been demonstrated by test and experience to produce satisfactory repairs with commercially available materials. Each specific procedure must be acceptable to, and qualified by, the operator having legal responsibility for the performance of the piping system. This document was not intended to provide system design information. Go to the PPI website at www.plasticpipe.org for different system design documents.

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PPI intends to revise this report from time to time, in response to comments and suggestions from users of this note. Please send suggestions for improvements to PPI. Information on other publications can be obtained by contacting PPI directly or visiting the web site.

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DIFFERENCES BETWEEN PEX AND PB SYSTEMS FOR POTABLE WATER APPLICATIONS

Just as various types of metals (eg. steel, copper, iron) have different properties, various types of plastics also have different properties. Not all metal pipes perform the same, and clearly, not all plastic pipes perform the same.

Thanks to modern polymer technology, crosslinked polyethylene (PEX) tubing and piping systems perform in ways that provide superior reliability and safety when compared to polybutylene (PB) piping systems used in plumbing and heating applications in Canada and USA until the mid-1990's.

Crosslinked polyethylene (known as "PEX") is a high-temperature, pressure resistant, yet flexible, plastic (polymer) pipe. PEX tubing is approved for potable hot- and cold-water plumbing systems and hot-water (hydronic) heating systems in all model plumbing and mechanical codes across the USA and Canada. PEX tubing systems are durable, provide security of safe drinking water, and use reliable connection systems.

PEX piping systems have been used for potable water applications for more than 30 years in Europe and for more than 15 years in North America. Today, the North American PEX industry is thriving in both residential and commercial construction. There are at least ten domestic producers of quality PEX piping and tubing systems today.

The PEX industry is highly regulated. Product standards, specifications, test methods and code requirements developed over the past twenty years define tight material and production controls, require continuous-use temperature ratings as high as 200°F (93°C), and mandate standardized chlorine resistance testing. Third-party certification agencies require strenuous quality control testing for PEX systems, including frequent unannounced inspections of plants and annual monitoring and re-testing.

According to product standards from organizations such as ASTM International, CSA International and NSF International, the testing requirements for PEX systems are far more stringent than for PB systems. Combining these requirements with the robust capabilities of PEX tubing and fittings, PEX systems have several key advantages:

- **PEX is a crosslinked material**. During production of PEX the molecules of the high-density polyethylene (HDPE) base material are permanently linked to each other by a process known as crosslinking. Crosslinking gives PEX pipes enhanced properties, such as greater long-term stability against internal pressure, resistance against external damage such as scratches, and reduced creep (material flow) under compressive loads at fittings. PB piping is not crosslinked.

- **PEX pipes are thicker than PB pipes**. As required by PEX pipe standards such as ASTM F876, AWWA C-904 and CSA B137.5, PEX pipes have a wall thickness that is at least 22% thicker than the wall thickness of PB pipes. This thicker wall (SDR9 vs. SDR 11) gives better mechanical strength and resistance to damage.

- **PEX pipes are tested to demonstrate minimum chlorine resistance.** Mandatory chlorine resistance testing, according to test method ASTM F2023, requires that all PEX tubing used for plumbing applications be tested to meet a minimum extrapolated lifetime of at least 50 years under extremely aggressive water conditions. Similar research testing using chloramines, another potable water disinfectant, indicates that PEX is equally or even more resistant to chloramines at the same high levels and test conditions.

- **PEX piping systems do not use polyacetal fittings.** PEX piping systems use fittings that, as required by ASTM standards, are made from brass, copper, stainless steel or high-temperature polymers engineered to be chlorine-resistant. When required, these fitting materials are tested to the same standards as PEX pipes, and must also be certified by the same third-party testing agencies. *Note: Consult with each PEX pipe manufacturer for recommended fitting(s).*

- **PEX piping systems have long-term performance requirements up to 200°F (93°C),** whereas the highest-temperature testing required for PB was 180°F (82°C). Long-term hydrostatic testing required by PEX piping system standards, such as ASTM F876, AWWA C-904 and CSA B137.5, and certified to stringent requirements as established in PPI TR-3, are used to demonstrate the following extrapolated continuous-use temperature/pressure ratings for PEX systems:

  - 80 psi @ 200°F
  - 100 psi @ 180°F
  - 160 psi @ 73.4°F

For more information on PEX pipes and PPI hydrostatic requirements, please refer to PPI Technical Report **TR-3 "Policies and Procedures for Developing HDB, PDB, SDB and MRS Ratings for Thermoplastic Materials or Pipe"** and Technical Note **TN-17 "Crosslinked Polyethylene (PEX) Tubing"**, or visit the website at www.plasticpipe.org.