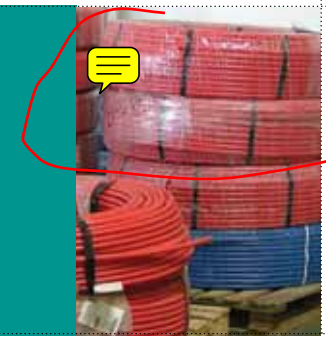

# TECH TOPIC: PEX
## It's everywhere!
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Cross-Linked Polyethylene has become one of the most familiar piping materials in the plumbing industry. Commonly known as PEX, the generally milky white plastic tubing has proven itself a perfectly acceptable pipe material for potable water, and let's not forget how well it works with radiant hydronic heating when installed under a flooring system.

This month we contacted a quartet of heavyweights in the world of PEX and asked them to explain the material's benefits and to detail how it came to be widely accepted for potable water applications.

This month, we spoke with Tom Coe, NIBCO's PEX product manager, Dale Stroud, the senior director of offerings and marketing for Uponor, Inc., Steve Barrett, a product director at Watts, and Todd Anglin, the national sales director for Zurn PEX.

Here, without further ado, here are the results of the discussion:

***RJ: What is PEX and when was it discovered?***

**NIBCO:** PEX stands for cross-linked high density polyethylene ("HDPE"). The cross-linking process makes the tubing suitable for temperatures and pressures typically found in domestic hot and cold water plumbing.

**Uponor:** PEX is an acronym for crosslinked. The "X" stands for crosslinking and the "PE" stands for polyethylene. Essentially, PEX is created when polyethylene (typically the high-density type) molecules are forced to physically and permanently connect to one another; the connection points are called crosslinks. Crosslinking increases the ability of the resulting molecular structure to withstand pressure at elevated temperatures.

There are three primary ways to achieve crosslinking of polyethylene: peroxide (PEX-a), saline (PEX-b), and radiation (PEX-c). Tubing made from all three types (a, b, and c) must meet the same standard specification (i.e., ASTM F876) even though there are some subtle differences among the types.

The ability to crosslink polyethylene was discovered about a half century ago; however, PEX, as a piping material, originated about 40 years ago. In the United States, PEX for radiant floor heating applications originated in the early 1980s; PEX plumbing applications became prevalent in the mid- to late-1990s.

**Watts:** PEX, or cross-linked polyethylene tubing, goes all the way back to the 30s, in Europe. Among the first uses was plastic insulation for submarine power cables. After World War II, German scientists began to develop PEX pipe.

**Zurn:** PEX is cross-linked polyethylene. The polyethylene molecules have been irreversibly linked together by physical or chemical processes to improve the high temperature strength and toughness of the material. The chemistry for cross-linking polyethylene has been known since the early 1960's. A practical process for making PEX pipe was first invented in 1968 with commercialization in the early 1970's.

***RJ: Where did PEX find its first major acceptance?***

**NIBCO:** PEX first became popular in Europe after its introduction in 1972.

**Uponor:** PEX gained its primary acceptance as a piping material in Europe about 40 years ago. PEX was first produced in North America about 30 years ago.

**Watts:** I highly recommend that anyone interested in this topic read "The History and Influence of PEX Pipe on Indoor Environmental Quality" by Robert Bean (just Google it). In the early years, Germany and England were the early developers. It was in the 1960s when the German firm, B.A.S.F. put development into high gear, refining development of the material for broad commercial use.

**Zurn:** The first major acceptance for PEX pipe was for hydronic heating in Europe in the early 1970's quickly followed by plumbing applications in Europe. PEX was introduced into the North American market in the mid 1980's.

***RJ: Someone once said PEX was the "most scrutinized" pipe material to come to the U.S. market in years. Briefly, were there problems with earlier types of plastic pipe in the potable environment?***

**NIBCO:** In the 1990s, acetyl fittings used to join polybutylene tubing in the U.S. were subject to degradation and leaks. Although polybutylene tubing was associated with these fittings and was withdrawn from the U.S. market, there was never a problem with the tubing itself, and polybutylene continues to be used in many other countries today.

**Uponor:** Over the years, PEX has undergone a significant amount of testing and evaluation—and passed all these tests with flying colors. For example, PEX was subjected to an exhaustive Environmental Impact Review before being incorporated into the California Plumbing Code in 2010. No other piping material has ever been examined in similar depth as occurred during that environmental review.

Polybutylene preceded PEX as a flexible plastic piping material, but it was withdrawn from the market in its raw material form by its primary supplier in the late 1990s. Chlorinated polyvinyl chloride is another plastic piping material that has been in use for more than 40 years.

In new single-family residential construction, PEX plumbing has the highest market share, outselling both copper and CPVC. In multi-family and commercial applications, the use of PEX is increasing rapidly.

**Watts:** That's true. This dates back to the polybutylene days—when that type of plastic was used for potable water and radiant heat. The pipe wasn't the problem. The problem was with the acetyl fittings, which were prone to problems with chlorine and circulation temperatures higher than 120 degrees Fahrenheit. Ultimately, the fittings became brittle and leaked; this gave the industry a black eye. PEX is an entirely different, much better ballgame for potable water and radiant heat uses.

***RJ: Today PEX is accepted in most jurisdictions for potable water and it's usefulness in radiant hydronic heating is well-known. Is there anything for which PEX is unsuitable?***

**NIBCO:** Care and caution is advised for use of PEX in commercial applications, fire sprinkler systems, and air plenums.

**Uponor:** Though it seemingly could be used in other applications where plastic piping systems are prevalent, its cost/performance balance is, for now, best suited for its primary existing markets (i.e., plumbing, residential fire sprinklers, radiant heating and cooling, and geothermal applications) where its capabilities (i.e., pressure-holding capability at elevated temperatures), coupled with its flexibility, make it an ideal choice.

Although not prevalent in the United States, PEX is also sometimes used for compressed air, natural gas transmission and fluid handling in medical devices.

**Watts:** PEX is so stable, versatile and durable, it's hard to name uses it's not well suited for. We've seen how it weakens when exposed to UV radiation—sunlight—for long periods of time. That's to be avoided. Also, PEX shouldn't be used in contaminated soil where pesticides or petroleum contaminants are present—which can penetrate the walls of the pipe. We occasionally see this when PEX pipe is used to transport potable water from the curb to the house, but this is rarely an issue.

**Zurn:** Flexibility, ease of installation and strength at elevated temperatures are properties that make PEX an attractive piping material for many applications. The user should always consult with the PEX manufacturer when considering PEX for process piping or other applications that may not be covered by codes. Most PEX piping is not intended for unprotected outdoor installations for any type of system. Also, it is important to consider the materials from which the fittings are made when considering PEX for "non-standard" applications.

***RJ: Are there any common misperceptions among plumbers in regards to PEX? Take a moment and clear them up.***

**NIBCO:** The most common misperception is there is a rating system for PEX using a letter code: PEX-a, PEX-b, and PEX-c. This actually refers to the discovery date of the manufacturing process, PEX-a being the oldest and PEX-c the most modern.

**Uponor:** A misconception that sometimes arises is the mistaken impression that PEX is a new material without a proven track record. In fact, billions of feet of PEX are installed throughout North America. PEX is a proven material with an outstanding record of performance spanning more than 30 years in North America.

Also, professionals familiar with rigid installation practices (such as copper or CPVC) are not always aware of the benefits that flexible PEX provides. PEX tubing can be installed with fewer fittings, because it can bend to "change direction." Also, the availability of multiport tees (sometimes called remote manifolds) and centralized distribution manifolds for PEX plumbing systems provides versatility that is not as easily achieved with other piping systems.

**Watts:** Yes. The biggest misconception takes us back to question No. 3: PEX isn't polybutylene. Also, there are still plenty of "old schoolers" out there who feel copper is king. Yet, PEX has proven to be more cost-effective, cleaner, easier to install and more profitable for trade installers.

**Zurn:** One of the most common misperceptions among plumbing and mechanical contractors is layout. Unlike a rigid piping system, PEX can be installed in a number of methods. It can be installed in a conventional branch and tee, remote manifold, or homerun system. Many contractors try to make a PEX system look like a rigid system and use too many fittings. A professional installation will take advantage of the flexibility of PEX and will have fewer fittings for fewer connections and improved flow.

Another common misperception is hanger spacing for commercial installations. Since PEX is flexible, it has to be supported more often than a rigid piping system. If the hanger type is changed allowing for a support track, the hanger spacing can be left the same as a rigid piping system. **RJ**