WHITE PAPER

Understanding PEX Tubing Designation Codes

The case for using PEX instead of plumbing materials like copper and CPVC has continually gained traction over the past number of years in both residential and commercial settings. When considering the benefits of PEX, it is not hard to see why more and more contractors are making the switch. To start, PEX is generally more cost effective when considering the installed cost of many other materials. It also offers flexibility, speed, resistance to corrosion and assurance that a connection has been properly made. There are now multiple PEX offerings on the market, and it can be difficult to know how to make an informed decision.

Breaking Down PEX Coding

PEX, for those who are not familiar, is a cross-linked, high-density polyethylene. It is the cross-linking process that gives PEX the ability to withstand higher temperatures, pressures and increase resistance to stress cracking when compared to standard polyethylene. Many installers of PEX tubing are familiar with the three main techniques used for crosslinking PEX tubing in North America: peroxide, silane and e-beam. These crosslinking methods are often referred to in the field as PEX-a (peroxide), PEX-b (silane) and PEX-c (e-beam). The designation system is based on the manufacturing method for each type of PEX product. The designations “a,” “b” and “c” are nothing more than a holdover from early European tubing standards. All types of PEX must adhere to the same standards, including pressure and temperature rating, minimum bending radius and pipe wall thickness.

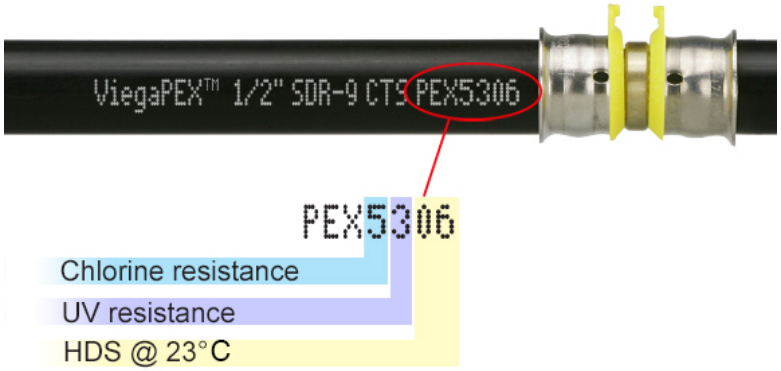


Photo 1: PEX material designation codes indicate chlorine resistance, UV resistance and hydrostatic design stress.

The information below will break down the PEX designation standards and provide guidance for selecting PEX products.

Designation Codes: Identifying Chlorine Resistance, UV Resistance and Hydrostatic Design Stress

Many installers are already familiar with the four-digit code printed on each product, known as a "standard thermoplastic tubing materials designation code," but some might be confused as to what the figures printed on the products mean in relation to the tubing material. For starters, the standard thermoplastic tubing materials designation code is a requirement of ASTM F876, the standard specification for cross-linked polyethylene PEX tubing.

According to the Plastic Pipe Institute, the first digit of the PEX material designation code represents the chlorine resistance tested in accordance with ASTM F2023, the chlorine-resistance test method for PEX pipes.

- A first digit of "0" indicates the tubing either does not meet the ASTM requirement or has not been tested.
- A first digit of "1" indicates the PEX tubing was tested and meets the F876 requirement for minimum chlorine resistance at the end-use condition of 25 percent at 140 degrees Fahrenheit and 75 percent at 73.4 degrees Fahrenheit.
- A first digit of "3" indicates the PEX tubing was tested and meets the same requirements at the end-use condition of 50 percent at 140 degrees Fahrenheit and 50 percent at 73.4 degrees Fahrenheit.
- A first digit of "5" indicates the tubing was tested to meet the same requirements at the end-use condition of 100 percent at 140 degrees Fahrenheit.
- A first digit of "2" or "4" is reserved for future applications.

High-chlorine resistance is important for applications such as hot-water recirculation systems, which circulate water that is up to 140 degrees Fahrenheit. Buildings with their own water treatment or disinfection systems also require high-chlorine resistance.

The second digit of the PEX material designation code is used to indicate the level of UV resistance for the PEX material when tested in accordance with ASTM F2657, the UV-resistance test method for PEX pipes.

- A second digit of "0" indicates the product either does not meet any minimum UV-resistance requirement or it has not been tested.
- A second digit of "1" indicates the PEX tubing was tested and meets the F876 requirement for minimum UV resistance of one month.
- A second digit of "2" indicates the product was tested and meets the F876 requirement for minimum UV resistance of three months.
- A second digit of "3" indicates the PEX tubing was tested and meets the F876 requirement for minimum UV resistance of six months.

UV resistance may not be a top-of-mind factor in selecting PEX tubing. However, for construction applications that have a long schedule or may be prone to delays, a high UV resistance provides peace of mind in the stability and quality of the product when installed.

The last two digits of the PEX material designation code represent the Plastic Pipe Institute's (PPI) recommended hydrostatic design stress (HDS) at 73.4 degrees Fahrenheit. HDS is determined based on a material-specific design factor applied to the hydrostatic design basis or HDB. The HDB offers values specific to each plastic material type that the Hydrostatic Stress Board has determined, with a high degree of certainty, will not fail within standard operating parameters. For PEX tubing, the HDS can fall within the following range:

- An "06" designation indicates a 630psi HDS
- An "08" designation indicates an 800psi HDS.

The value, entered in the following formula provided by ASTM F876, determines the maximum operating pressure the tubing is approved to:

P=2*HDS/(SDR-1) or P=2*630/(9-1); P=157.5 which gets rounded up to 160 psi

For "06" this relates to a 160psi @ 73.4F rating

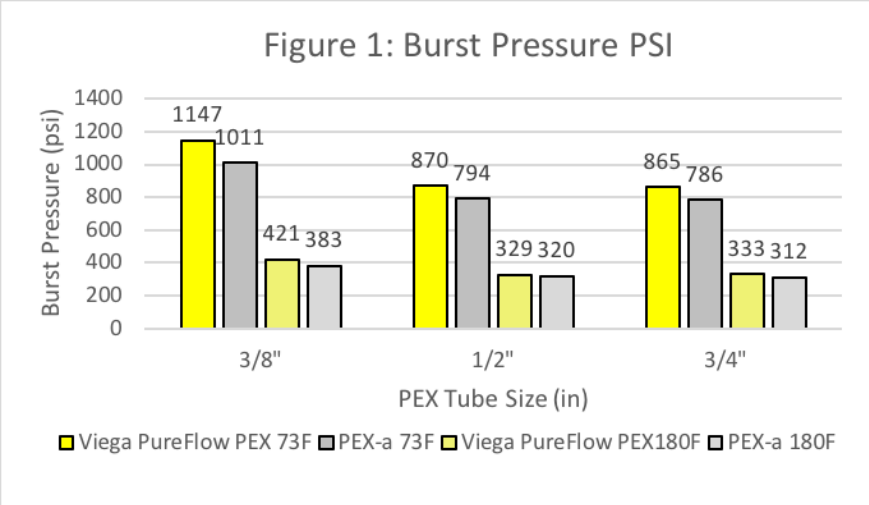
Designation codes are limited in providing information on tubing performance in that they only indicate if the product meets a standard, not if it exceeds the standard, or by how much. For example, some manufacturers, like Viega, manufacture their PEX tubing to exceed standard requirements by a sizable margin. Through better design, manufacturers can provide superior protection and density to deliver greater quality assurance and performance. Reviewing manufacturer information can provide additional knowledge on product performance and testing to enable the best product selection.

How do various manufacturers compare?

PEX Manufacturer Matrix	Code Comparison			
	Chlorine	UV	HDS	
Viega PureFlow	5	3	0	6
Uponor	5	2	0	6
Zurn	5	3	0	6
SharkBite	5	0	0	6
MrPEX	5	1	0	6
Rehau	3	3	0	6

In order to get an idea about how two of the leading PEX manufacturers exceed the basic requirements for the designation codes above, consider the following burst pressure test recently performed in a research and development facility.

Burst Pressure Performance During Testing



The table above shows that the burst pressures observed for ½" PEX tubing are considerably higher than any operating condition for which it has been rated (160psi at 73.4 degrees Fahrenheit).

Choosing PEX Applications

Residential Building

The residential building market is a great application for choosing PEX, especially when using faster PEX connection methods such as pressing. The flexibility of the tubing, combined with the use of a plumbing manifold system leads to faster hot water delivery, less wasted water, and the ability to shut off individual lines. A plumbing manifold is a homerun parallel water distribution system that provides dedicated lines to each fixture in the home. Installers can eliminate a significant number of fittings behind the wall thanks to the flexibility of PEX and can be certain of the quality and consistency on the connections that they do make. PEX also helps save on installation costs and gets crews onto the next job sooner.

Retrofit and Repairs

Retrofits and repairs can present many challenges with tight spaces and old copper systems, but a wide range of adapters and transition fittings, along with the compact tools to access them, provide a perfect opportunity for repairing and upgrading a plumbing system with PEX tubing.

Commercial Buildings

As PEX tubing continues to evolve as a viable option for commercial products, manufacturers are offering solutions to optimize commercial building. Solutions such as copper to PEX transition fittings enable running large mains in copper and transitioning to PEX tubing up to 2" diameter for branch runs. This saves time and decreases the installed cost of a job. With pipe support trays, hangers for PEX can be spaced out to typical rigid pipe spacing.

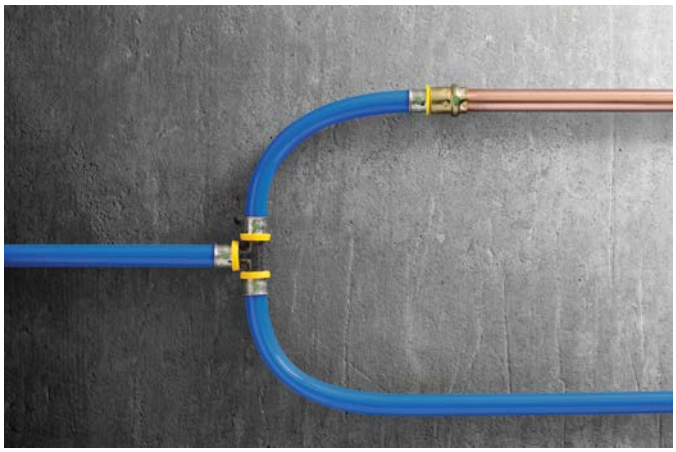


Photo 2-3: Viega copper to PEX transition fittings enable running large mains in copper and transitioning to PEX tubing up to 2" diameter for branch runs.

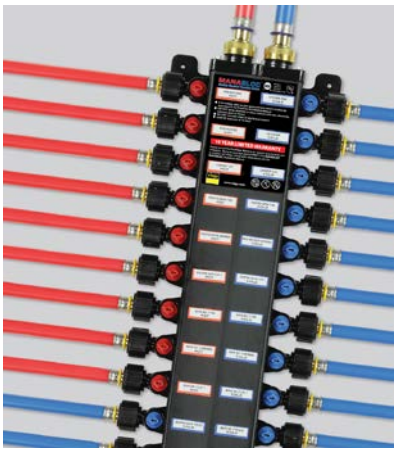
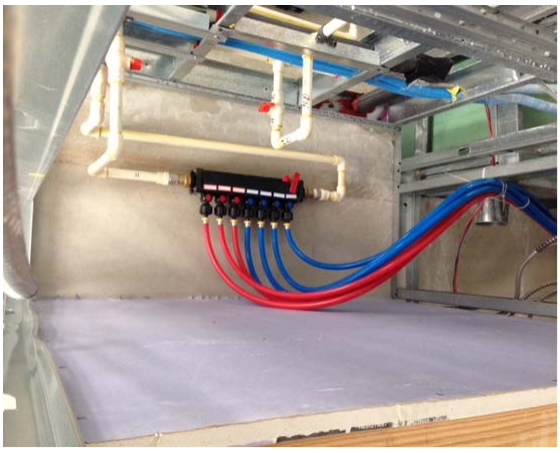
Photo 4: With Viega pipe support trays, hangers for PEX can be spaced out to typical rigid pipe spacing.

Hotels and Hospitality

Hotels and hospitality venues also provide a great opportunity to install a plumbing manifold system between adjacent rooms. With fewer fittings hidden behind the walls, the system minimizes potential leak points and allows the system to operate multiple fixtures at once without dramatic temperature and pressure changes. It allows building operations to have access to individual fixtures should repair or renovations be necessary and can provide a better guest experience with faster hot water delivery.

If a more traditional branch and tee system design is desired, manufacturers offer a hybrid system consisting of fittings for copper and PEX transition fittings so that PEX can branch out.

As PEX is a consideration for more and more applications, it's important to understand its benefits, as well as the distinction between the different types of PEX that are available and the seemingly complex coding that designates their use.


Photos 5-7: Hotels and hospitality venues also provide a great opportunity to install a plumbing manifold system, such as this Viega ManaBloc manifold system between adjacent rooms. With fewer fittings hidden behind the walls, the system minimizes potential leak points and allows the system to operate multiple fixtures at once without dramatic temperature and pressure changes.

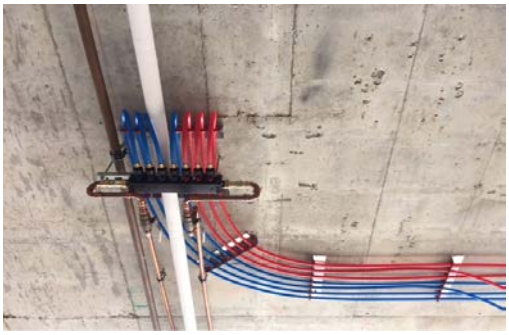


Photo 8: Viega MiniBloc manifold system also allows building operations to have access to individual fixtures should repair or renovations be necessary.

About the Author

William Dutcher is Product Engineer, Plastics at Viega LLC. In his position, he is responsible for support of business planning, research and development, technical documentation and technical support for Viega's PureFlow product line. A mechanical engineer with five years of experience, Dutcher earned his bachelor's degree in mechanical engineering from The State University of New York at Buffalo (UB).

The Viega Group, with a tradition of innovation for more than 115 years, has more than 4,000 employees worldwide and is among the leading manufacturers of pipe fitting installation technology. Known for its quality, Viega manufactures all of its PureFlow PEX and PureFlow Press polymer fittings in the USA. Through vertical integration, Viega controls the manufacturing process in house—from resin production to quality control of finished product. Every ManaBloc system is 100-percent factory tested and PureFlow Press fittings are completely factory assembled so installers can rely on a consistent and reliable product. In the U.S., Viega employs more than 600 people and offers more than 3,000 products including press fittings for copper, stainless steel, carbon steel and PEX. Viega also specializes in the design, production and installation of radiant heating and cooling systems, and offers complete systems for marine applications. For more information, visit viega.us.