

# CHILLKING

## Chiller Systems

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### Use of PEX Pipe in Brewery Applications

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#### PEX and GENERIC BRANDS OR SIMILAR

CHILLKING Chillers Inc. and Patrick G. King provide this information based on our experience, education, and training. It is to be viewed as an opinion only. This is not meant to be critical of a particular manufacturer or brandname. PEX when used for certain applications appears to be a very suitable substitute for copper. By stating that PEX is suitable for certain applications is in no way meant as an endorsement. Please take from this experience and opinion and use it to make a decision that is best for your company.

Chillking has a great deal of experience working with many different products. We have used PEX in the field on some of our applications when we felt it was suitable. For this paper we are considering PEX for breweries. This paper is based on the experience of Chillking Chillers using PEX and similar products. PEX is as any product perfect for a particular application.

#### PEX for BREWERY

We do NOT recommend PEX for brewery applications for a number of reasons. The most critical is size. If you are planning to pump your product through PEX lines, please, at least read the below sections named PERMEABLE and CAUTION. PEX was originally marketed to European markets and is sized accordingly. PEX was invented in the 1950's and improved by Dow Corning in the 1960's. For this report I will not go into the chemical make up or how it is manufactured. We will concentrate on its usability in a brewery environment. There has been a rash of lawsuits regarding PEX failures however I believe many of these failures are user induced. I will get into that later.

#### METRIC TO FRACTIONAL PIPE SIZE

Since PEX was targeted for European markets it is sized in metric and converted to U.S. sizes.

We have photographs throughout this article and at the bottom to document our experience. Most brewery users are going to be familiar with 1" PEX if they considered using PEX. Disclaimer: when I refer to 1" PEX, it is not 1" but the sizes that are being proven by photographs and the actual product specs. The ID of 1" PEX is .77". It will vary by brand. I have seen it fit snugly on a 1" brass fitting. That would indicate the ID of the pipe is .75". That is far less than 1". The brass fitting loses even more because the ID of a 1" brass fitting is .70". That equates to 11/16 inside diameter that the water/pg flows through. Your flow rate is always reduced to the smallest ID within the system. The final ID for water/glycol flow is 11/16". Let's examine how much of a difference that will make in flow. 11/16" is less than 3/4" but for ease we will use 3/4" to compare the GPM. 1" copper vs 1" (actually 11/16" ID) PEX. This calculation is based on 1 BTU to raise 1 pound of water 1F in 1 hour. 1 gallon of water weighs 8.34 pounds.

BTU LOAD CALCULATION 1" copper (CPR) vs 1" rated PEX (actual 11/16" ID) 1" PEX with crimp fittings is reduced to 11/16" ID. Thus we have to use that number for GPM.

1" CPR, 12 PSI, 16 GPM x 60 minutes = 960 gallons x 8.34 lbs = 8006.4 lbs x 6F = 48K BTU

1" PEX, 12 PSI, 11 GPM x 60 min = 660 gallons x 8.34 lbs = 5504.4 lbs x 6F = 33K BTU

There is a significant difference between 48,000 BTU and 33,000 BTU. If PEX is used as the main feed and then branches are T'd from it the flow is even more reduced. Although the primary line is carrying 16 GPM it doesn't mean the secondaries are. If it is branched into two circuits the flow is close to 8 GPM per line.

As you can see 1" PEX will carry about 30% less BTU than 1" ID copper or Cool Fit Pipe.

Upsizing the PEX can help reduce the problems however be very cautious. The pipe I used for these measurements came from a location we changed out, the pipe said 1 1/8" however it was the OD rating with 1" ID PEX size which is actually less than 3/4" with brass fittings. The problem is not solved by using the fittings that use an "O" ring seal by slipping over the outside of the pipe. Your 1" PEX would still have an ID of .77" or 3/4". I was generous in the above calculations because the ID of the brass fitting is .70" or 11/16" which is 1/16 less than 3/4".

#### SIZE THERMAL EXPANSION

PEX pipe has to have an expansion loop or bend plumbed into it because it expands and shrinks about 1' per 100' of 1" pipe when there is a temperature change. Depending on how your system is plumbed there should only be a portion that will experience changes in length. The problem is that some DIY folks didn't know any better and they plumbed their system with PEX when the ambient temperature was 95F or 100F. They wanted a nice tight fit and plumbed their system snug. When the chiller dropped the coolant to 28F the pipe shrunk and pulled loose.

#### NO ROOM FOR MOVEMENT

PEX is meant to be permanently installed. If installed on a piece of equipment that has constant movement or flexing it will twist back and forth on the fitting. The fitting has ribs that seal the pipe when the steel band is properly crimped over it. It must be

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checked with the "Go, NoGo" tool. I have never had a leak when I used the tool.

A perfect example of movement would be an ice cream manufacturer had installed their system with PEX and had done a wonderful job. They even sized it properly based on PEX ID. They planned to pull the equipment out once a week for cleaning. PEX will not twist within its length like rubber hose, it will bend only. It will instead twist on the ribs of the fitting. As the equipment was pulled back and forth, the twisting motion cause leaks and they lost their propylene glycol. It was leaking so slowly over time that they didn't notice, then would have sudden shut downs.

Always have an experienced glycol technician examine your system. There are little things that will cost you in the long run. The low temp chiller companies for the most part have very good experts on board.

### PEX IS A VERY GOOD PRODUCT

Before I go into UV and how permeable PEX is, let me now stand up for PEX. I think PEX is a very good product when used for residential and commercial plumbing. I plumbed my new home with it. I have color coded manifolds and can isolate my entire home, a portion, or one line. It pulls around corners and is very durable. As long as it is used within its limitations it is an excellent product. If I was afraid the fittings would leak I would have used copper. I believe they are there for at least 50 years. If they leak I will re crimp or if a line is bad, I will tie it to the old line and pull another. You can't do that in residential walls using copper. If a screw penetrates the wall and hits the side of the PEX line, it may not pierce. The PEX is flexible and will move to the side. Don't depend on that, never test that possibility by damaging your lines.

In a residence the flow of water isn't as critical as when processing and needing the lines to carry coolant. Last, I trust the compression fittings much more than the "O" ring fittings. I wouldn't put those behind drywall. I may be totally wrong because the jury is still out however I know contractors that have experienced problem after just a few years because they opted for speed using the "O" rings.

### CHLORINE AND UV

Chlorine can cause oxidation of the inner wall of the pipe. Manufacturers have added antioxidants to the piping during manufacturing. The antioxidants act much as a sacrificial diode would except this is on the inner surface of the pipe. It normally has a long life and chlorine concentration will affect it. Once this sacrificial element is gone the PEX begins to breakdown. I don't believe the chlorine stays in the water/pg mix long enough to cause significant damage however PG (propylene glycol) is made using chlorides. Try as I may I couldn't find any information on the possible breakdown. It is a concern since chlorides are used in the manufacture of PG. Once mixed with other chemicals and processing the chemistry changes however I couldn't find a significant "yes it's okay to use with PEX" answer.

I'll be honest, our chlorine content is high in this part of Texas and every drop of water I see near a wall gives cause for concern.

UV will definitely breakdown PEX. I have seen exposed PEX on roof tops, this is a definite "don't do." Make sure exterior PEX piping is insulated if you already have used PEX. Also, the sunlight will penetrate the pipe and aid bacteria and algae growth in the correct conditions. It is best to never expose PEX to sunlight.

### USER CAUSED FAILURES

Many times a product will get a name because of user failure. I've seen people pressure up their system and have leaks in their PEX system. Beautifully installed, color codes with correct hot and cold isolation manifolds. I quickly found the reason for the leaks when I asked where is his "Go, NoGo gauge". The owner didn't know, he looked at me very blank and said "what gauge." That gauge is critical on the compression rings used to attach PEX to the fittings. That's why he had leaks. The company that moved the equipment in and out developed leaks because they didn't consult a glycol expert. However, experts sometimes miss things. In my case it is often because we haven't made that mistake yet. Try as we may, we still make mistakes. We do try to avoid them. Those are a couple of examples, oh yes, the man that didn't account for thermal expansion of the lines, his lines pulled apart when the PEX contracted. Examples of user induced problems. Whose fault is it when a consumer makes a mistake installing? It's our fault, the manufacturer, that's who. We need to find a better way of getting the information to our customers. If we are on location for a few installs, we can learn from that. We can also call customers and ask what we can do better. I would much rather hear a complaint than find out later the customer sold his chiller for something we did.

### PERMEABLE

Although PEX is used for potable water and many drink manufacturers have used PEX or similar products for the water and syrup it is not food taste safe if swamped. You may have experienced the problem in a restaurant. Maybe you had a waitress draw up your favorite soft drink and took a big drink on a really hot day, then felt like you had a gulp of mop bucket discards and cola mixed. You almost did. We call that a swamped line. The taste will osmore through the line and flavor the water or syrups. They run the lines in tunnels under the slabs, then as people mop floors and spray down floors those tunnels fill with the worst and most vile smelling water that can be created. Coca Cola gets props here. They have changed nearly all of their under slab lines to stainless steel at great cost, or they have plumbed over head. Do not run your brew through PEX. We do not advise it.

### VERY IMPORTANT: CAUTION! CAUTION!

This is not something that has been experienced by Chillking Chillers however we always err on the side of safety. I am passing on information from the link that will be provided below. Certain manufacturers have left behind byproducts in the pipe. These being chemicals such as MTBE and TBA. I cannot and will not vouch for the accuracy of this report however I feel it worth mentioning. If you decide to use PEX please research it and find your own comfort level.

### LINK

All of the information above is from our experience and training. I do not have permission to print the following but I can provide a

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link. I am attempting to get authorization to put this on the website. It is a list of problems experienced using PEX plumbing. I haven't studied it in its entirety and I do not vouch for its findings. The following link to the PEX failures paper is written by; Cadell Caulkins, BAE/MAE, Penn State, 2011  
[www.failures.wikispaces.com/PEX+Plumbing+Failures](http://www.failures.wikispaces.com/PEX+Plumbing+Failures)

### IMPORTANT NOTICE

**"The information in this article was gathered from my extensive experience and training. Additional information can be found from publicly available sources, including reports of tests conducted by various independent entities. The contents of this article are informational only and are not intended as an endorsement or warranty with respect to any product or system.**

**Chillking Chillers, Inc. and any agents thereof have no responsibility for the design, administration, results, or evaluation of any test performed on PEX plumbing in conjunction with a brewery system. Furthermore, Chillking Chillers, Inc. and any agents thereof make no warranties, express or implied, as to the fitness of any product or system for any particular purpose, the suitability of any product or system for any specific application, or the performance of any product or system.**

**Chillking Chillers, Inc. and any agents thereof encourage those wishing to use PEX in a brewery environment to further research the disadvantages associated with the use of PEX in such an environment and make an informed decision based on further research."**