

INSULATING PLASTIC PIPES (CPVC and PEX) IN RESIDENTIAL AND COMMERCIAL APPLICATIONS

Condensation Control vs. Energy Conservation Codes

There has been some confusion and misleading statements made in the marketplace regarding insulation requirements when using plastic piping materials such as CPVC and PEX in plumbing and hydronic heating applications. The plumbing, mechanical and energy conservation codes base insulation requirements or thermal efficiency on the *type of system* (e.g. domestic hot and cold water, hot water heating, and service hot water). These requirements apply regardless of the piping material and are requirements to aid against heat loss within the system. Plastic piping does offer some increased thermal performance over copper tubing, but neither CPVC nor PEX piping can meet the minimum required thermal performance called out in today's state, local and model codes.

Based on a the basic requirements for thermal performance of piping systems in the ICC Model Codes, the minimum R-value range is from R-2 up to the equivalent of an R-5 based on the pipe size and system. In the following chart we have calculated the corresponding R-value for PEX, CPVC and Copper using the Cylindrical "R" value Calculation formula which confirms that plastic piping without pipe insulation does not meet the energy conservation code requirements mandated by State, Local , and Model codes.

Cylindrical "R" value Calculation

$$R = \frac{r_2 \ln\left(\frac{r_2}{r_1}\right)}{k}$$

r1 = inside radius (inches)
r2 = outside radius (inches)
k = thermal conductivity (BTU-in/hrft²°F)
ln = natural logarithm of a number (inches)

Corresponding Pipe R-value by Size and Material

	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
PEX	0.04	0.05	0.06	0.08	0.09	0.12
CPVC	0.08	0.09	0.12	0.15	0.17	0.22
Copper	-	-	-	-	-	-

Referenced Pipe/Tube Information

	K Value	r1						r2					
		Pipe Inside Radius (in.)						Pipe outer Radius (in.)					
		1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
PEX	2.40	0.238	0.336	0.432	0.528	0.623	0.815	0.313	0.438	0.563	0.688	0.813	1.063
CPVC	0.95	0.245	0.358	0.461	0.563	0.665	0.870	0.313	0.438	0.563	0.688	0.813	1.063
Copper	2616	0.271	0.391	0.510	0.630	0.750	0.989	0.313	0.438	0.563	0.688	0.813	1.063

We recognize that plastic piping materials have a lower thermal conductivity than copper piping materials and in some conditions may reduce the need for insulation to control condensation. For system piping that falls outside the defined plumbing, mechanical, and or energy conservation system code requirements, value engineering may reduce the thickness requirements based on environmental conditions. Please consult with a Nomaco Insulation Representative to have conditional condensation control recommendations calculated for your next project.

For specific energy conservation requirements on your project please reference your city and state energy conservation code or contact your local inspector's office for specific details for your area.

References:

Installation Handbook: CPVC Hot & Cold Water Piping, **Plastic Pipe and Fittings Association**; www.ppfahome.org

BOW FlowGaurd Gold® Product Installation Guide, 2008; **Bow-Group**; www.bow-group.com

Uponor Reference Guide (CommPLU_RefGuide_P400_0312), 2012; **Uponor**; www.uponor.com

ViegaPEX™ Cross-linked Polyethylene (PEX) (TD-PF-0411); **Viega** ; www.viega.com

The Facts on Cross-Linked Polyethylene (Pex) Pipe Systems; December 3, 2004, **Plastic Pipe Institute**; www.plasticpipe.org

Plastics Technical and Installation Manual; February 17, 2012; **Charlotte Pipe and Foundry Co.**; www.charlottepipe.com