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TIAC FACT BULLETIN No. 1

Pipe Insulation and Plastic Piping

Introduction

The use of plastic pipe to convey Domestic Hot Water (DHW), Domestic Cold Water (DCW), Heating Hot Water (HHW), and Chilled Water (CW) is a popular construction practice. The plastic pipe manufacturers claim the wall thickness of the plastic pipe has sufficient thermal conductivity to either reduce or eliminate the need for additional insulation. For most operating and ambient conditions, it doesn't.

TIAC does not comment on the effectiveness of plastic pipe systems. We take strong exception, however, to the marketing efforts of the plastic pipe manufacturers' insulation claims; use our plastic pipe and you'll save money by not having to insulate the piping.

The following facts are backed up by references to specific recognized sources. For the sake of brevity, this Bulletin does not necessarily include these sources; however, the sources and technical rationale are available from TIAC upon request.

Energy Codes

The Model National Energy Code for Buildings-1997 (MNECB-1997), the National Energy Code for Buildings-2011 (NECB-2011), the provinces with specific energy codes, and those that follow MNECB-1997 or NECB-2011 *do not* make an exception for the claimed insulation value of plastic pipe. All piping, regardless of what it's made of, *must* follow the minimum pipe insulation thickness tables in the respective codes.

ASHRAE follows the same requirements, but does make an exception with respect to the tables on minimum pipe insulation thicknesses:

> "The table is based on steel pipe. Non-metallic pipes Schedule 80 thickness or less shall use the table values. For other non-metallic pipes having thermal resistance greater than that of steel pipe, reduced insulation thicknesses are permitted if documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per foot than a steel pipe of the same size with the insulation thickness shown in the table."

CMHC states in a research report titled, "Energy and Water Tune-ups for Multi-unit Residential Buildings":

- "Distribution piping should be insulated."
- "Give priority to uninsulated piping located in unheated areas such as basements, attics, and parking garages. Also give priority to larger pipes."

Ontario Building Code (OBC) states:

Resource Conservation — Water Conservation OR1:

An *objective* of this Code is to limit the probability that, as a result of the design or *construction* of a *building*, water resources will be exposed to an unacceptable risk of depletion or the capacity of the water supply, treatment and disposal infrastructure will be exposed to an unacceptable risk of being exceeded, caused by the consumption of water.

Resource Conservation — Energy Conservation OR2:

An *objective* of this Code is to limit the probability that, as a result of the design or *construction* of a *building*, a natural resource will be exposed to an unacceptable risk of depletion or the capacity of the infrastructure supporting the use of the resource will be exposed to an unacceptable risk of being exceeded, caused by the consumption of energy.

Fire Codes

AquaRise states in "Volume V: AquaRise CPVC Hot & Cold Water Systems – Mechanical Technical Manual Series":

- Page 29: "AquaRise may not be permitted to be used in a Vertical Shaft."

Thermal Conductivity

AquaRise states in "Volume V: AquaRise CPVC Hot & Cold Water Systems – Mechanical Technical Manual Series":

- Page 5: Thermal Conductivity – "Note: To maximize system efficiency for hot water recirculation systems, it is recommended that AquaRise or any other pipe should be insulated."

AquaRise 0.95 BTU/hr./ft2/°F/in.
R-value = 1.05/in.
Note: "/in." (per inch)

If the wall thickness of the CPVC pipe is 1/8", the actual equivalent R-value is 0.13.

1" of glass fibre pipe insulation has an R-value of 4.17.
1" of elastomeric foam insulation has an R-value of 3.70.
½" of elastomeric foam insulation has an R-value of 1.85.

- Page 25: Freeze Issues – "All model plumbing codes require that piping exposed to freezing temperatures be properly insulated."

Note: If heat tracing is required, the heat tracing and plastic pipe manufacturers must be consulted to determine the appropriateness of this combination.

Condensation

Aquatherm Technical Bulletin 201208C-AQTTB (rev. 1) Piping Condensation and Aquatherm, states in part:

"**The only solution to condensation problems is to insulate** the pipes and equipment where sweating can occur."

"But even **Aquatherm piping cannot be guaranteed not to sweat** when exposed to the proper conditions."

"It is, therefore, the position of Aquatherm that all piping installations where chilled water is to be carried in the piping or where the **surface temperature of the piping is expected to be below the ambient dew point temperature shall be insulated per code."**

Bubble Wrap as Pipe Insulation

Aquatherm Technical Bulletin 201212A-AQTTB Aquatherm Advanced, states in part:

"… and due to a strong market preference towards fiberglass insulations, we are discontinuing offering the wrap for the Aquatherm Advanced composite system, effective December 1, 2012 …"

Wasted Water

If there is sufficient heat loss along the length of an uninsulated DHW plastic pipe system, anyone turning on a tap will allow the water to flow until they sense a comfortable temperature.

The American Society of Plumbing Engineers (ASPE) recommends:

- Acceptable performance: 1 to 10 seconds.
- Marginal performance: 11 to 30 seconds.
- Unacceptable performance: more than 31 seconds.

Engineering Considerations

Throughout the plastic pipe manufacturers' literature there is constant reference to design conditions, authorities having jurisdiction, code, and the decisions of the consultants. This, in our view, begs for serious scrutiny of the conditions into which plastic pipe is to be installed. We recognize every project is different. It would only take a few minutes to confirm if uninsulated plastic pipe will meet the actual operational conditions of a project.

3E Plus and the MIDG Calculator Tools are recognized sources of determining actual heat loss or gain, condensation control, personnel protection, and GHG reductions.

As an example using 3E Plus:

Hot water with a temperature of 140F flowing in a 1" dia. uninsulated plastic pipe will lose **34.26** BTU/hr per foot of pipe assuming an ambient temperature of 70F.

If this same plastic pipe, under the same conditions, were to be insulated with 1" glass fibre pipe insulation the energy loss per foot of pipe is **7.95** BTU/hr.

Installing 1" of glass fibre pipe insulation represents an energy saving of 77%

Conclusion

With very rare exception, plastic pipe systems should be insulated. This advice comes not only from plastic pipe manufacturers, but from various energy codes and independent studies.

Should the consultant deviate from the minimum pipe insulation thicknesses mandated in the energy code tables, the consultant must provide proof the change is justified, and must obtain approval from the authority having jurisdiction.

TIAC has the resources to construct the engineering/design rationale to justify insulation on plastic piping systems. In addition, we are also in a position to advise on payback. We are available to lend a hand whenever you're ready.