

ENERGY STANDARDS AND CODES FOR MECHANICAL INSULATION IN COMMERCIAL BUILDINGS

Energy conservation is important to everyone. It reduces the consumption of natural resources, reduces pollution in the environment, and saves building owners and homeowners money. As a result, energy conservation standards and codes were developed to ensure energy conservation is a priority for new and existing buildings. The most widely used of these standards is *ASHRAE 90.1* which outlines standards for constructing energy efficient commercial buildings. Since *ASHRAE 90.1* is a standard, and not a law, it is not enforceable unless it is adopted by a state or municipality or provisions within it are included in a model code that is adopted.

By far, the most widely adopted model energy code is the *International Energy Conservation Code (IECC)* which uses a significant portion of the energy-saving provisions of *ASHRAE 90.1*. Over 80% of states have a mandatory energy conservation code and all of these states have used *ASHRAE 90.1*, the *IECC*, or a combination of both as a basis for their code. Therefore, it is critical for building designers to understand the energy saving requirements outlined in *ASHRAE 90.1* and the *IECC*.

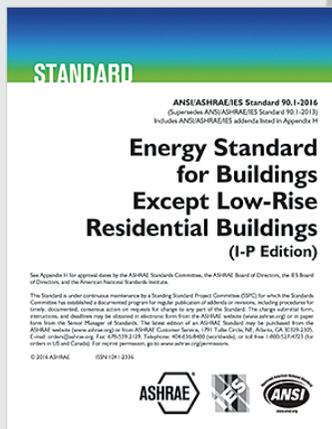
This particular technical bulletin focuses on the requirements for mechanical insulation for HVAC and plumbing systems. All of the information in this bulletin is based on the 2016 version of *ASHRAE 90.1* and the 2015 version of the *IECC* and is for general guidance only. Please consult your local energy code for specific requirement in your area.

conductivity range at a specified mean temperature that the insulation must meet for the table to be applicable. If the insulation is not within the range, it can still be used but a thickness must be calculated using a supplied calculation. The thickness required for low temperature pipes, like refrigerant and chiller water, is less than higher temperature pipes and smaller pipes require less insulation as well.¹ In general, refrigerant suction lines and chilled water pipes require either 1/2" or 1" insulation depending on the size and temperature of the pipes.² Hot pipes require anywhere from 1" to 5" of insulation depending on size and temperature.

In addition to the insulation thickness, section 6.4.4.1.1 in *ASHRAE 90.1* and section C402.2.10.1 of the *IECC* require that all insulation installed outdoors must be protected from damage due to sunlight, moisture, maintenance, and wind. Therefore, any insulation installed outdoors must have a protective coating or covering to meet energy codes. Please see *Armacell TB 38: Exterior Protection of Insulation* for more information regarding protecting insulation installed outdoors.

Armacell Pipe Insulation

Armacell pipe insulation products all fall within the thermal conductivity ranges specified in *ASHRAE 90.1* and the *IECC* for the temperature ranges within the limits of the insulation. Therefore, Armacell insulation complies with the standards at the thickness listed in the tables.



HVAC Systems

The requirements for insulation on pipes and ducts supporting an HVAC system are outlined in both *ASHRAE 90.1* and the *IECC*. In fact, there is almost no difference between these documents when it comes to mechanical insulation for HVAC systems.

Pipe Insulation Requirements

For pipes, section 6.4.4.1.3 in *ASHRAE 90.1* and section C403.2.10 in the *IECC* contain the identical table that shows the insulation thickness required depending on the pipe operating temperature and the size of the pipe. These sections also give the thermal

Duct Insulation Requirements

Duct insulation requirements are outlined in section 6.4.4.1.2 of *ASHRAE 90.1* and in section C403.2.9 of the *IECC*. In both standards, the required insulation thickness is based on the climate zone and where the duct is located. *ASHRAE 90.1* also includes different requirements for heating and AC ducts, heating only ducts, and AC only ducts. The *IECC* does not differentiate between heating and cooling ducts and the thickness requirements are based on the heating and AC requirements from *ASHRAE 90.1*. *ASHRAE 90.1* and the *IECC* both require R-6 insulation for ducts in unconditioned spaces and R-8 or R-12, depending on the climate zone, for ducts installed outside the building. *ASHRAE 90.1* also has a requirement of R-1.9 for supply ducts installed in indirectly conditioned spaces, which includes plenum spaces above ceilings. The *IECC* does not list requirements for ducts in indirectly conditioned spaces and neither document has insulation requirements for duct

installed in conditioned spaces. Section 6.4.4.1.1 in *ASHRAE 90.1* requires that duct insulation be protected from sunlight and water when installed outdoors but the *IECC* does not address outdoor protection for duct insulation. This is instead addressed in section 604.12 of the International Mechanical Code which requires an approved weatherproof barrier over any duct insulation installed outdoors.

Armacell Duct Insulation

The table below shows the R-values for Armacell duct insulation. One must simply choose the right thickness to comply with the code requirement for their particular application.

Plumbing Systems

The 2015 version of the *IECC* significantly increased the requirements for insulation on service hot water pipes compared to previous versions. Whereas previous versions required insulation only on recirculation hot water lines and the first 8 feet

of pipe from the water heater in a non-recirculation system, the 2015 *IECC* requires all service hot water pipes to be insulated from the water heater to the fixture. The hot water pipes must be insulated according to table C403.2.10; the same table that is used for HVAC piping. Assuming that the temperature of most domestic hot water is 105°F – 140°F, the required insulation thickness is 1" for pipes below 1 1/2" diameter and 1.5" thickness for pipes 1-1/2" and above.

ASHRAE 90.1 still requires that only recirculation loops be completely insulated and only the first 8 ft from a non-recirculation system be insulated. Where insulation is required, the thickness must be installed according to table 6.8.3-1; the same table used for HVAC systems and the *IECC*. Therefore, where required, the insulation thickness could be 1" or 1-1/2" as listed above.

R-Values for Armacell Duct Insulation

Thickness	3/8"	1/2"	3/4"	1"	1-1/2"	2"
R-Value	1.6	2.1	3.1	4.2	6	8