By John W. Bartok Jr.

# Pipe insulation is an inexpensive, energy-saving measure

In conducting energy audits of greenhouse operations, I've frequently observed uninsulated hot-water system piping.

These are in areas where heat is not needed or where better heat control could be obtained if piping was insulated. It's surprising how much heat an uninsulated pipe gives off.

I know one grower with two large boilers heating a gutter-connected greenhouse. He told me that before insulating the supply/return pipes in his boiler room, he frequently had to leave the windows and doors open or it would get too hot in the room to work. Once the pipes were insulated, extra heat had to be added to the room to make it comfortable.

Heat loss from pipes depends on several factors, including the diameter and length of the pipe, the water temperature inside the pipe, the air temperature surrounding the pipe and the length of time the pipe is carrying hot water. Adding insulation slows the heat loss and lowers the fuel bill.

## Estimating your savings

Table 1 provides the approximate annual savings from insulating a linear foot of different diameter pipe with 1-inch of fiberglass or foam. It assumes 2,000 hours of annual use, typical of a greenhouse heating system in a northern climate.

To use the table, select a pipe diameter and multiply the length of pipe by the savings given in the table. For example, a grower can save $372 a year by insulating 100 feet of 2-inch diameter heating system pipe carrying 180°F water if the boiler is fired with natural gas costing $1.05 per therm. The savings from the pipe insulation = 100 feet × $3.72 per linear foot = $372.

## Selecting an insulation material

Pipe-insulating materials are selected based on where the heating pipes are located, maximum temperature of the water and the insulating value of the insulation material. Most insulation materials are available with formed pieces to fit over pipe elbows and tees.

All insulation materials are flexible or semi-rigid except for those that are enclosed in a protective jacket. This makes them easy to install in tight locations. Depending on the material, the length of individual pieces may be 2 to 6 feet long. These pieces can be cut with a utility knife to the desired length. All materials can either be slit to fit over an existing pipe or come in two pieces.

Due to the low service temperature, polyethylene materials are fine for use in domes-

**Table 1. Approximate annual fuel savings with pipe insulation (per linear foot)***

| Nominal diameter (inches) | Surface area (sq. ft.) | Heat loss bare pipe (Btu/hour-foot) | Heat loss 1" insulation (Btu/hour-foot) | Natural gas @ $1.05/therm | Fuel oil @ $2/gallon | Propane @ $1.75/gallon |
|---|---|---|---|---|---|---|
| ½ | 0.22 | 52 | 11.5 | $1.22 | $1.62 | $2.43 |
| ¾ | 1.05 | 65 | 13 | $1.56 | $2.08 | $3.12 |
| 1 | 1.32 | 82 | 15 | $2.01 | $2.68 | $4.02 |
| 1¼ | 1.66 | 102 | 18 | $2.52 | $3.36 | $5.04 |
| 1½ | 1.9 | 118 | 19 | $2.97 | $3.96 | $5.94 |
| 2 | 2.4 | 147 | 23 | $3.72 | $4.96 | $7.44 |
| 3 | 3.5 | 218 | 30 | $5.64 | $7.52 | $11.28 |
| 4 | 4.5 | 279 | 37 | $7.26 | $9.68 | $14.52 |
| 6 | 6.6 | 409 | 51 | $10.74 | $14.32 | $21.48 |

** Steel pipe, 180°F water temperature, 70°F room air temperature, 2,000 hours per year, 1-inch foam insulation, 70 percent heating system efficiency*

tic hot water systems, but should not be used where the boiler water is greater than 200°F. All other materials can withstand higher temperatures.

Table 2 gives the insulation factor for the different materials. The lower the "k" value, the better the insulation value of the material and the greater the savings. Except for domestic hot-water pipes that may contain 140°F water, all piping should be covered with at least 1-inch thick insulation.

## Insulation installation

The time it takes to install pipe insulation depends on the material and access to put it on. Average time varies between 250 feet per day for smaller size pipe to 80 feet per day for larger size pipe.

Scaffolding or a man-lift may be required for installation in some greenhouses. If a heating contractor installs the insulation, expect to pay labor costs of about $2.50 per linear foot for small size pipe to about $4 for larger pipe. If the insulation installation is done with the greenhouse labor force during slower periods, it may cost considerably less.

Payback for most pipe installation will be less than two years. USDA or state grant money may be available to offset some of the cost. Visit www.dsireusa.org for information on grant programs.

**Table 2. Pipe insulation selection.**

| Insulation material | Maximum pipe temperature | Insulation factor k* | Cost | Application |
|---|---|---|---|---|
| Polyethylene | 180°F | 0.29 | Very low | Indoor/outdoor |
| UV polyethylene | 200°F | 0.25 | Very low | Outdoor/underground |
| Elastomer foam rubber | 220°F | 0.27 | Low | Indoor |
| Urethane foam | 300°F | 0.19 | Medium | Indoor |
| Cellular glass | 400°F | 0.29 | Medium | Outdoor/underground |
| Fiberglass | 850°F | 0.23 | Medium | Indoor/jacket |
| Rock fiber | 1,200°F | 0.24 | High | Indoor |

**k is conductivity in Btu-inch/hour-square foot-°F at 75°F*

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