



Insulate Steam Distribution and Condensate Return Lines

Uninsulated steam distribution and condensate return lines are a constant source of wasted energy. The table shows typical heat loss from uninsulated steam distribution lines. Insulation can typically reduce energy losses by 90% and help ensure proper steam pressure at plant equipment. Any surface over 120°F should be insulated, including boiler surfaces, steam and condensate return piping, and fittings.

Insulation frequently becomes damaged or is removed and never replaced during steam system repair. Damaged or wet insulation should be repaired or immediately replaced to avoid compromising the insulating value. Eliminate sources of moisture prior to insulation replacement. Causes of wet insulation include leaking valves, external pipe leaks, tube leaks, or leaks from adjacent equipment. After steam lines are insulated, changes in heat flows can influence other parts of the steam system.

Distribution Line Diameter, Inches	Heat Loss per 100 Feet of Uninsulated Steam line, MMBtu/yr			
	Steam Pressure, psig			
	15	150	300	600
1	140	285	375	495
2	235	480	630	840
4	415	850	1120	1500
8	740	1540	2030	2725
12	1055	2200	2910	3920

Based on horizontal steel pipe, 75°F ambient air, no wind velocity, and 8,760 operating hours per year.

Example

In a plant where the fuel cost is \$8.00 per million Btu (\$8.00/MMBtu), a survey of the steam system identified 1,120 feet (ft) of bare 1-inch-diameter steam line, and 175 feet of bare 2-inch line, both operating at 150 pounds per square inch gauge (psig). An additional 250 ft of bare 4-inch-diameter line operating at 15 psig was found. From the table, the quantity of heat lost per year is:

1-inch line: 1120 ft x 285 MMBtu/yr per 100 ft = 3192 MMBtu/yr
 2-inch line: 175 ft x 480 MMBtu/yr per 100 ft = 840 MMBtu/yr
 4-inch line: 250 ft x 415 MMBtu/yr per 100 ft = 1037 MMBtu/yr

Total Heat Loss = 5069 MMBtu/yr

Given a boiler efficiency of 80%, the annual cost savings from installing 90% efficient insulation is:

$$(0.90 \times \$8.00/\text{MMBtu} \times 5069 \text{ MMBtu/yr})/0.80 = \$45620$$

Best Practice Tip Sheet information is adapted from information provided by the Industrial Energy Extension Service of Georgia Tech and reviewed by the DOE Best Practices Steam Technical Subcommittee. For additional information on industrial steam system efficiency, contact the EERE Information Center

Best Practice Tip 102

Suggested Actions

Conduct a survey of your steam distribution and condensate return piping, install insulation, and start to save.

Insulation Optimization Software Available

The North American Insulation Manufacturers Association has developed a software package (3EPlus) that determines the optimum thickness for a wide variety of insulating materials. outputs include the simple payback period, surface heat loss, and surface temperature for each specified insulation thickness. 3EPlus is available at no cost through the EERE Information Center.

Use Insulating Jackets

Removable insulating jackets are available for valves, flanges, and other fittings. Remember that a 6-inch gate valve may have over 6 square feet of surface area from which to radiate heat.