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.

### Heat Loss per 100 feet of Uninsulated Steam Line

<table>
<thead>
<tr>
<th>Distribution Line Diameter (inches)</th>
<th>Heat Loss per 100 feet of Uninsulated Steam Line (MMBtu/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>140 285 375 495</td>
</tr>
<tr>
<td>2</td>
<td>235 480 630 840</td>
</tr>
<tr>
<td>4</td>
<td>415 850 1,120 1,500</td>
</tr>
<tr>
<td>8</td>
<td>740 1,540 2,030 2,725</td>
</tr>
<tr>
<td>12</td>
<td>1,055 2,200 2,910 3,920</td>
</tr>
</tbody>
</table>

Based on horizontal steel pipe, 75°F ambient air, no wind velocity, and 8,760 operating hr/yr.

### Example

In a plant where the value of steam is $4.50/MMBtu, a survey of the steam system identified 1,120 feet of bare 1-inch diameter steam line, and 175 feet of bare 2-inch line both operating at 150 psig. An additional 250 feet 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: 1,120 feet x 285 MMBtu/yr per 100 ft = 3,192 MMBtu/yr
2-inch line: 175 feet x 480 MMBtu/yr per 100 ft = 840 MMBtu/yr
4-inch line: 250 feet x 415 MMBtu/yr per 100 ft = 1,037 MMBtu/yr
Total Heat Loss = 5,069 MMBtu/yr

The annual operating cost savings from installing 90% efficient insulation is:

0.90 x $4.50/MMBtu x 5,069 MMBtu/yr = $20,530

### Suggested Actions

Conduct a survey of your steam distribution and condensate return piping, install insulation, and start to save.
BestPractices is part of the Office of Industrial Technologies’ (OIT’s) Industries of the Future strategy, which helps the country’s most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

OIT and its BestPractices program offer a wide variety of resources to industrial partners that cover motor, steam, compressed air, and process heating systems. For example, BestPractices software can help you decide whether to replace or rewind motors (MotorMaster+), assess the efficiency of pumping systems (PSAT), compressed air systems (AirMaster+), steam systems (Steam Scoping Tool), or determine optimal insulation thickness for pipes and pressure vessels (3E Plus). Training is available to help you or your staff learn how to use these software programs and learn more about industrial systems. Workshops are held around the country on topics such as “Capturing the Value of Steam Efficiency,” “Fundamentals and Advanced Management of Compressed Air Systems,” and “Motor System Management.” Available technical publications range from case studies and tip sheets to sourcebooks and market assessments. The Energy Matters newsletter, for example, provides timely articles and information on comprehensive energy systems for industry. You can access these resources and more by visiting the BestPractices Web site at www.oit.doe.gov/bestpractices or by contacting the OIT Clearinghouse at 800-862-2086 or via email at clearinghouse@ee.doe.gov.

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Peter Salmon-Cox
Office of Industrial Technologies
Phone: (202) 586-2380
Fax: (202) 586-6507
Peter.Salmon-Cox@hq.doe.gov
www.oit.doe.gov/bestpractices

OIT Clearinghouse
Phone: (800) 862-2086
Fax: (360) 586-8303
clearinghouse@ee.doe.gov

Please send any comments, questions, or suggestions to webmaster.oit@ee.doe.gov

Visit our home page at www.oit.doe.gov

Office of Industrial Technologies
Energy Efficiency and Renewable Energy
U.S. Department of Energy
Washington, DC 20585-0121

DOE/G0-102002-1504
March 2002
Steam Tip Sheet #2