

Determination of Heat Loss from Pipes and Flat Surfaces

Conservation of energy requires that areas of high heat loss be insulated to keep this loss to a minimum. Areas of high heat loss can be found by measuring the surface temperature of pipes and walls. This temperature can be converted to heat loss in Watts per metre (BTU/hr/ft), in the case of pipe, or Watts per square metre (BTU/hr/sq ft), for surfaces, using the appended graphs.

The Calex PyroPen Infrared Thermometer allows non-contact measurement of these temperatures. This instrument has several major advantages over contact temperature measurement techniques:

1) FAST. Readings are instantaneous allowing hundreds of temperatures to be measured per hour.

2) ACCURATE. Since no contact is required, no errors result from poor contact with rough, dirty surfaces.

3) SAFE. Hard to reach pipes and walls can be measured from the floor - without climbing structures.

Heat loss from pipes is a function of outside pipe diameter and surface temperature. Graph A gives heat loss in W/m (BTU/hr/ft) of pipe length

for pipes to approximately 25.4 cm (10") in diameter with measured pipe temperature to approximately 371°C (700°F).

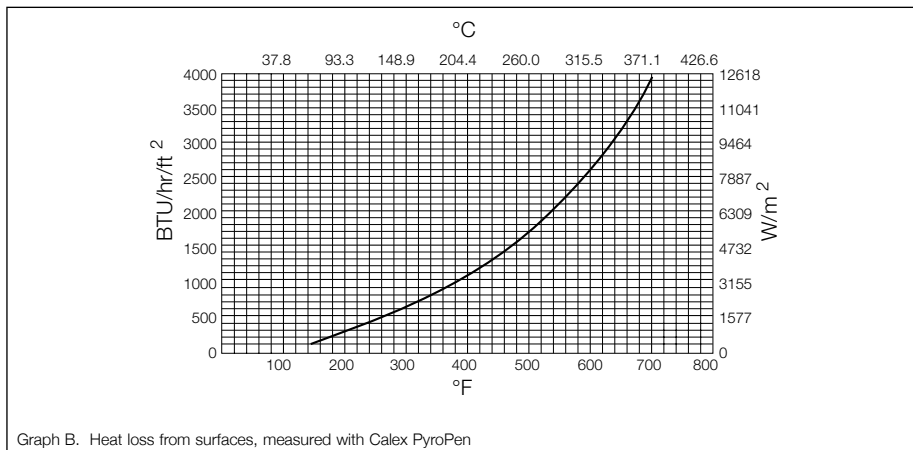
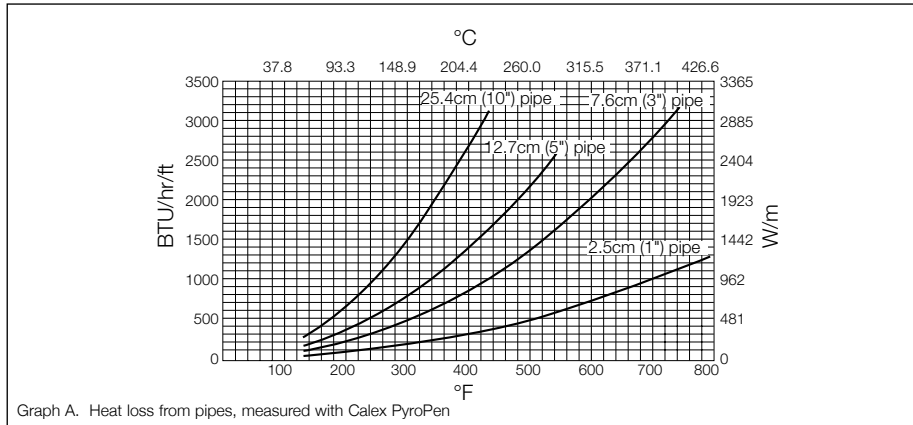
EXAMPLE: Pipe Diameter = 10.2 cm (4")
Temperature measured with PyroPen = 176.7°C (350°F)
HEAT LOSS (from graph) = 798 W/m (830 BTU/hr/ft)

The data assumes a room temperature of - approximately 26.7°C (80°F). Minor variations in ambient however, do not affect the results. To determine heat loss from valves and fittings, approximate the diameter and length of an equivalent pipe and use the graph.

Heat loss from a SURFACE is a function of the surface temperature. Graph B gives heat loss in W/m² (BTU/hr/ft²) for temperatures to approximately 371°C (700°C).

Approximately 2.5 to 5.1 cm (1 to 2 inches) of insulation applied to bare surfaces generally will reduce heat loss by at least 90%. In the previous example where the heat loss from the 10.2 cm (4") pipe was 798 W/m (830 BTU/hr/ft), insulation will reduce that to about 79.8 W/m (83 BTU/hr/ft), or a saving of 718.2 W/m (747 BTU/hr/ft). Using this rule of thumb, temperature measurement with the PyroPen will allow calculation of potential savings as well as preventing heat loss.

The instrument typically used for heat loss studies is the Calex PyroPen L -20°C to +500°C (-4 to 932°F). It will measure approximately 2.5 cm (1") target for each 20 cm (4") of distance between the PyroPen and the object being measured. As an example, a 5.1 cm (2") pipe can be measured up to a maximum distance of 35m (1ft 2") with this instrument.



Note: Metric (S.I. units) are approximations, converted from original Imperial (British) units using the following factors:
 1 cm = 0.39370 inches
 1m = 3.28084 ft
 1m² = 10.7639 ft²
 °F to °C: -32 x 0.5555
 °C to °F: x1.8 +32
 1W = 1J/s = 3.41214 BTU/hr
 1W/m² = 0.316998 BTU/ft²/hr