



Air Transported Heat Loss

Air-transported heat loss is calculated in BTU per **cubic feet per hour (CFH)**

$$\text{Btuh} = V \times \text{ACH} \times 0.0182 \text{ Btu/ft}^3 \times \Delta T \text{ (Typically for load calcs @ design temp)}$$

To calculate BTU per heating season, insert HDD x 24 hours in place of ΔT

$$\text{Btu/yr} = V \times \text{ACH} \times 0.0182 \text{ Btu/ft}^3 \times \text{HDD} \times 24 \text{ (Btu/heating season)}$$

V = volume

ACH = air changes per hour

0.0182 Btu/ft³ = Constant - Specific Heat of air per cu.ft. (SH). This is the number of BTUs needed to raise a standard 1 ft³ of air 1^o Fahrenheit. (.24 btu/lb ÷ 13.18 cu.ft. per lb.)

ΔT = temperature difference

HDD = Heating degree days for specific location

24 = hours/day

Example:

A 1200 ft² house has 8-foot ceilings and is in Grand Rapids Michigan which has an average of 6894 Heating Degree Days (HDD). The building has an infiltration rate of .4 ACH. What is the infiltration load per hour at a design temp of 0^o F. Calculate from an indoor temp of 65^o. The home is heated with a 92% forced air natural gas furnace at \$1.10 per therm.

What is the Btuh? _____ (9600 x .4 x .0182 x 65 = **4,542.7**)

What is the annual infiltration load in Btu/yr? _____ (9600 x .4 x .0182 x 6894 x 24 = **11,563,388**)

Approximately what will this cost? _____ (11,563,388 ÷ 100,000 = 115.6 therms ÷ .92 efficiency adjustment x \$1.10 = **\$138.22 / year**)

See next page for alternate method

Alternate method. This may be easier. Compare numbers and you will see they are close.

$$\text{Btuh} = \text{CFM} \times 1.08 \times \Delta T \quad (\text{Typically for load calcs @ design temp})$$

To calculate BTU per heating season, insert HDD x 24 hours in place of ΔT

$$\text{Btu/yr} = \text{CFM} \times 1.08 \times \text{HDD} \times 24 \quad (\text{Btu/heating season})$$

CFM = Cubic feet / minute

1.08 = Constant that converts CFM into lbs. of air/hr. x the Specific Heat (SH) (.075 lbs/cu.ft. x 60 min x .24 btu/lb)

ΔT = temperature difference

HDD = Heating degree days for specific location

24 = hours/day

Use this formula with the same example from above.

What is the Btuh? _____ $(9600 \times .4 \div 60 \times 1.08 \times 65 = 4,492.8)$

What is the annual infiltration load in Btu/yr? _____ $(9600 \times .4 \div 60 \times 1.08 \times 6894 \times 24 = 11,436,318)$

Additionally:

There is 80 CFM of supply duct leakage in a ventilated attic. The supply temperature is 130°F and the outdoor temperature is 40°F. Fuel cost is \$1.10/therm. The 92% furnace has a 50% run time. What is the Btu/hr heat loss when the unit is operating on this day?

$$\text{Btuh} = \text{CFM} \times 1.08 \times \Delta T$$

Btuh: _____ $(80 \times 1.08 \times 90 = 7,776)$

What is the daily load? Btu/day: _____ $(7,776 \times 12 \text{ hours run time} = 93,312)$

Approximately what will this duct leak cost on this day? _____ $(93,312 \div 100,000 = .933 \text{ therms} \div .92 \text{ efficiency adjustment} \times \$1.10 = \$1.12/\text{day})$