How To Calculate Heat Loss?

industrialheatingsystems.com/How-calculate-heat-loss.html

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Heat is energy and heat can affect molecules, recall Bill Nye the Science Guy (you dont need to sing along to his music videos). Now everyting is made up of molecules. Air, water, walls, tanks, and metal are all particles where heat can be transferred or lost. There are 3 types of heat transfer: **Conduction, Convection & Radiation** which I will cover below.

Everything has heat, whether it is hot or cold. It's important to understand the movement of molecules and its relationship to temperature. Warmer water will rise while cooler water will sink because the atoms become closer together adding density. If you heat something up too much, the matter will vibrate so fast they vaporize.

This is why you learn how to calculate heat loss.

Understanding Heat Transfer Types

Now that we have middle school science covered, lets move on to the types of heat transfer or movement. Some might call it **heat loss types**. Click below for definitions and examples of thermal energy phase changes.

What is Conduction & Conduction Heat Loss?

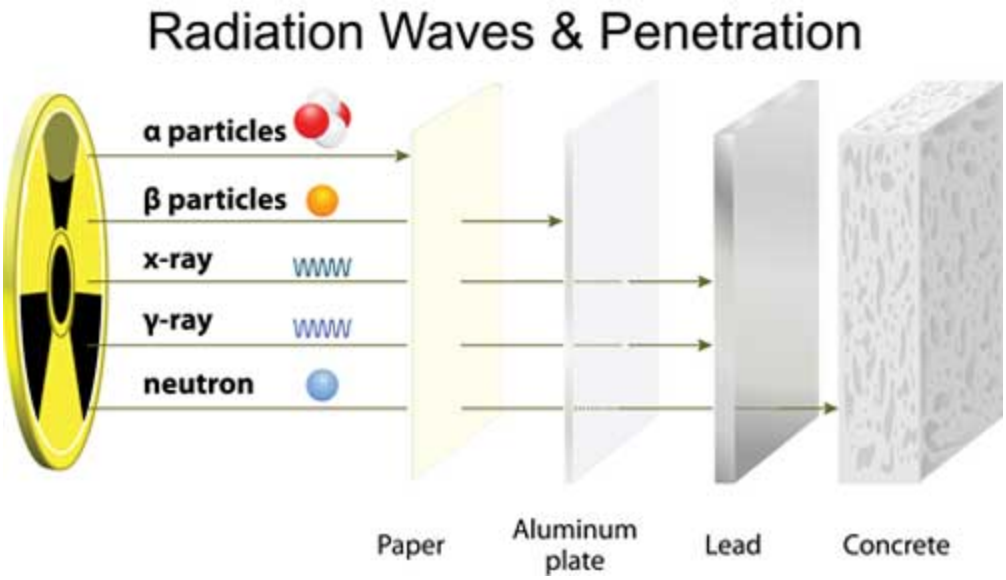
What is Convection?

Convection is the transfer of heat through fluids (gases or liquids) from a warmer spot to a cooler spot. Place an ice cube in hot coffee and the molecules on top become cooler and dense therefore moving to the bottom.

If you heated the bottom of the coffee mug the opposite would happen. The more dense liquid on bottom would expand becoming lighter and would move to the top. This movement of heat is called convection.

What is Radiation?

Radiation is the transition of energy (heat) from one body in the form of waves or particles.



Sounds simple but radiation can come in different forms and energy strengths, here are some examples of radiation:

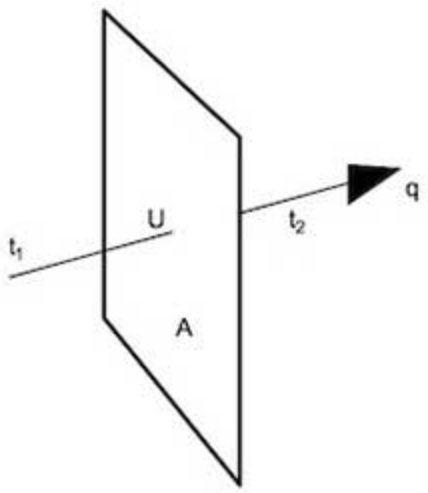
- • ultraviolet light from the sun
- • heat from a camp fire
- • light from a candle
- • x-rays from an x-ray device
- • alpha particles emitted from radioactive decay of uranium
- • cooking waves from a microwave oven
- • electromagnetic radiation from your mobile phone

Heat Loss Formulas & Calculations

In most low-to-medium temperature applications, **radiation and convection account for about 10% of the heat loss** of objects. The formula for calculating heat loss of a system can be calculated by adding in 10%.

Calculating Flat Surface Heat Loss

The term “heat loss” commonly refers to the thermal transfer of an object to its ambient environment. For example a wall is at a temperature above the ambient temperature. The formula for calculating heat loss of a system through conduction (Fourier's Law), expressed in BTU/hour is:



$$Q=(U)(A)(\Delta T)$$

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Where U is the thermal conductance, $BTU/(ft^2)(F^o)(hr)$
A is the surface area of object, ft^2
ΔT is the temperature difference (T1 -T2), F^o
Conductance is the inverse of resistance, R, and can be expressed as U = 1/R So, another equation for general heat loss in BTU/hr is:

$$Q=k(A)(\Delta T)(1.1)L$$

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How Is Heat Loss Measured?

Heat loss is measured in kWs or BTUs. It is a function of heat transfer rates. Heat transfer rates in walls, floors and roofs are measured in U values. To calculate the U value of a wall, pipe, metal or water tank, you need to know the composition and thickness of each part.

Calculate Heat Loss in Watts:

Heat Transfer Rate Equation

Learn More about Fourier's Law Thermal Conduction Formula:

Heat Loss From a Water Tank Calculator

Open water tanks like plating tanks, di water tanks, hot tubs or swimming pools lose excessive heat due to evaporation. SAVINGS TIP: Cover open water containers with insulation when not in use. The overall heat loss from an open water tank can be expressed as:

$$Q = Q_{evaporation\ fluid} + Q_{radiation\ fluid} + Q_{transmission\ through\ walls}$$

The heat loss due to evaporation of water from a surface of an open tank is dominant at higher water temperatures. Any heat loss through insulated walls is minimal, this is especially try for polypro tanks. Polypropelne is an excellent insulator.

Remember– heat rises, so all the energy is being released on the top.

	Heat Loss from Liquid Surface *(Btu/ft²hr)*			Heat Loss Through Tank Walls *(Btu/ft²hr)*			
					Insulated (inches)		
Water Temperature *(F°)*	**Evaporation Loss**	**Radiation Loss**	**Total**	**Bare Steel Uninsulated**	**1**	**2**	**3**
90	80	50	130	50	12	5	4
100	160	70	230	70	15	8	6
110	240	90	330	90	19	10	7
120	360	110	470	110	23	12	9
130	480	135	615	135	27	14	10
140	660	160	820	160	31	16	12
150	860	180	1040	180	34	18	13
160	1100	210	1310	210	38	21	15
170	1380	235	1615	235	42	23	16
180	1740	260	2000	260	46	25	17
190	2160	290	2450	290	50	27	19
200	2680	320	3000	320	53	29	20
210	3240	360	3600	360	57	31	22

the values above are for *60 F⁰* still ambient air

Example Formula Heat Loss From Open Water Tank

Here is a sample calculation of a water tank heat loss using the Table above (NOTE: the room temperature is at 60⁰ F), where:

- Water temperature: *150* F⁰
- Surface area: *10 ft²* (You calculate this by measuring the top open area; IE 4' x 2.5'=10 ft ²
- Un-insulated steel tank walls area: *50 ft²* (Add up each area on a metal rectangle container; 10 ft ² + 15 ft ²+ 10 ft ²+15 ft ²= 50 ft ²)

$Q_{(evaporation\ fluid\ +\ radiation\ fluid)} = (\ 1040\ Btu/(ft^2\ hr))\ (10\ ft^2)$

$= 10400\ Btu/hr$

$Q_{transmission\ through\ walls} = (\ 180\ Btu/(ft\ Btu/(ft^2\ hr))\ (50\ ft^2)$

$= 9000\ Btu/hr$

$Q = Q_{(evaporation\ fluid\ +\ radiation\ fluid)} + Q_{transmission\ through\ walls}$

$= (10400\ Btu/hr) + (9000\ Btu/hr)$

$= 19400\ Btu/hr$