Calculating Condensate Loads

When the normal condensate load is not known, the load can be approximately determined by calculations using the following formulae.

General Usage Formulae

Heating water with steam (Exchangers)*

$$\text{lb/h Condensate} = \frac{\text{GPM}}{2} \times (1.1) \times \text{Temperature Rise } ^\circ\text{F}$$

Heating fuel oil with steam

$$\text{lb/h Condensate} = \frac{\text{GPM}}{4} \times (1.1) \times \text{Temperature Rise } ^\circ\text{F}$$

Heating air with steam coils

$$\text{lb/h Condensate} = \frac{\text{CFM}}{800} \times \text{Temperature Rise } ^\circ\text{F}$$

Steam Radiation

$$\text{lb/h Condensate} = \frac{\text{Sq. Ft. E. D. R.}}{4}$$

$$\text{lb/h Condensate} = \frac{\text{BTU/HR}}{\text{Latent Heat at Operating Pressure}}$$

$$\text{lb/h Condensate} = \frac{\text{MBH x 1,000}}{\text{Latent Heat at Operating Pressure}}$$

*Delete the (1.1) factor when steam is injected directly into water.

Specialized Applications

Sterilizers, Autoclaves, Retorts Heating Solid Material

$$\text{lb/h Condensate} = \frac{W \times Cp \times \Delta T}{L \times t}$$

W = Weight of material — lbs.
Cp = Specific heat of the material
ΔT = Temperature rise of the material ˚F
L = Latent heat of steam Btu/lb
t = Time in hours

Steam Jacketed Dryers

$$\text{lb/h Condensate} = \frac{1000\ (Wi - Wf) + (Wi \times \Delta T)}{I}$$

Wi = Initial weight of the material — pounds per hour
Wf = Final wether of the material — pounds per hour
ΔT = Temperature rise of the material ˚F
L = Latent heat of steam Btu/lb

Heating Liquids in Steam Jacketed Kettles and Steam Heated Tanks

$$\text{lb/h Condensate} = \frac{G \times s.g. \times Cp \times \Delta T \times 8.3}{L \times t}$$

G = Gallons of liquid to be heated
s.g. = Specific gravity of the liquid
Cp = Specific heat of the liquid
ΔT = Temperature rise of the liquid ˚F
L = Latent heat of the steam Btu/lb
t = Time in hours

Heating Air with Steam; Pipe Coils and Radiation

$$\text{lb/h Condensate} = \frac{A \times U \times \Delta T}{L}$$

A = Area of the heating surface in square feet
U = Heat transfer coefficient (2 for free convection)
ΔT = Steam temperature minus the air temperature ˚F
L = Latent heat of the steam Btu/lb

Note: The condensate load to heat the equipment must be added to the condensate load for heating the material. Use same formula

Steam Tracing Lines:
Approximate load is 10 to 50 lb/h for each 100 ft. of tracer

Recommended Safety Factors for Steam Traps
The actual safety factor to use for any particular application will depend upon accuracy of:

1. Estimated load
2. Estimated pressure at trap
3. Estimated backpressure

Any unusual or abnormal conditions must be taken into consideration.

Safety Factor by Type of Trap	Safety Factor
Balanced-Pressure Thermostatic Traps	2 to 4
Thermo-Matic ThermostaticTraps	1.5 to 2.5
Liquid Expansion Traps	2 to 4
Bimetallic Traps	2 to 3
Float and Thermostatic Traps	1.5 to 2.5
Inverted Bucket Traps	2 to 3
Thermo-Dynamic® Traps	1.2 to 2

Safety Factor by Application	General	With Temperature Control
Mains Drainage	x 2	—
Storage Heaters	x 2	—
Unit Heaters	x 2	x 3
Air Heating Coils	x 2	x 4
Submerged Coils (low level drain)	x 2	—
Submerged Coils (siphon drain)	x 3	—
Rotating Cylinders	x 3	—
Tracing Lines	x 2	—
Platen Presses	x 2	—

Rule of Thumb:
Use factor of 2 on everything except Temperature Controlled Air Heater Coils and Converters, and Siphon applications

Effect of Backpressure on Steam Trap Capacity

% Reduction in Capacity

Backpressure % of Inlet	Inlet Pressure Psi g			
	5	25	100	200
25%	6%	3%	0%	0%
50	20	12	10	5
75	38	30	28	23