Rules of Thumb for Chilled Water Systems

- ΔT of 10°F = 2.4 gpm/ton; ΔT of 12°F = 2 gpm/ton; ΔT of 16°F = 1.5 gpm/ton.
- On a centrifugal chiller, if the chilled water temperature is raised by 2˚F to 3˚F, the system efficiency can increase by 3 - 5%.
- On a centrifugal chiller, if condenser water temperature is decreased by 2˚F to 3˚F, the system efficiency can increase by 2 - 3%.
- For every 10°F of water temperature drop across the cooling tower, there is an evaporative loss of approximately 1%, equating to 2.5 to 4.0 gpm per 100 tons of capacity.

Rules of Thumb for HVAC Systems

Ventilation Rate	5 CFM/person	**Set points for distribution system**	**Rebuilt Systems Design**	55°F supply air
Fan Energy	1000-1500 CFM/hp			30°- 40° rise reheat coils
Chiller Size	300-400 ft²/ton		**Dual Duct and Multizone design**	55° cold deck
Ton	12,000 BTU/ton			70-105° hot deck – with ODA Reset Schedule
Chilled Water	2.4 GPM/ton (10 F rise)		**VAV**	55°F cooling
Condenser Water	3 GPM/ton (10 F rise)			10% box leakage flow
People Load	450 BTU/person/hr			40-50% minimum fan volume
Infiltration	0.5-1.5 ACH without building pressurization	**Typical Chiller Efficiencies in kW/ton**		
Heat Transmission Through Envelope	Overall Building – 0.15 to 0.5 BTU/ ft² / F	**Chiller Type**	**ASHRAE Standard 90.1 Minimum**	**Good**	**Best**
	See ASHRAE Handbook of Fundamentals for accurate heat loads by envelope types	**Air- Cooled**	1.26	1.21	1.13
		Water - Cooled	0.72	0.65	0.45

Quick Calculations and Conversions

$$EER = COP \times 3.412$$

$$kW/Ton = 12/EER$$

$$kW/Ton = 12/(COP \times 3.412)$$

$$1\ psi = 2.31\ ft\ w.g.$$

$$1\ l/s = 15.85\ GPM$$

$$1\ l/s = 2.12\ CFM$$

$$Q(Btu/hr) = 500 \times GPM \times \Delta T\ (Chilled\ Water)$$

$$Q(Btu/hr) = 1.08 \times CFM \times \Delta T\ (Air\ Sensible\ Heat)$$

$$Q(Btu/hr) = 0.69 \times CFM \times \Delta(\frac{gr}{lb})\ (Air\ Latent\ Heat)$$

$$Q(Btu/hr) = 4.5 \times CFM \times \Delta h\ (Air\ Total\ Heat)$$

$$Ton\ (Cooling\ Tower) = 15\ MBH = 15{,}000\ BTU/h$$