

Chilled Water Plant Costs Estimated

Water chillers (with starters)			Pumps (not including VFD or starter)	\$100/ton
Centrifugal:			Cooling Tower	
300 to 600 tons		\$255/ton	normal	\$80/ton - \$100/ton
600 to 1400 tons		\$180/ton	permanent	\$130/ton - \$250/ton
1500 to 2500 tons		\$165/ton	Piping (see chart)	\$150/ton - \$300/ton
Absorption			Controls	\$60/ton - \$120/ton
1 stage	500 to 1350 tons	\$450/ton	Electrical	\$120/ton - \$250/ton
2 stage	350 to 1650 tons	\$650/ton	Plate and Frame Heat exchanger	
direct-fired	100 to 1100 tons	\$700/ton	unit only	\$50/ton - \$100/ton
Rotary Screw			complete installation with piping	\$100/ton - \$170/ton
water cooled	70 to 130 tons	\$365/ton		
water cooled	150 to 450 tons	\$260/ton		
air cooled	70 to 400 tons	\$420/ton		
Setting, rigging, installation		\$110/ton	Note: These prices are typical construction costs for normal access applications.	
Add 4160 volt motor		\$20/ton - \$24/ton	For total project cost, add fees, testing and contingencies.	\$315/ton
Add 0.035 tubes		\$15/ton		
Add Gas Engine		\$260/ton		

Useful Formulas

Pump Hp = (GPM x Total Head in ft. water) / (Pump Eff. x 3960)

kW/ton = 3.516/COP
kW/ton = 12/EER

1 Ton = 12,000 BTU/HR
Tons = (GPM x Δ T x specific heat* x specific gravity*) / 24
* for fluids other than water

GPM ∝ RPM
Head ∝ RPM²
Power ∝ RPM³ ∝ GPM³

Example:
Pump HP @ 5,000 gpm = 26.1 HP* x (5,000GPM / 4,000GPM)³
* pump hp @ 4,000 gpm from water piping capacity chart

Specification Bid Form

Energy cost savings of a high efficiency chiller can be accredited to the chiller in the bid process. The lifetime (or any other span of time) can be used to calculate cost savings for every 0.01 kW/ton better than the base bid chiller.

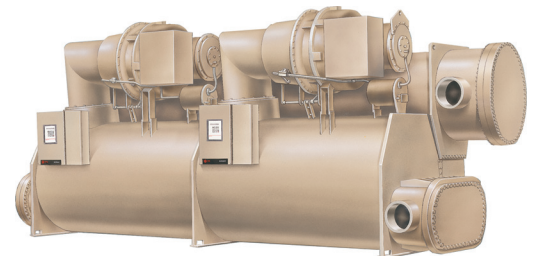
kW/ton	Purchase Price	Cost Savings	Comparative Cost	
.60 kW/Ton	From vendor	none	base bid	Choose the Best Value
.59 kW/Ton	"	\$ savings	(base bid) - (\$ savings)	
.58 kW/Ton	"	2 x \$ savings	(base bid) - (2 x \$ savings)	
.57 kW/Ton	"	3 x \$ savings	(base bid) - (3 x \$ savings)	
*	"	*	*	
*	"	*	*	
.50 kW/Ton	From vendor	9 x \$ savings	(base bid) - (9 x \$ savings)	

Energy Cost Savings = 0.01 kW/ton x Chiller Tons x \$ / kWh
x Equivalent Full Load Hours (per year) x Chiller Lifetime (years)

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Quick Reference for Efficient Chiller System Design





Water Piping Capacity (Tons)

			Chilled Water					
Pipe Size	GPM Price*	Pump**	20°ΔT	18°ΔT	16°ΔT	14°ΔT	12°ΔT	10°ΔT
			1.2 GPM/Ton	1.33 GPM/Ton	1.5 GPM/Ton	1.7 GPM/Ton	2 GPM/Ton	2.4 GPM/Ton
48	60,000 GPM \$1200/ft 195 HP		50,000	45,000	40,000	35,000	30,000	25,000
			40,000	36,000	32,000	28,000	24,000	20,000
42	40,000 GPM \$1000/ft 115 HP		33,300	30,000	26,600	23,300	20,000	16,600
			26,600	24,000	21,300	18,600	16,000	13,300
36	30,000 GPM \$850/ft 110 HP		25,000	22,500	20,000	17,500	15,000	12,500
			20,000	18,000	16,000	14,000	12,000	10,000
30	20,000 GPM \$700/ft 80 HP		16,600	15,000	13,300	11,600	10,000	8,300
			13,300	12,000	10,650	9,300	8,000	6,600
24	12,000 GPM \$550/ft 45 HP		10,000	9,000	8,000	7,000	6,000	5,000
			8,000	7,200	6,400	5,600	4,800	4,000
20	8,000 GPM \$500/ft 32.2 HP		6,650	6,000	5,300	4,650	4,000	3,300
			5,300	4,800	4,250	3,700	3,200	2,650
18	7,000 GPM \$450/ft 37.6 HP		5,800	5,250	4,650	4,050	3,500	2,900
			4,650	4,200	3,700	3,250	2,800	2,300
16	6,000 GPM \$375/ft 43.5 HP		5,000	4,500	4,000	3,500	3,000	2,500
			4,000	3,600	3,200	2,800	2,400	2,000
14	4,000 GPM \$300/ft 26.1 HP		3,300	3,000	2,650	2,300	2,000	1,650
			2,650	2,400	2,100	1,860	1,600	1,300
12	3,600 GPM \$250/ft 29.4 HP		3,000	2,700	2,400	2,100	1,800	1,500
			2,400	2,160	1,920	1,680	1,440	1,200
10	2,400 GPM \$200/ft 22.8 HP		2,000	1,800	1,600	1,400	1,200	1,000
			1,600	1,440	1,280	1,120	960	800
8	1,500 GPM \$175/ft 18.3 HP		1,250	1,125	1,000	875	750	625
			1,000	900	800	700	600	500
6	700 GPM \$150/ft 7.9 HP		585	525	460	400	350	290
			465	420	375	325	280	230
5	460 GPM \$140/ft 5.9 HP		385	345	300	270	230	190
			305	275	245	215	185	150
4	260 GPM \$125/ft 3.5 HP		215	200	175	150	130	100
			175	155	140	120	105	85
3	130 GPM \$100/ft 1.9 HP		110	100	85	75	65	50
			85	80	70	60	50	40
Pipe Size	GPM Price*	Pump**	20°ΔT	18°ΔT	16°ΔT	14°ΔT	12°ΔT	10°ΔT
			1.5 GPM/Ton	1.66 GPM/Ton	1.88 GPM/Ton	2.14 GPM/Ton	2.5 GPM/Ton	3 GPM/Ton

Condenser Water

Pipe sizes in inches.
 GPMs were selected to maintain water velocities below 10 fps and pressure drop below 1'/100' for pipe size 8 inch and larger. Smaller size pipes were selected to maintain water velocities below 7 fps and pressure drop below 4'/100'.
 *Total estimated installed cost per linear ft of single piping (buried) for typical applications.
 Price includes trenching, insulation, fittings, backfill and moderate amounts of surfacing repairs.
 ** HP values to pump water through 1000' of pipe calculated using the following equation
 $HP = (GPM \times Pump\ Head) / (3960 \times Pump\ Efficiency)$
 Pump efficiency estimated as 0.70 for these calculations.

For chiller capacity when given **chilled water** pipe size, GPM or ΔT, read chart down in dark blue.
 For chiller capacity when given **condenser water** pipe size, GPM or ΔT, read chart up in light blue.
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Brochure concept inspired by:



Tucson, Arizona
www.glnh.com