

CHEMICAL FEED PUMP

Cooling Water Treatment Applications

For each system a survey should be made which will include the following basic information.

1. Tons of refrigeration — 1 ton = 12,000 BTU.
2. Hours of operation per day.
3. Total water capacity of the system.

In addition, you must estimate or calculate the following:

4. Evaporation of water from the system in gallons per minute.
5. From inspection of water, decide on concentration to be maintained.
6. Amount of water to be bled from the system (bleed off in gallons per minute).
7. Total bleed off in gallons per minute per day.
8. Amount of chemical required per day.

Normally speaking, the tons of refrigeration, hours of operation per day, and the total water capacity of the system will be readily available from the mechanical contractor, mechanical engineer, or maintenance superintendent.

Figuring the amount of evaporation in gallons per minute must be determined by the number of tons refrigeration. Two different types of systems:

Using tons refrigeration:

1. **Vapor-Compression System:** Compression systems may use reciprocating, centrifugal, gear, or rotary compressors and any one or more of a variety of refrigerants, depending upon the job.

To obtain evaporation of water from the cooling system, multiply the "tons refrigeration" by the factor 0.03, and the product is the rate of evaporation of water in gpm.

2. **Adsorption Systems:** Systems using heat to raise pressure of the refrigerant instead of a compressor. Adsorption refrigeration relies on the ability of some liquid solutions to adsorb vapors when cold, readily give up when hot.

Multiply the "tons refrigeration" by the factor 0.06, the product is the rate of evaporation of water from the system in gpm.

Total Amount of Water Evaporated Per Day:

The number of gpm of water evaporated/min., as determined by one of the preceding methods, multiplied by 60, equals the number of gallons/hour evaporated. This figure, multiplied by the number of hours of operation/day, will give the total amount of water evaporated per day.

Amount of water to be bled from the system. (Bleed off in gallons per minute.)

1. The amount of water to bleed off from the system each minute is based on the amount of water evaporated per minute — and — on the desired concentration (cycles of concentration) to be maintained in the cooling system.

2. The allowable concentration (AC) to be maintained in a given cooling system will be determined by using the following rules:

(A.) Normally, as a rule of thumb, it is not recommended to use more than five cycles of concentration in a cooling system.

(B.) Allowable concentrations with vapor-compression systems.

1. Without PH Controls:

$$\text{Allowable Concentration} = \frac{40}{\text{TA} \& \text{TH}}$$

TA = Total Alkalinity
TH = Total Hardness

2. With PH Control:

$$\text{Allowable Concentration} = \frac{40}{\text{TH}}$$

Note: PH Control — Feeding acid to a cooling tower requires constant supervision by trained personnel — at best — in most small systems it is risky.

3. Allowable concentrations in adsorption systems:

(A.) **Systems under 75 Tons:**

Determine the maximum allowable concentration in the usual manner. $\frac{40}{\text{TA} \& \text{TH}}$. But in no

case allow more than two cycles of concentration.

(B.) **Systems over 75 Tons:**

Softened water on PH Control should be used. 1. If PH Control is used, figure the allowable concentration = $\frac{40}{\text{TH}}$

2. If softened water is used, figure — $\frac{40}{\text{TA}}$ + 10%.

* Maximum 5 cycles of concentration.

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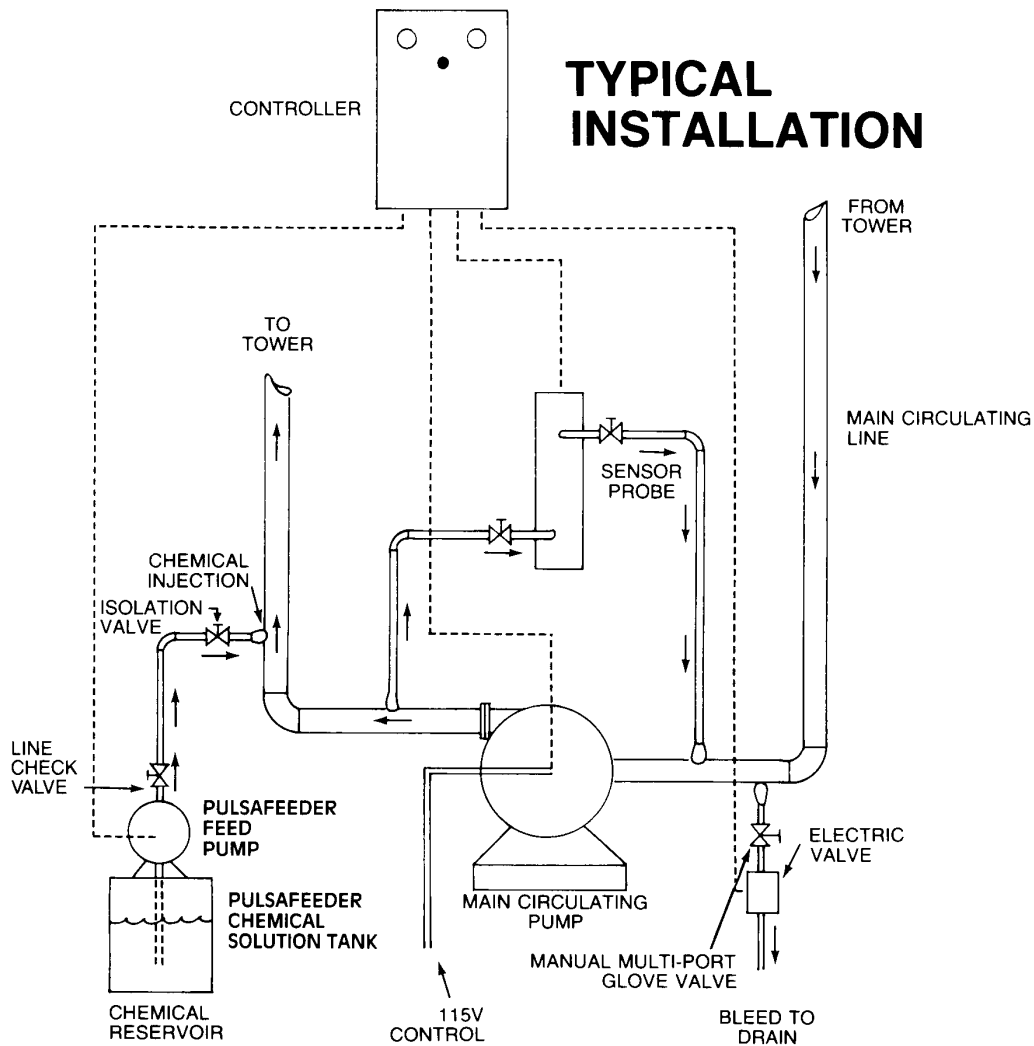
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After you have determined the desired number of cycles from one of the above rules, the amount of bleed-off to obtain that specific concentration can be determined in accordance with the table to the right.

The rate of evaporation in gallons per minute times the percentage determined by the number of concentrations to be maintained equals the amount of water to be bled off per minute of operation.

Concentration	Rate of bleed-off as a percent of the rate of evaporation
5	25%
4	33.5%
3	50.0%
2.75	57.0%
2.5	66.0%
2.25	80.0%
2.0	100%
1.75	133%
1.5	200%
1.25	400%

Amount of bleed-off in gallons per minute.



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