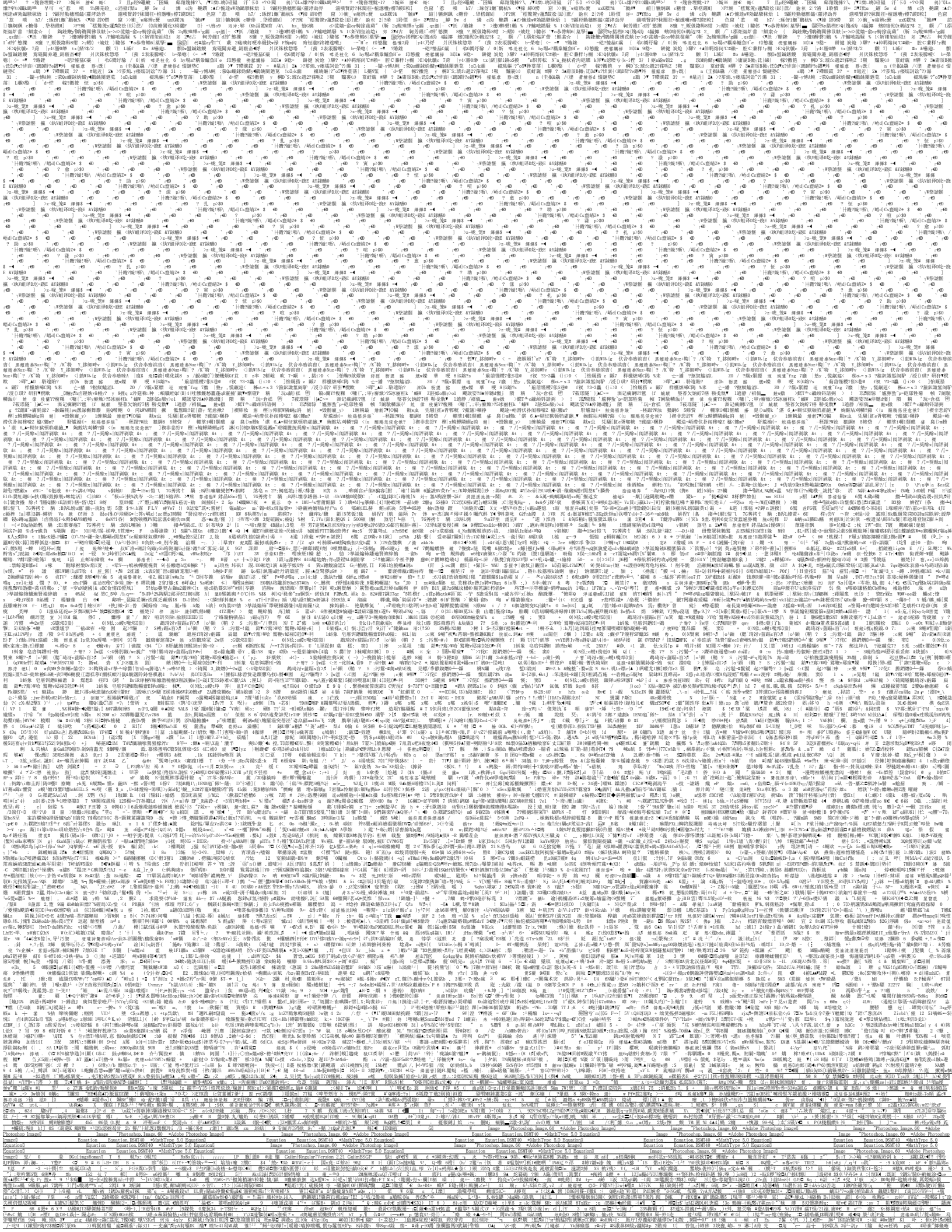


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When liquid is evaporated the difference in pressure between the steam chest and the vapor space at the boiling liquid and depth of liquid over heating surface. The friction loss in the tubes. $\Delta P = \dots$

In actual evaporators, however, the boiling point of a solution is affected by two factors: The boiling point elevation due to the dissolved solids and the boiling point elevation due to the liquid film resistance. $\Delta T = \dots$

The boiling point of a solution is plotted against that of water at the same pressure, a straight line results. Different lines are obtained for different concentrations. $\Delta T = \dots$

The resistance of the liquid side controls the overall rate of heat transfer to the boiling liquid. Forced circulation gives high liquid-side coefficients. $K = \dots$

When the liquid film resistance is negligible, the overall coefficient is strongly influenced by the design and method of operation of the evaporator. $K = \dots$

The steam film coefficient is high. Since the presence of non-condensable gas seriously reduces the film coefficient. $K = \dots$

Enthalpy balances for single-effect evaporator. $W = \dots$

It is assumed that there is no leakage of entrainment. That the flow of non-condensable is negligible and that heat losses from the evaporator need not be considered. $W = \dots$

Under these assumptions the difference between the enthalpy of the steam and that of the condensate is simply $\Delta T = \dots$

The liquid-side enthalpies depend upon the characteristics of the solution being concentrated. Most of solutions when mixed or dilute at constant temperature do not give much heat effect. $W = \dots$

For solutions having negligible heats of dilution, the enthalpy balances on a single-effect evaporator can be calculated from the specific heats and temperatures of the solutions. $W = \dots$

Enthalpy balance with appreciable heat of dilution. $W = \dots$

The latent heat of vaporization of water at the pressure in the vapor space. $W = \dots$

The final equation for the enthalpy balance can be written from Eqs. (16-5) and (16-6) when the heat of dilution is negligible. $W = \dots$

Equation (16-7) states that the heat from the condensing steam is utilized to vaporize water from the solution to heat the feed to the boiling point. $W = \dots$

The use of material balances, enthalpy balances, and the capacity equation (16-11) in the design of single-effect evaporator is shown in example 1. $W = \dots$

A condenser and air heater establish a vacuum in third effect in the series and withdraw noncondensables from the system. $W = \dots$

The first effect in the series is the effect to which the raw steam is fed and in which the pressure in the vapor space is a minimum. $W = \dots$

In this manner the pressure difference between the steam and the condenser is spread across two or more effects in the multiple-effect system. $W = \dots$

The pressure in each effect is lower than that in the effect from which it receives steam and higher than that of the effect which supplies vapor. $W = \dots$

In steady operation all internal concentrations, flow rates, pressures, and temperatures are kept constant. $W = \dots$

The heating surface in the first effect will transmit per hour an amount of heat given by the equation (16-8). $W = \dots$

If the part of this heat that goes to heat the feed to the boiling point is negligible for the reason $\Delta T = \dots$

The temperature of the condensate leaving the second effect is very near the temperature of the boiling liquid in the first effect. $W = \dots$

The heat transmitted in the second effect, however, is given by the equation (16-9). $W = \dots$

This same reasoning may be extended to show that, roughly (16-11). $W = \dots$

Therefore, from Eq. (16-11) follows that since $\Delta T = \dots$

Summary Information

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