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Cold W·A·R·

Whether it's Air Conditioning or Refrigeration

SPORLAN

Refrigeration Calculations

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27

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Refrigeration Calculations

Pressure-enthalpy charts are ***tools*** to use in better understanding refrigeration cycles, for judging whether the operation is normal, and for estimating the effect of change in operation. Learning how to read the charts and to do the calculations involved ***will pay rich dividends*** in all phases of refrigeration work.

Examples of various refrigeration calculations are shown below.

1. Net Refrigeration Effect, Btu/lb	=	Heat content of vapor leaving evaporator, Btu/lb — Heat content of liquid entering evaporator, Btu/lb
2. Net Refrigerating Effect, Btu/lb	=	Latent heat of vaporization, Btu/lb — Change in heat content of liquid from condensing to evaporator temperature, Btu/lb
3. Net refrigerating Effect, Btu/lb	=	$\frac{\text{Capacity, Btu/min}}{\text{Refrigerant circulated, lb/min}}$
4. Refrigerant Circulated, lb/min	=	$\frac{\text{Load or capacity, Btu/min}}{\text{Net refrigeration effect, Btu/lb}}$
5. Compressor Displacement, cu ft/min	=	Refrigerant circulated, lb/min X Volume of gas entering compressor, cu ft/lb
6. Compressor Displacement, cu ft/min	=	$\frac{\text{Capacity Btu/min} \times \text{Volume of gas entering compressor, cu ft/lb}}{\text{Net refrigerating effect, Btu/lb}}$
7. Heat of Compression, Btu/lb	=	Heat content of Vapor leaving Compressor, Btu/lb — Heat content of Vapor entering Compressor, Btu/lb
8. Heat of Compression Btu/lb	=	$\frac{\text{(42.41 Btu/min - hp) (compression horsepower)}}{\text{Refrigerant circulated, lb/min}}$
9. Compression Work, Btu/min	=	Heat of compression, Btu/lb X Refrigerant circulated, lb/min
10. Compression Horsepower	=	$\frac{\text{Compression work, Btu/min}}{\text{Conversion factor, 42.41 Btu/min - hp}}$ or $\frac{\text{Btu/hr}}{\text{2546 Btu/hr - hp}}$

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11. Compression Horsepower	=	$\frac{\text{Heat of compression, Btu/lb} \times \text{Capacity, Btu/min}}{(42.41\ \text{Btu/min - hp}) \times \text{Net refrigeration effect, Btu/lb}}$
12. Compression Horsepower	=	$\frac{\text{Capacity, Btu/min}}{(42.41\ \text{Btu/min - hp}) \times \text{Coefficient of performance}}$
13. Compression Horsepower per Ton	=	$\frac{4.716}{\text{Coefficient of performance}}$ $\left\{ \frac{200}{42.41} = 4.716 \right\}$
14. Power, watts	=	Compression horsepower per Ton X 745.7 w - ton/hp
15. Coefficient of Performance	=	$\frac{\text{Net refrigeration effect, Btu/lb}}{\text{Heat of compression, Btu/lb}}$
16. Capacity, Btu/min	=	Refrigerant circulated, lb/min X Net refrigerating effect, Btu/lb
17. Capacity, Btu/min	=	$\frac{\text{Compressor displacement, cu ft/min} \times \text{Net refrigerating effect, Btu/lb}}{\text{Volume of gas entering compressor, cu ft/lb}}$
18. Capacity, Btu/min	=	$\frac{\text{Compression horsepower} \times 42.41\ \text{Btu/min - hp} \times \text{Net refrigerating Effect, Btu/lb}}{\text{Heat of compression, Btu/lb}}$

Reference: Fluorocarbon Refrigerants Handbook

Example of # 15

$$\textbf{COP} = \frac{\textbf{Net refrigeration effect}}{\textbf{Heat of compression}} = \frac{\textbf{63.7}}{\textbf{10.1}} = \textbf{6.61}$$

$$\left\{ \text{NRE is } \begin{array}{r} 108.8 \\ -\ 45.1 \\ \hline 63.7 \end{array} \qquad \text{H of C is } \begin{array}{r} 118.9 \\ -108.8 \\ \hline 10.1 \end{array} \right\}$$

SCT is Saturated Condensing Temperature
SST is Saturated Suction Temperature