of hours per year during which definite wet-bulb temperatures and corresponding refrigeration rates pertain.

Wet-Bulb Temperature F	No. of Hours per Year	Refrigeration Required Tons
80	6	284
79 – 75	100	233
74 – 70	277	183
69 – 65	330	157
64 – 60	277	144
59 – 55	158	79
54 – 50	52	37
	Total 1200 hours	

If the power requirements of a dichlorodifluoromethane refrigeration system are in accordance with the following data on partial load operation, determine the seasonal power cost at 2 cents per kwhr:

Tons of Refrigeration	284	233	183	157	144	79	37
Kw per ton	0.89	0.89	0.87	0.86	0.86	0.93	0.97

Solution. Seasonal power cost:

Wet Bulb Temperature F	Ton-Hours	Kwhr
80	6 × 284 = 1,704	1,704 × 0.89 = 1,517
79 – 75	100 × 233 = 23,300	23,300 × 0.89 = 20,750
74 – 70	277 × 183 = 50,700	50,700 × 0.87 = 44,100
69 – 65	330 × 157 = 51,800	51,800 × 0.86 = 44,500
64 – 60	277 × 144 = 39,900	39,900 × 0.86 = 34,300
59 – 55	158 × 79 = 12,500	12,500 × 0.93 = 11,600
54 – 50	52 × 37 = 1,920	1,920 × 0.97 = 1,860
Totals	181,824 ton-hours	158,627 kwhr

The 158,627 kwhr at 2 cents per kwhr will cost $3,173.

The average consumption will be $\frac{158{,}627 \text{ kwhr}}{181{,}824 \text{ ton-hours}} = 0.873$ kw per ton.

Example 3. Using the data from Example 2, if city water costs 20 cents per thousand gallons, and if 1.25 gal are used per minute per ton, estimate the annual water cost.

Solution.

$60 \times 1.25 = 75$ gal per ton-hour.

$181{,}824$ ton-hours $\times\ 75 = 13{,}620{,}000$ gal per year.

$\frac{13{,}620{,}000 \times \$0.20}{1000} = \$2{,}724$ the yearly cooling water cost.

Chapter 25

HEAT TRANSFER SURFACE COILS

Coil Applications, Construction and Arrangement, Steam Coils, Water Coils, Direct-Expansion Coils, Flow Arrangements, Applications, Calculation of Heat Transfer, Air Flow Resistance, Coil Performance, Selection

THE coils described in this chapter are used in air conditioning systems for heating or cooling an air stream under forced convection. The surface coil equipment may be made up of a number of banks assembled in the field, or the entire assembly may be factory constructed. The applications of each type of coil are limited to the field within which it is rated. Other limitations are imposed by code regulations, by proper choice of materials for the refrigerants used and the condition of the air handled, or by an economic analysis of the possible alternates on each installation.

For heating service, these coils are used as preheaters, reheaters or booster heaters, (see Chapters 20 and 21). The function of the coils is air heating only, but the apparatus assembly may include means for humidification and air cleaning. Steam or hot water are the usual heating media, although others are used in special cases, such as reheating by means of discharge gas from a refrigerating system.

Coils are used for air cooling with or without accompanying dehumidification. Examples of cooling applications without dehumidification are precooling coils using well water or other relatively high temperature water to reduce the load on the refrigerating machinery, or water cooled coils to remove sensible heat in connection with chemical moisture-absorption apparatus. By proper coil selection it is possible to handle both sensible cooling and dehumidification together as further explained later. The apparatus assembly usually includes an air cleaning means to protect the coil from accumulation of dirt and to keep dust and foreign matter out of the conditioned space. Although cooling and dehumidification are the usual functions, there are cases of cooling coils purposely wetted as an aid to air cleaning and odor absorption.

The usual cooling media used in surface coils are cold water and volatile refrigerants such as dichlorodifluoromethane and methyl chloride, but others are used in special cases. Brines are seldom required for the range of applications covered by this chapter, although there are cases where low entering air temperatures with large latent heat loads require a refrigerant temperature so low that water becomes impractical. Some-