TABLE 8. EQUIVALENT FULL LOAD OPERATING HOURS OF REFRIGERATION EQUIPMENT USED FOR SUMMER COOLING MAY 15 TO OCT. 15[a]

Application	Hr Open for Business	Atlanta	Boston	Chicago	Detroit	Los Angeles	New Orleans	New York	Phila-delphia	Okla-homa City	St. Louis	Wash-ington D.C.
Barber shops	1280	1010	650	720	720	680	1080	830	860	1020	890	940
Department Stores	940	840	560	610	610	580	890	700	720	840	750	780
Drug Stores	2100	1630	950	1060	1060	980	1790	1280	1330	1650	1420	1530
Funeral Parlors	600	440	300	330	330	310	470	370	380	440	400	410
Offices	940	870	560	620	620	580	900	710	740	880	770	810
Restaurant (Short Hour)	1290	970	535	620	620	570	1060	760	800	980	830	880
Restaurant (Long Hour)	2100	1510	820	930	930	850	1690	1170	1210	1530	1300	1400
Specialty Shops (5 & 10)	1090	800	530	590	590	560	860	670	690	810	720	750
Theaters—Continuous	1500	1010	700	750	750	720	1080	850	870	1020	910	950
Theaters—Neighborhood	900	640	420	450	450	430	650	500	520	650	550	580

[a]Modern Air Conditioning, Heating and Ventilating, by W. H. Carrier, R. E. Cherne and W. A. Grant (*Pitman Publishing Corp.* 1940, p. 73).

The season electrical power cost for refrigerating equipment is then given by the following equation:

$$\text{Season power cost} = \frac{0.746\,(\text{bhp}_t)\,T\,H_e\,R}{\eta} \qquad (3)$$

where

bhp_t = Brake horsepower per ton (see Fig. 1) for *average* load during period. (Due allowance should be made for poorer compressor efficiency at light load).
T = Tons of refrigeration at maximum design load.
H_e = Equivalent full load refrigeration operating hours (Table 8).
R = Power cost, dollars per kwhr, including demand and energy charges.
η = Motor efficiency at average load (decimal).

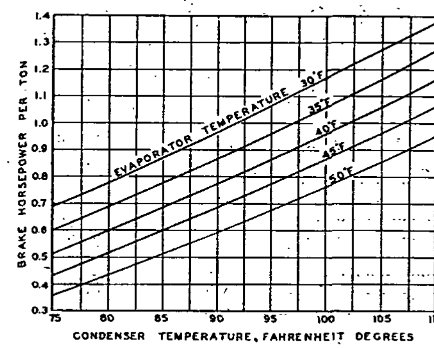

FIG. 1. TYPICAL BRAKE HORSE POWER REQUIREMENTS FOR REFRIGERATION[a]

[a]Values given are representative of "F-12" reciprocating machines of about 25 tons capacity in air conditioning applications. Requirements of smaller machines are usually higher, and for larger machines may be lower. Values shown are for liquid refrigerant at condenser temperature (no subcooling). Subcooling of the liquid may decrease these values approximately 0.3 per cent to 0.5 per cent for each Fahrenheit degree the liquid temperature is lowered.

Table 9 will be useful in estimating the design load in the absence of detailed load estimates.

In considering refrigeration power consumption, it should be noted that the use of weather records for a specific year may lead to large inaccuracies in estimating operating costs, since there may be wide variations from year to year, and therefore, average yearly weather records should be used rather than those for any individual year.

If the refrigeration compressor is steam turbine driven, the same general method can be followed, taking into account average water rate per bhp-hr and the cost of steam.

Condenser Water

Condenser water cost estimates can also be based on equivalent full load operating hours of the refrigeration equipment. The varying temperature of the water at its source, as well as the temperature of the discarded water, must however be taken into account. In general, when water is purchased, control is provided to hold the leaving water temperature (or condensing temperature) constant; and in such case the entering water temperature becomes the major variable and the gpm per ton can readily be calculated for any water temperature rise.

The following equation for cost of condenser water is useful: