Table 1 .... Cost Dollars per Ton for a Complete System, Including Heating and Cooling Coils, Fan, Ducts, Refrigeration Equipment, Temperature Controls, etc.*

1	2	3	4	5	6	7	8	9	10	11	12	13
			Unit Costs		Total Cost[a]			Unit Costs[b]				
Refrigeration Tons	Floor Area Sq Ft	Air Distributed Cu Ft	Refrigeration Equipment per Ton	Ducts, Fans, Heating Coils, etc. per Cfm	Refrigeration Equipment	Air Handling Equipment	Total	Per Ton	Per Sq Ft Floor	Per Cfm	Evaporative Condensers Per Ton[c]	Cooling Towers Per Ton[c]
25	8,333	12,500	250	1.05	6,250	13,100	19,350	775.00	2.32	1.55	190.00	
50	16,666	25,000	224	0.98	11,200	24,500	35,700	730.00	2.15	1.43	155.00	
75	25,000	37,500	212	0.95	15,900	35,700	51,600	690.00	2.07	1.38	120.00	
100	33,332	50,000	204	0.92	20,400	46,000	66,400	664.00	1.99	1.33	90.00	52.00
150	50,000	75,000	195	0.91	29,200	68,200	97,400	650.00	1.95	1.30	60.00	50.00
200	66,664	100,000	192	0.90	38,200	90,000	128,200	641.00	1.93	1.28		48.00
250	83,333	125,000	187	0.88	46,800	110,000	156,800	628.00	1.88	1.25		46.00
300	100,000	150,000	182	0.86	54,600	129,000	183,600	612.00	1.84	1.23		44.00
400	133,328	200,000	165	0.84	66,000	168,000	234,000	585.00	1.76	1.17		42.00
500	166,666	250,000	158	0.82	79,000	205,000	284,000	568.00	1.71	1.14		40.00

* These cost figures (based on 1954 prices which may be adjusted by using current building cost index) cover only the average type of comfort air conditioning in open spaces as in department stores, or for industrial air conditioning involving large areas. Where a multiplicity of small spaces must be individually controlled, as in office buildings, hotels, and apartment houses, these costs do not apply.

[a] Includes only final water, drain, and electrical connections within the equipment room.

[b] Columns 9, 10, and 11 represent costs where well water or city water is available for condensing purposes. Where conservation of water is required, add column 12 or 13 to column 9 to obtain total cost per ton.

[c] Does not include cost of structural reinforcing if required, to support the weight of cooling towers or evaporative condensers.

space for which the system is to be used; (2) the type of equipment to be employed as a part of the system; (3) the character of the business; and (4) the lease or ownership conditions.

Depreciation, due to deterioration or obsolescence, must be considered in arriving at the amortization period. Maintenance and deterioration usually have the effect of offsetting one or the other. If a long depreciation period is to be used, then the item for maintenance, repair, and the replacement of wearing parts must be greater than for a short depreciation period.

In determining the length of the amortization period, the owner's accounting practices will have considerable bearing upon the number of years used in the calculation. For taxation purposes, this period depends upon the use and the service to which the equipment is applied. At the present time indications are that varying interpretations on depreciation will be made by the Bureau of Internal Revenue. While most air-conditioning equipment may be considered as having a normal useful life of 20 years for depreciation purposes, no final value for depreciation should be determined without consultation with the owner's tax consultant or perhaps referral to Bulletin F Publication 173, which is issued by the United States Treasury Department, Internal Revenue Service, and summarized in Table 2.

Interest

The interest charged to the cost of ownership may be based upon the average interest rate for the period during which the first cost of the equipment will be amortized. While some accountants do not include interest in the annual fixed charges and consider it a negligible item, the money invested in air-conditioning, heating, or ventilating equipment, must be either borrowed or diverted from the owner's funds and converted to the purpose of making the installation. Whether it is borrowed or taken from surplus funds, the money that might have been earned as interest is properly chargeable to the operation of the system.

Table 2 .... Probable Useful Life of Equipment*

	Life in Years
1. Heat Producing Equipment	
(a) Boilers	20
(b) Stokers and burners	20
2. Heat Distributing Equipment	
(a) Piping—copper	same as bldg.
(b) Piping—iron	20
(c) Radiation—concealed	25
(d) Radiation—direct	25
(e) Valves	20
(f) Specialties	10
3. Air Handling Equipment	
(a) Filters—automatic	20
(b) Heating and cooling coils	20
(c) Spray humidifiers and dehumidifiers	10
(d) Fans	15
(e) Air-conditioning units	10
(f) Motors	20
(g) Electrical starting equipment	20
(h) Pneumatic control systems	20
(i) Electric control systems	20
4. Air Distributing Equipment	
(a) Ductwork	same as bldg.
(b) Outlets, grilles	20
(c) Duct insulation	20
5. Refrigerating Equipment	
(a) Centrifugal refrigerating machines	20
(b) Reciprocating refrigerating machines	20
(c) Motors and starters	20
(d) Piping—copper	20
(e) Piping—steel	20
(f) Pumps	20
6. Water Saving Devices	
(a) Evaporative condensers	15
(b) Cooling towers	15
(c) Wells	25

* Taken from U. S. Bureau of Internal Revenue Bulletin F, Tables of Useful Lives of Depreciable Property.

Table 3 .... Owning and Operating Cost

First Cost	
Cost of mechanical system	
Other costs	
First Cost (FC)—Total	
Annual Fixed Charges	
Amortization—Depreciation period Y years	
Interest rate i%	
Amortization and Depreciation $\frac{FC}{Y}$ =	
Interest: $\frac{Y+1}{2Y} \times i \times$ cost =	
Taxes	
Insurance	
Rent	
Annual Fixed Charges: (Total)	
Annual Maintenance Costs	
Replacement or servicing of air filters	
Outside maintenance service	
Water treatment	
Lubricating oil and grease	
Painting for corrosion protection or other purposes	
Replacement of worn parts	
Refrigerant	
Wages of engineer or operator	
Annual Maintenance Cost—Total	
Annual Service Cost	
Electric power costs	
Fans	
Pumps—chilled water	
Pumps—condenser water	
Pumps—well water	
Cooling tower fans	
Cooling tower pumps	
Refrigeration machines	
Miscellaneous or other	
Gas	
Coal	
Oil—for boilers or Diesel engines	
Steam	
For Direct heating	
For Ventilation—preheaters	
For Ventilation—reheaters	
For Turbine driven equipment	
For Engine driven equipment	
For Absorption equipment	
Sewers	
Charges for discharging water into public drainage systems	
Condenser water	
Annual Service Costs: Total	
Summary	
Annual Fixed Charges	
Annual Service Costs	
Annual Maintenance Costs	
Annual Owning and Operating Costs—Total	

Table 4 .... Approximate Combined Operating and Maintenance Cost for Large Air-Conditioning Installations, Using High-Quality Equipment*

	Dollars per (Ton) (Year)
Repairs for refrigeration machinery	1.07
Refrigerant	0.40
Oil and grease	0.11
Painting (Water boxes and dehumidifiers)	0.45
Filters, clean and re-oil 4 times per year	1.50
Controls, outside service	0.26
Cleaning air conditioners	1.38
Total	5.17

* Estimated for 1955.

The formulas for computing interest and amortization are given in Table 3. This table also serves as a check list for the various items to be considered in calculating the cost of ownership and operation.

Taxes

The taxes that may be charged to the property as a result of the improvement due to the installation of an air-conditioning system, will vary according to the practice of the official agencies levying property taxes.

To the cost of the air-conditioning system can be charged the cost of that part of an existing property which is removed or destroyed and rebuilt to install the air-conditioning system as this cost does not result in an improved value of the structure.

Insurance

Insurance against losses by fire is ordinarily secured by increasing the building fire insurance coverage to cover all or part of the first cost of installing the air-conditioning and other mechanical systems. Various types of extended coverage are available for protection against a number of other types of losses.

Boiler insurance may be extended to cover the air-conditioning equipment to protect against losses due to explosion, rupture of piping, and similar hazards. Since insurance rates vary widely depending upon the type of structure in which the equipment is located and the nature of the owner's business, the rates are usually set by rating organizations specializing in this work. Exact insurance rates must be determined by consulting the owner's underwriter.

Rent

If the equipment under consideration is to be located in rented or leased quarters, or if additional space must be rented, such expense becomes a fixed charge.

MAINTENANCE COSTS

Maintenance charges consist of expense for labor and material necessary to make repairs and replace parts, as well as cleaning, painting, inspection, etc., for the purpose of eliminating or minimizing the need for repairs. Generally, routine maintenance labor requirements will be the function of an operating engineer or staff. If the responsibility of the group extends to facilities beyond the equipment discussed here, it is important that only an equitable share of the group's time be charged to maintenance.

Extraordinary repairs are quite often handled by separate maintenance divisions and the expense charged back to air conditioning, heating, and ventilating. In other cases, all