

An approximation of the useful life of various items of equipment and parts of systems is shown in Table 5. It should be noted that if an appropriate maintenance item is not established, the rate of equipment deterioration may be substantially increased.

Interest

The interest chargeable may not represent the existing money rates. It may include an item to cover the diversion of capital or other items

TABLE 6. OWNING AND OPERATING COST

FIRST COST	ANNUAL SERVICE COST
Cost of mechanical system.....	Electric Power Costs
Other costs.....	Fans.....
First Cost (FC)—Total.....	Pumps—Chilled water.....
	Pumps—Condenser water.....
	Pumps—Well water.....
ANNUAL FIXED CHARGES	Cooling tower fans.....
	Cooling tower pumps.....
Amortization—Depreciation	Refrigeration machines.....
period Y years.....	Miscellaneous or other.....
Interest rate I%.....	Gas.....
Amortization and Deprecia-	Coal.....
tion.....	Oil—for boilers or Diesel
$\frac{FC}{Y} =$	engines.....
Interest: $\frac{Y+1}{2Y} \times I =$	Steam.....
Taxes.....	For direct heating.....
Insurance.....	For Ventilation—preheat-
Rent.....	ers.....
Annual Fixed Charges:	For Ventilation—reheaters
(Total).....	For Turbine driven equip-
	ment.....
	For Engine driven equip-
	ment.....
	Sewers.....
ANNUAL MAINTENANCE COSTS	Charges for discharging
	well water into public
Lubricating oil and grease.....	drainage systems.....
Painting for corrosion pro-	Annual Service Costs—
tection or other purposes.....	TOTAL.....
Replacement of worn parts.....	
Refrigerant.....	SUMMARY
Wages of engineer or operator.....	Annual Fixed Charges.....
Annual Maintenance Cost—	Annual Service Costs.....
	Annual Maintenance Costs.....
TOTAL.....	Annual Owning and Oper-
	ating Costs—TOTAL.....

depending on existing tax laws which may make it necessary to charge interest due to diversion of capital as a cost item. It should be noted that interest may be based on an unamortized balance. As an example, a 15 year amortization period with a 4 per cent interest rate will approximate a 2.1 per cent average annual interest rate.

Taxes

The taxes chargeable will be the proportion of property tax caused by the increased valuation of the property due to air conditioning.

Insurance

The rate for insurance may vary considerably depending on the type of structure in which the equipment is located and upon other governing factors. A rate of about \$0.60 per \$1,000 may be considered as being representative for normal installations.

Rent

If the equipment under consideration is to be located in rented or leased quarters, it may be necessary to include an item for space rental.

An orderly arrangement of the various components of owning and operating costs, which will also serve as a check list to forestall inadvertent omissions, is illustrated in Table 6. The formulas for computing amortization and interest are given in the table. Interest should be computed on the undepreciated portion of investment only.

MAINTENANCE COSTS

Maintenance costs include replacement parts and the labor required for making repairs, replacing parts, cleaning, painting, etc. It should be noted

TABLE 7. APPROXIMATE MAINTENANCE COST FOR LARGE AIR CONDITIONING INSTALLATIONS, USING HIGH QUALITY EQUIPMENT

	DOLLARS PER TON PER YEAR
Repairs for refrigeration machinery.....	0.60
Refrigerant.....	0.25
Oil and grease.....	0.07
Painting (Water boxes and dehumidifiers).....	0.25
Filters, clean and recoil 4 times per year.....	0.85
Controls, outside service.....	0.15
Cleaning air conditioners.....	1.15

that major overhauling or complete replacement may restore the capital value of certain items of equipment, and in such cases the costs incurred may not necessarily be charged as maintenance costs. Generally, routine labor requirements will be the function of an operating engineer or staff, and the responsibility of this group may extend beyond the equipment being discussed here; hence, it is important to include only an equitable share of the time of this group. Extraordinary repairs involving special machinery will usually be covered by contract with equipment service divisions, and should be accounted for on that basis.

Many of the items included in maintenance costs are highly variable and depend on the type and quality of the purchased equipment. For large air conditioning installations, using high quality equipment, some approximate costs per ton are given in Table 7.

In addition to the costs listed in Table 7, consideration should possibly be given to other items such as: water treatment for boilers; other boiler and heating plant cleaning and repairs; repair and replacement of heating plant valves, traps, and vents; water treatment for cooling tower or chilled spray water; drive belts, possible damage due to freezing weather; cleaning of air ducts; and repairs to insulation.