

maintenance generally go hand in hand. If a long depreciation period is to be used, then the item for maintenance, repair and replacement of wearing parts must be greater than for a short depreciation period.

Obsolescence depends mainly on time required for the equipment to become out-moded. Air conditioning, particularly, would probably

TABLE 5. APPROXIMATE LIFE OF EQUIPMENT
(Including Obsolescence and Deterioration)^a

	LIFE IN YEARS
1. HEAT PRODUCING EQUIPMENT	
(a) Boilers.....	15
(b) Stokers and burners.....	10
2. HEAT DISTRIBUTING EQUIPMENT	
(a) Piping—copper.....	20
(b) Piping—iron.....	10
(c) Radiation—concealed.....	12
(d) Radiation—direct.....	10
(e) Valves and specialties.....	5
3. AIR HANDLING EQUIPMENT	
(a) Filters—automatic.....	8
(b) Heating and cooling coils.....	10
(c) Spray humidifiers and dehumidifiers.....	10
(d) Fans.....	10
(e) Air conditioning units.....	10
(f) Motors.....	15
(g) Electrical starting equipment.....	8
(h) Pneumatic control systems.....	10
(i) Electric control systems.....	8
4. AIR DISTRIBUTING EQUIPMENT	
(a) Ductwork.....	20
(b) Outlets, grilles.....	20
(c) Duct insulation.....	10
(d) Painting.....	2
5. REFRIGERATING EQUIPMENT	
(a) Centrifugal refrigerating machines.....	15
(b) Reciprocating refrigerating machines.....	10
(c) Motors and starters (see Item 3 above).....	
(d) Piping—copper.....	20
(e) Piping—steel.....	15
(f) Pumps.....	15
6. WATER SAVING DEVICES	
(a) Evaporative condensers.....	10
(b) Cooling towers.....	10
(c) Wells.....	Varies Widely

^aModern Air Conditioning, Heating and Ventilating, W. H. Carrier, R. E. Chrene and W. A. Grant (Pitman Publishing Corp. 1940, p. 66).

suffer more from obsolescence in small plants than in large establishments. In addition the obsolescence of the building or property in which the equipment is installed may have a similar effect upon the equipment.

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 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.

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

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.