

Owning and Operating Costs

*Fixed Charges: Amortization, Interest, Taxes, Insurance,
Rent; Maintenance Costs, Service Costs: Operating Refrig-
eration Equipment, Condenser Water, Heating*

THE purpose of this chapter is to discuss the owning and operating costs of heating, ventilating, air conditioning and refrigeration systems for buildings from an economic standpoint so that owners or prospective purchasers may compare the operating economics of one system with another and evaluate properly the over-all costs of the systems instead of considering only the first cost.

There are cases in which it may be desirable to study the possibilities of installing a system for the purpose of obtaining a substantial increase in income or a better return on the investment due to: increased patronage in theaters, stores, or hospitals; increased occupancy in office buildings; improved efficiency of employees in offices or factories; or improvement in a manufactured product or a decrease in its cost of production.

Owning and Operating Costs may be grouped under three headings: (1) Fixed charges, (2) Maintenance Costs, and (3) Service Costs.

FIXED CHARGES

Fixed Charges, which are the costs of owning the system, include: (1) Amortization, (2) Interest, (3) Taxes, (4) Insurance, and (5) Rent.

Amortization

Amortization cost will depend on: (1) the total first cost, and (2) the amortization period.

The total first cost of an installation is the actual dollar outlay or capital expenditure required to buy and install the air conditioning, or heating and ventilating system ready for operation. It can be divided into two parts: (a) The first cost of the air conditioning or heating and ventilating system itself, and (b); other first costs incurred because of the installation of the air conditioning or heating and ventilating system.

The first cost of air conditioning or heating and ventilating systems includes the following:

1. Heat producing equipment including boilers, burners, etc.
2. Heat distributing equipment including direct radiation, piping, etc.
3. Air handling equipment including fans, air heaters, air conditioners, filters, controls, etc.
4. Air distributing equipment including ducts, outlets, grilles, etc.
5. Refrigerating equipment including piping, pumps, etc.
6. Water conservation devices including towers, evaporative condensers, etc.

The best procedure for establishing the first cost of any system is to select the various parts after thorough engineering study, and then to estimate the installed costs of same. When such detailed work is not warranted or when only rough comparisons are desired between several types, approximate unit costs are of value as time savers.

Approximate installed prices of the various parts are shown in Tables 1, 2, and 3 and, as indicated, vary with the size or capacity of the equip-

ment. The apparatus and items included in each group are stated in the footnotes beneath the tables. By use of these three tables it is possible to obtain a reasonable approximation of the cost of heating or air conditioning a given space or building. In order to use the approximate values indicated in Tables 1, 2 and 3, a rough estimate of the load is required. If time does not permit a determination of the load and if extremely rough figures will suffice, Table 4 may be used as an indication of the price of various types of air conditioning applications.

Other first costs, incurred because of the installation of the air conditioning or heating and ventilating system, include costs of electrical work, plumbing, miscellaneous piping, building alterations, cutting, patching, remodeling, or redecorating after installation, consulting engineer's fees, licenses, permits, etc. These vary so widely that no approximations are possible and each case must be considered alone.

The length of the amortization period to be used depends upon: the type and remaining life of the building or space for which the system is to be used; the type of equipment to be employed as a part of the system; the character of the business; and the lease or ownership conditions. For small shops in rented quarters on short term leases, a period of 5 years or less may be proper, whereas for larger installations in buildings that are owned outright a period of 10 or 20 years or more may be used.

Depreciation due to deterioration and obsolescence must also be considered in arriving at the amortization period. Deterioration and

TABLE 1. TYPICAL INSTALLED COSTS OF HEAT PRODUCING AND HEAT DISTRIBUTING SYSTEMS

BTU PER HOUR (MILLIONS)	SQ FT EDR (STEAM) THOUSANDS	BOILER HORSE POWER	COST IN DOLLARS—PER MILLION BTU PER HOUR ^a			
			1	2	3	4
			BOILERS WATER TUBE	BOILERS FIRE-TUBE	HOT WATER SYSTEM FORCED CIRCULA- TION	DIRECT RADIATION SYSTEM STEAM
0.8	3.3	24		2100	8500	7850
1.2	5.0	36	2300	1750	8200	7600
1.6	6.6	48	2000	1570	8000	7350
2.0	8.3	60	1850	1460	7800	7200
3.0	12.5	90	1600	1230	7600	7000
4.0	16.6	119	1400	1100	7500	7000
5.0	20.8	149	1250	980	7500	7000
6.0	25.0	179	1160	920	7500	7000
7.0	29.2	209	1100	880	7500	7000
8.0	33.3	239	1050	850	7500	7000
10.0	41.6	299	1000		7500	7000
12.0	50.0	358	970		7500	7000
14.0	58.3	418	930		7500	7000
16.0	66.6	478	900		7500	7000
18.0	75.0	538	860		7500	7000

^aColumns 1 and 2 include hand fired boiler erected, with shaking grates and standard trimmings. Column 1 includes brickwork and rotating soot blowers. Foundations and piping are not included.

Columns 3 and 4 include direct radiation, piping, valves, specialties, and insulation. Boilers, condensate and circulating pumps, boiler connections, and all building construction or alterations are not included.

^bThe approximate figures given above may vary as much as 30 per cent due to job conditions, labor rates, and locality. These figures represent the selling prices of the individual items indicated above based on costs encountered in the year 1940. It is suggested that correction be made according to the particular locality for increases in labor and material costs since that year.