

adequate ventilation of the attic. Double-glazed and weather-stripped windows, heat-absorbing glass, planned shade tree locations, and light-colored exterior wall and roof surfaces, also help to reduce the cooling load.

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STORE AIR CONDITIONING

SMALL STORES: Load Determination, Equipment Selection, Air Distribution, Control System, Cost Determination, Maintenance; **VARIETY STORES:** Spaces to be Conditioned, Load Calculations, Types of Systems, Controls, Maintenance; **SUPERMARKETS:** Control Systems, Design Considerations, Load Calculations, Air Distribution, Equipment; **DEPARTMENT STORES:** Load Determination, System Design, Air Distribution, Temperature Control

THIS chapter will discuss the design and application of air-conditioning systems for various types of stores, including: (1) small stores, (2) variety stores, (3) supermarkets, and (4) department stores.

PART I: SMALL STORES

Air conditioning in modern small stores has become more of a necessity rather than just a convenience to provide comfort for the customer. With the advent of greater lighting intensities in show windows and sales areas, and with internal fixture layouts discouraging use of windows for internal ventilation, air conditioning has become a prime requirement of modern store design.

The requirements for air-conditioning design and installation in small stores are fairly uniform with variations as to location of equipment, services, and air distribution.

Generally, in small store air-conditioning design, unitary equipment should be considered. Ease of installation, economy in first costs, minimum space requirements, factory warranties and relocation of equipment are some of the advantages of unitary equipment. For information on unitary air conditioners, see Chapter 57 of the 1961 GUIDE AND DATA BOOK.

LOAD DETERMINATION

In order to properly apply equipment, it is necessary to know the construction of the space to be conditioned, as well as the use and occupancy. The time of day in which greatest occupancy occurs, as well as physical building characteristics and lighting layouts, should be obtained from drawings. If drawings are not available, an actual survey of the premises should be made, including the following pertinent information:

- Windows—type, size, number, storm sash and shading devices available.
- Skylights—size.
- Walls—construction, insulation and interior finish.
- Partitions—type, height, exposure to show windows.
- Ceiling and Roof—construction, insulation, type of occupancy above.
- Floor—construction, type of occupancy below.
- People—data from Owner as to estimated maximum number, time and duration.
- Lights—watts per square foot or actual fixture count.
- Appliances—type, size, heat input, output, or motor size (if available).
- Electric Power—size of existing service.
- Heating—availability of steam, hot water, gas or electric.
- Cooling—availability of chilled water, well water, city water, water conservation equipment.
- Rigging and Delivery of Equipment—access for equipment delivery.
- Structural Considerations.
- Existing Obstructions—removed or relocated.
- Ventilation—opening through roof or wall for outside air duct, number of doors to sales area and exposures.
- Orientation of Store.

Specific design requirements must be considered, such as

exhaust systems where soda and lunch counters exist, requiring an increased quantity of outdoor air. Heavy smoking and objectionable odors may require special filtering media in conjunction with outdoor air intake. Load calculations often can be made with sufficient accuracy by use of the short form cooling load estimate form as recommended by the Air-Conditioning and Refrigeration Institute.¹ If a more detailed load calculation is necessary, the procedure outlined in Chapter 26 of the 1961 GUIDE AND DATA BOOK should be used.

Table 1 presents typical factors which may be used as check figures and for field estimate information. However, Table 1 should not be used for final determination of load since the values are only averages.

EQUIPMENT SELECTION

Modern unitary equipment is offered in many types and models as discussed in Chapter 57 of the 1961 GUIDE AND DATA BOOK. Free standing types are most commonly used where floor space is available. The units are readily adapted for installation within the store fixture work. Units also can be installed remote from the conditioned areas, in utility or basement spaces, with distribution through ductwork.

Where floor space is not available, suspended unitary equipment can be installed. Existing stores with small cooling loads often use room air conditioners installed in transoms above the doors or through walls where space is available.

Where air-cooled condenser operation is advantageous, units are available with air-cooled condensers and compressors combined as a unit to be mounted remotely, with fan coil unit mounted within or adjacent to the conditioned area.

The reverse-cycle system (heat pump) offered as packaged equipment can be readily adaptable for small store application with economies in first costs, if the heating equipment is

Table 1 Average Load Factors for Checking and Field Estimates

Type of Store	Lighting, Watts Per Sq Ft	Ventilation, Minimum Outdoor Air Changes Per Hr	Ventilation, Minimum Per Person Cfm	Average Floor Area, Sq Ft Per Ton
Camera Shop	3	1	6	180
Candy Store	3	1	6	180
Drug Store	3	2	10	150
Drug Store with Lunch Counter	3	4	15	120
Furrier's Shop	2	1	6	250
Grocery	1	2	10	300
Clothing Store	2	1½	7½	200
Novelty Store	2	1	6	220
Jewelry Shop	5	1½	7½	160