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CHAPTER 1

CENTRAL STATION SYSTEMS FOR AIR CONDITIONING

Determination of System Requirements, Control Requirements, Simplified Psychrometric and Control Processes, Selection of Refrigeration Equipment, Selection of Central Station Equipment, Equipment Arrangement

CENTRAL station systems are systems in which air handling equipment, including fans, coils, and filters, is located at a central point to serve a number of rooms or a large area by means of a duct system. This chapter will describe various arrangements of central air handling equipment that are in common use.

The refrigeration system will not be considered as a part of the central station equipment in the discussions in this chapter. The refrigeration system may be located in the same apparatus room or at a remote location from the central station equipment with the chilled water piping or refrigerant piping connecting to the dehumidifier or cooling coils.

A central station system is the only type that logically could be considered for certain air conditioning applications. Architectural considerations and the use of the conditioned space frequently require remotely located air treatment equipment. Certain control requirements, such as constant humidity, may make it impracticable to use the unit system of air conditioning in which fans, coils and filters are located within the space to be conditioned. Even when it is practicable to use the unit system of air conditioning, the advantages of a central station system over a unit system should be carefully considered. Central station equipment generally is considered to have longer life, to be easier and less expensive to maintain, to occupy less expensive building space, and to reduce maintenance requirements in the occupied parts of the building to a minimum.

The various components of a central system are discussed in Chapters 34, 38, 39, 40, 48, and 49 of the 1961 GUIDE AND DATA BOOK.

Central station equipment also is used in dual-duct, induction unit, fan-coil unit, and panel-air systems. For specific arrangements required for these particular types of systems, see Chapters 2 and 3 of this volume.

DETERMINATION OF SYSTEM REQUIREMENTS

Before attempting to design and select equipment for a central station air conditioning system, it is necessary to analyze the requirements of the system including first cost, operating and maintenance cost, degree of year around control, and equipment space allocation. Simple cooling and heating without humidity control may be all that an owner desires, or can afford from a first cost standpoint. In this case, subject to total air supply capacity limitations, a factory assembled air-conditioning unit with a filter section, heating and cooling coils, and fan, in a factory built casing would meet the job requirements. Due to duct space limitations and zoning requirements, it might be desirable to provide several central station units rather than one large system with an extensive duct system.

For large central systems (over 35,000 cfm), it is desirable in almost all cases to use built-up or field assembled central station equipment. For central systems with between 10,000

and 35,000 cfm capacity, a carefully analysis should be made. There are many times when, because of long equipment life, maintenance and accessibility requirements, it is better to use built-up equipment rather than factory assembled central station units.

For central station equipment with less than 10,000 cfm, factory assembled units usually are used unless the premium in initial cost can be justified.

The degree of air filtering required is another factor that might influence the selection of equipment. Normally, factory assembled equipment is available only with throw-away or permanent filters. If electrostatic or automatic self-cleaning filters are required, a built-up unit would be favored.

CONTROL REQUIREMENTS

It is important to analyze the control requirements of the system before attempting to select or lay out equipment. Generally for comfort air conditioning, one of the following control processes will meet the system requirements.

1. Simple cooling and heating control. No definite control of humidity level, either in summer or winter.
2. Cooling and heating control with controlled high limit for humidity in summer. No humidification in winter.
3. Cooling and heating control with humidity maintained at a fixed level during the entire year.
4. Cooling and heating control with humidity maintained at one fixed level in summer and at a lower level in winter, to prevent condensation on windows.

Other control factors which will affect the equipment arrangement and should be determined, are as follows:

1. Zoning requirements of central station equipment. Decide whether final room temperature control is to be determined by air discharge from central station equipment, or by means of reheat coils or mixing box units.
2. Fixed minimum amount of outdoor air or variable amount with economy cycle using outdoor air to conserve refrigeration.

The latter two factors might be considered with any one of the four basic control processes given in the preceding section.

SIMPLIFIED PSYCHROMETRIC AND CONTROL PROCESSES

It is usually beneficial and many times absolutely necessary, before selecting equipment, to sketch the air treatment process on a psychrometric chart. Space cooling load calculations alone cannot determine the cooling coil or dehumidifier load requirements since additional load might be imposed by reheat, outdoor air mixing and other specific requirements. Before presenting the skeleton psychrometric process for the four control processes listed in the section Control Requirements, the mixing and bypass principles will be discussed briefly. For detailed information, see Chapter 3 of the 1961 GUIDE AND DATA BOOK.

For the mixing of two air streams such as return air with outdoor air, the following equations are derived from the laws