cost of the equipment installed, and (2) because of the increased size it results in less desirable humidity conditions within the residence.

A number of manufacturers, as well as several organizations, have been working on methods of calculating summer air-conditioning loads for domestic applications. One of these is the method developed by the *National Warm Air Heating and Air Conditioning Association* in conjunction with the *Air-Conditioning and Refrigeration Institute*. This method is based on a load at a particular time of the day and takes into consideration the amount of solar radiation and heat gain due to the temperature difference between the conditioned area and the outside area on the assumption that the peak cooling load occurs from 3:00 to 4:00 o'clock in the afternoon.

Another method[2] evaluates the daily average cooling load on the design day rather than the maximum instantaneous heat gain. During the time the peak load occurs the room air temperature is allowed to rise from 72 F to about 78 F, thereby taking advantage of thermal storage in the structure and furnishings.

TYPES OF EQUIPMENT

Low Side

Three types of low sides (the equipment that actually removes the heat from the conditioned space) have been developed for residential work as follows: (1) water-cooled coil, (2) chilled-water coil, and (3) refrigerated coils.

The water-cooled coil using water directly from the supply sources, such as city water or a well is the most simple type of installation. Cold water is circulated directly through the coil while air from the conditioned space is passed over the coil to remove heat and moisture. After the water has passed through the coil, it is wasted. To operate satisfactorily, an installation of this type requires water of sufficiently low temperature to chill the air enough to remove the desired amount of heat and moisture. Where a large supply of water at a cold temperature is obtainable, the water-cooled coil will operate with satisfactory results. As a general rule a water-cooled coil should not be used unless there is a supply of 52 F or colder water at the peak of the cooling season and in sufficient quantities to take care of the cooling load with a temperature rise of no more than 10 deg. Where water is not obtainable in sufficient quantities or at the required temperatures, it is necessary to chill the water to the desired temperature by using mechanical refrigeration. This is known as a chilled-water system.

In a chilled-water system, water is circulated through a closed circuit containing two coils. In one coil the water removes heat and moisture from the air in the conditioned space. In the other coil (water chiller) the heat is removed from the water by mechanical refrigeration. This type of system is called a duplex system in that the heat is picked up by chilled water and later removed from the water by means of a refrigeration system.

The third method of absorbing heat from the conditioned air is by means of direct evaporation of the refrigerant in a coil with the air to be conditioned passing over the outside of the coil surface. The heat is passed directly from the air into the refrigerant for removal.

High Side

The high side of a conditioning system, the section of equipment that removes the heat from the refrigerant and reclaims the refrigerant for further use in the system may be either the air or water-cooled type. The air-cooled high side is so constructed that the heat is removed from the compressed or hot refrigerant by passing it into a cooling coil over which outside air (air taken from outside the conditioned area and returned to outside of the conditioned area) is circulated.

The major advantage of air-cooled equipment is that no water is required to accomplish the removal of heat from the refrigerant and only an electrical supply is needed. The disadvantage is that operating pressures are higher because of the inability to cool the refrigerant as much by air as by water. This results in an increase in electrical input to the compressor motor.

Water-cooled equipment can be of two types. In one type the water drawn from a well or from city mains is passed through the condenser of the high side and is allowed to flow to a drain, swimming pool, a wetted roof, or to other means of disposal. Where the water supply is sufficient and at low cost, this type of water-cooled unit is the better type installation because of lower equipment cost and lower operating costs and quieter operation. In a second type, if water is in short supply or is expensive, about 95 per cent of the cooling water can be reclaimed by evaporating sufficient water to rid the remaining water of the heat picked up in the condensing unit. This can be done by the use of an evaporative condenser or a cooling tower. These units are described in Chapters 35 and 37.

TYPES OF APPLICATION

The common methods of cooling residences today make use of room air conditioners, central systems for cooling only, or central systems designed for both summer cooling and winter heating. The choice between these methods is largely one of cost and the relative heating and cooling loads.

ROOM AIR CONDITIONERS

Window and cabinet-type air conditioning units can be used to cool small sections of a house.

The window units fit into an opening of a standard double-hung window and vary in size from ⅓ to 1 ton of cooling capacity. Room air is circulated through the unit where it is cooled, dehumidified, and filtered. No water pipes are necessary since the condenser is air-cooled; nor is a drain necessary inasmuch as the moisture condensed from the air is evaporated into the outdoor air. Electrically operated, the units can generally be plugged into existing electrical outlets although a voltage of 220 is required for units having one-horsepower motors.

Cabinet units stand on the floor and require an opening in the wall through which air to cool the condenser is brought in and discharged.

The room cooler is popular for use in offices or residences where the existing heating system does not contain provision for summer cooling or where cooling is not required in the entire space.

CENTRAL SYSTEMS—SUMMER ONLY

In some areas there is little or no need for heating but there is a distinct need for summer cooling. Both air- and water-cooled package cooling units are available for such installations, ranging in size from one ton to at least 15 ton capacity. To install these units it is only necessary to make plumbing and electrical connections and add the duct work required to convey air to and from the conditioned space. These units can also be used to provide