HV3 *Cooling and Heating Loads* (Climate Zones: all)

Cooling and heating system design loads should be calculated in accordance with generally accepted engineering standards and handbooks such as *ASHRAE Handbook—Fundamentals* or *ACCA Manual N*. Any safety factor should be applied cautiously and only to a building's internal loads to prevent oversizing of equipment. If the unit is oversized and the cooling capacity reduction is limited, short-cycling of compressors could occur and the system may not have the ability to dehumidify the building properly. Include the cooling and heating load of the outdoor air to determine the total cooling and heating requirements of the unit. In determining cooling requirements, the sensible and latent load to cool the outdoor air to room temperature must be added to the building cooling load. For heating, the outdoor air brought into the space must be heated to the room temperature and the heat required added to the building heat loss. On variable air volume systems, the minimum supply airflow to a zone should comply with local code, the current ASHRAE Standard 62, and the current ASHRAE Standard 90.1 and should be taken into account in calculating heating loads of the outdoor air.

HV4 *Humidity Control* (Climate Zones: all)

The sensible load in the building does not decrease proportionately with the latent load, and as a result, the space relative humidity will tend to increase under cooling part-load conditions. Select systems with cooling part-load performance that minimizes the number of hours that the space relative humidity remains above 60%. For part loads and variable air volume systems, multiple compressors are desirable to reduce the capacity as low as possible to meet the minimum cooling requirements and operate efficiently at part loads. On systems with multiple compressors, the compressors turn on or off or unload to maintain the space air temperature setpoint. On systems that employ supply air temperature reset, controls must be added to ensure that the relative humidity within the space does not exceed 60%.

HV5 *Energy Recovery* (Climate Zones: all)

Total energy recovery equipment can provide an energy-efficient means of dealing with the latent and sensible outdoor air cooling loads during peak summer conditions. It can also reduce the required heating of outdoor air in cold climates.

Exhaust air energy recovery can be provided through a separate energy recovery ventilator (ERV) that conditions the outdoor air before entering the air-conditioning or heat pump unit, an ERV that attaches to an air-conditioning or heat pump unit, or an air-conditioning or heat pump unit with the ERV built into it.

For maximum benefit, energy recovery designs should provide as close to balanced outdoor and exhaust airflows as is practical, taking into account the need for building pressurization and any exhaust that cannot be incorporated into the system.

Exhaust for ERVs may be taken from spaces requiring exhaust (using a central exhaust duct system for each unit) or directly from the return airstream (as with a unitary accessory or integrated unit).

Where economizers are used with an ERV, the energy recovery system should be controlled in conjunction with the economizer and provide for the economizer function. Where energy recovery is used without an economizer, the energy recovery system should be controlled to prevent unwanted heat and an outdoor air bypass of the energy recovery equipment should be used. In cold climates, manufacturer's recommendations for frost control should be followed.

HV6 *Equipment Efficiency* (Climate Zones: all)

The cooling equipment should meet or exceed the listed seasonal energy efficiency ratio (SEER) or energy efficiency ratio (EER) for the required capacity. The cooling equipment should also meet or exceed the integrated part-load value (IPLV) where shown.

Heating equipment should meet or exceed the listed annual fuel utilization efficiency (AFUE) or thermal efficiency for indirect gas-fired heaters at the required capacity. For heat pump applications, the heating efficiency should meet or exceed the listed heating seasonal performance factor (HSPF) or coefficient of performance (COP) for the required capacity based on 47°F outdoor air temperature.

HV7 *Ventilation Air* (Climate Zones: all)

The amount of outdoor air should be based on ASHRAE Standard 62.1-2004 but in no case be less than the values required by local code. The number of people used in computing the ventilation quantity required should be based on either known occupancy, local code, or Standard 62.1-2004. For retail sales, Standard 62.1-2004 suggests 16 cfm per person based on 15 people per 1,000 ft^2. Ventilation guidelines for pharmacies, photo processing areas, receiving docks, and warehousing spaces are detailed in the standard.

Each air-conditioning or heat pump system should have an outdoor air connection through which ventilation air is introduced and mixes with the return air. The outdoor air can be mixed with the return air either in the ductwork prior to the air-conditioning or heat pump unit or at the unit's mixing plenum. In either case, the damper and duct/plenum should be arranged to promote mixing and minimize stratification. A typical design for the ventilation system of a small retail building is shown in Figure 5-27.

An air economizer mode can save energy by using outdoor air for cooling in lieu of mechanical cooling when the temperature of the outdoor air is low enough to meet the cooling needs. The system should be capable of modulating the outdoor air, return air, and relief air dampers to provide up to 100% of the design supply air quantity as outdoor air for cooling.

Systems should use a motorized outdoor air damper instead of a gravity damper to prevent outdoor air from entering during the unoccupied periods when the unit may recirculate air to maintain setback or setup temperatures. The motorized outdoor air damper for all climate zones should be closed during the entire unoccupied period except when it may open in conjunction with an economizer cycle.

Demand control ventilation should be used in areas that have varying and high occupancy loads during the occupied periods to vary the amount of outdoor air in response to the need in a zone. The amount of outdoor air could be controlled by carbon

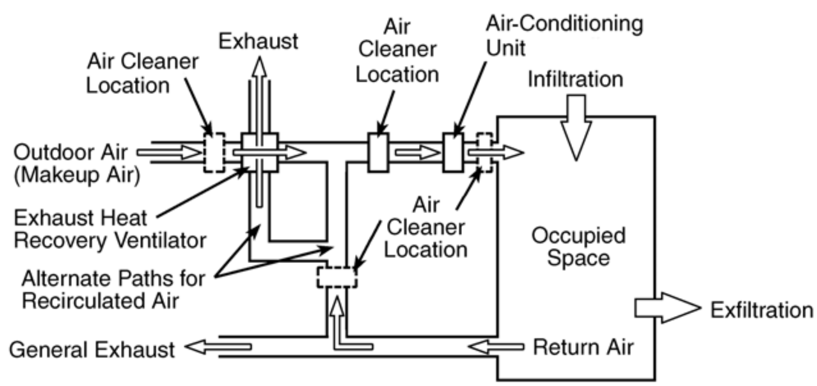

Figure 5-27. (HV7) Example of ventilation system.