In new home construction and in retrofits, proper duct system design is critical. Many existing duct systems lose a lot of energy from leaks and poor insulation. Efficient and well-designed duct systems distribute air properly throughout a home without leaking to keep all rooms at a comfortable temperature.

Duct systems should provide balanced supply and return flow in order to maintain a neutral pressure within a home. Maintaining a neutral indoor air pressure is important to the health, safety, and comfort of a home's occupants, as well as to the energy efficiency of the home. An unbalanced system reduces the home's comfort and energy efficiency. It can also draw mold spores, dust, humidity, radon gas, and other contaminants indoors.

Air return duct systems can be configured in two ways. In a distributed return duct system, each room has a return duct that provides a pathway for air to flow back to the air handler. In a central return duct system, or whole-house return, return grilles are located in central locations on each floor, usually close to the air handler.

**Central returns vs. distributed returns**

Traditionally, central returns have been less popular than distributed returns because of privacy problems and noise transfer. A central return duct system that has been installed using best practices, however, exhibits none of these issues. In addition, placing the HVAC system in a centralized location requires less ductwork than a distributed system. When the amount of ductwork is reduced, fewer connections are required, providing a more direct path for air flow. With fewer seams and joints, potential leaks are minimized, and the system is more efficient. The system minimizes the surface area of the ductwork, resulting in less energy loss. There's less pressure loss too, since the duct size is larger overall. A centralized location also reduces installation time and the cost of materials. So despite criticism, central return duct systems are the better choice in duct system design.

**Central return duct systems**

In order to keep supply air from pressurizing closed rooms, transfer grilles or jump ducts are installed to allow supply air to flow back to the central return grille. A transfer grille is a grille that allows air to move from one space to another to alleviate pressure differences. For example, a pressure grille installed above a bedroom door enables air to move between the bedroom and the hallway, regardless of whether the door is open or closed. The standard practice for homes with central returns is to undercut doors to allow for air flow, but undercutting alone doesn't provide enough room for air to move; the best practice is to use transfer grilles or jump ducts, so air can easily reach the central return grille.

Although they're often located above interior door frames, transfer grilles can also be installed in a full wall cavity in order to reduce noise transmission. When installed in a full wall cavity, the best practice is to install grilles using the high/low method, where one grille is low on one side of a wall, and the corresponding grille is high on the opposite side of the wall. The standard practice is to use the wall cavity as the duct between the two grilles, but this creates noise problems that can bother homeowners. Instead, the HVAC trade contractor should install ductwork connecting the high and low grilles, significantly reducing sound transfer.

Jump ducts are short ducts that run in the attic from the ceiling of a closed room to a ceiling in the main body of the
home to provide an alternative pathway for air to flow when a door is closed. They're routed through the attic in order to minimize noise transmission in a home. Jump ducts are often less than 6 feet long and connect one room to another. Each end of a jump duct is then connected to a standard return air register vent.

Transfer grilles and jump ducts work to equalize the pressure in rooms and allow for conditioned air from the supply ducts to flow evenly throughout the home. Consider these points about central return duct systems:

- Over-the-door transfer grilles are normally smaller vents installed over bedroom doors. Most floor plans will place bedrooms off of a main hallway; when the bedroom doors are shut, a grille allows air to flow into the hallway and back to the central return duct in the main living area.

- Transfer grilles can be installed with baffles inside. These baffles work to minimize sound traveling from the hallway, allowing for a more soundproof room.

- Jump ducts are a great way to reduce ductwork. They're often installed in the ceiling and provide pressure balance between bedrooms and main living areas.

Good duct design provides a home with proper air distribution, economical heating and cooling system operation, and economical duct installation. Central return duct systems are a good way to provide a comfortable indoor environment for homeowners.

For more information about duct systems, visit:  
www.eere.energy.gov/buildings/info/documents/pdfs/air_dist_sys_design-0782.pdf

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