Scope

Provide for pressure balancing between bedrooms and the rest of the house.

- Install ducted returns or a combination of ducted returns, transfer grilles, jump ducts, and/or door undercuts in bedrooms to allow pressure balancing between bedrooms and the rest of the house in homes with ducted heating and cooling systems by providing a path for room air to return to a central air handler thereby increasing the volume of conditioned air circulating in the room.

- ENERGY STAR Certified Homes requires that the dedicated return ducts, transfer grilles, jump ducts, and/or door undercuts together achieve a rater-measured pressure differential of \( \pm 3 \) Pascals (0.012 inch water column) with respect to the main body of the house when bedroom doors are closed and the air handler is operating on the highest design fan speed. A rater-measured pressure differential of \( \pm 5 \) Pascals (0.020 inch water column) is acceptable for rooms with a design airflow \( \pm 150 \) cfm.

- If transfer grilles or jump ducts are used, refer to the balancing report provided by the HVAC contractor for the bedroom air flows to size the grilles or ducts. If a balancing report was not provided, the flow of the supply register when the air handler is on high speed may need to be measured using a flow hood, anemometer, or other flow measurement tool. Ensure that both openings have the required free area. Seal all seams, gaps, and holes in the ducts and connections.

- Test the pressure differential with the bedroom doors closed.

See the [Compliance Tab](#) for related codes and standards requirements and criteria to meet national programs such as DOE’s Zero Energy Ready Home program, ENERGY STAR Certified Homes, and Indoor airPLUS.
Description

For central “forced air” furnace and air conditioning systems to operate properly, the HVAC distribution system should be designed with adequate supply and return registers to provide conditioned air to all parts of the house and return stale air to the furnace for reconditioning. Inadequate return air pathways can cause pressure imbalances from room to room, which can cause drafts and temperature differences between rooms or floors, leading to comfort complaints. Pressure imbalances can also cause the furnace and air conditioning equipment to work harder than necessary. A well-designed return air strategy is critical for the performance of the HVAC system in an energy-efficient house, which may have lower airflow requirements to meet the lower heating and cooling loads (Burdick 2011). The return air must have a clear path back to the air handler from every room that has a supply outlet, with the exception of bathrooms or kitchens due to the potential for spreading odors through the house (Burdick 2011).

Most forced air systems use central return registers consisting of one more centrally located return registers that are ducted to the return side of the air handler. To provide a pathway for air from rooms with closed doors to these central return registers, builders can use door undercuts or install transfer grilles or jump ducts. A transfer grille is a grille or register installed in the wall or above the door to connect the closed room with an open space such as a hallway or living room, thereby providing an additional pathway for stale air to reach the centrally located return.

Transfer grilles may be installed by the framer or drywaller. This task should be included in the contract for the appropriate trade depending on the workflow at a specific job site.

How to Install a Transfer Grille

1. Determine a location for the transfer grille on an interior wall between the frequently closed room and an open area; preferably this should be the wall where air would have the most direct path to the central return. Mark a location between two studs. Measure and cut openings in the drywall on both sides of the wall to snugly fit the duct registers. Install the registers. Sound and light transfer between rooms can be minimized in one of the ways described below.

   Figure 1 - Installing transfer grilles is one way to balance pressures from room to room

2. Offset the openings from each other with the grille on the room side located high on the wall (to avoid being blocked by furniture) and the grille on the hallway side located low on the wall. The registers are offset to minimize sound and light transfer. Air flows through the uninsulated interior wall cavity.
Figure 2 - A transfer grille is installed in the wall to connect a closed room with an open area, thus providing an air pathway to the central return air register. The registers are offset to minimize sound and light transfer. Air flows through the uninsulated interior wall cavity.

Or –

3. Cut the wall openings directly opposite each other and install sheet metal baffles offset from each other inside each opening to allow air passage but prevent light passage and minimize sound transfer.

Figure 3 - Hidden sheet metal baffles prevent the transmission of light and sound through the grille.
Figure 4 - The baffles are made of sheet metal

Figure 5 - The baffles are offset to allow the transmission of air but not light or sound
Ensuring Success

To determine if an adequate pathway exists for air to return to centrally located returns, the following room-to-room pressure measurement can be used:

1. Turn on the air handler to high.
2. Close all interior doors.
3. Using a manometer, connect tubing to the input port. The reference port for the differential pressure measurement can remain open.
4. While standing in the center of the house or hallway, place the tubing from the manometer under each door and record the pressure difference from each room with respect to the main body of the house (note the presence of a negative or positive sign). The bedroom will typically be pressurized (positive) when the doors are closed.
5. ENERGY STAR requires that rooms should not be pressurized or depressurized by more than 3 Pascals for any room being supplied with less than 150 cfm of conditioned air. If the supplied airflow to a room exceeds 150 cfm, a threshold of 5 Pascals is required. These are good metrics to strive for regardless of whether or not pursuing ENERGY STAR certification.
Climate

No climate specific information applies.
Training

Right and Wrong Images

Display Image: ES_HVAC_QIRC_2.8A_PG38_45c_102811.jpg
(1) Direct through - the wall grille with baffle grid

(2) Hi/low transfer grilles, utilizing wall cavity

Positioning room-side grille in high position prevents air flow blockage by room furniture.

Passive Air-Return Pathway - 3 Options

- Adequate volume of return air cannot pass under closed door. Passive pathways from rooms to hallway (and central return duct) provide efficient route for removing stale air and balancing volumes of air supplied and air removed from room (helping balance the HVAC system).
CAD
None Available
**Compliance**

The Compliance tab contains both program and code information. Code language is excerpted and summarized below. For exact code language, refer to the applicable code, which may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our [webmaster](mailto:webmaster) if you find broken links.

**ENERGY STAR Certified Homes, Version 3/3.1 (Rev. 09)**

Rater Field Checklist

HVAC System.


6.2 Bedrooms pressure-balanced (e.g., using transfer grilles, jump ducts, dedicated return ducts, undercut doors) to achieve a Rater-measured pressure differential ? -3 Pa and ? +3 Pa with respect to the main body of the house when all air handlers are operating. Test configuration and an alternative compliance option in Footnote 34.

Footnote 34) Item 6.2 does not apply to ventilation or exhaust ducts. For an HVAC system with a multi-speed fan, the highest design fan speed shall be used when verifying this requirement. When verifying this requirement, doors separating bedrooms from the main body of the house (e.g., a door between a bedroom and a hallway) shall be closed and doors to rooms that can only be entered from the bedroom (e.g., a closet, a bathroom) shall be open. As an alternative to the ± 3 Pa limit, a Rater-measured pressure differential ? -5 Pa and ? +5 Pa is permitted to be used for bedrooms with a design airflow ? 150 CFM. The Rater-measured pressure shall be rounded to the nearest whole number to assess compliance.

Please see the [ENERGY STAR Certified Homes Implementation Timeline](https://www.energystar.gov/certified-homes/implementation-timeline) for the program version and revision currently applicable in your state.

**Air Conditioning Contractors of America**


**Associated Air Barrier Council**


**National Environmental Balancing Bureau**

National Environmental Balancing Bureau (NEBB) Section 15990 – Testing, Adjusting, and Balancing, NEBB is a certification association whose members perform testing, adjusting and balancing (TAB) of heating, ventilating, and air-conditioning systems and commission and retro-commission building systems. This document is the TAB procedural standards.

**2009, 2012, 2015, and 2018 IECC**

This topic is not specifically addressed in the IECC.

**2009, 2012, 2015, and 2018 IRC**

This topic is not specifically addressed in the IRC.
Case Studies

1. **High Performance Builder Spotlight: Green Coast Enterprises, New Orleans, Louisiana**
   (872KB)
   **Author(s):** PNNL
   **Organization(s):** PNNL
   **Publication Date:** September, 2010
   Case study about new home construction in the hot-humid climate, part of a project building 100 new homes after hurricane Katrina.

References and Resources*

1. **AABC National Standards for Total System Balance 2002**
   **Author(s):** Associated Air Barrier Council
   **Organization(s):** Associated Air Barrier Council
   **Publication Date:** January, 2002
   Standards book discussing changes, additions and enhancements over the 5th edition of the AABC National Standards for Total System Balance.

   **Author(s):** Air Conditioning Contractors of America
   **Organization(s):** Air Conditioning Contractors of America
   **Publication Date:** June, 2009
   Standard providing guidance on how to select, size, and locate the supply air diffusers, grilles and registers, and the return grilles.

3. **DOE Zero Energy Ready Home National Program Requirements (Rev. 07)**
   **Author(s):** U.S. Department of Energy
   **Organization(s):** DOE
   **Publication Date:** May, 2019
   Standard requirements for DOE’s Zero Energy Ready Home national program certification.

4. **ENERGY STAR Certified Homes, Version 3/3.1 (Rev. 09) National Program Requirements**
   **Author(s):** U.S. Environmental Protection Agency
   **Organization(s):** EPA
   **Publication Date:** September, 2018
   Webpage with links to documents providing the program requirements and checklists for ENERGY STAR Certified Homes (Ver. 3/3.1, Rev. 09).

5. **NEBB Section 15990 - Testing, Adjusting, and Balancing**
   **Author(s):** National Environmental Balancing Bureau
   **Organization(s):** National Environmental Balancing Bureau
   **Publication Date:** January, 2005
   Standard that includes testing, adjusting and balancing (TAB) to produce design flows for air and hydronic systems.

*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

Contributors to this Guide

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- **Pacific Northwest National Laboratory**