Placement of Ducts and HVAC Systems in Conditioned Space:

An Overview

EEBA Excellence in Building Conference

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Building Science Corporation
www.buildingscience.com

Why move ducts inside?

- Energy savings from reducing forced air exchange due to duct leakage

Why move ducts inside? (continued)

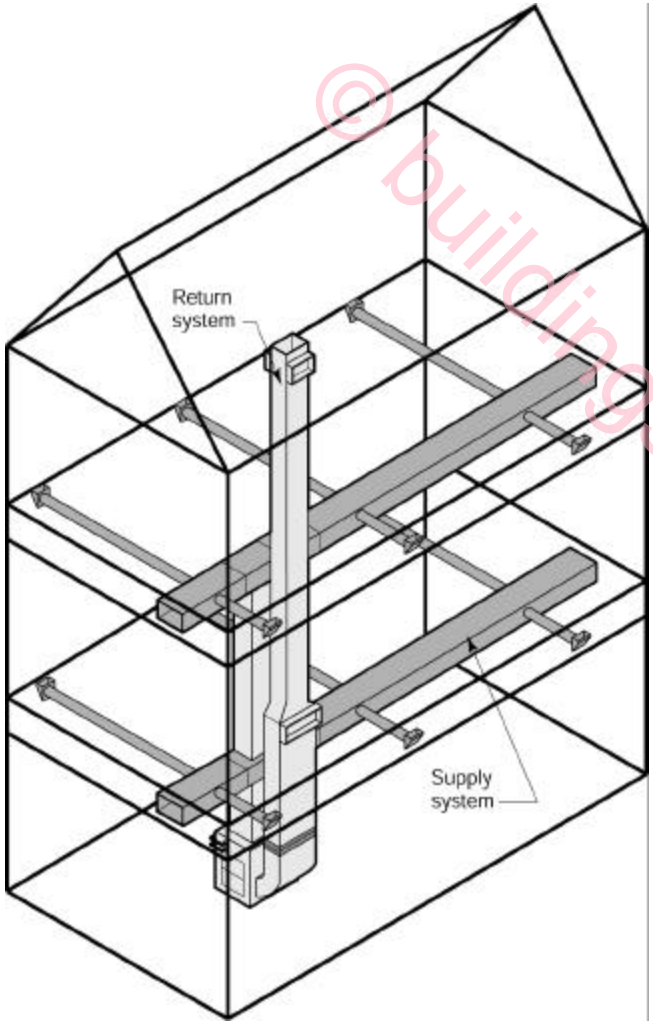
- Reduce pressure imbalance problems
- Energy savings from less hostile duct environment
- Reduced heating & cooling loads—equipment downsizing

Duct Location Options

- Basement + interior walls
- Conditioned crawl space + interior walls
- Dropped HVAC coffer
- Raised HVAC coffer
- Floor truss space (two-story plans)
- Unvented roof system

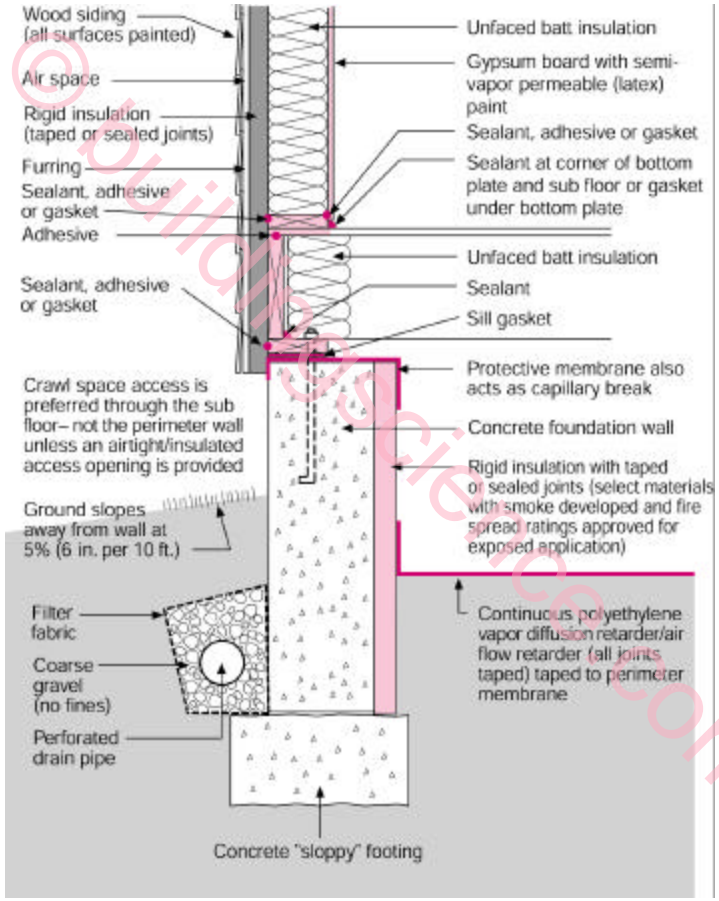
- **Warning: Combustion Appliance Location**

Basement Duct System

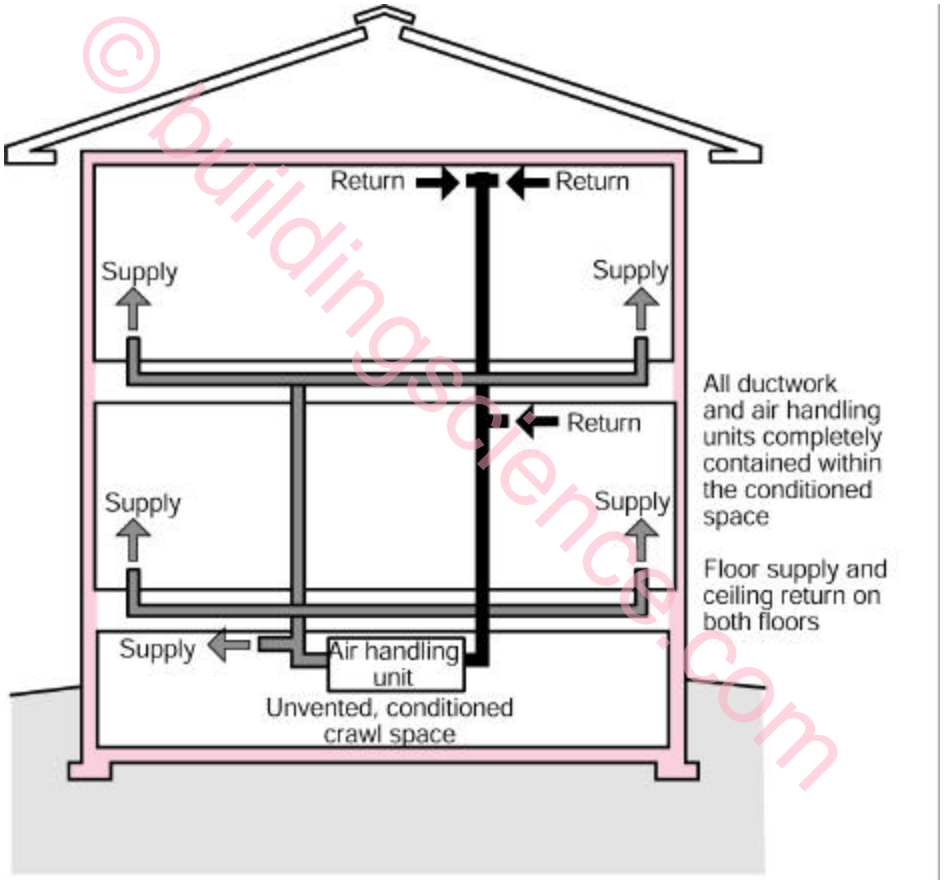


- Standard system in many regions
- Second floor ducts must be in first floor interior walls or trunks off of floor system—not in attic.

Conditioned Crawl Space



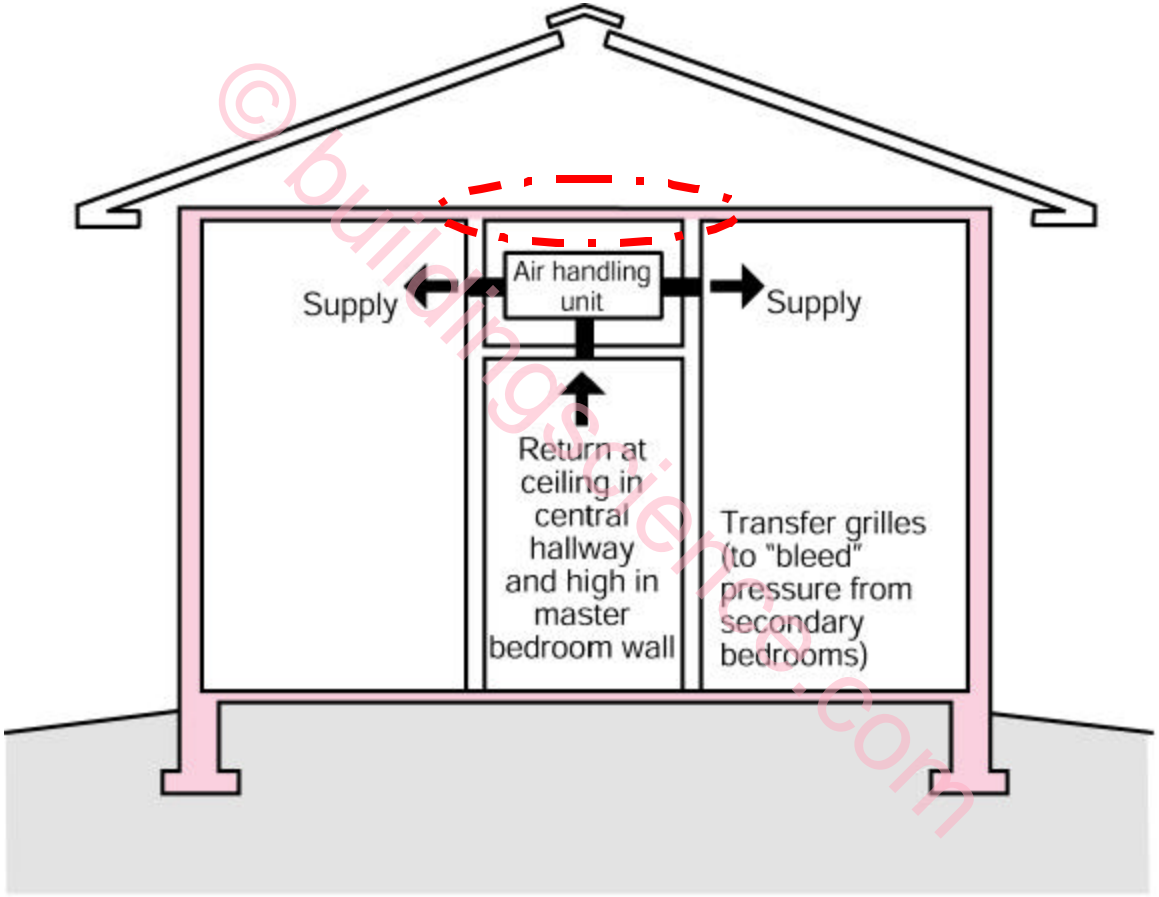
Conditioned Crawl Space Duct System



Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

Conditioned Crawl Space Duct System

Dropped Ceiling Coffer Duct System



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Dropped Ceiling Coffer Duct System

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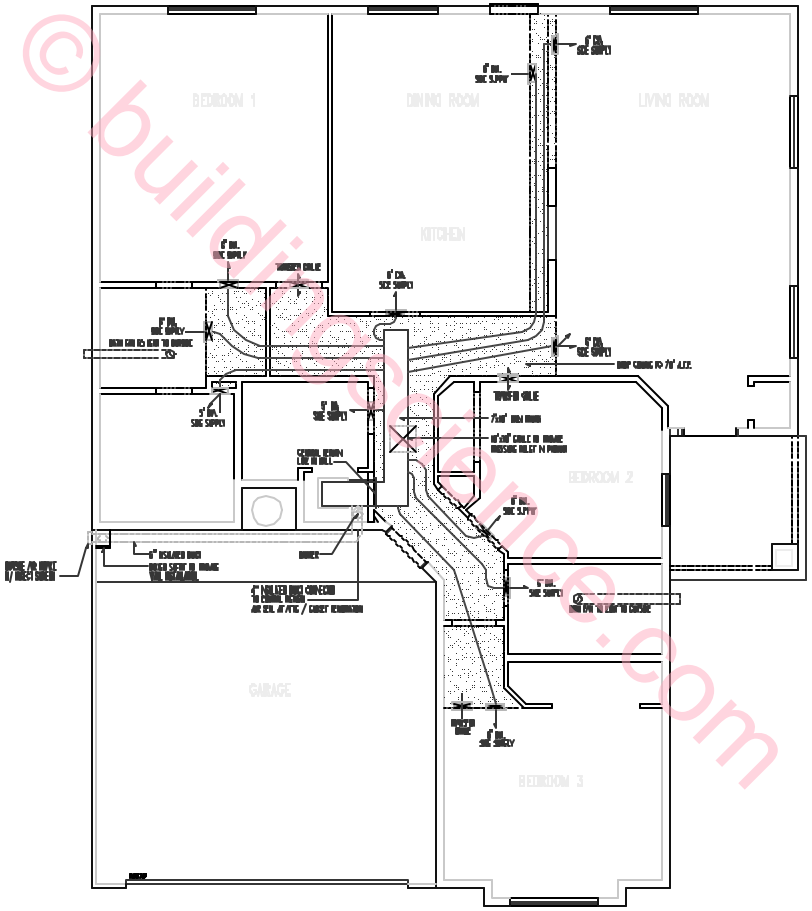
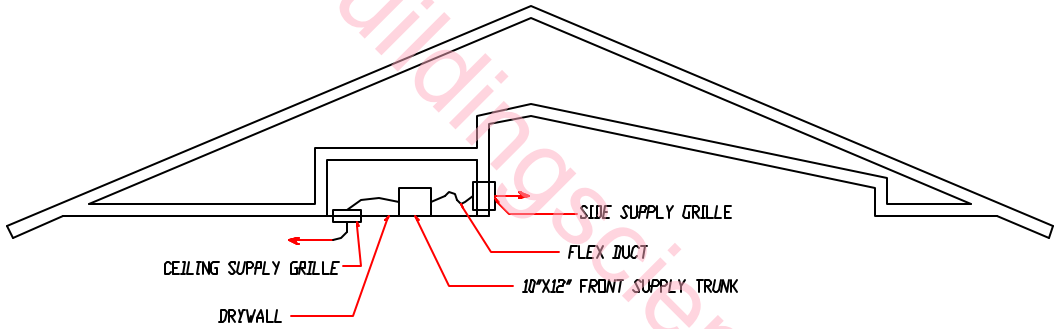


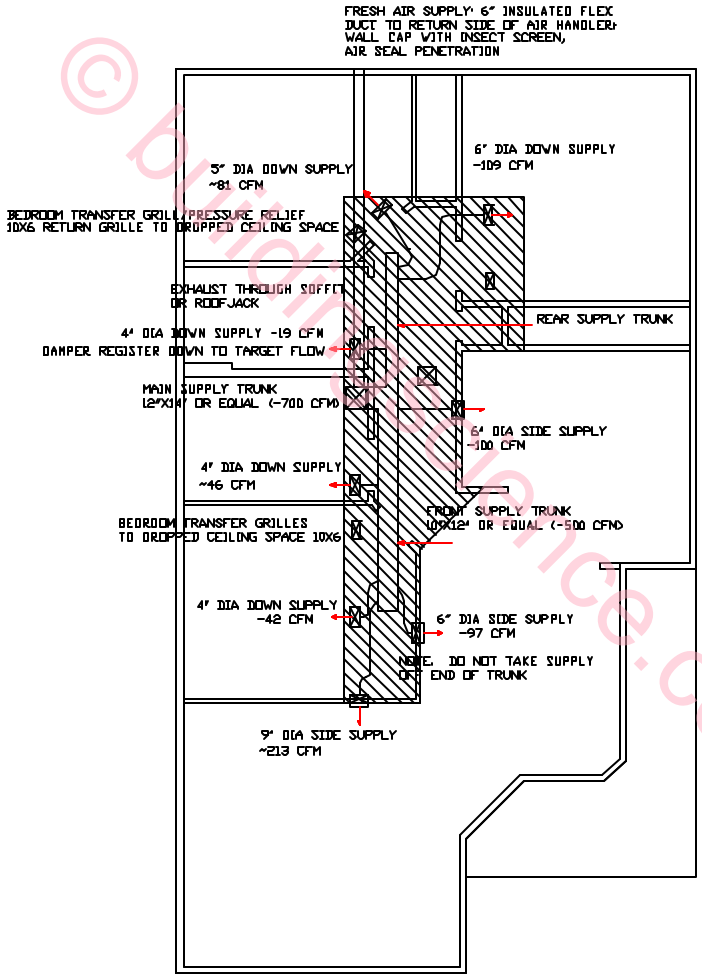
Raised Ceiling Coffer Duct System



NOTES:
1. THIS DETAIL ONLY SHOWS BOTH POSSIBLE CONFIGURATIONS FOR SUPPLY DUCTS. INSTALL DUCTS AS DETAILED ON FLOOR PLAN

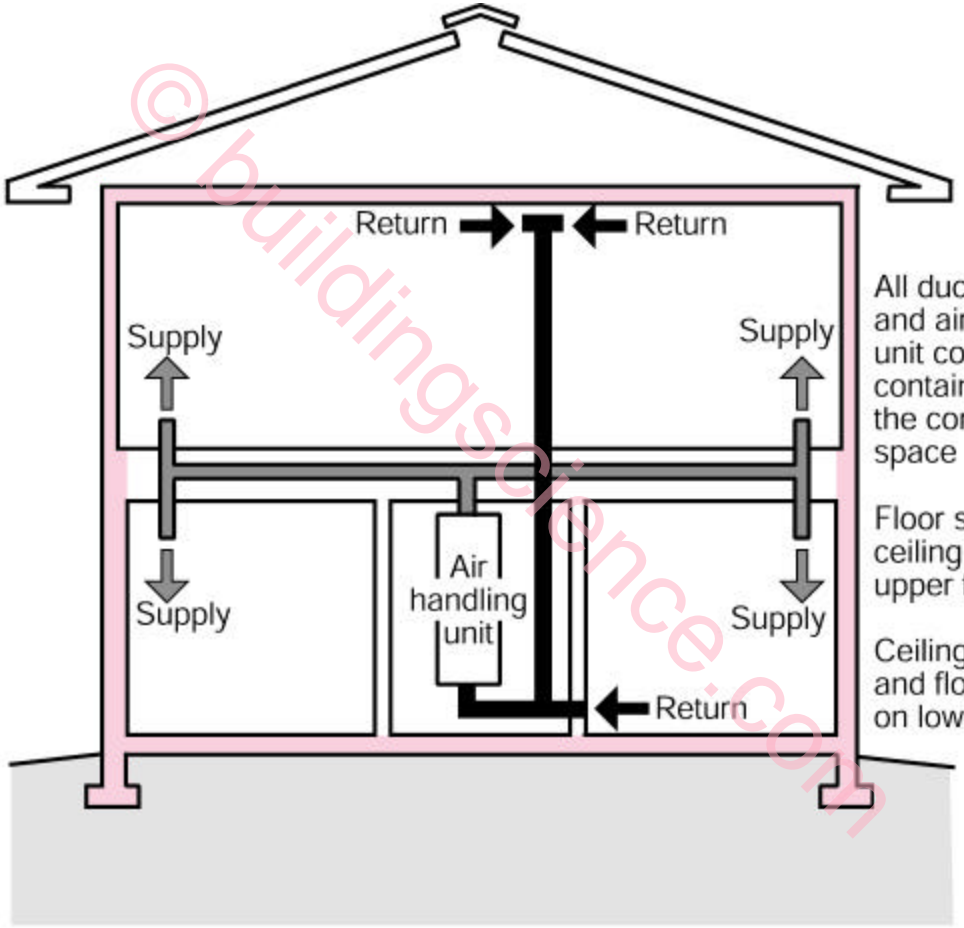
BSC+2 HVAC COFFER DETAIL
NOT TO SCALE

Raised Ceiling Coffer Duct System



Raised Ceiling Coffer Duct System

Engineered Floor Truss Duct System



All ductwork and air handling unit completely contained within the conditioned space

Floor supply and ceiling return on upper floor

Ceiling supply and floor return on lower floor

Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

Engineered Floor Truss Duct System

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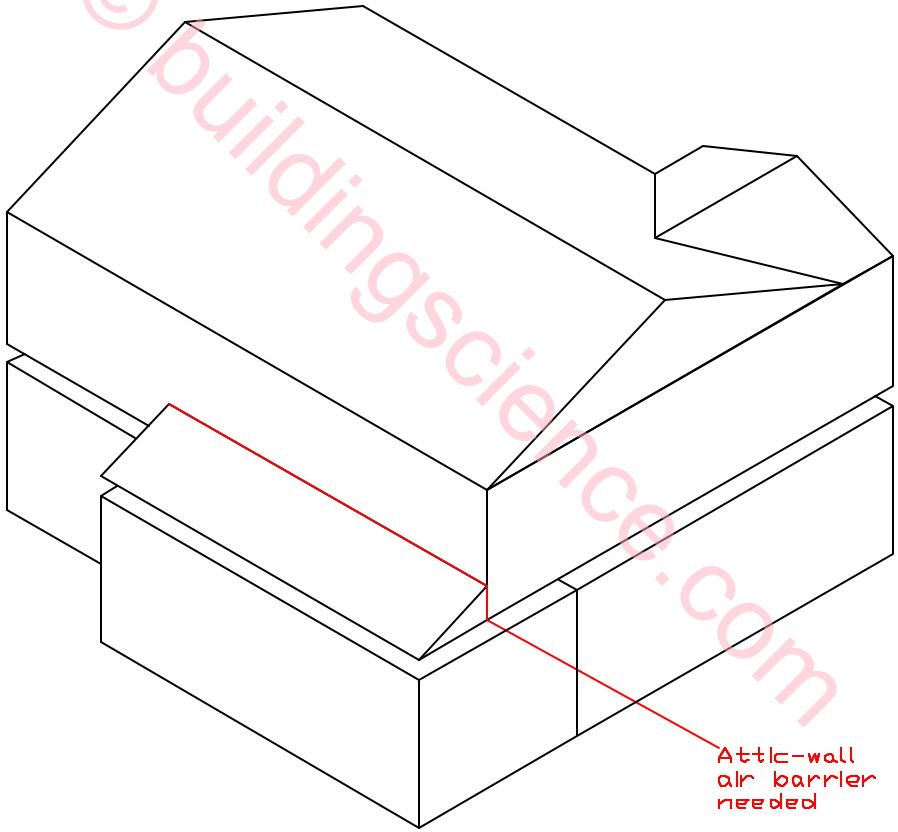
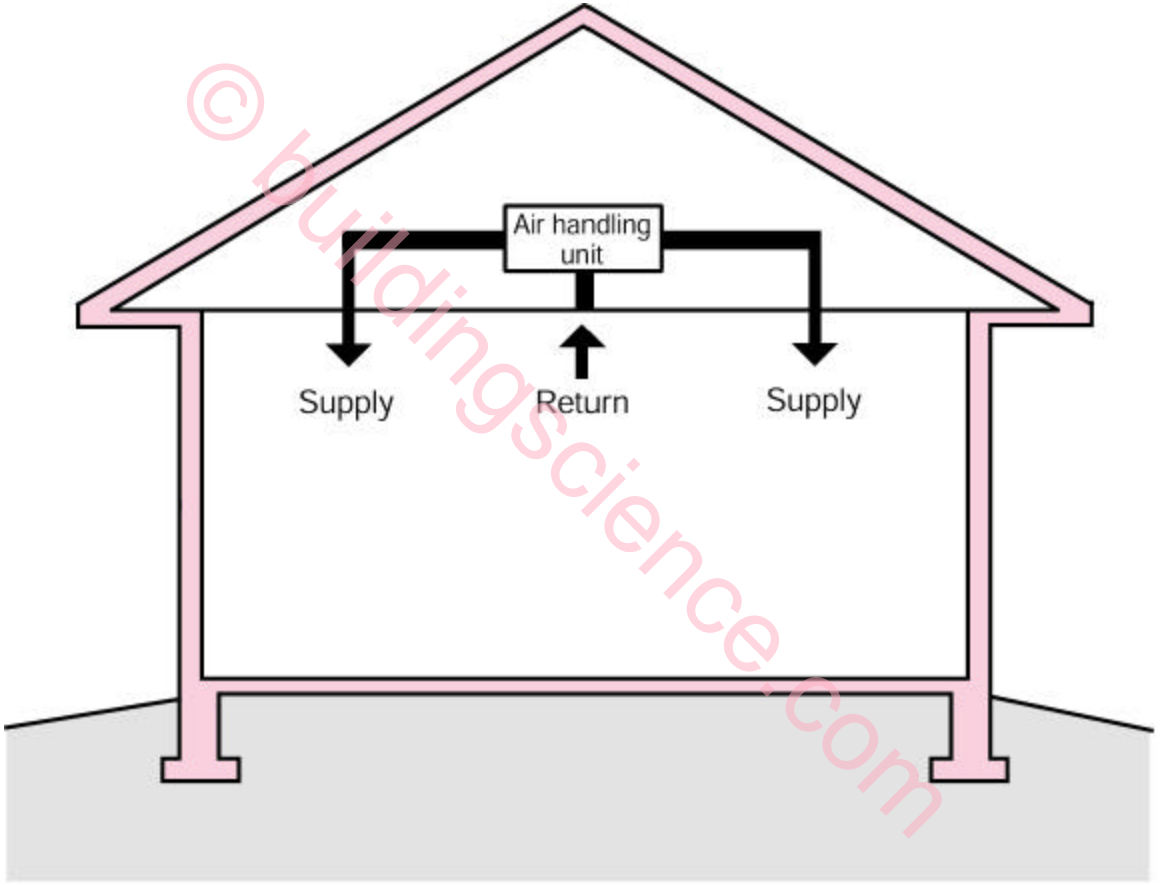
Engineered Floor Truss Duct System



Engineered Floor Truss Duct System

Unvented Roof Duct System



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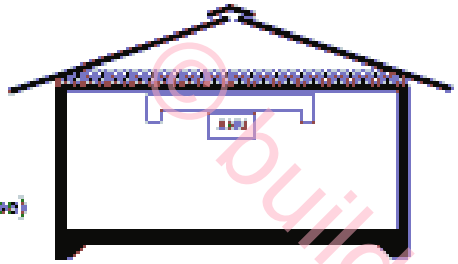
Unvented Roof Duct System

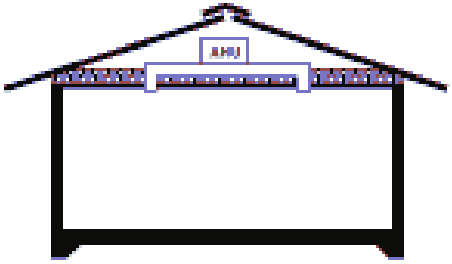
Unvented Roof Ducts: Energy Comparisons



House 1
(Base Case)

Fully Ventilated Attic, No Ductwork in Attic, Perfect Air Barrier at Ceiling

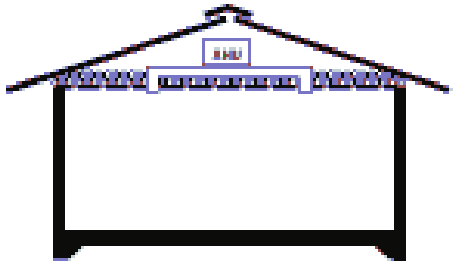
AHU and ductwork completely inside the conditioned space



House 2

Fully Ventilated Attic, Perfectly Sealed Ductwork and AHU in Attic, Perfect Air Barrier at Ceiling

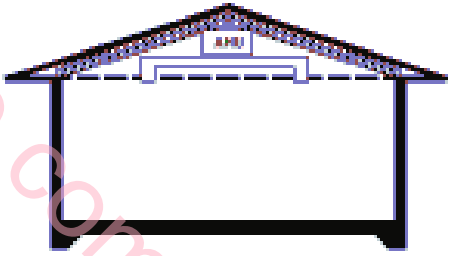
Energy performance -3% to -5% penalty compared with base case due to conductive losses across the ductwork and AHU.



House 3

Fully Ventilated Attic, Leaky Ductwork and AHU in Attic, Imperfect Air Barrier at Ceiling

Energy performance -15% to -30% penalty compared with base case due to air change induced by leaky ductwork. House 3 is the true "Base Case" for typical residential construction.



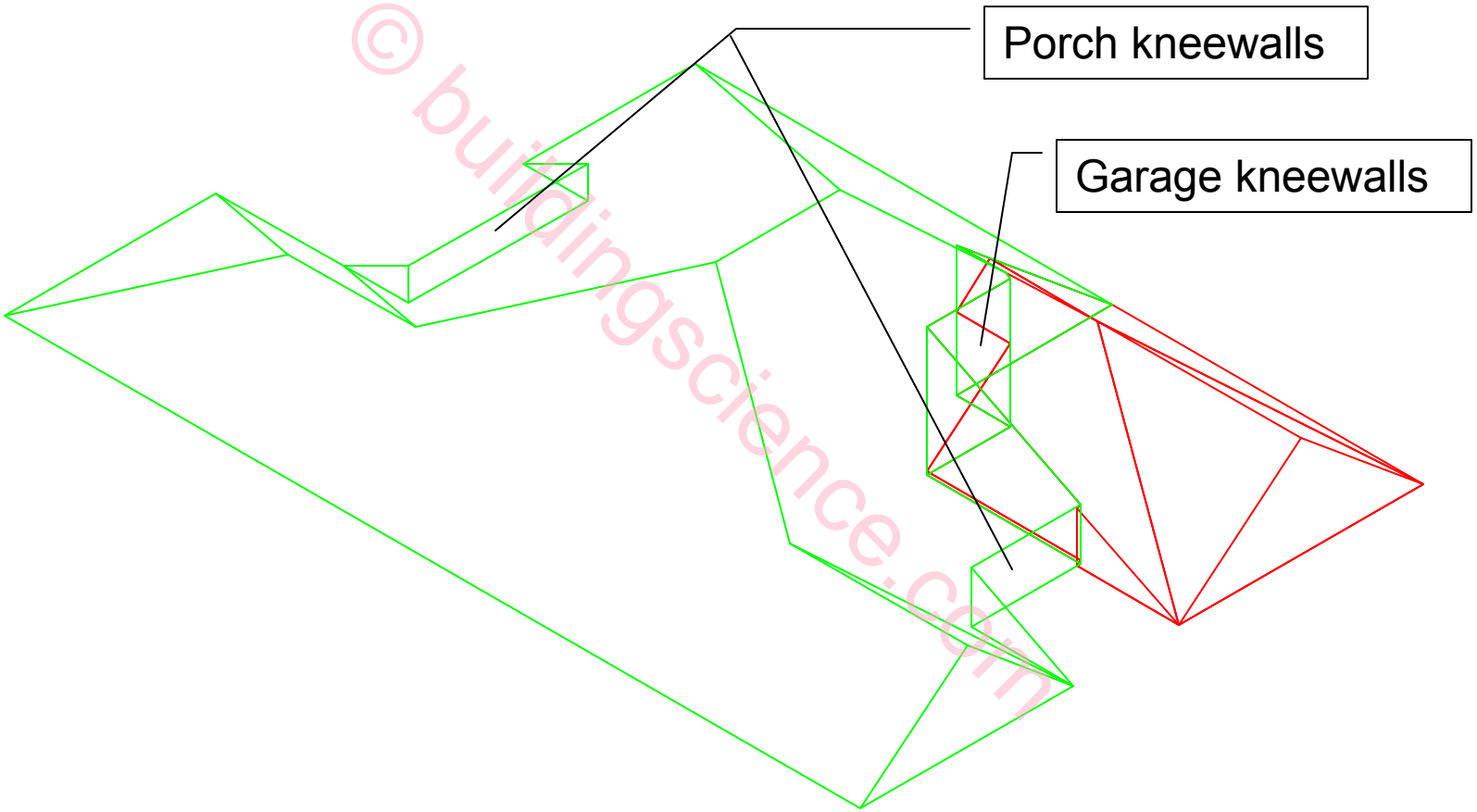
House 4

Cost = -$300 compared with House 3

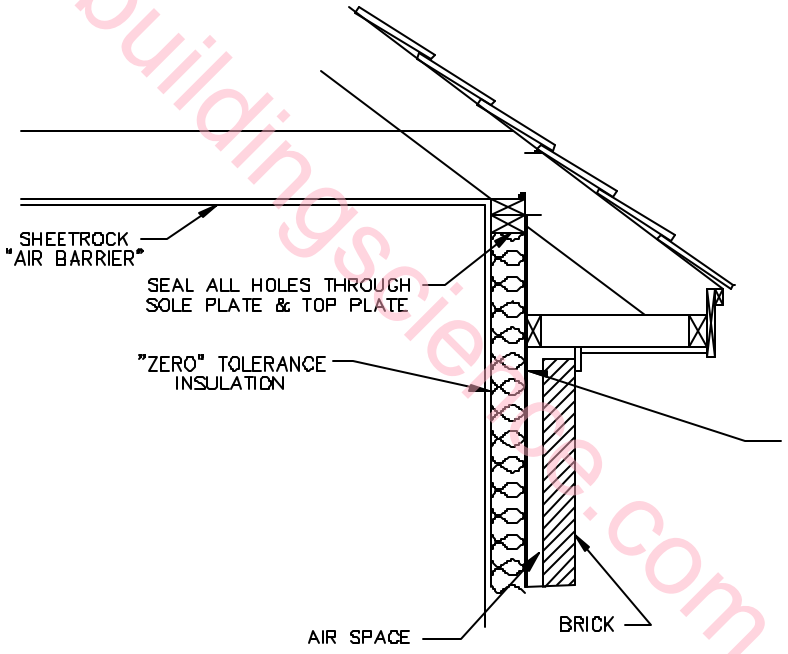
Non-Ventilated Attic, Insulation Tight to Underside of Roof Deck, Leaky Ductwork and AHU completely inside the Conditioned Attic, Typical Ceiling Construction

Energy performance -3% to -5% penalty compared with base case (House 1). However, it allows for 15% to 25% savings over the true base case (House 3).

Unvented Roof: Air Sealing Locations



Unvented Roof: Construction Detail



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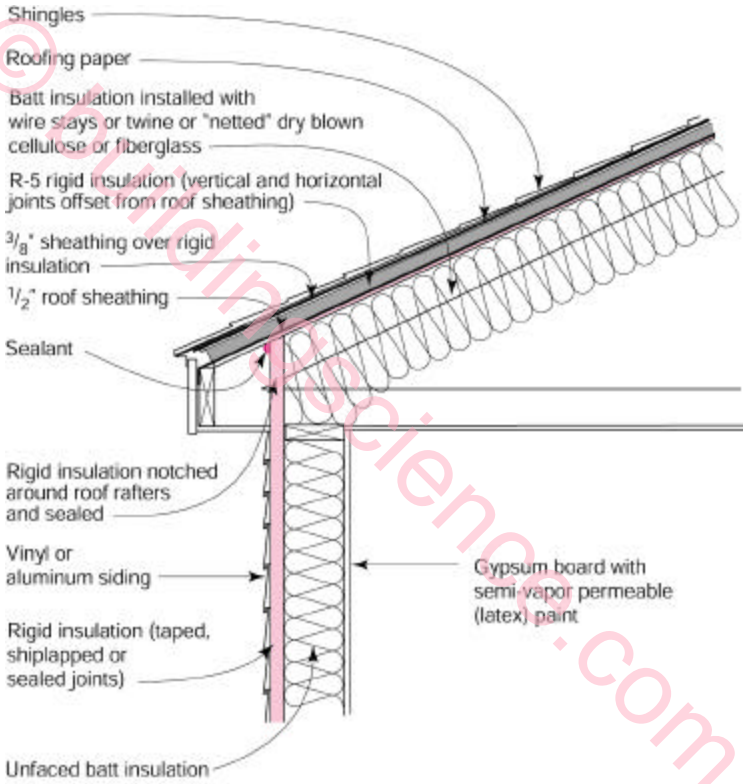

Note: Colored components designate air flow retarder system