

Figure 5

HVAC System for Hotel

- 25 L/s is extracted from each suite
- 15 suites per floor plus 100 L/s extracted from each corridor
- 475 L/s extracted per floor
- 2,850 L/s extracted from 6 floors with suites
- Each suite's PTHP supplies 30 L/s when it is operating. One additional PTHP serves each corridor supplying 100 L/s of outside air. A total of 550 L/s is supplied per floor when all the PTHP's on a floor are operating.
- However, the typical duty cycle of a PTHP is approximately 20%, i.e. 80% of the units are off at any one time.
- When 3 suite PTHP's and the corridor PTHP are operating only 190 L/s supplied to a floor. If 475 L/s is extracted per floor, a deficit of 285 L/s exists per floor or 1,710 L/s for all the suite floors combined.

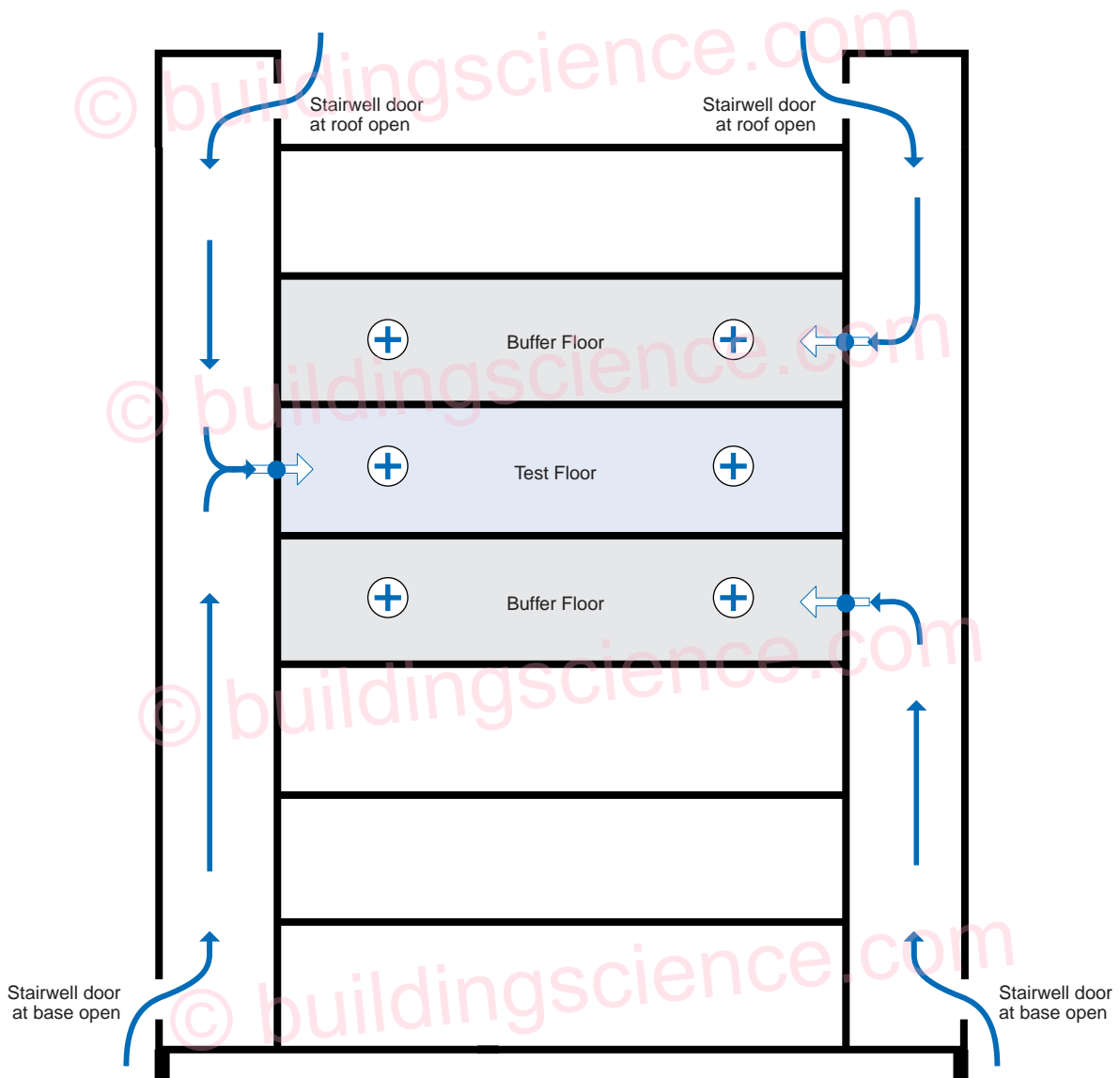


Figure 6
Air Leakage Test Zones

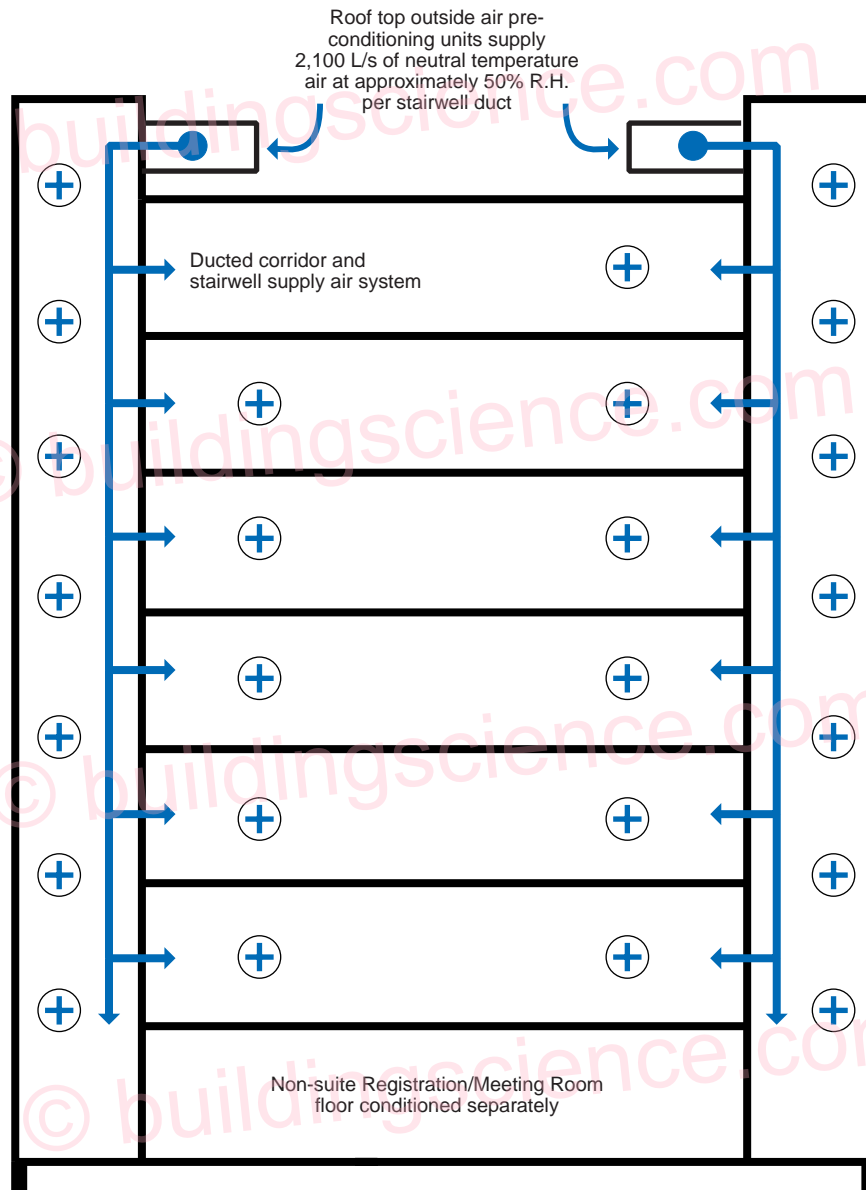


Figure 7

New Air Pressure Relationships

- Hotel suite floors supplied with 4,200 L/s of preconditioned air
- Hotel suite floors are exhausted to a total of 2,850 L/s
- Surplus of 1350 L/s pressurizes suite floors
- Stairwell held open with magnetic latches

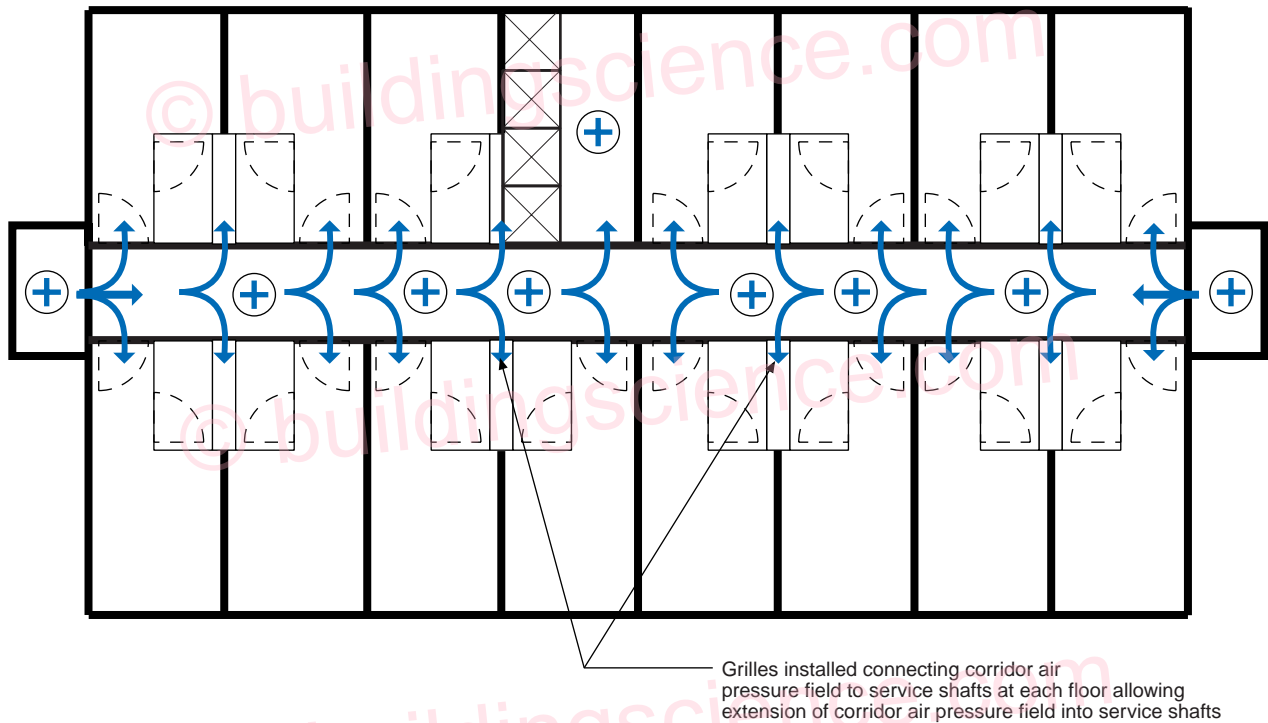


Figure 8

**Supply Air Approach
Plan View**

- 700 L/s supplied to each corridor from ducted system in each stairwell
- A total of 4,200 L/s is supplied for all suite floors combined via two stairwells (or 2,100 L/s per stairwell)

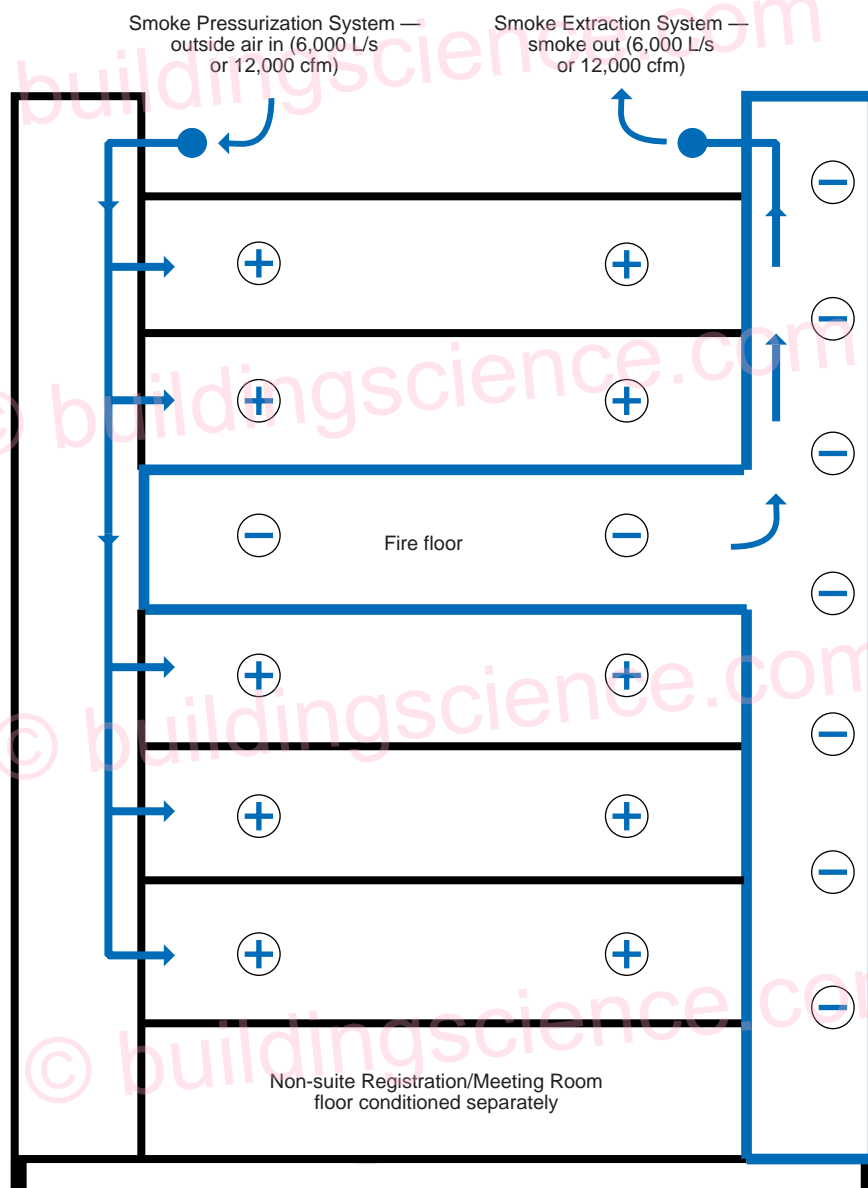


Figure 9

Smoke Extraction System

- If hotel is pressurized 25 Pa and smoke floor/floors are depressurized 25 Pa, net minimum smoke control pressure difference is greater than the design specified 25 Pa
- Approximately 1,000 L/s per floor is required to pressurized each floor 25 Pa relative to the exterior or approximately 6,000 L/s to pressurize the 6 hotel floors with suites when the roof top exhaust systems are not operating

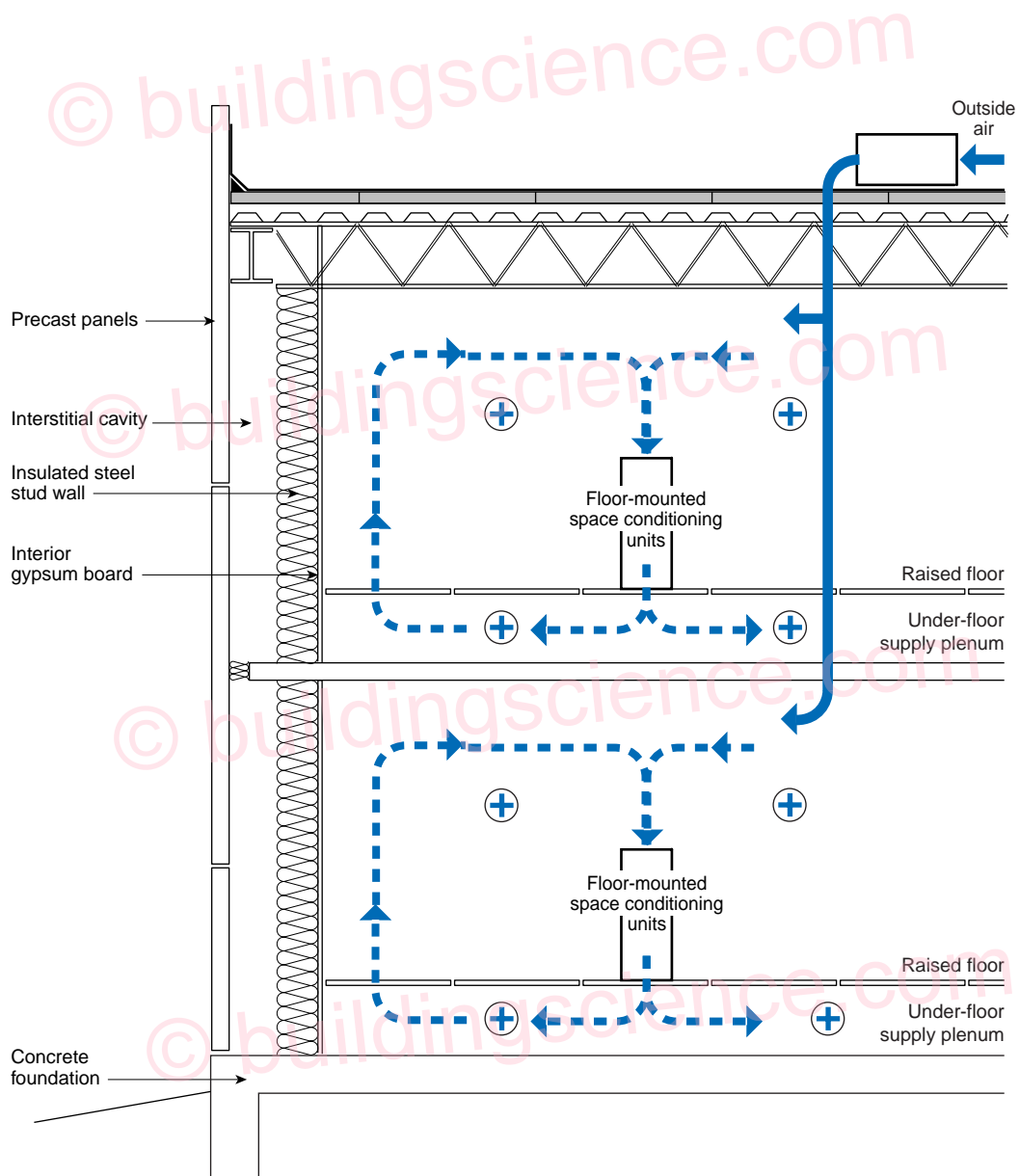


Figure 10
HVAC System as Designed

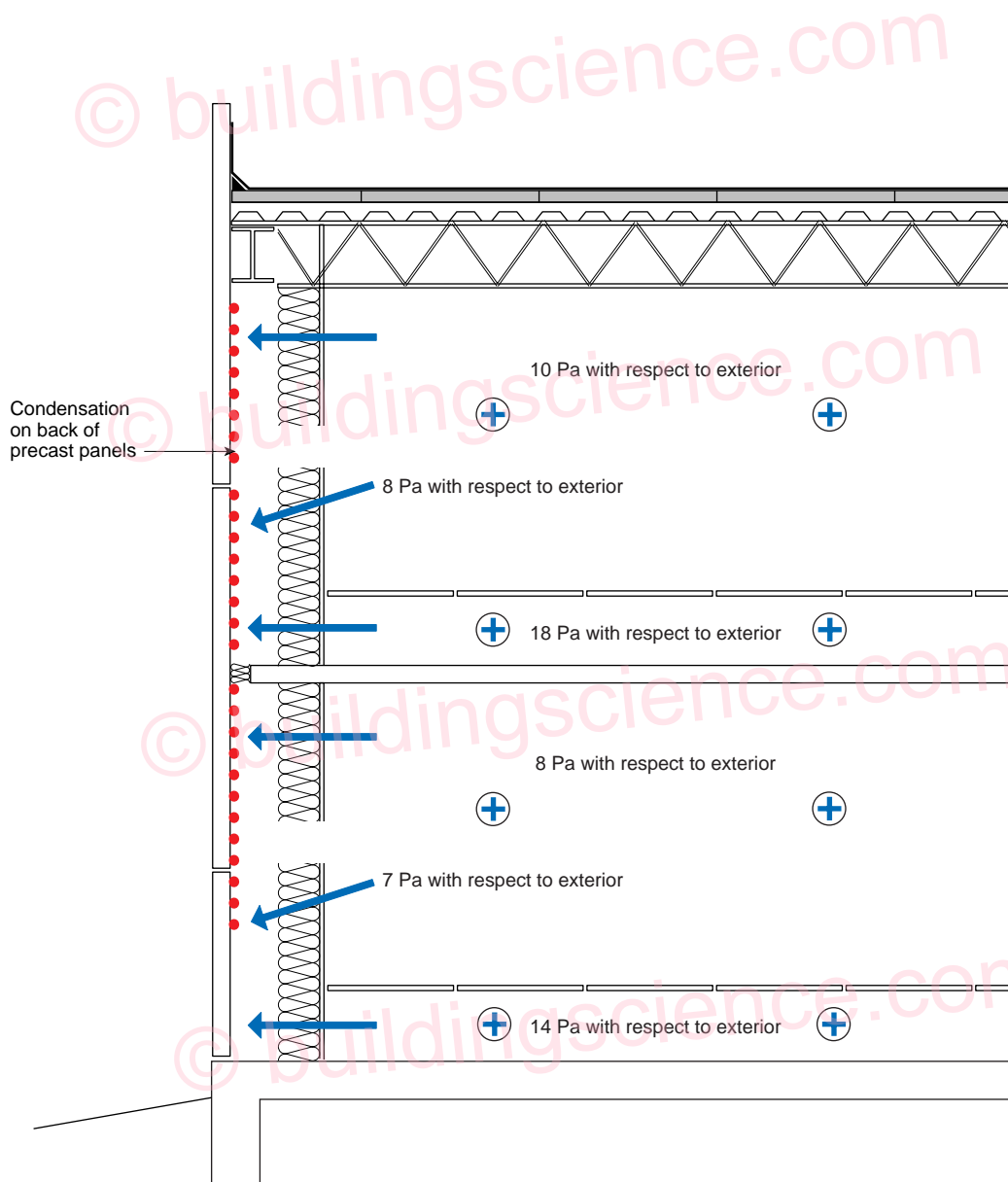


Figure 11
Unintended Pressurization of Interstitial Cavity

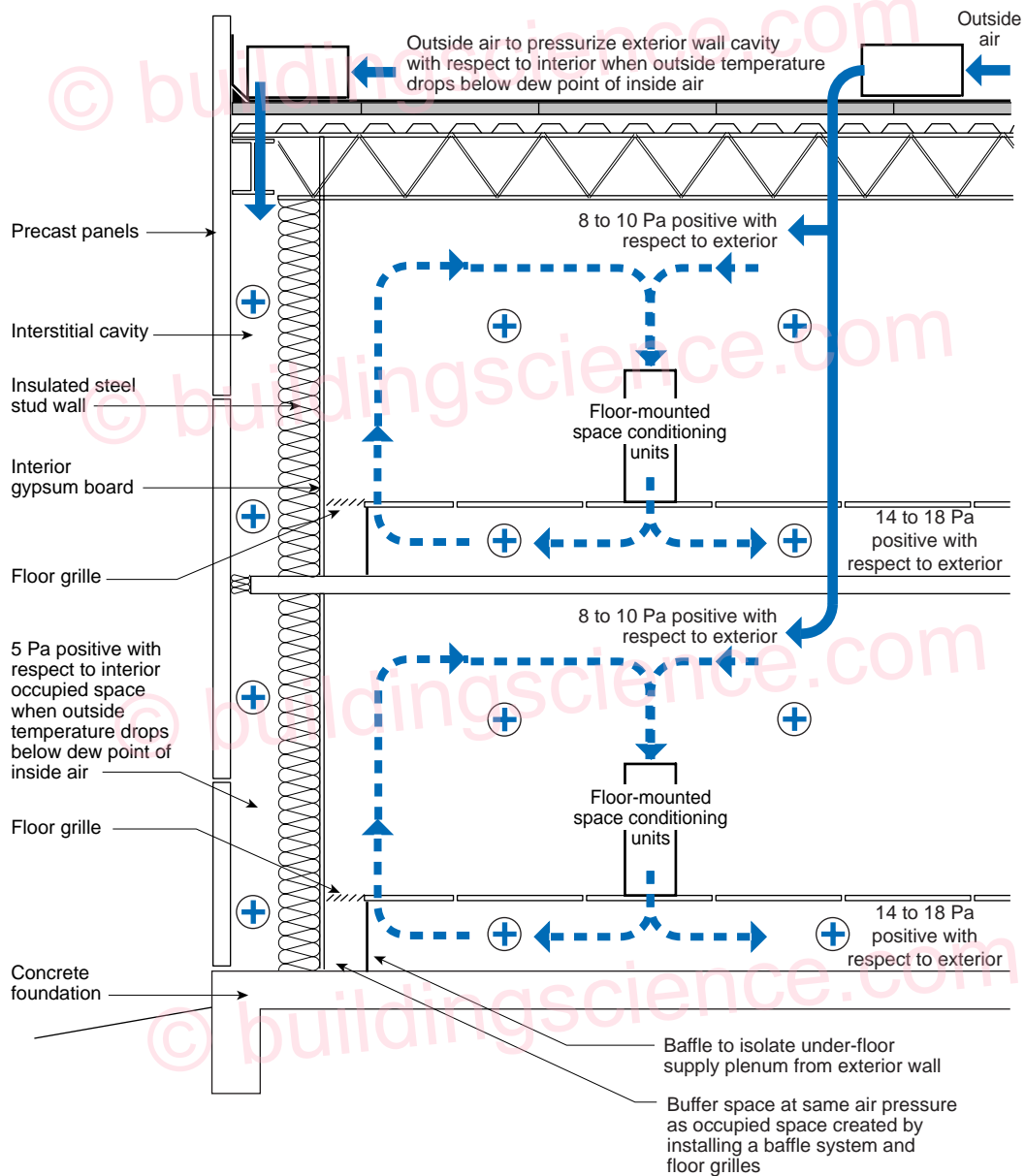


Figure 12
Modified Pressure Relationship

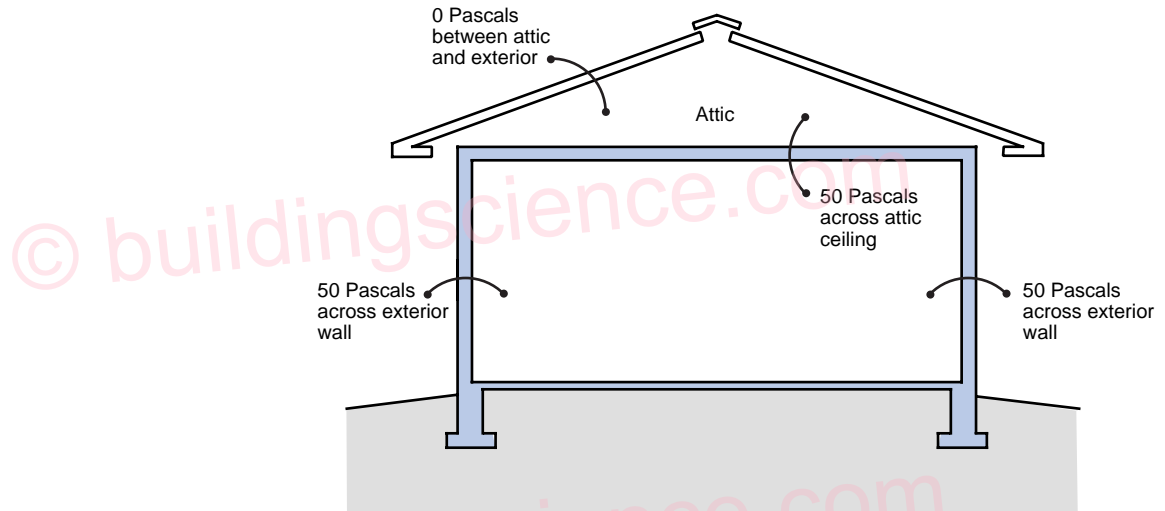


Figure 13

Well-Defined Pressure Boundary

- Pressure boundary defines effective building envelope environmental separator

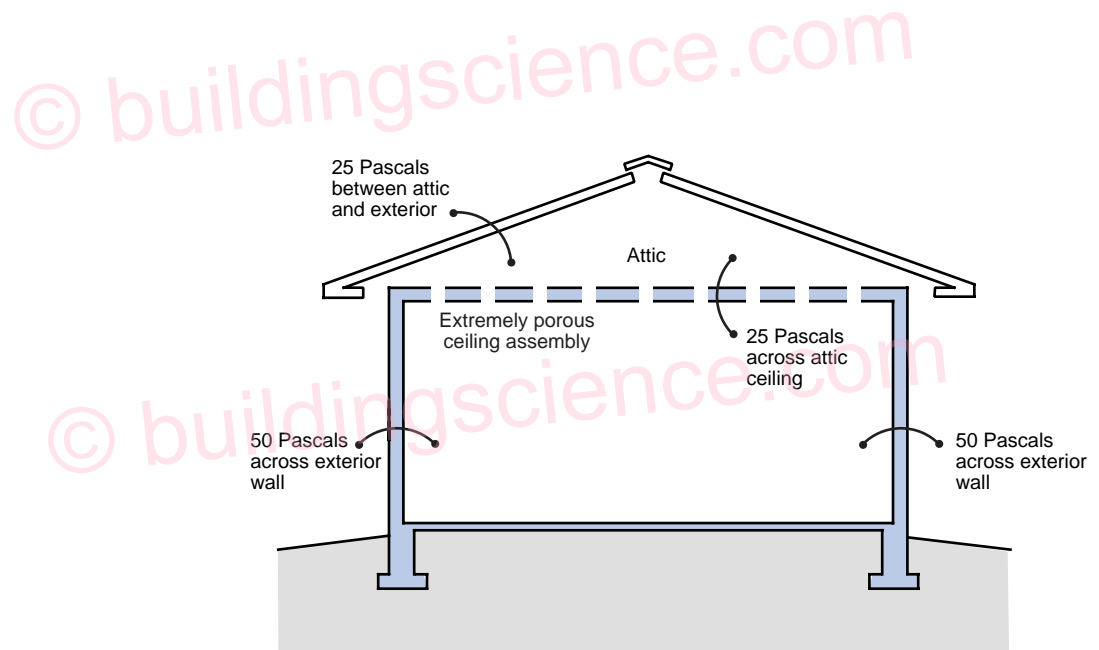


Figure 14

Poorly-Defined Pressure Boundary

- Pressure boundary poorly defined — ineffective at ceiling
- Pressure boundary not continuous at ceiling

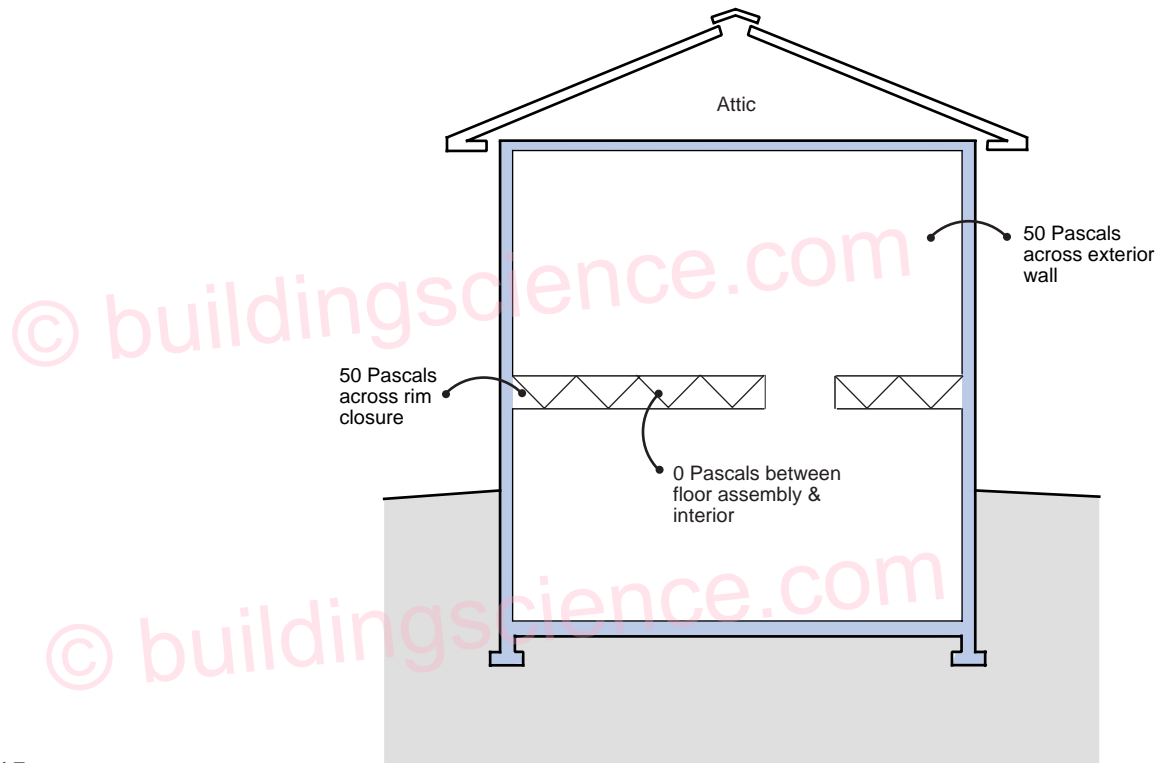


Figure 15

Tight Rim Closure

- Floor assembly “inside” well-defined pressure boundary
- Pressure boundary continuous at rim closure

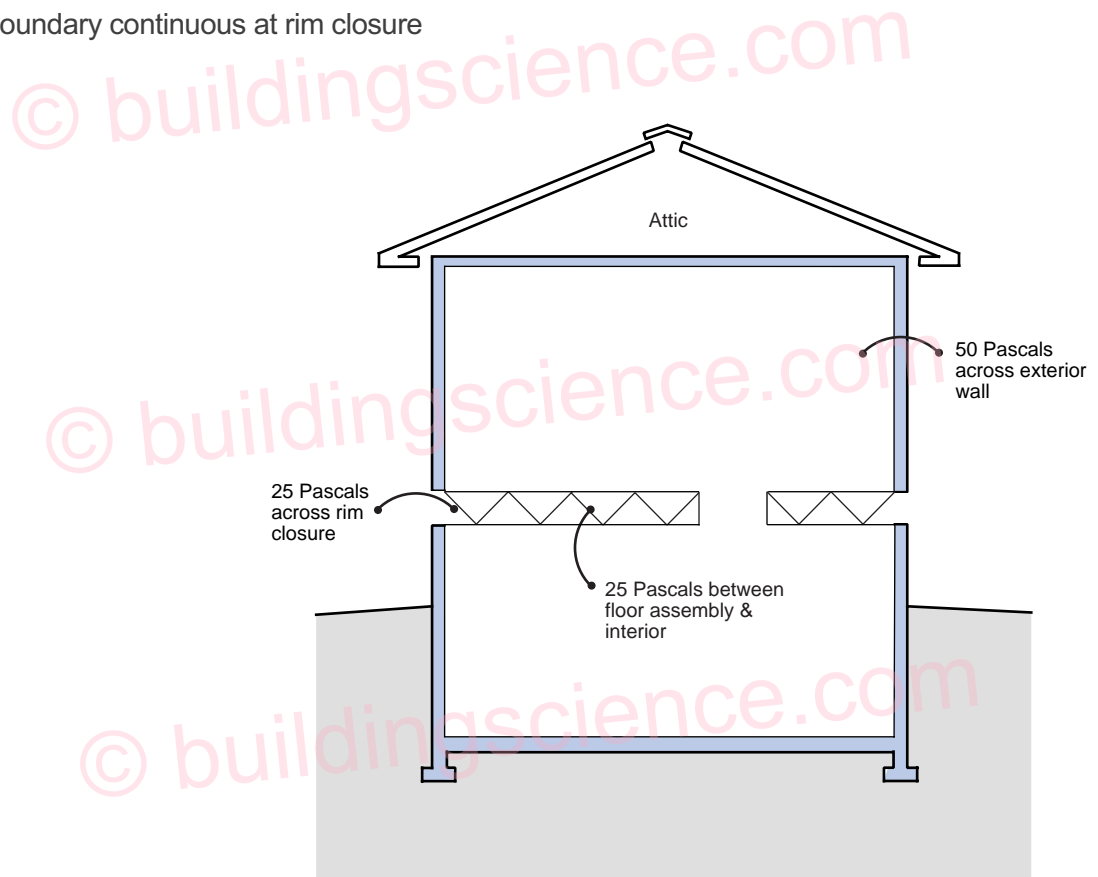


Figure 16

Leaky Rim Closure

- Floor assembly “outside” pressure boundary
- Pressure boundary not continuous at rim closure

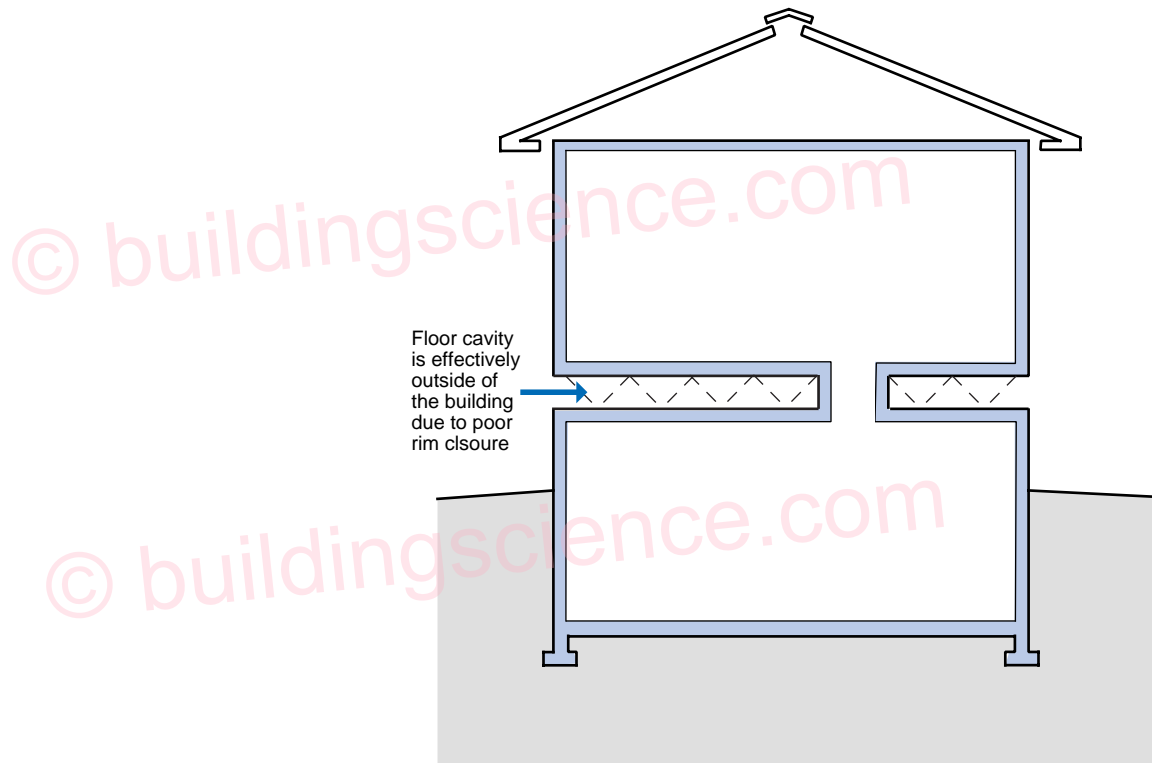


Figure 17

Pressure Boundary at Interior Floor

- Pressure boundary not contiguous with building envelope thermal boundary

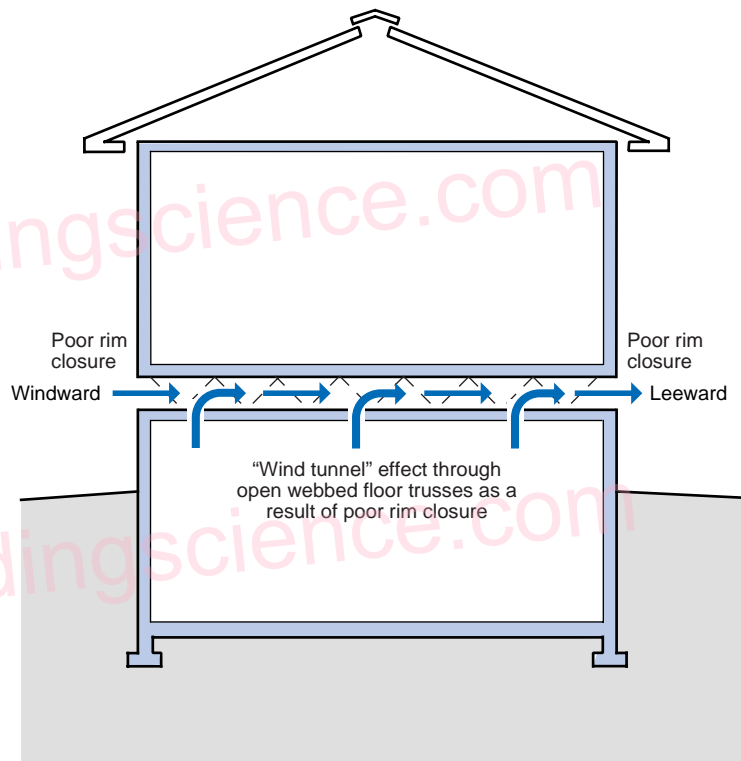


Figure 18

Wind Tunnel Effect



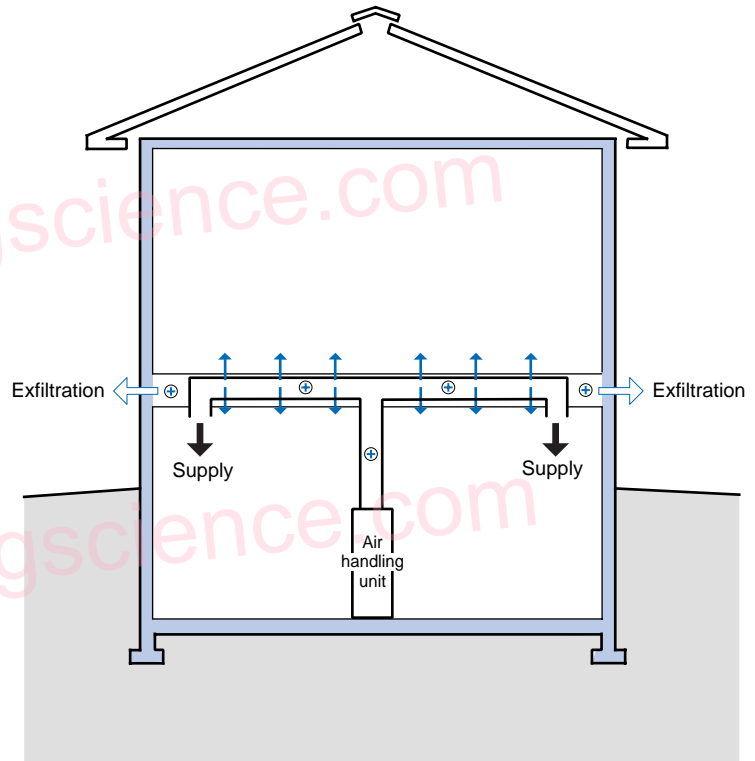


Figure 19

Supply Duct Leakage

- Leakage of supply ducts into floor space pressurizes floor space leading to exfiltration at rim closure

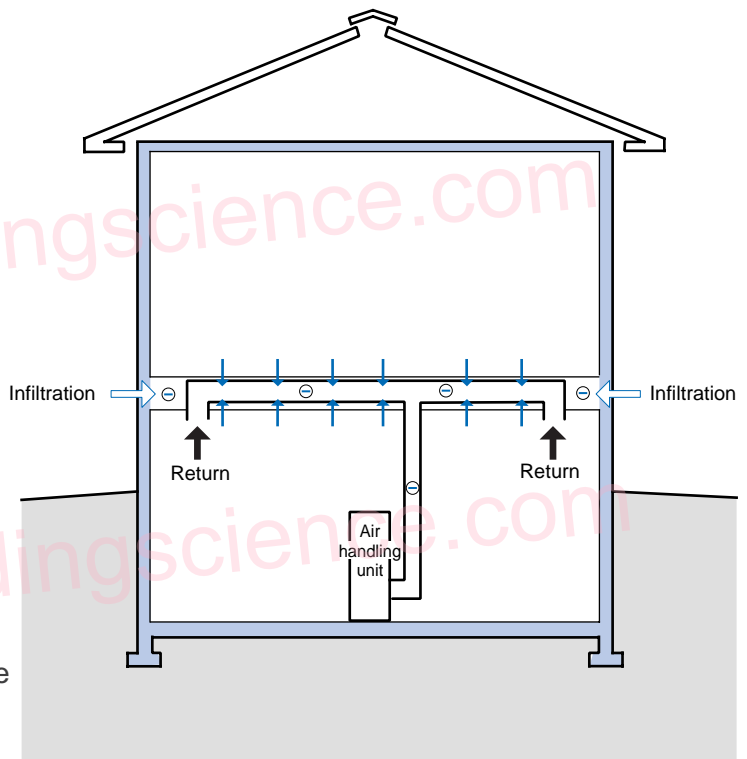


Figure 20

Return Duct Leakage

- Leakage of return ducts into floor space depressurizes floor space leading to infiltration at rim closure

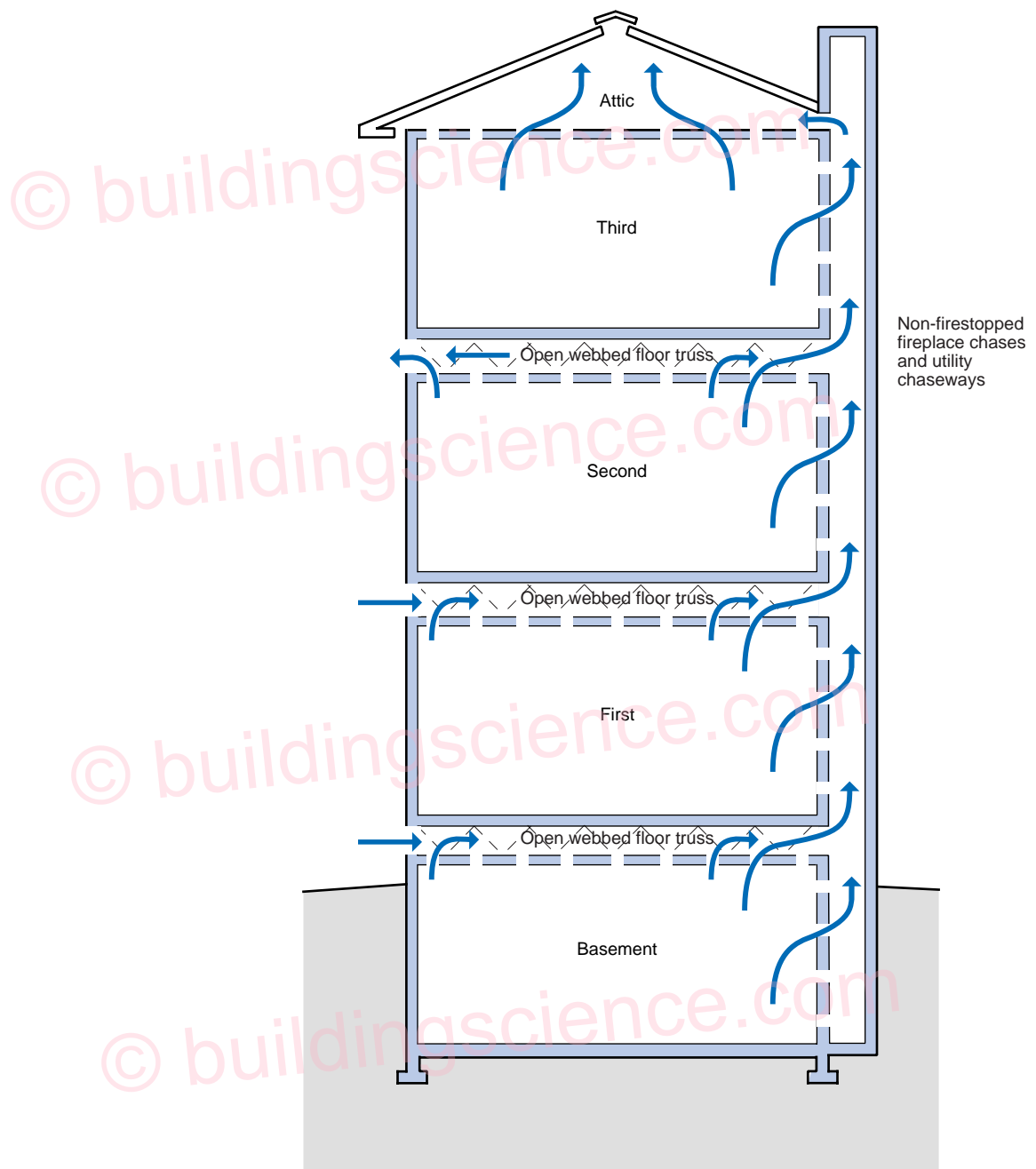


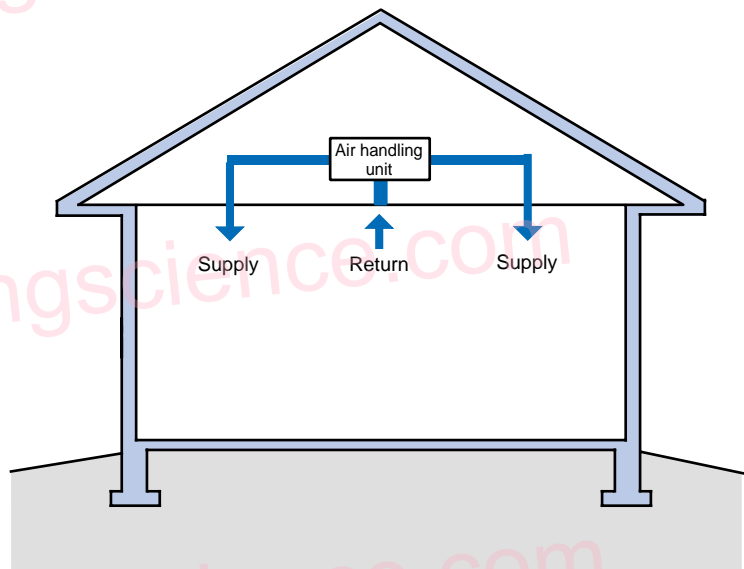
Figure 21

Combined Floor Paths and Pressure Drivers

- Vertical and horizontal communication of open webbed floor trusses through fireplace and utility chaseways
- Pressure drivers are wind, the stack effect and the operation of the HVAC system

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Figure 22

Unvented-Conditioned Attic

- The air handling unit is located in an unvented, conditioned attic
- The attic insulation is located at the roof deck

About the Author

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