Joseph Lstiburek, Ph.D., P.Eng, ASHRAE Fellow

Building Science

Building Science and the Building Enclosure

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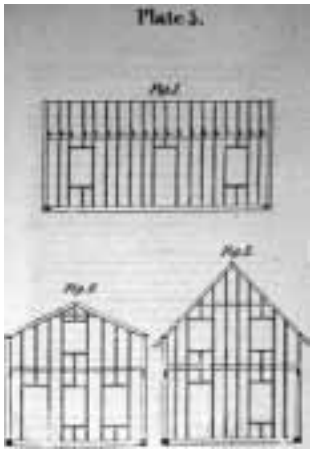
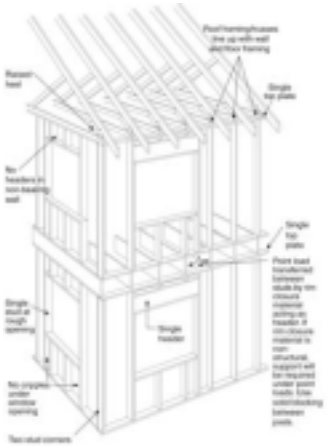
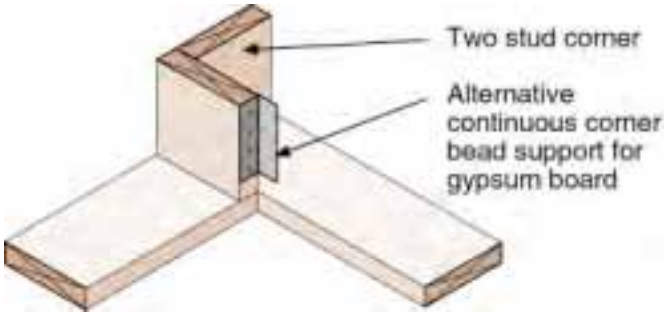
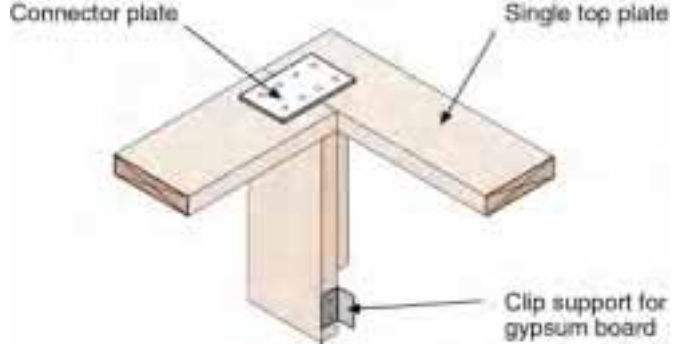
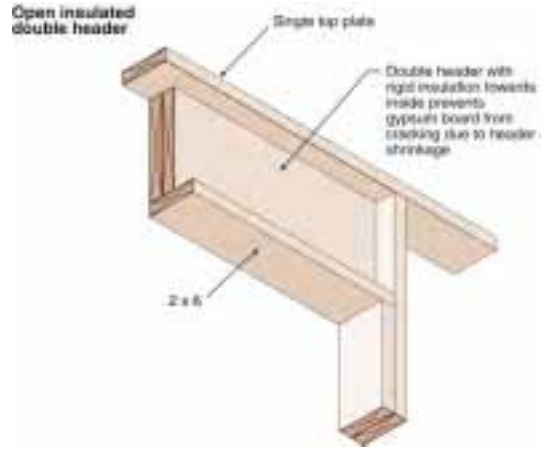


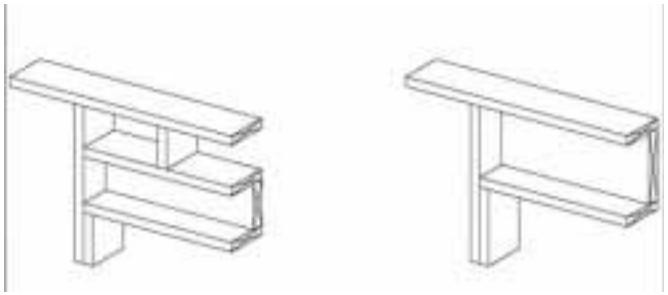






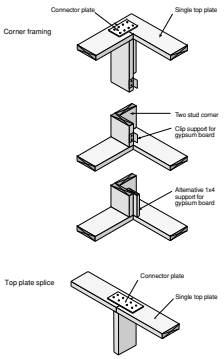

Single top plate
Single header with cavity left open to be insulated from interior
2 x 6


Open insulated double header
Single top plate
Double header with rigid insulation towards inside prevents gypsum board from cracking due to header shrinkage
2 x 6



Advanced Framing System

- 2 Stud Corners

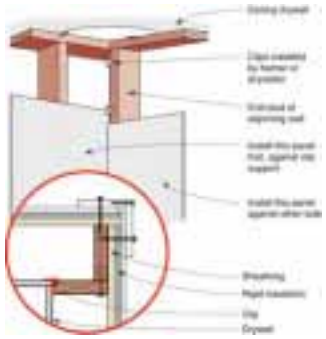


Advanced Framing System

- Insulated headers
- No header necessary at non-bearing walls

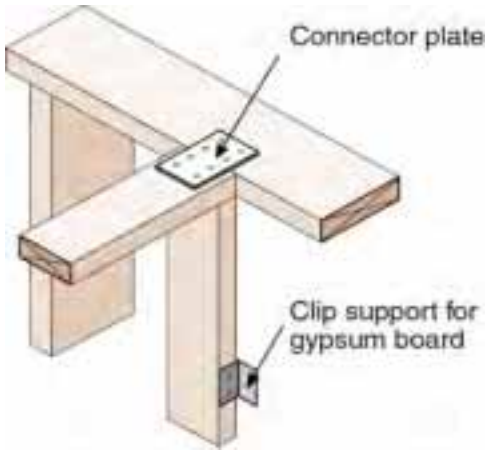
Advanced Framing System

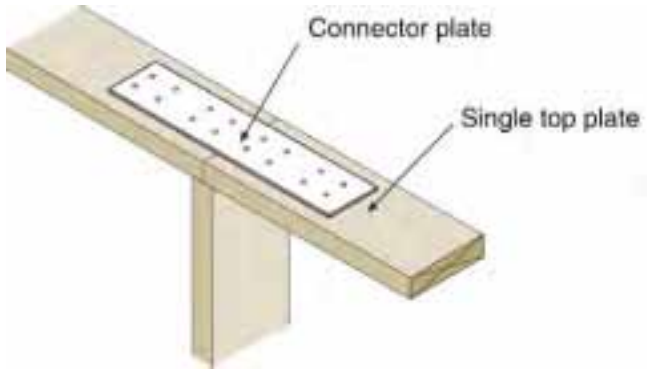
- Drywall clips allow for better installation with less drywall cracking

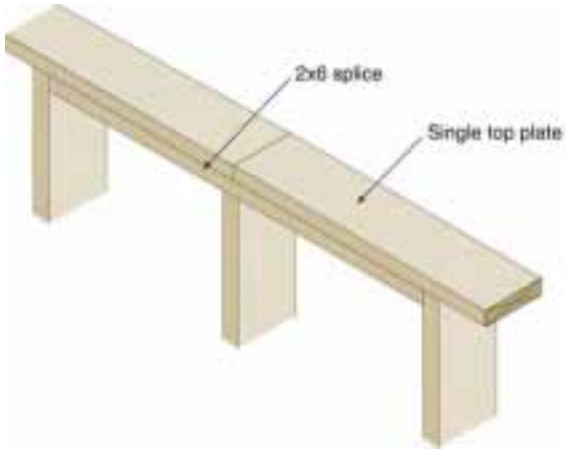


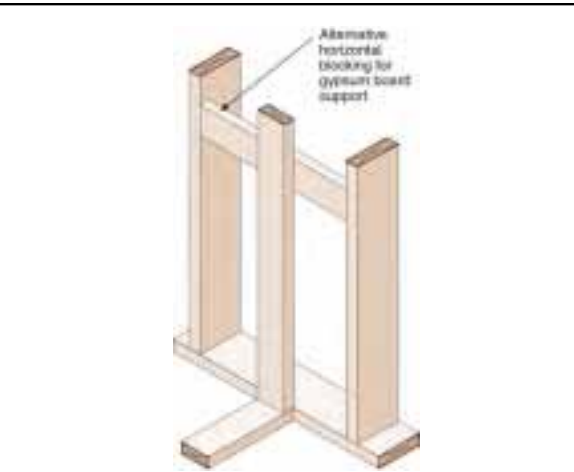
Advanced Framing System

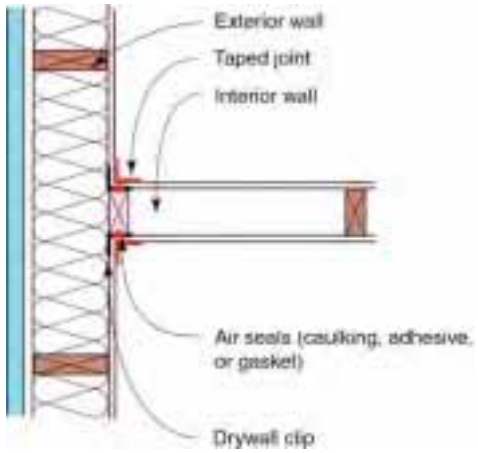
- Drywall clips at corner and intersecting wall






2x6 splice
Single top plate


Alternative horizontal blocking for gypsum board support


Exterior wall
Taped joint
Interior wall
Air seals (caulking, adhesive, or gasket)
Drywall clip


DOW

CASE STUDY

- HOUSE SPECIFICATIONS
  - Conditioned Floor Area 2,495 sq ft
  - Total Floor Area 2,910 sq ft
  - Typical Wall Height 9'-11 ½"
  - Total Conditioned Volume 24,850cu ft
  - Length of Exterior Wall 252 ln ft
  - Length of Interior Wall 340 ln ft

CASE STUDY

- 2x4 16" oc WALL

	8'Studs	Bd Ft	Cost
– Ext Wall	467	1634 bd ft	$ 866
– Ext Plate	95	331 bd ft	$ 175
– Int Wall	715	2502 bd ft	$1326
– Int Plate	126	446 bd ft	$ 237
– Header		273 bd ft	$ 145
– **TOTAL WALL FRAME COST**		**$2749**	

CASE STUDY

- 2x6 24" oc ADVANCED FRAME WALL

	8'Studs	Bd Ft	Cost
– Ext Wall	238	1312 bd ft	$695
– Ext Plate	63	347 bd ft	$183
– Int Wall	279	977 bd ft	$518
– Int Plate	85	298 bd ft	$158
– Header		148 bd ft	$78
– **TOTAL WALL FRAME COST**		**$1632**	

CASE STUDY

- WOOD FRAME WALL SUMMARY

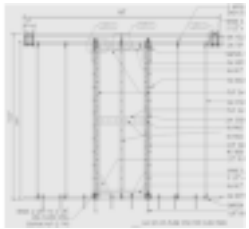
	2x4	2x6	REDUCED BY
– 8' Studs	1403	665	(-738 / -52%)
– Bd Ft	5186	3082	(-2104 / -40%)
– **COST**	**$2749**	**$1632**	**(-$1117 / -40%)**

Shear Panel

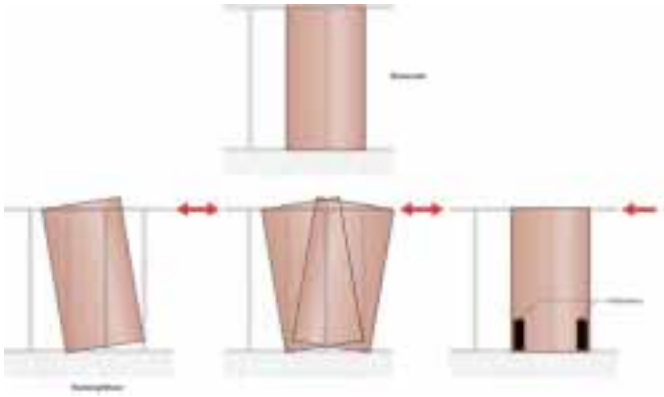
Shear Panel

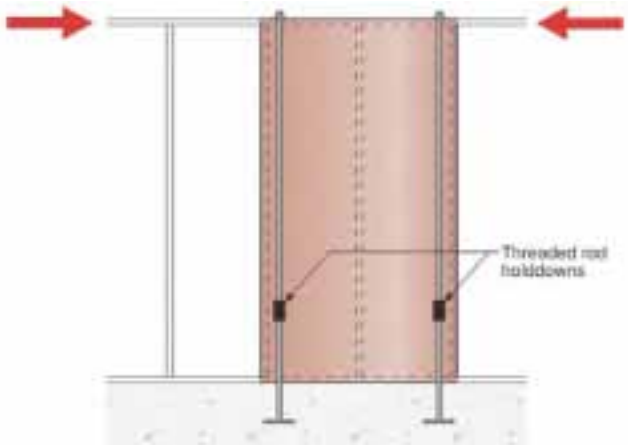
Seismic Testing

•Work with CERL (the US Army research laboratory), and BSC to facilitating code approval of advanced framing techniques by the Division of the State Architect in California, and other earthquake and high wind loading locations.



•Full scale assemblies have been tested under the new dynamic seismic loading protocols developed after the Northridge earthquake. New non-proprietary shear panels are now available for use that allow for advanced envelope design

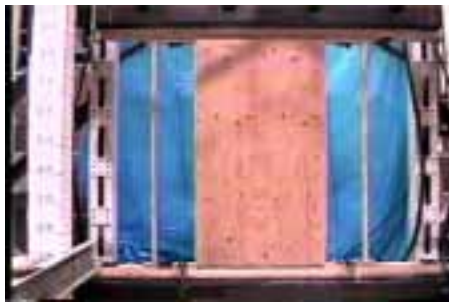




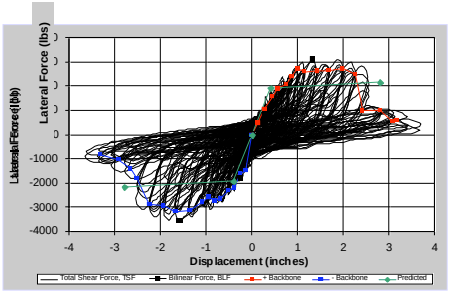
2 Story Aligned

Standard Plywood Panel

2x4 panel with plywood to establish baselines

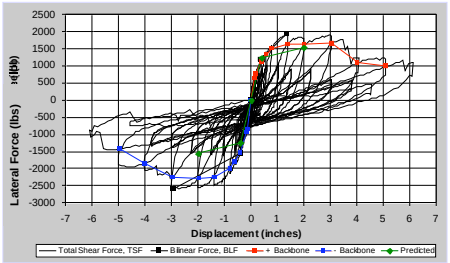


Standard Plywood Panel Performance



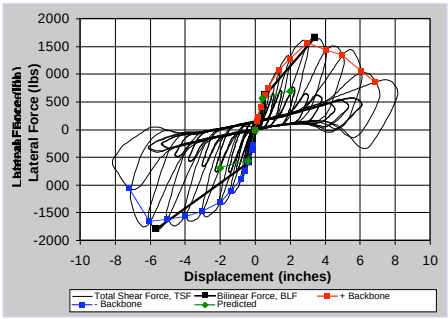
Standard OSB Panel

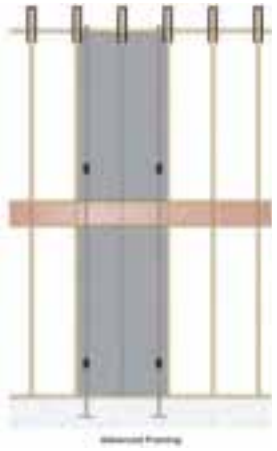
Standard OSB Panel Performance

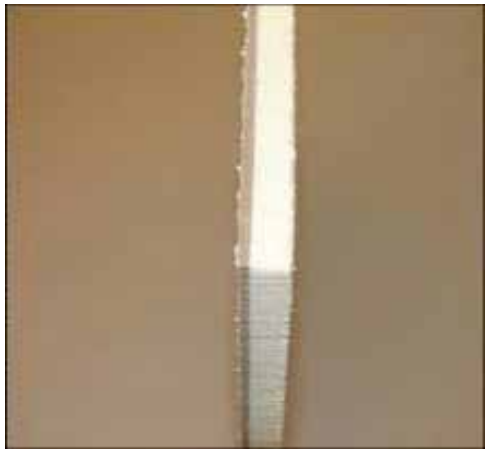


Diagonal Strap Shear Panel CURe1

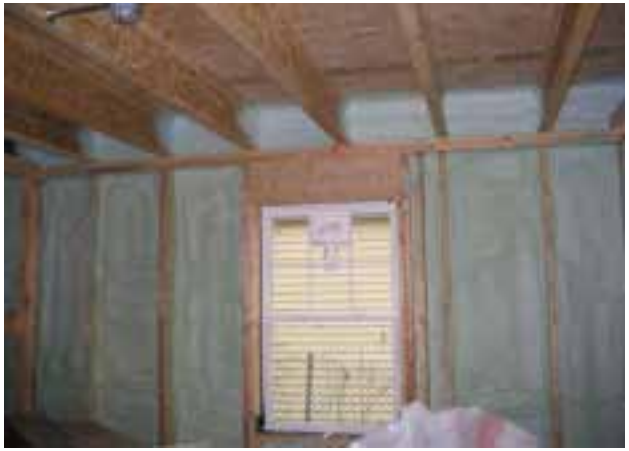
Diagonal Strap Shear Panel CURe1

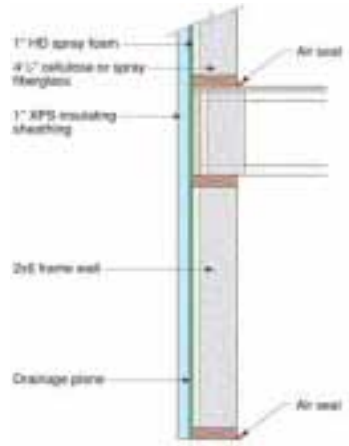







R-11 3½"
Fiberglas
Building
Insulation



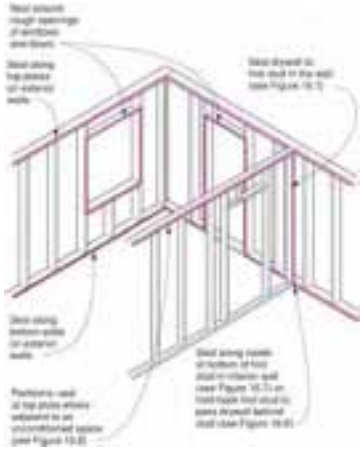

Air seal
2x6 frame wall
Drainage plane
Air seal

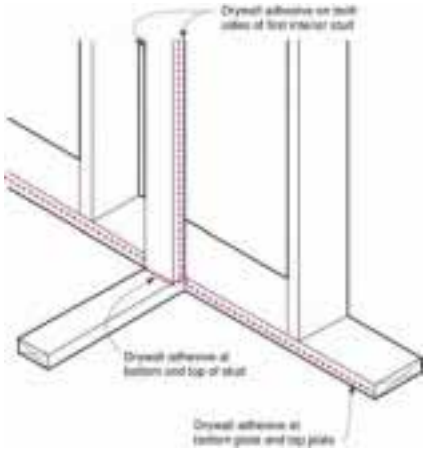

ply

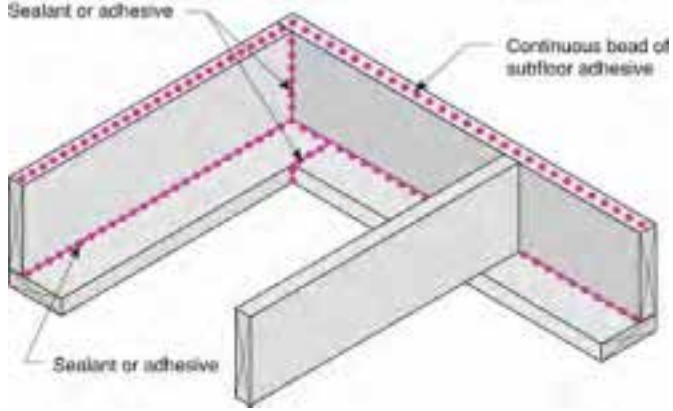

Thermo
ply
Thermo
ply

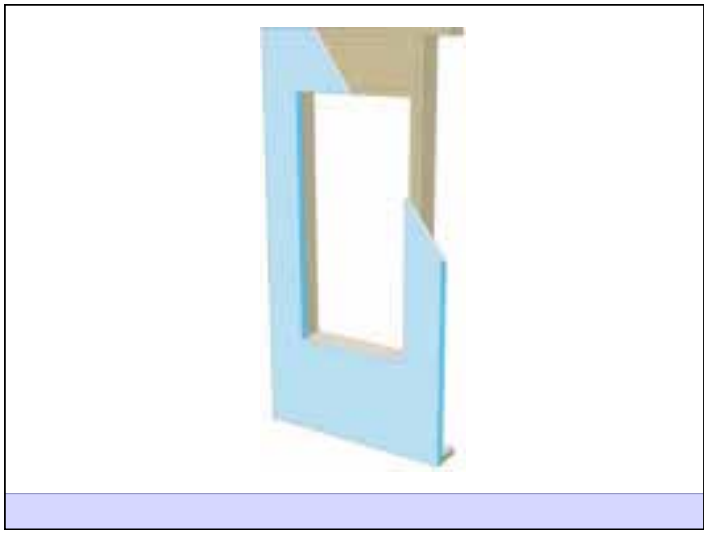

Thermo
ply

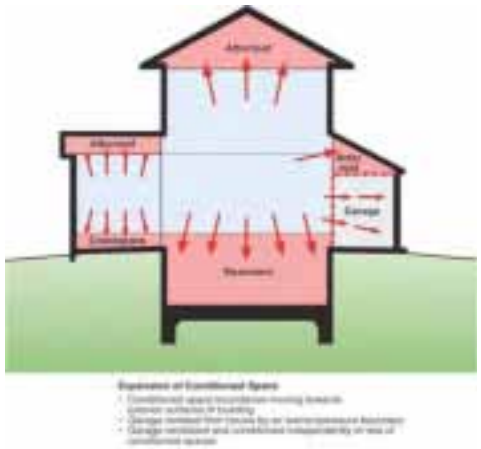

ermo-ply

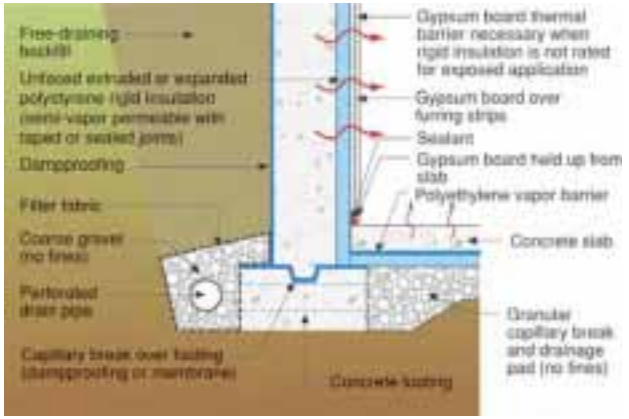


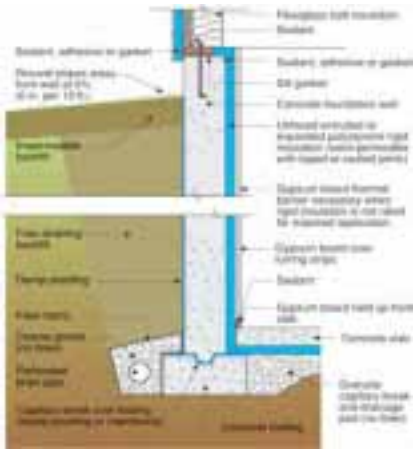


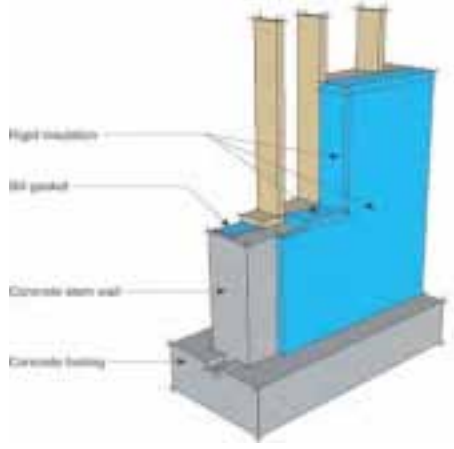


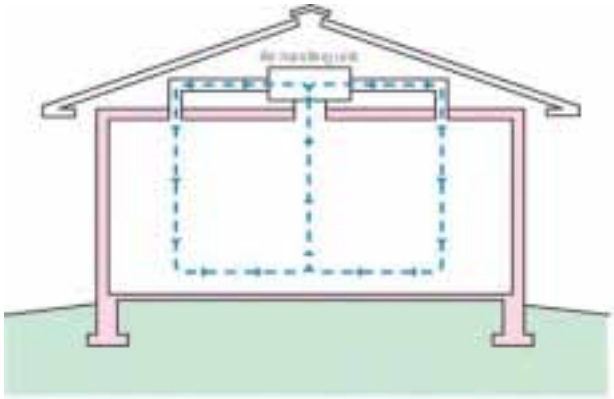




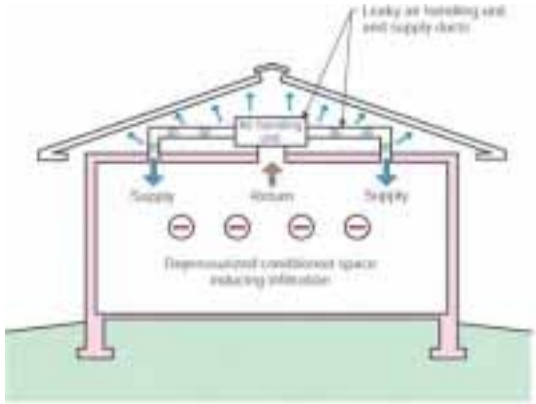








Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.



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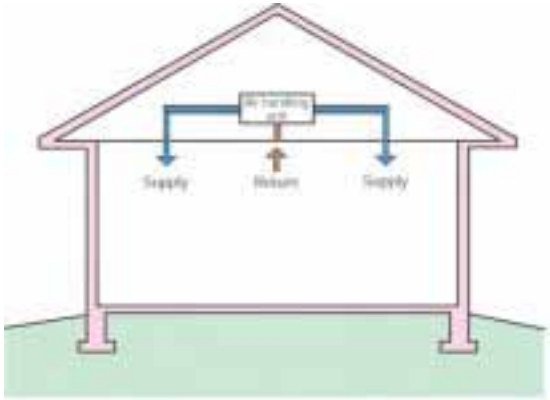

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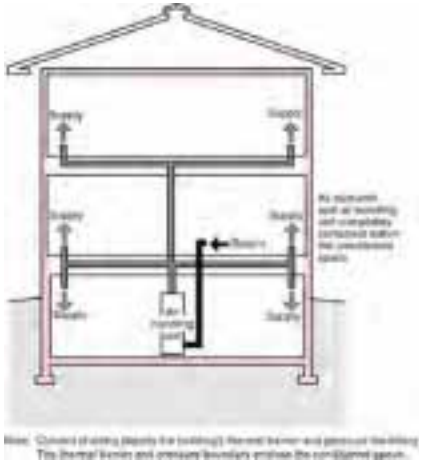

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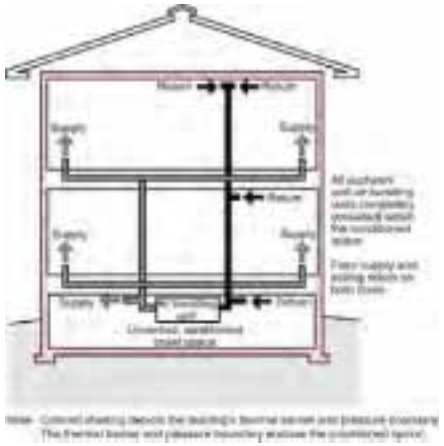

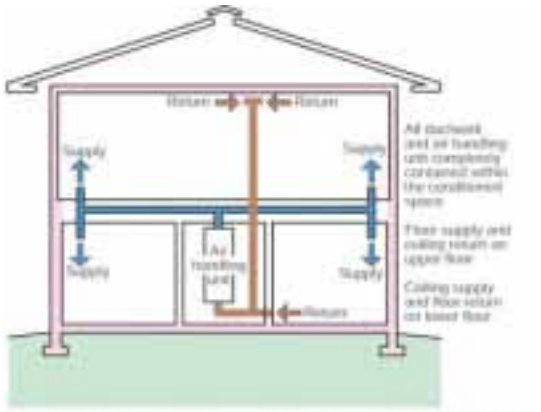

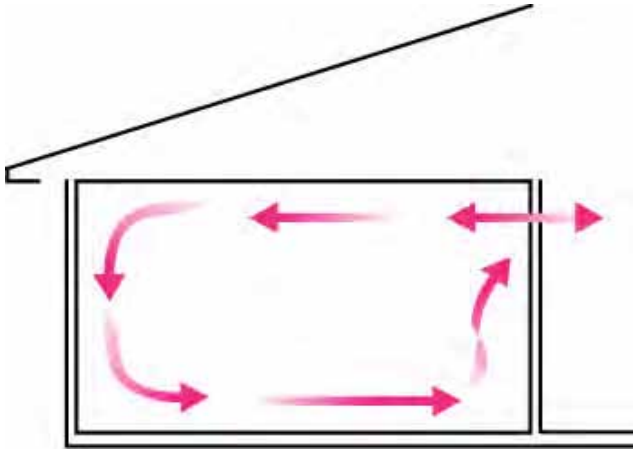

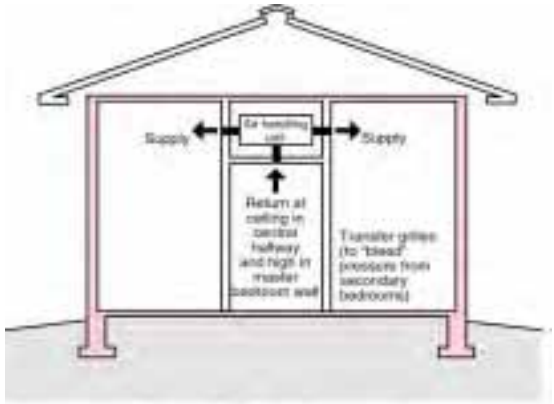

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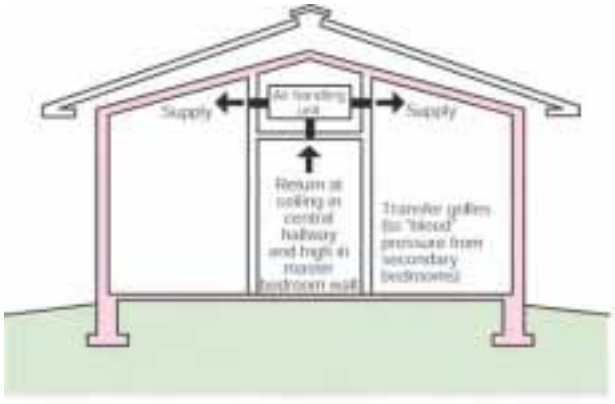

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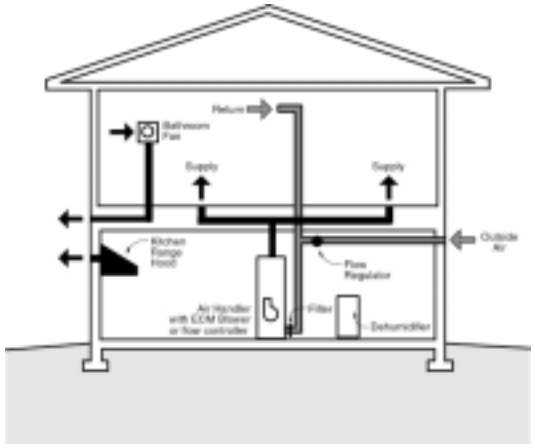
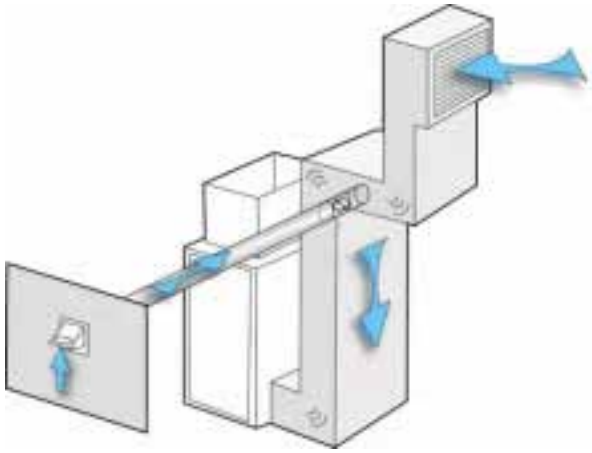
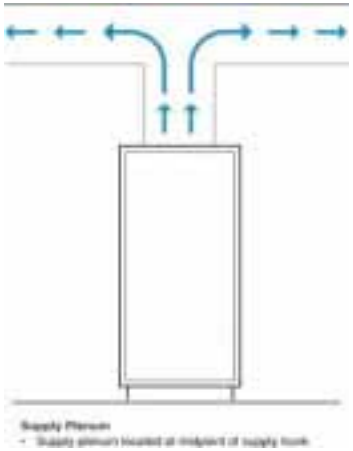
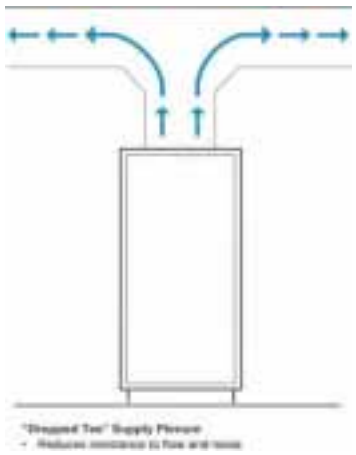
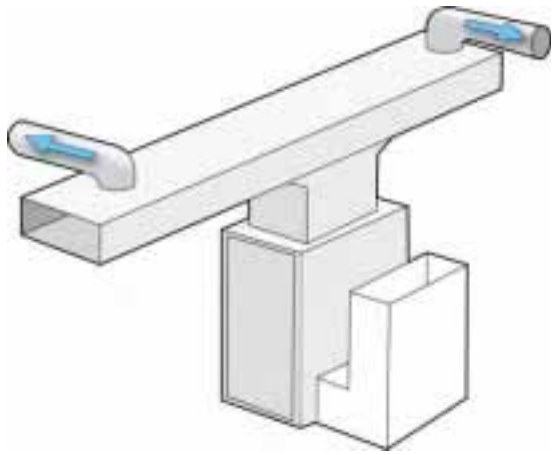
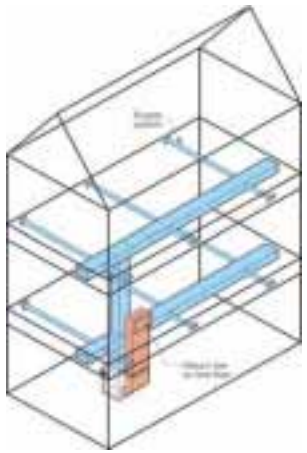

Return
Supply
Supply
Outside Air
Flow Regulator
Filter
Dehumidifier

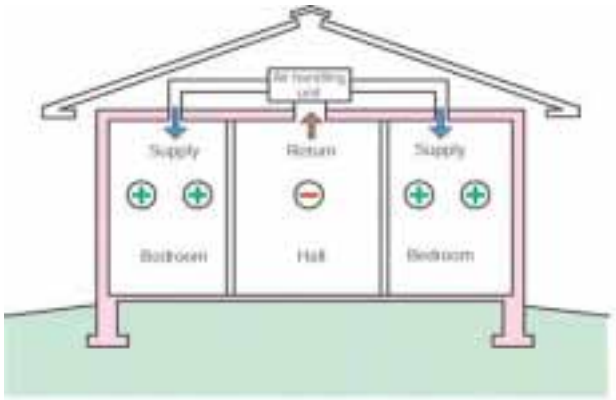












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