

CONTINUOUS INSULATION PRIMER

PART 1 – Continuous Insulation

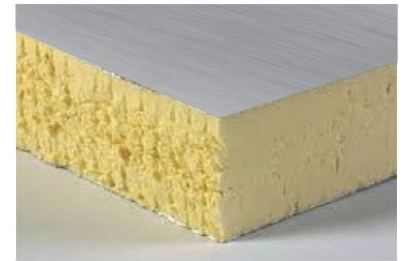
- Definition ([ASHRAE 90.1](#))

continuous insulation (c.i.): insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

- Applications: Roof, Wall, and Foundations

Kinds of Continuous Insulation

- Foam Plastic Insulating Sheathing
 - [EPS](#), [XPS](#), [Polyiso](#)
- Spray Polyurethane Foam
 - [SPF](#) (closed cell polyurethane)
- Others
 - Rock wool
 - Fiberglass boards
 - Fiberboard



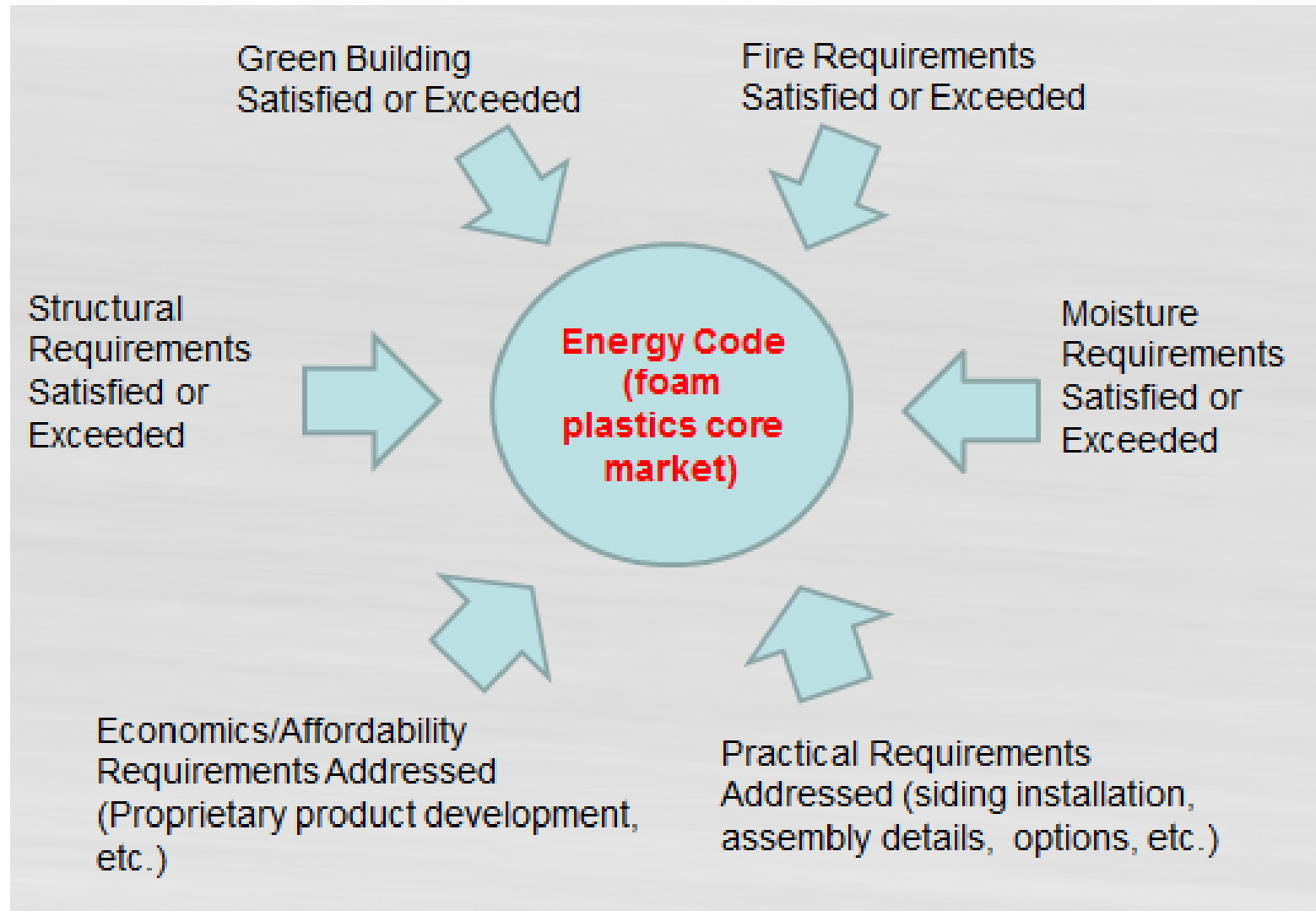
CI History & Experience

- In early 1900's, solid wood board sheathing was considered as a form of continuous wall insulation (HEW, 1931) (~1.2 R/in)
- Cellulosic Fiber Insulating Board ('Fiberboard') is a form of continuous insulation in use since the early 1900's (~2.5 R/in)

CI History & Experience

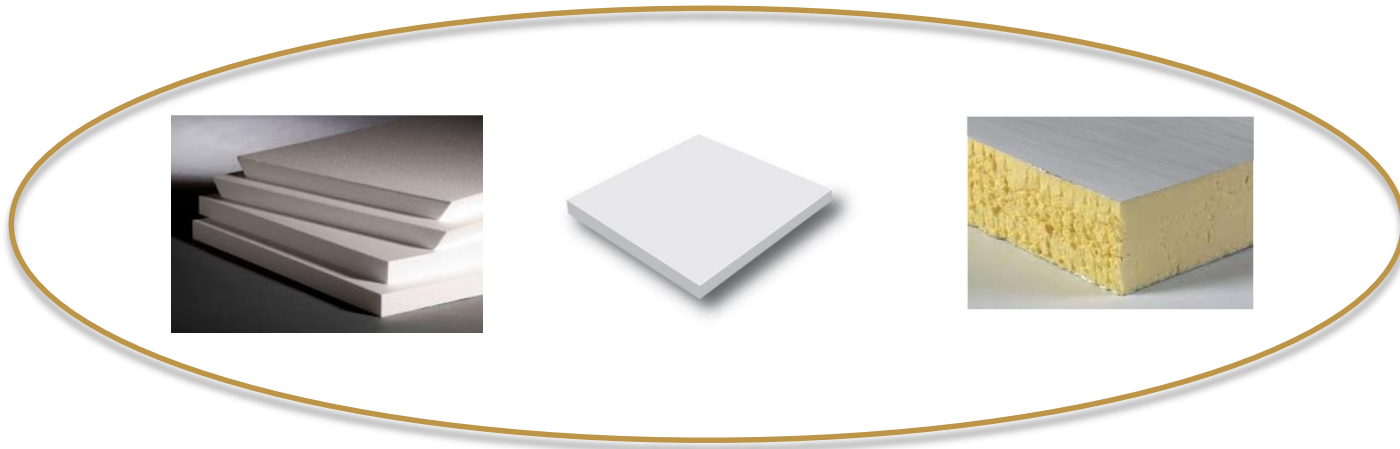
- Continuous insulation is not a new concept. Foam plastic insulating sheathing has been successfully used in this application for more than 50 years.
 - Foam sheathing has been used as continuous insulation for low-slope roofs since the 1940's (~4-6 R/in)
 - Wall applications of continuous insulation saw increased interest after the 1970's oil crisis

Role of CI and Various Requirements for Appropriate Use



Foam Plastic Insulating Sheathing (FPIS)

- Expanded Polystyrene (EPS), [ASTM C578](#)
- Extruded Polystyrene (XPS), [ASTM C578](#)
- Polyisocyanurate (Polyiso), [ASTM C1289](#)



R-value per Inch

TABLE 1. Examples of Minimum R-Value Per Inch for Common Types of Continuous Insulation (Foam Sheathing)

Continuous Insulation Material Type	R-value per Inch of Thickness
EPS (ASTM C578, Type II)	4.0
XPS (ASTM C578, Type X)	5.0
Polyiso (ASTM C1289, Type I)	6.0

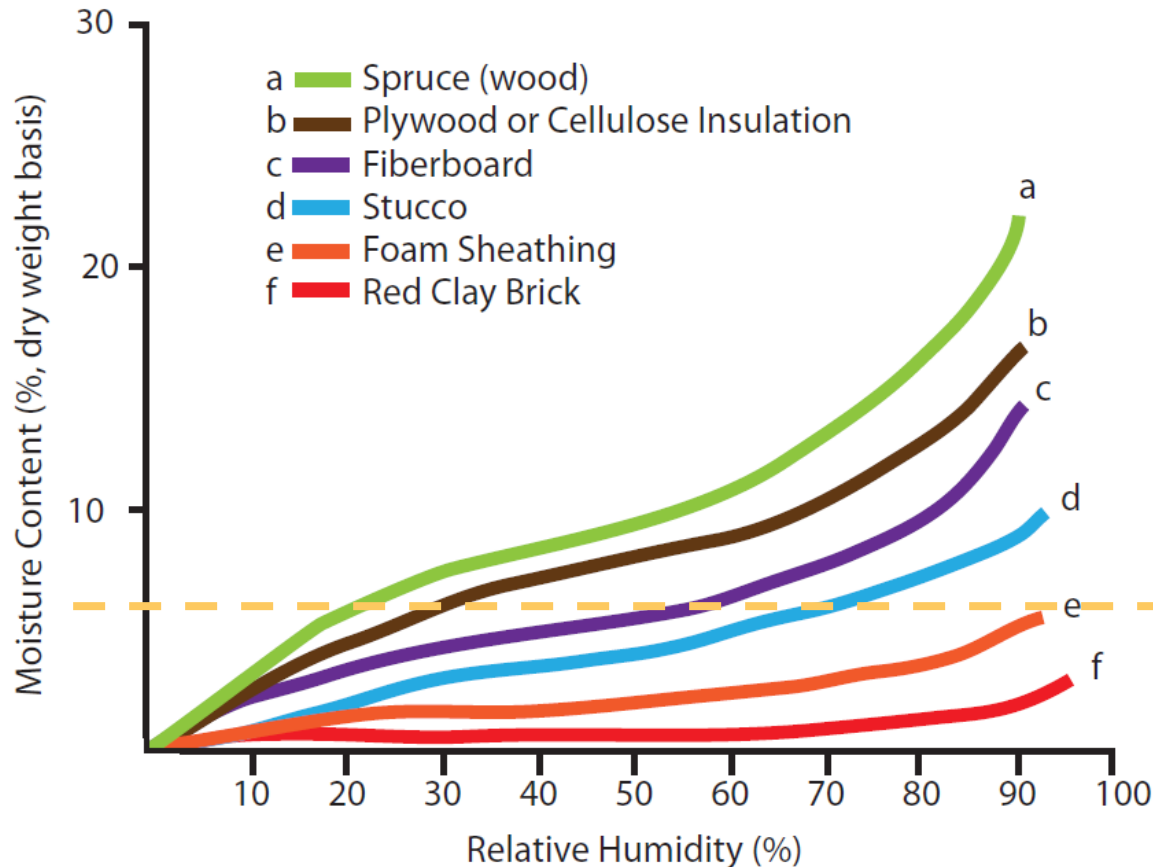
- Consult with FPIS manufacturer for specific values.
- Values shown are representative minimum values.

Water Resistance

Table 1 – Standard Test Methods and Criteria for Moisture Absorption Resistance Characterization of Various Insulation Board Materials

Insulation Material Type	Maximum Moisture Content (% volume basis)	
	ASTM C272 (24 hr water immersion test)	ASTM C 209 (2 hr water immersion test)
XPS (ASTM C578)	0.3%	n/a
EPS (ASTM C578)	2 to 4%	n/a
Polyiso (ASTM C1289)	n/a	1-2%
Fiberboard (ASTM C208)	n/a	7-10%

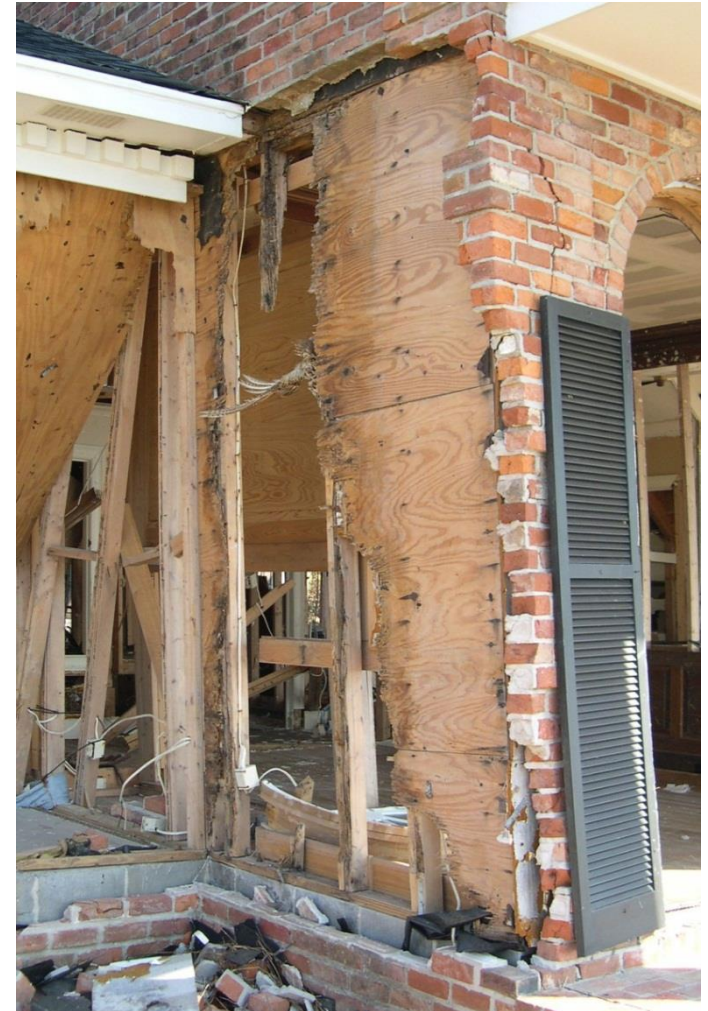
Moisture Sorption Comparison



XPS, EPS, and Polyiso all have a lower tendency to adsorb moisture than many other common building materials.

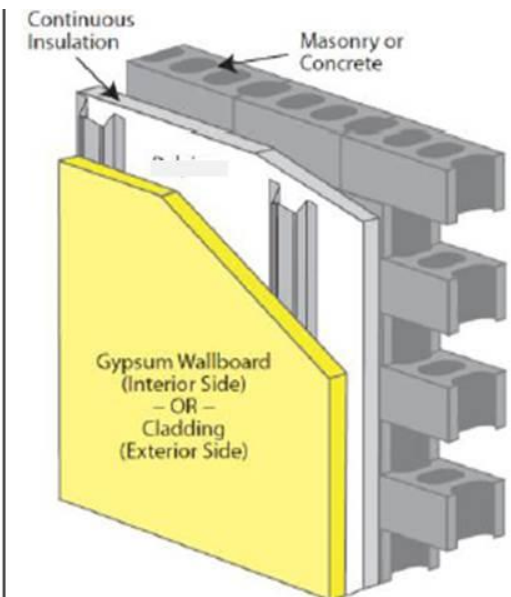
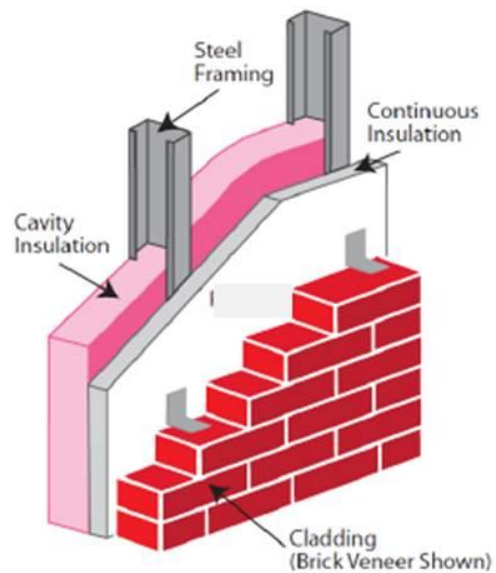
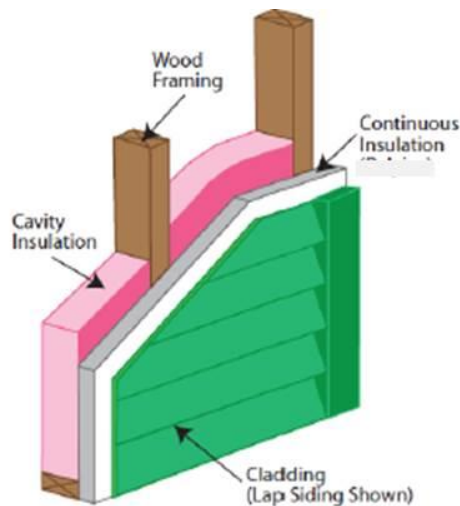
Durability

- Foam Plastic Insulating Sheathing (FPIS)
 - Does not rot, decay or corrode
 - Not food for termites
 - Can be used to protect moisture sensitive sheathing and framing materials
- Other wall sheathing
 - May be prone to moisture damage without adequate protection



Wall Applications

- Adaptable to a variety of exterior wall construction types, cladding types, and building types



Wall Functions of CI

- Continuous Thermal Insulation (CI)
 - Water Resistive Barrier (WRB)
 - Air Barrier (AB)
 - Water Vapor Control (WVC)
- *The code compliant application of the above functions will be covered later in this presentation*

Going beyond minimum code with CI

- Zero Energy
- WRB
- AB
- WVC



Building Science Corporation
NIST Net Zero Energy Research Home

Topical Resources for Parts 2 & 3

Topic	Resource (link)
U-factor	http://appliedbuildingtech.com/calculator.html
Fire	TER No. 1202-01 , TER No. 1202-03 , TER No. 1202-04
Bracing	TER No. 1410-07 (not online yet)
Air Barrier	TER No. 1410-06
WRB	TER No. 1410-05
Vapor Control	TER No. 1309-02 (not online yet)
Wind Pressure	ANSI/SBCA FS100-12
Detailing	TER No. 1205-05
Air-space R-value	Tech Matters - Energy Code Compliance: Thermal Resistance of Air Spaces Behind Exterior Wall Coverings
Termites	Tech Matters – Analysis of and Recommended Actions for Termite Related Code Change Proposals for the 2012 IBC & IRC
Vinyl Siding Over Foam	TER No. 1006-01 (pending updates)