Construction Sequencing for Minimum Infiltration

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Overview

- Project: 300 SF cottage
- Primary Purpose: Achieving .6 ACH50
- Secondary Purpose: Experimentation
- Skill Level: Owner/Builder (25 years), long-time HERS Rater
- Fun Fact: Cohen+Duclos Method
Project Basics

- 10” slab on grade with 4” EPS (R-20)
- 8” above-grade stem wall with 3.5” EPS (R-21)
- 2x6 24” O.C. fiberglass + 2” exterior mineral wool (R-32)
- 6” SIP roof + 2” exterior mineral wool (R-39)
- Electric resistance heat
- Solar thermal DHW + gas tankless backup
- Lunos e2 HRV + separate kitchen/bath exhaust fans
- 2+ kW solar PV
Section

- 300 SF exterior
- 240 SF 1st floor
- 95 SF loft
- 180° south
- ACH50 target: 16 CFM50
Construction Sequencing

- Hire out slab, framing, sheathing, SIP roof: one door opening, weak link is top of stem wall/air barrier transition
- Install exterior weather/air barrier
- Eave framing
- Cut out window openings and flash them
- Install windows
- Test various penetrations to determine affect
- Test ACH50 at each stage
Stem Wall

- RGuard Cat5 Rain Screen
- RGuard Fast Flash
- RGuard Joint & Seam Filler
- Silicon caulk
- Air/Weather Barrier
- SIGA tape
- 10 mil Vapor Barrier
- Stainless termite shield/counter flashing
- Type XV High-Density EPS
- Roxul Rock Board 60
- Blown-in Fiberglass
- Type I EPS
- 4000+ psi concrete with 30% flyash and xylene waterproofing additive

Footer/Sill Detail

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Slab, Framing, Sheathing, SIPs

- CFM50 = 400 -> 109
- Spray foam in seams
Air/Weather Barrier

- CFM50 = 75 -> 20
- Smoke, blower door, rain
- Stem wall counter flashing
Windows w/Foam Gaskets

- CFM50 = 95
Windows w/Foam Gaskets and Liquid Flashing

- CFM50 = 20
Penetrations – Commercial Dampers

- CFM50 = 28 w/two dampers installed

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Last Round of Testing

- Tried to find at least 12 CFM of holes
- Removed dampers and sealed the penetrations
- Heated up interior to create delta T for IR camera
- Tried smoke analysis again
- No identifiable leaks
Next Steps

- Cover exterior with CatV weather/air barrier
- Install exterior outlets
- Install front door and seal threshold (2-3 CFM?)
- Test again with careful blower door sealing (2-3 CFM?)
- Re-examine all the stuff currently “sealed”
Lessons Learned

- There may not be any useful tools to find leakage at these low levels.
- The most sensitive instrument we have is our hands, used in conjunction with a blower door.
- It’s not that hard to seal a building shell with the right products/assemblies.
- The sequencing/assemblies worked pretty well.
- Exterior window detailing is more challenging.
- This building would pass with the new PHIUS ACH criteria.

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Thank You – Questions?

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