Updated: 27 April 2022

Envelope Air Tightness Strategies

A significant contributor to building air leakage is from exterior walls. We have had consistent success with these three methods to address air leakage through walls, which each rely on rigid sheathing as a stable substrate with long-term integrity:

1. Tape the exterior seams and edges of the plywood sheathing for continuity (in addition to a separate loose water resistant barrier), or
2. Install a fully-adhered weather resistant barrier (WRB) sheet good for both air tightness and bulk water management, or
3. Install a fluid-applied WRB for both air tightness and bulk water management.

We have found that relying on spray foam for air sealing is unreliable and cannot be corrected once it's installed. The material itself is less airtight in real life conditions than "best case" laboratory testing and doesn't address spaces outside the insulated cavities, such as mudsills over concrete stem walls, penetrations, sheathing seams, etc. We do not recommend spray foam as an air sealing strategy.

The following guidance is based on method 1. above and assumes insulated cathedral ceilings (rather than vented attics with insulation at ceiling). Include in the contract drawings:

- "Plywood [or OSB] exterior sheathing (wall/roof/subfloor) is the primary air barrier and is to cover all exterior wall and roof assembly surfaces. Tape seams, penetrations, and edges to adjacent materials to ensure air barrier continuity using an acrylic air sealing tape, *SIGA Wigluv* or equal."
    - See Appendix B for example air sealing tapes.
    - Rafter tails and other situations can create challenges. This labor can be creatively avoided by visualizing the path of the air barrier continuity in section and collaborating with the GC on such details.
- "Perform an air leakage test and field work session under negative pressure to identify and correct air leakage defects before walls are insulated."
    - See Appendix A for an example spec. Specialty equipment (such as a blower door and associated fan) is not necessarily required and can involve only a large shop fan and portable heater(s). The details of the procedure may vary for each project. This is a few hours of time for the GC and laborers. Often the owner and architect enjoy participating. :-)

Appendix A: Recommended Specifications for Architect

Air Pressure Leakage Testing at Rough-in Phase

Use the following procedure to test for and correct air leakage in the building shell at the rough-in stage of construction. The shell is the plywood sheathing continuous with the concrete foundation and installed windows and doors. The subfloor is the shell, where the subfloor is "exterior" over a crawlspace, garage, or outdoors.

1. The objective is to measure building leakage no greater than 1.5 air changes per hour (ACH) at 50 Pa test pressure at the rough-in stage.
2. Tape wall and roof sheathing and exterior subfloor seams, penetrations, and edges joining concrete airtight using an acrylic adhesive-backed air-sealing tape such as *SIGA Wigluv* or equal [or alternate method]. Taping to concrete requires a fluid-applied primer.
3. Install and tape windows and doors at the interior between the rough opening framing and the door/window frame (to be concealed by finishes).
4. Complete first pressure test at the first opportunity once window and door installation is complete, but cavities remain open to the interior and no insulation has been installed.
5. Temporarily cover and securely air seal intentional HVAC, plumbing, electrical penetrations including conduit, and crawlspace and attic hatches to avoid interference with the test.
6. Heat the house interior to a temperature differential to the outdoors of at least 10°F. This may require using a portable heater(s) to raise the interior temperature. The best time of day for the test is morning when outside air is coldest.
7. Depressurize the house using the blower door or a shop fan placed in a plywood cut-out in a door or window opening.
8. Walk the interior of the entire house using an infrared (IR) camera to find cold exterior air leaks that are visible on the camera. Air leaks appear as blue or purple streaks. Alternatively, just feeling for leaks with a wetted hand is very effective.
9. For San Francisco Bay Area projects, IR-cameras may be loaned from PG&E's Pacific Energy Center. Alternatively, purchase an IR camera add-on for a smartphone, or a standalone device.
10. Correct air leaks using air-sealing tape or sealant on the exterior where practical. It is often time-efficient to have several laborers correcting leaks as they are discovered during the walk.
11. Test-out with the blower door to meet the leakage target specified above.

Appendix B: Air Sealing Materials

These tapes are different from bituthene-type flexible flashing. They use acrylic adhesive with no solvents or bitumen products. The tape bond gets stronger over time, rather than more brittle as the solvents escape. Some of these tapes will bond to concrete when a liquid primer is applied to the concrete. Tape is more durable than caulk because the fabric matrix absorbs tension and provides a vehicle and protective shield for the adhesive. Listed in order of preference and experience with the product/quality/cost:

TESCON Vana by ProClima

- $0.47/linear ft. retail (to $0.37 with qty. discount) from http://www.foursevenfive.com
- Vapor-open, 8 Perm (Sd value: 0.4m)
- See also *Tescon Profil* with split release paper, for window interiors

ZIP Flashing Tape

- $0.40/linear ft. retail (3.75" x 90' roll, $36 at Lowes); look at lumberyards
- $0.77/linear ft. for shorter retail rolls (3.75" x 30' roll, Amazon)
- No release paper makes it quick, with less waste
- Wider rolls with split release paper are available

SIGA Wigluv

- $0.53/linear ft. retail (less with quantity discount) from Small Planet Workshop (http://www.smallplanetworkshopstore.com/siga-wigluv-60-2-1-4-wide-exterior-air-sealing-tape/)
- Vapor-open, Sd-value <2m (EN 1931, DIN 12572)

3M All-Weather Flashing Tape # 8067

- $0.53/linear ft. retail (Amazon.com – 3/5/2022), 4" x 75' roll
- Vapor-closed, 0.2 perm

Partel Conexo Multiseal, SKU: CONEX60

- $0.39/linear ft. for 2-3/8" width x 82' (60mm x 25m) for $32
- Vapor-closed, 0.08 Perm (US)
- https://www.partel.com/collections/tapes/products/conexo-60mm-x-25m
- Multiseal SL has split release paper, $0.46/ft

Tape applicator:

- 3M P.A.-1, 3M 71601 Pack of (5) Blue Plastic Squeegee: https://www.amazon.com/dp/B0038D9282?psc=1&ref=ppx_pop_dt_b_asin_title

Sealants and Caulks

These are less expensive than tape and can be used where tape won't fit or there is a seam <1/4" that won't move over time.

- Titebond Acoustical Sealant #2892, 28 oz. tube, Ace Hardware
- DAP Dynaflex 230 clear
- Red Devil Speed Demon acrylic latex caulk
- Ace Window & Door siliconized acrylic caulk, clear

Other Products

See Beyond Efficiency's current curated list of products, including weather resistive barriers (WRBs), here: https://tinyurl.com/be-library-product-gallery