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Typical Weatherization Measures

In no particular order

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Air Sealing and Attic Prep

Primary Air Infiltration Sites

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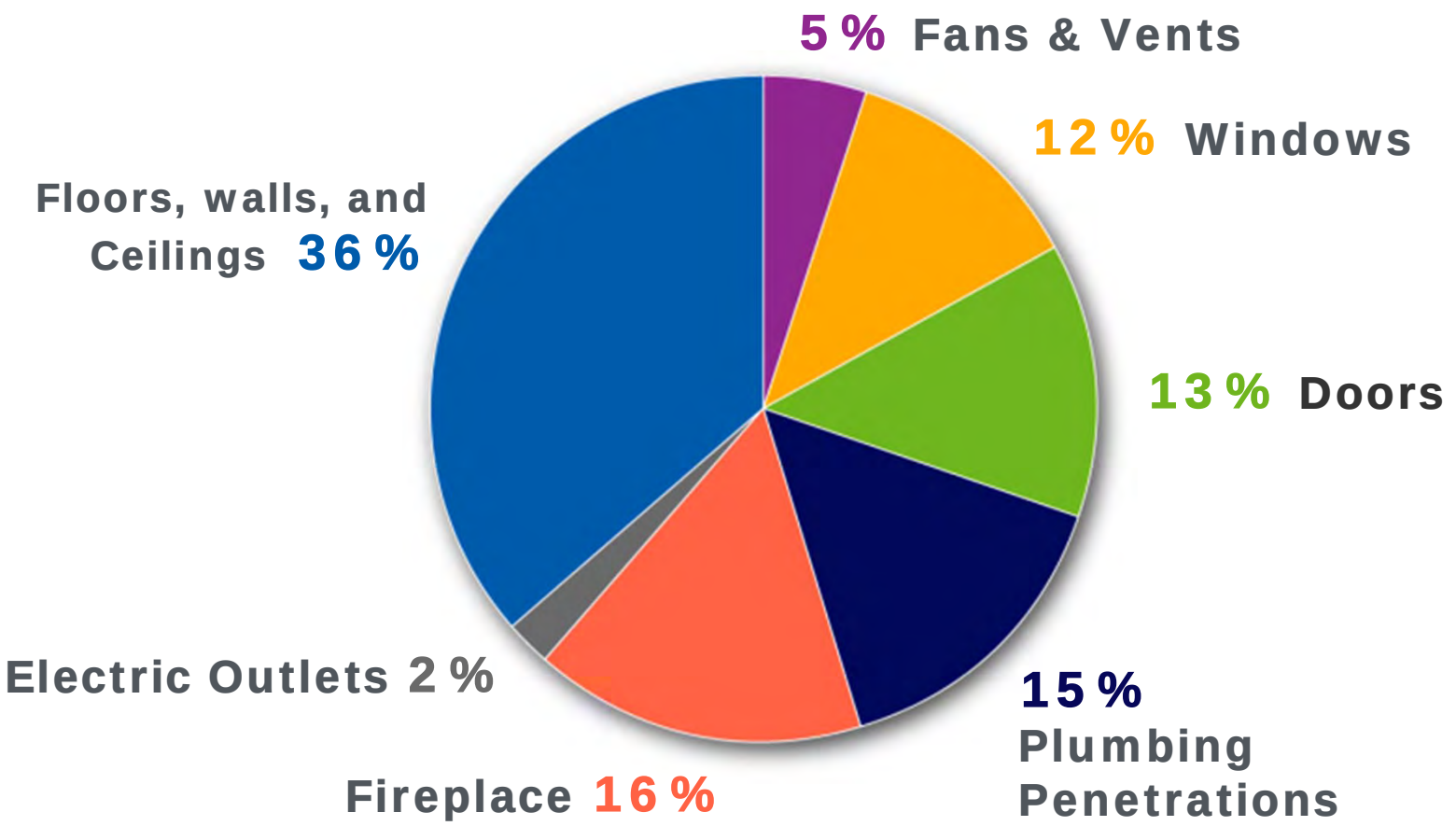
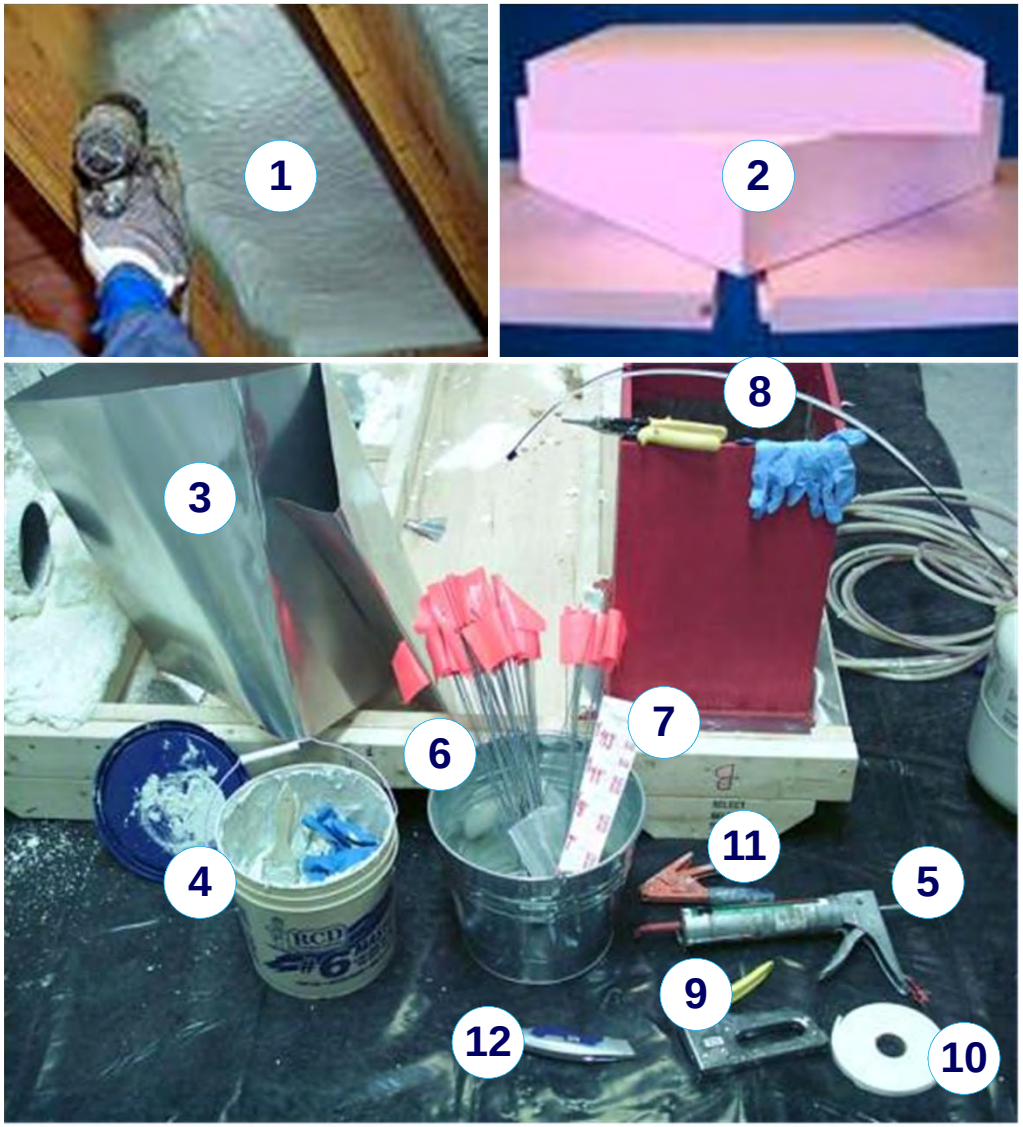


Data courtesy of the California Energy Commission

Common Tools for Attic Prep



1. Urethane foam (spray foam)
2. Foam board
3. Sheet metal/foil
4. Mastic and gloves
5. High-temperature caulk
6. Utility flags
7. Insulation rulers
8. Tin snips and zip ties
9. Stapler
10. Weatherstripping
11. Zip tie tightening tool
12. Utility knife

Finding Air Leaks

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Check typical hot-spots:

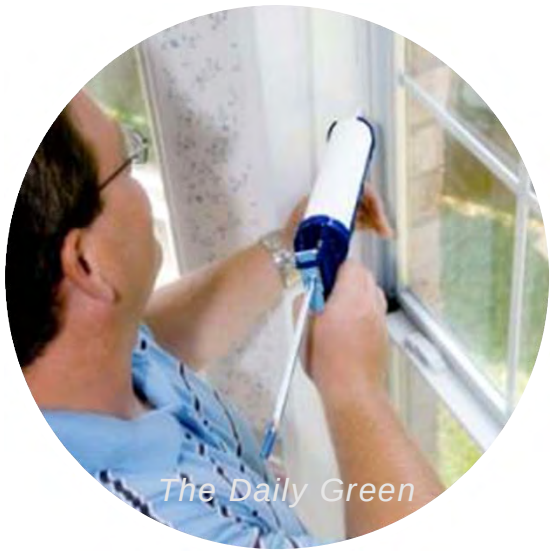
- Flues and plumbing vents.
- Wire pathways.
- Recessed fixtures (lights and fans).
- Chimney penetrations.

Signals:

- Blower door, smoke.
- Dirty or discolored Insulation.

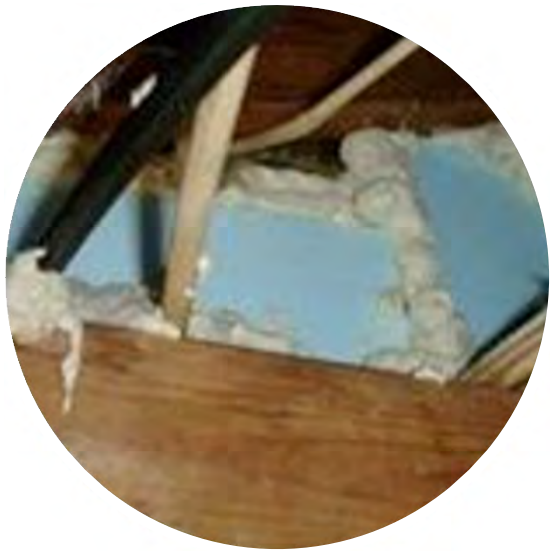
Photos courtesy of the US Department of Energy

General Guidelines



GAPS ≤ 1/4”
Caulk

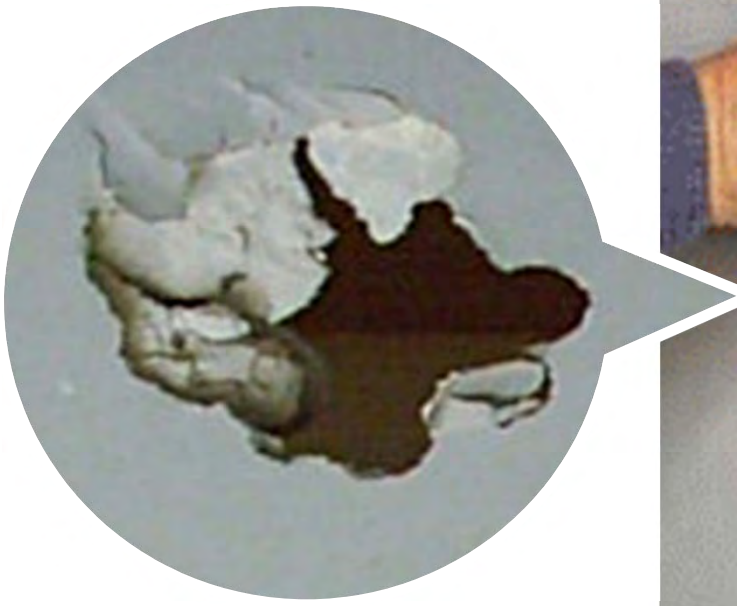
GAPS 1 / 4” – 3”
Spray foam



OTHER
Foam board, fiberglass in plastic bags, etc.

Drywall Repair

Sometimes sealing air leaks requires repairing damaged drywall.



Photos courtesy of the US Department of Energy

High Temperature Issues

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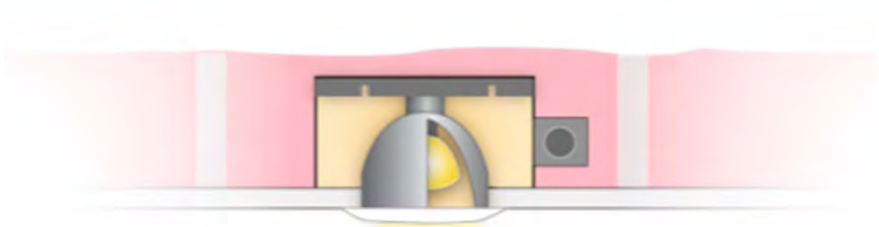
Recessed Light Fixtures



IC Rated Fixture

Non-IC Rated Fixture

Flues

Photos courtesy of the US Department of Energy

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Attic Insulation

Measuring Blown-In Insulation

How much is in that back corner?

Staple rulers every 15 feet for even coverage.

Properly Insulated Attic

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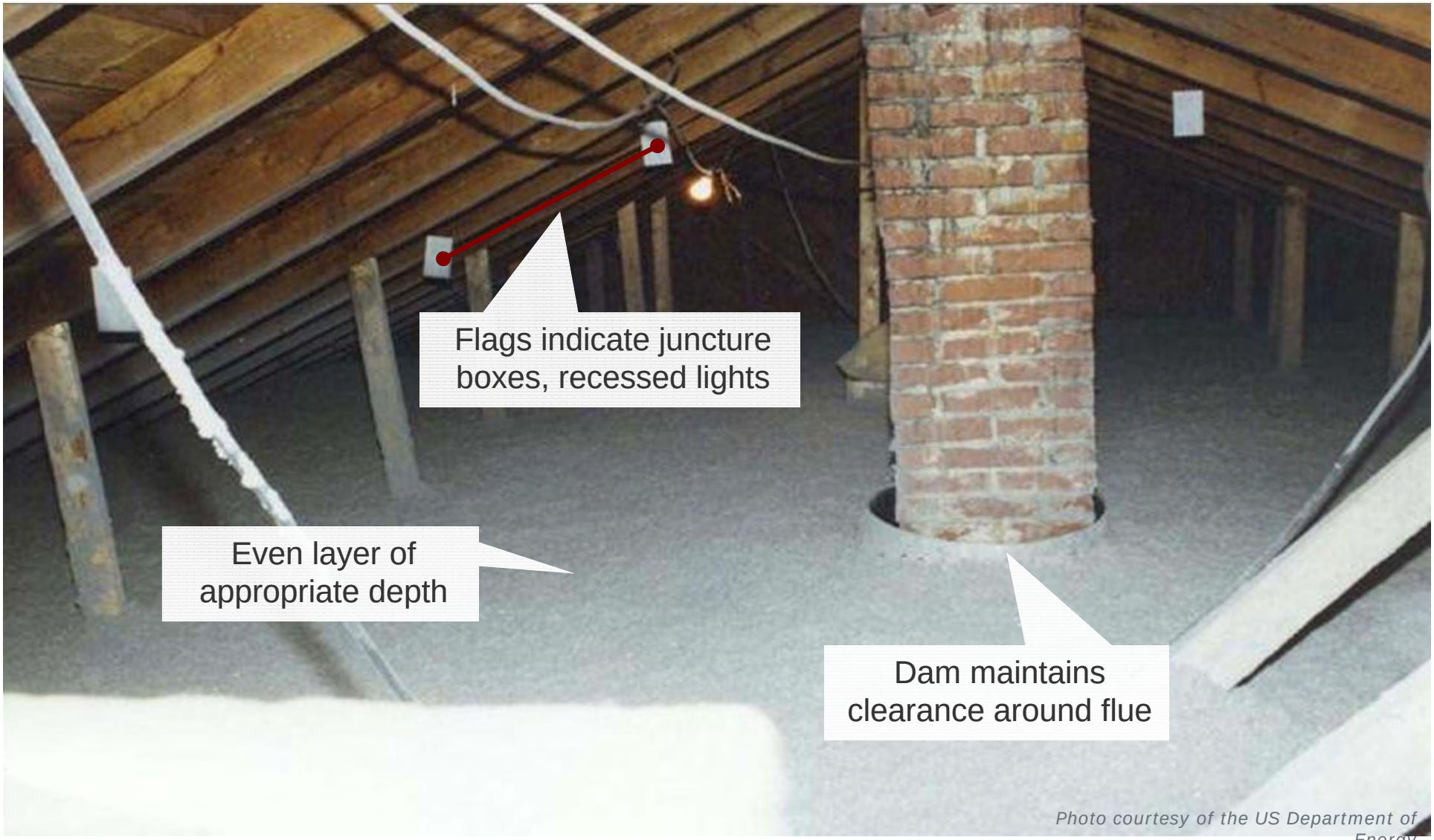

Photo courtesy of the US Department of Energy

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Dense-Pack Sidewall Insulation

It Works

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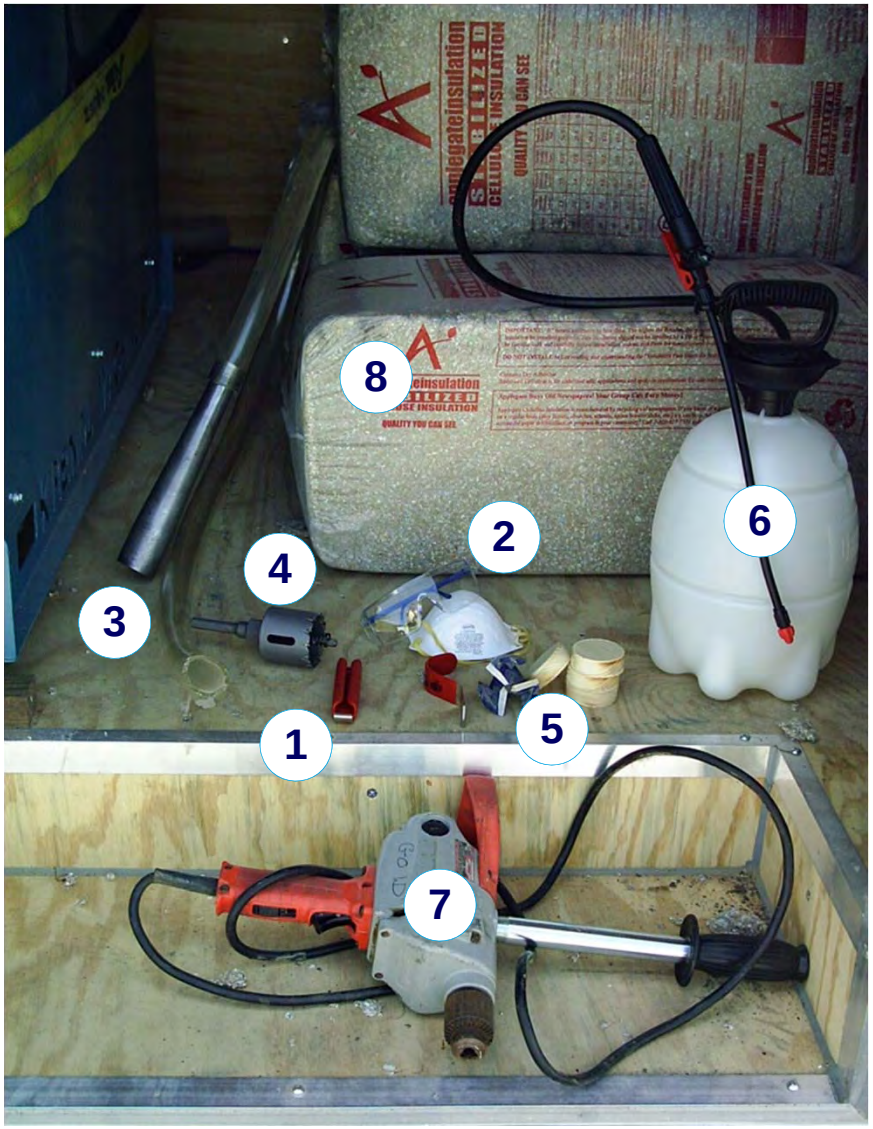
"It is not unusual to reduce overall house leakage by 30% to 50% by dense-packing walls and other closed-in cavities."

- Home Energy Magazine, Nov/Dec 1995

Typical Tools Used



1. Siding remover
2. Eye protection and dust mask
3. Hose cut at 45 degree angle
4. Drill bit
5. Plugs
6. Mister (for LSW)
7. Corded, 1/2” drill
8. Cellulose

Order of Operations

- Maintain equipment.
- Inspect walls.
- Determine fill strategy.
  (attic or wall, interior or exterior)
- Remove siding *(if exterior).*
- Drill.
- Fill.
- Replace/repair.

Determine Fill Strategy

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- Blow in from attic if you can.
- Interior.
- Exterior.
- Drill at top, bottom, middle?

Remove Siding

Photo courtesy of the US Department of

Aluminum

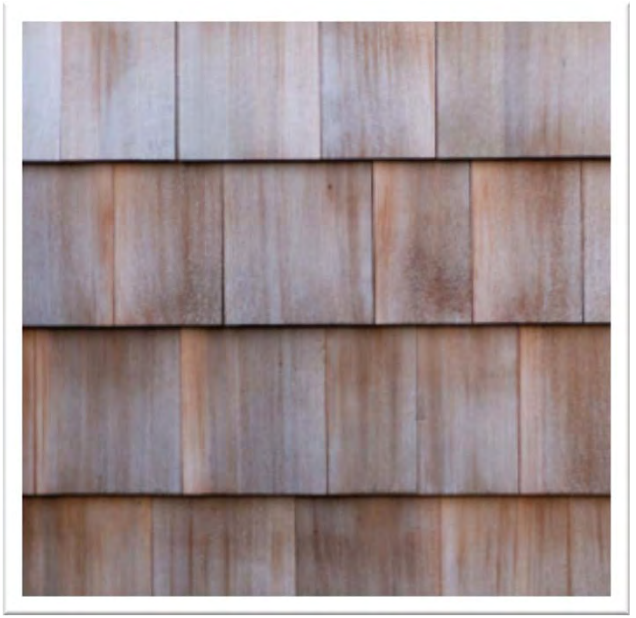
Vinyl

Wood

Asbestos

Wood Siding

Remove clapboards and pressed board.

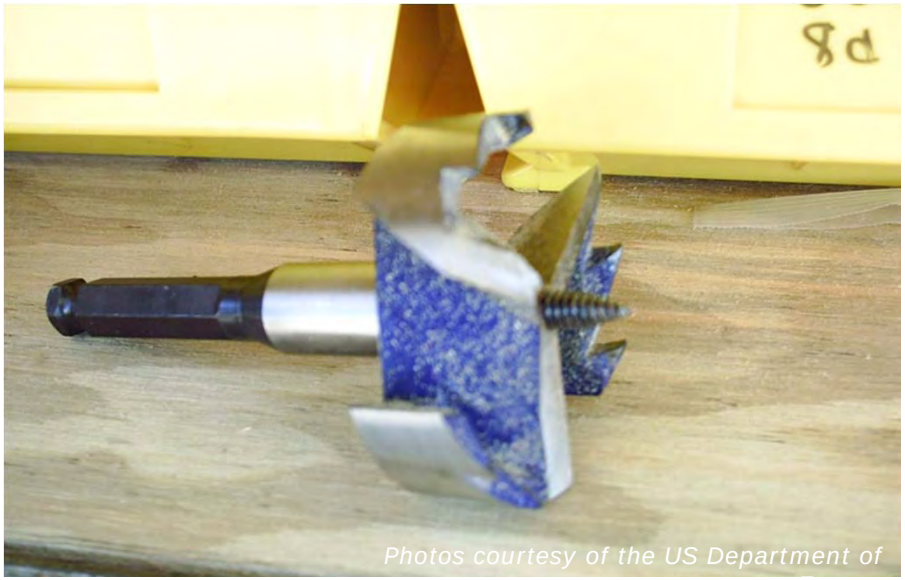


Remove enough shingles to re-cover holes.

Photo courtesy of the US Department of Energy

Drill

- Properly size bit to accept fill tube and movement.
- Drill at angle fill-tube will enter.
- Address large cavities first to get blower busy before tackling details.
- Probe around hole.



Photos courtesy of the US Department of Energy

Fill

- Probe cavities for blocks - request holes where needed.
- If holes are drilled in the middle of the wall, fill top then bottom.
- Feed hose to farthest point from hole, then pull back 12”.
- Cellulose-only blower: pull hose out 1’ at a time (Faster blower: pull out 2’).
- **Adjust air gate**: 8’ Cavity should fill in 2 - 4 minutes.

Proper Density

Photo courtesy of the US Department of

- **Check fill holes:** Shouldn't be able to stick your finger in.
- **Check material-to-Volume ratio:** One 30 lb. bag should almost fill 3 8' cavities with 2x4 16" O.C. framing.

Trouble-Shooting or Shooting Trouble?

If you've blown for over **four minutes** without reaching proper density, find out where cellulose is going!

Photo courtesy of the US Department of Energy

Replace and Repair

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The job isn't done until the house is put back together.

Photo courtesy of the US Department of Energy

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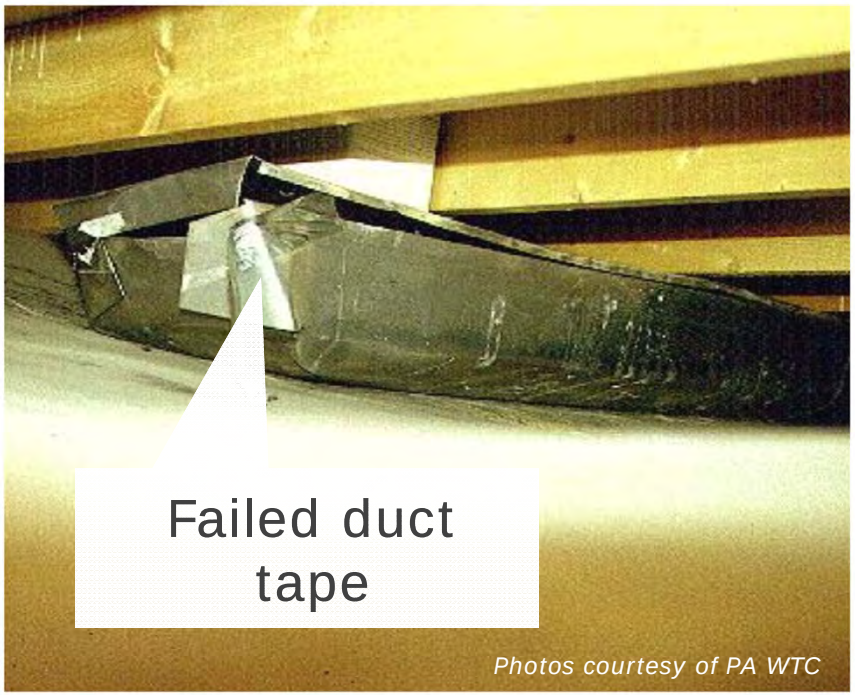
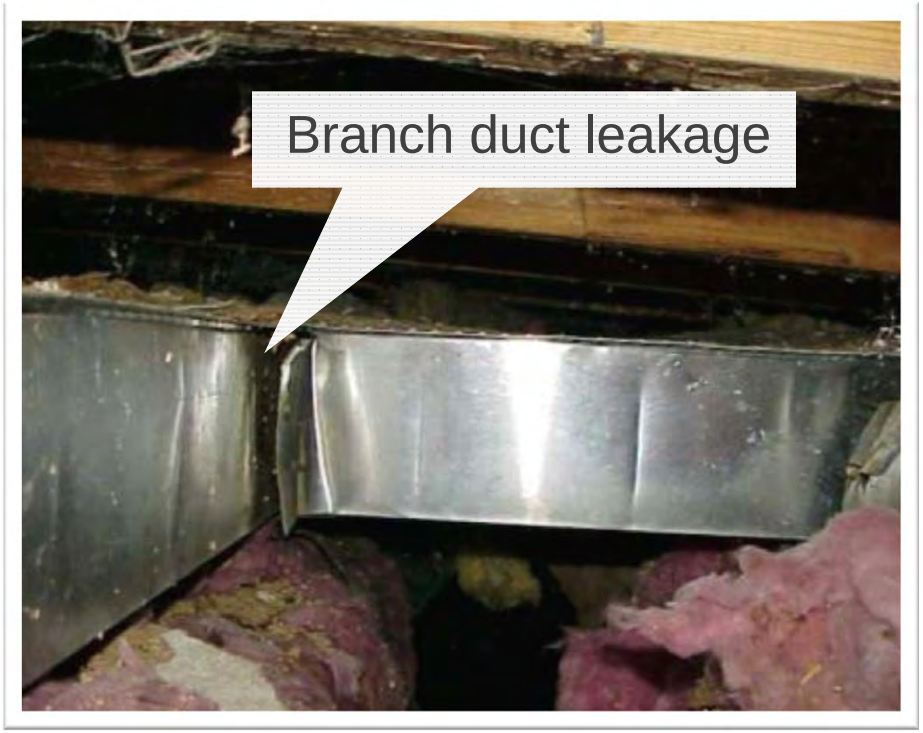
Duct Sealing/Repair

Problems and Opportunities



Visual Checks

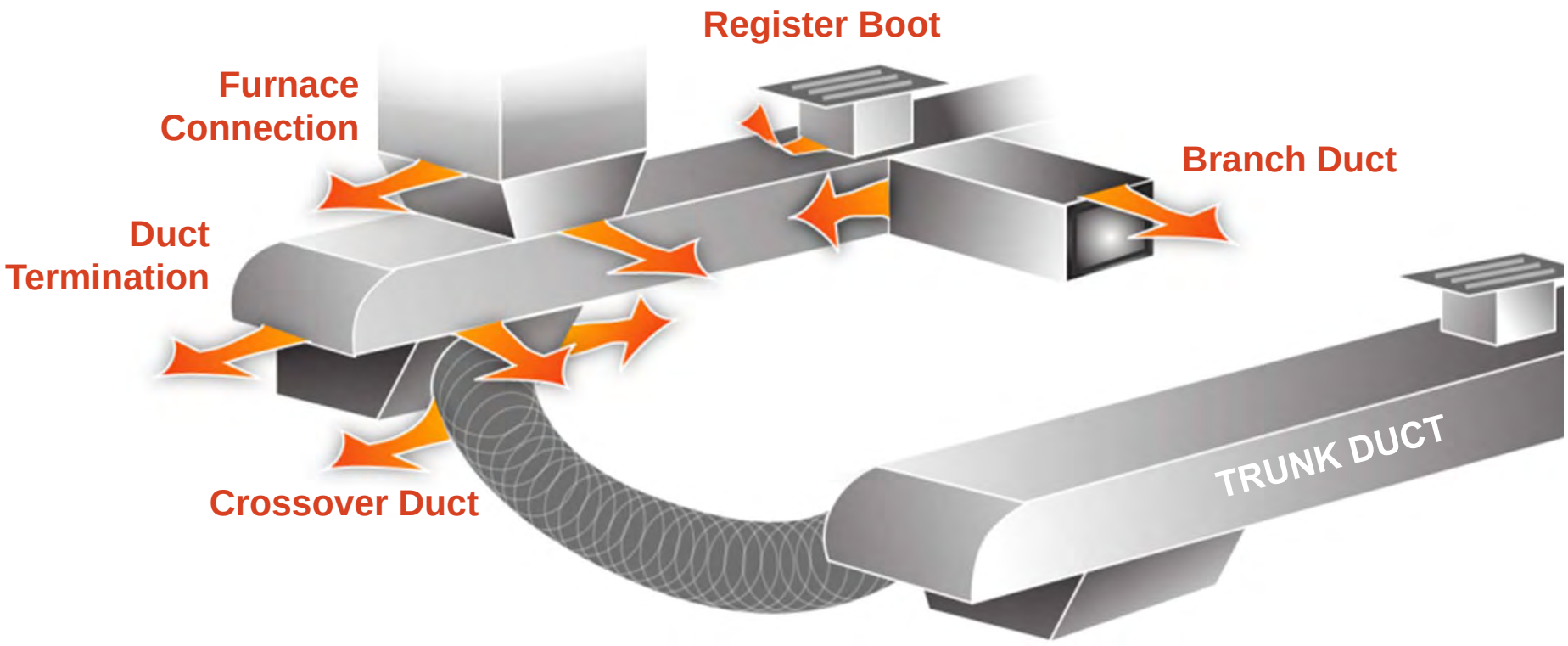


Visual Checks

The old flashlight and mirror trick

Is that a squeegee down there?!

Typical Air Leakage Locations



Pressure Pan Testing

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Photo Source: US Department of Energy

- Depressurize the home to 50 pascals
- Pressure pan each register location
- Record pressure differences
- Repair ducts and retest

The goal is to reduce pressure pan readings at each register location to less than 1 pascal.

Duct repair and sealing techniques

- Inspect ducts and boots
- Repair or replace ducts and boots
- Clean ducts
- Seal with mastic and fiberglass mesh tape
- Seal ends of trunk line
- Repair and seal furnace base

DUCT INSPECTION AND MODIFICATION TOOLS

Repairing & Sealing Ducts

Photo courtesy of the US Department of Energy

Make sure to clean ducts before sealing

Repairing & Sealing Ducts

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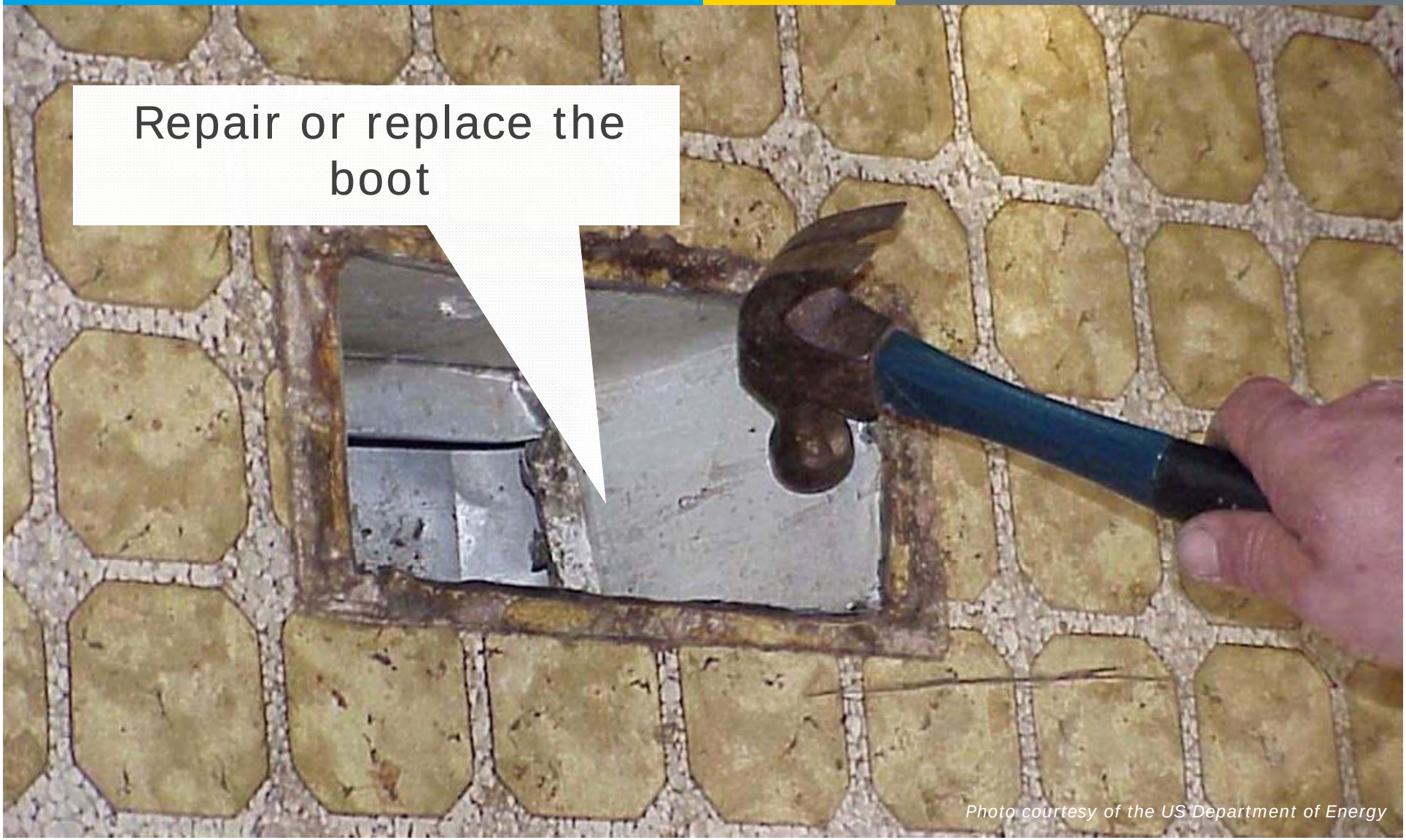


Photo courtesy of the US Department of Energy

Repairing & Sealing Ducts – Materials

Mastic sealant

Photo courtesy of the US Department of Energy

Image Source: http://www.rcdmastics.com/pd6.asp

Sealing with Mastic

Use fiberglass mesh tape to span gaps larger than ¼ inch

Photos courtesy of the US Department of Energy

Latex gloves are often your mastic brush

Repairing and Sealing Ducts

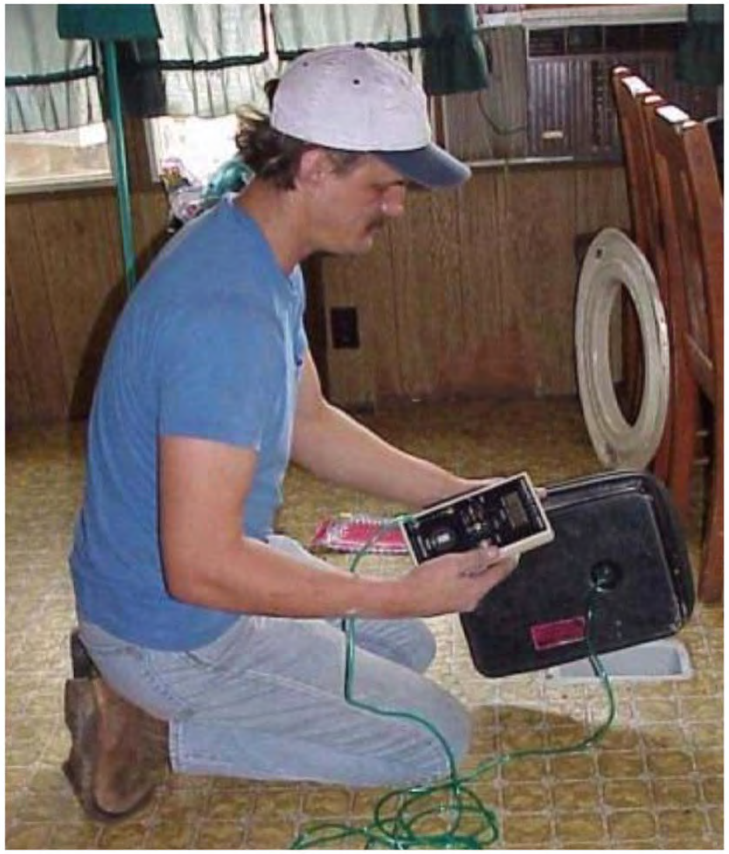
Photo courtesy of WV GOEO

Seal the duct, then patch the belly board

Photo courtesy of PA WTC

Mechanically fasten and seal with butyl-backed aluminum tape or mastic

Post Pressure Pan Testing



Photos courtesy of the US Department of Energy

Results!

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Basements and Crawl Spaces

Foundation Types

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- **Basements**
  - Intentionally or unintentionally conditioned
  - Unconditioned
- **Crawl Spaces**
  - Vented
  - Unvented
  - Conditioned
- **Pier and beam** (exposed floor)
- **Concrete Slabs**
  - Insulated
  - Uninsulated

Foundation Types

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Basement or Crawl Space Foundation

Photo courtesy of Wikipedia

Slab on Grade Foundation

Photo courtesy of PA WTC

Photo courtesy of PA WTC

Pier and Beam Foundation

Conditioned or Unconditioned?

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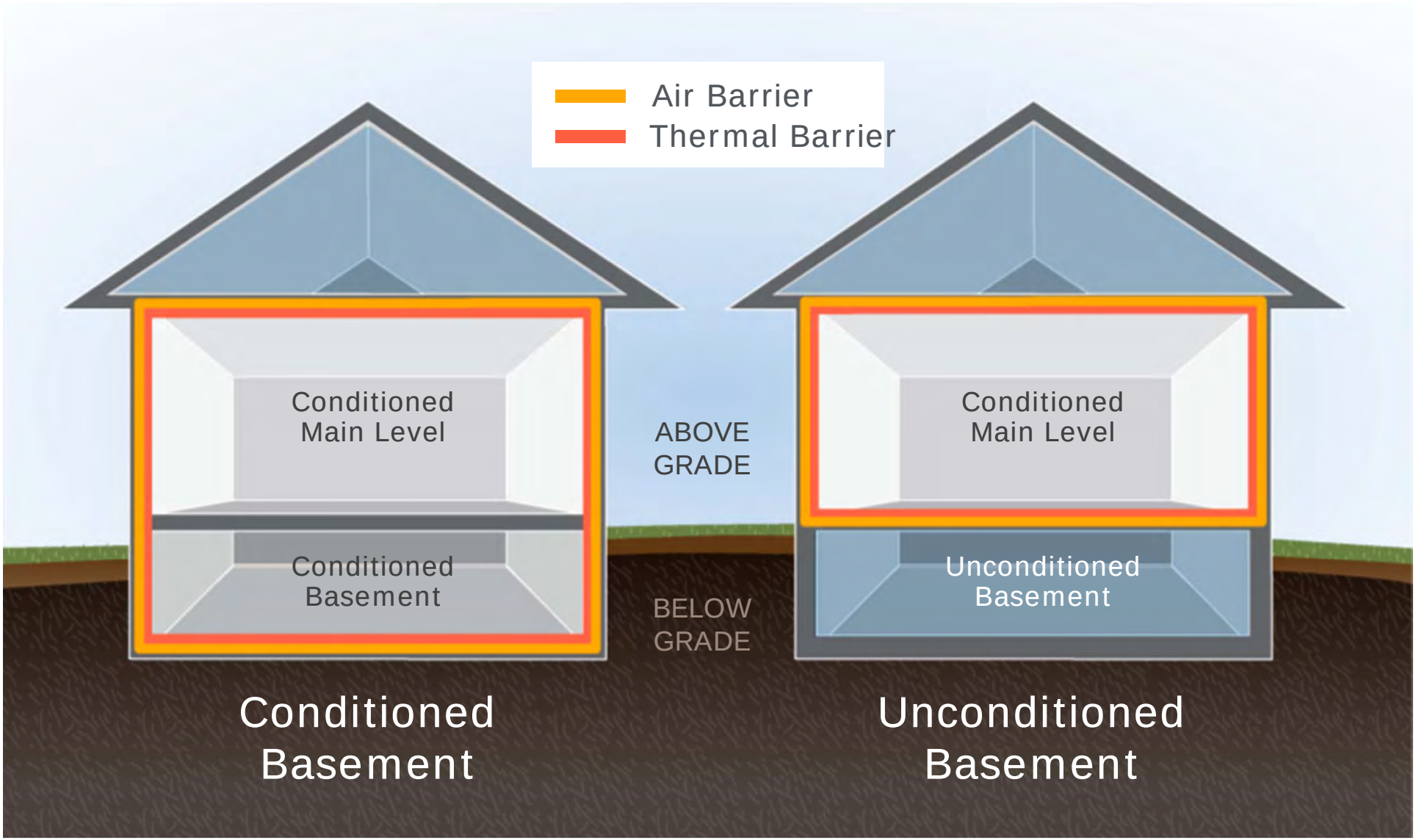

Guidelines

Conditioned

- More than 50% below grade.
- Relatively tight or unvented foundation.
- A living space.
- Intentional or unintentional space conditioning.

Unconditioned

- Less than 50% below grade.
- Leaky, vented, or severely degraded foundation.
- Not a living space.
- No intentional or unintentional space conditioning.

Basement Diagnostics

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Zonal Pressure Diagnostics (ZPD)

- Determine interconnectivity of basement or crawlspace WRT house.

Pressure Pan Testing

- Determine relative leakiness of ducts to outside.

CAZ Testing

- Diagnose problems caused by negative pressures.

Photo courtesy of PA WTC

Unconditioned Basements

- Air seal all air pathways between the basement and house.
- Seal all return and supply ducts.
- Insulate all duct work to the recommended R-value.
- Insulate open floor joists to the recommended R-value with fiberglass batt insulation. Be sure to fit insulation batts tightly to the bottom of the sub-floor and attach them with wire supports.
- Insulate enclosed floor cavities with dense-pack insulation.
- Pressure pan measurements on duct registers should read close to 0 Pa.

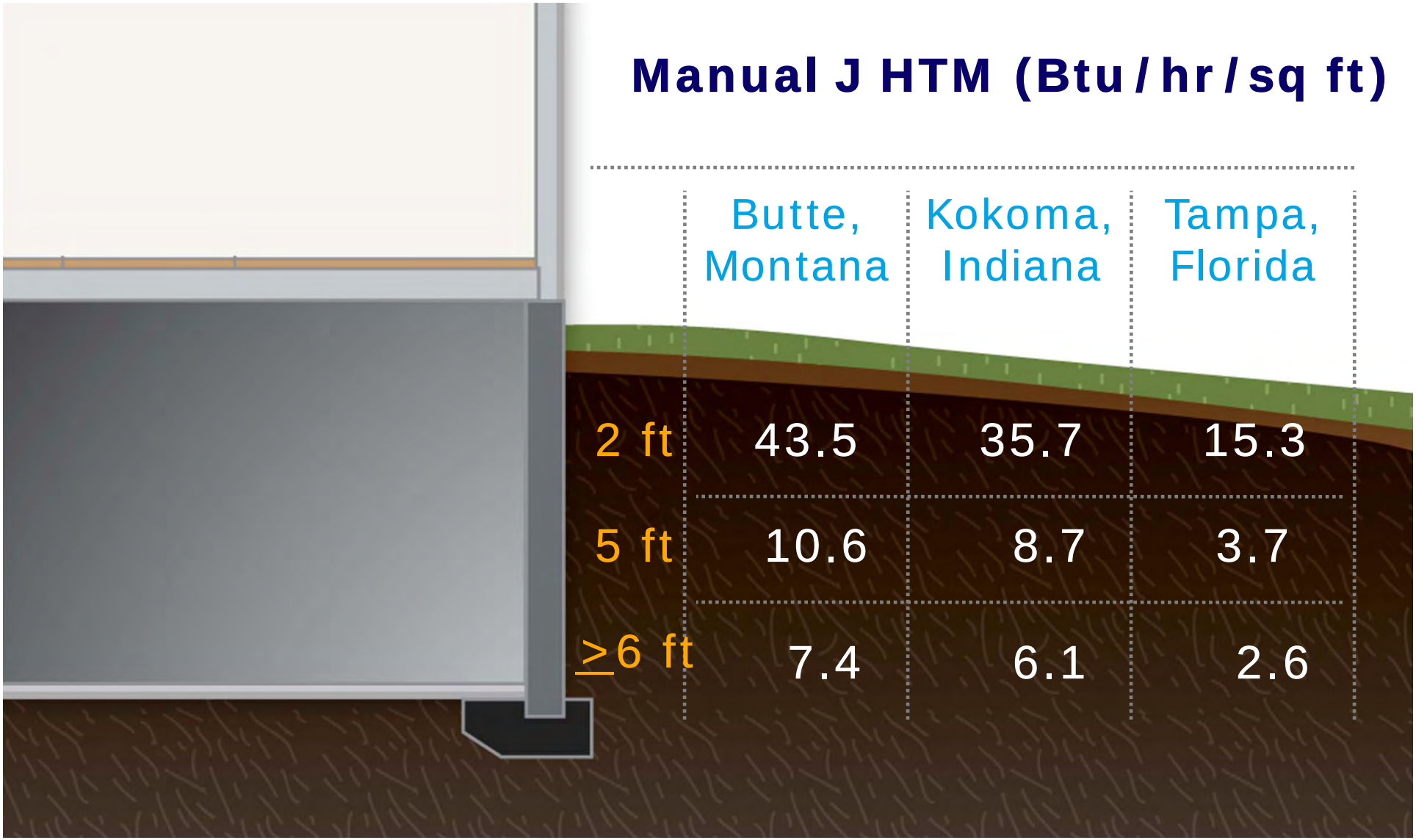

Photo courtesy of the US Department of Energy

Photo courtesy of the US Department of Energy

Conditioned Basements

- Air seal perimeter mud sill, band joist and all air pathways between the basement and the house.
- Seal return plenum and all return ducts for safety.
- Seal major leaks in supply ducts by mechanically reconnecting boots to register transitions.
- Insulate band joist area to recommended R-Value.
- Consider insulating basement walls.
- Use ZPD to verify that the conditioned crawl space with reference to the house is close to 0 Pa.

Heat Loss by Soil Depth



Manual J HTM (Btu/hr/sq ft)

	Butte, Montana	Kokoma, Indiana	Tampa, Florida
2 ft	43.5	35.7	15.3
5 ft	10.6	8.7	3.7
≥6 ft	7.4	6.1	2.6

Photo courtesy of INCAP

Photo courtesy of INCAP


Photo courtesy of INCAP


Photo courtesy of INCAP

Foaming the Band Joist

Photo courtesy of the US Department of Energy

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Thank you!

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