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Note to the Reader: Due to differing conditions, tools, and individual skills, the authors of this manual and Charlotte Region Habitat for Humanity assume no responsibility for any damages, losses incurred, deaths, or injuries suffered as a result of following the information published in this manual. Although this manual was created with safety as the foremost concern, every construction site and construction project is different.

Accordingly, not all risks and hazards associated with homebuilding could be anticipated by the authors of this manual and Charlotte Region Habitat For Humanity. Always read and observe all safety precautions provided by any tool or equipment manufacturer, and always follow all accepted safety procedures. Because codes and regulations are subject to change, you should always check with authorities to ensure that your project complies with all local codes and regulations.

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Introduction to the Insulation Section

This Section Includes

Task Lists
Safety Review
Tool, Equipment and Material List
Material Description
Construction Details and Drawings

Schedule: Insulation Days 1 & 2

Insulating a house takes three to four hours.

Crew Assignments
The insulation of a Charlotte Region Habitat home is typically done by a qualified subcontractor. This section is strictly for reference.

It is suggested that approximately three to five volunteers, including the homeowner and one crew leader be recruited for this task. The work can be divided up by tasks. Be sure that the appropriate clothing and protection is worn. The quality of the insulation job will affect the owner’s utility bills for years to come.
Insulation Safety Guidelines

Review these guidelines with each crew member at the start of the day or as they arrive on site.

“NO JOB IS SO IMPORTANT THAT IT CAN’T BE DONE SAFELY”

**Clothing:** Fiberglass particles can be particularly harmful. When handling insulation, wear sturdy, loose, long sleeved shirts, long pants, gloves, goggles (even glasses are inadequate protection), face mask, and a hat. Wear work boots that protect from falling objects, have a nonskid sole & resist nail penetrations. No open toed shoes allowed.

If particles get on your skin, do not scratch. Shower as soon as possible.

**Speak up** if something looks unsafe. An observer can spot danger quicker than a worker.

Know where **water & a first aid** kit are located. Tell the site supervisor immediately in the event of an injury.

Habitat requires **safety glasses or goggles at all times.**

**Utility knives** - keep your hand out of the blade’s path. Retract blade when not in immediate use. A sharp blade is safer than a dull one. Safely dispose of used blades.

Use a **ladder** that will reach the work. Move the ladder with your work. Do not overreach.

**Power Saws:**

- Only crew members with power saw **experience** can use them. A busy work day is not the time to teach saw skills nor is it the time to learn saw skills.
- Habitat advises that **ear and eye protection** be used when using power saws. Don’t bind the blade of any saw – listen for it. Back off and resupport lumber. Keep electric cords out of the way of the saw.
- Don’t cross hands over to stabilize material on the miter saw. Find another way or get help.
- **Guards** on saws must be in place & operating.

Tools must be in a safe condition (meet OSHA standards, i.e. no nicks in cords or missing ground prongs.)

**Think & concentrate on your task.**

If you are uncertain about how to do a task, or how to operate a power tool, ask your crew leader.
Task List - Insulation

Staffing
- House Leader Crew Leader
- Homeowner(s) and several additional volunteers

Tasks to Be Completed

- Fire stop ceiling & floor penetrations
- Insulate around windows and doors
- Caulk exterior wall corners and all bottom plates & thresholds
- Insulate under attic floor
- Insulate exterior walls
- Installing vapor barrier on walls
- Insulate and install Thermoply® behind shower unit
- Insulate crawl spaces
- Installing vapor barrier in crawl space

Quality Checkpoints

- All ceiling and floor penetrations insulated and fire proofed
- Insulation loosely packed around windows and doors
- Exterior walls caulked at base of bottom plates and up house corners
- Paper backing or poly entirely covering exterior walls
- Insulation Batts cut tight and neat to outlets, plumbing boxes, framing, ladders, and blocking.
- Face of insulation flush with face of stud (i.e. don’t push insulation into cavity).
- Insulation cut square and tight to all corners. No gaps or pushed down corners.
- Even small voids are unacceptable to Energy Star
- Cardboard Baffles installed to outside of cap plate and lower portion not bent.
- Crawl space floor 100% covered with poly with joints overlapping min. 12”
Insulation Tool, Equipment & Material List

Tools Each Crew Member Will Need
Safety Goggles
Safety Glasses
Gloves
Utility Knife
Face Mask
Long Sleeve Shirt and Long Pants
Water

Tools and Equipment Needed On Site
Staplers
Step Ladders
Straight 2x4 for cutting
Caulk Guns
Hammer
Screwdriver

Material List
Insulation Walls (R-Value 15, unfaced)
Insulation Under Attic Floor (R-Value 30, faced)
Vapor Barrier (Walls)
Vapor Barrier 6 mil poly (Crawl Space)
Staples
Caulk
Fire retardant Caulk
Cardboard Baffle Boards
Thermoply (was installed during framing)
Roll insulation Behind Tub (R-value 15, faced, installed during framing)
Insulation Material Description

Insulation

R-13 meets Charlotte’s code but our Energy Star homes need R-15. (“R” is the insulation value.) Batts come in pre-cut 93” pieces made to fit between studs. Insulation is either “faced”, which means it comes with a paper vapor barrier on it, or “unfaced”, which means it will require a poly vapor barrier to be installed.

Vapor Barrier

Refers to the Kraft type paper that comes on faced insulation or the 4 to 6 mil. polyethylene film that is stapled over a wall of unfaced insulation. A vapor barrier is also installed on the ground in the crawl space or under the concrete slab. The purpose of the vapor barrier is to keep excess moisture out of the house and from deteriorating the framing.

Note: The vapor barrier is installed toward the climate controlled area. Due to weather patterns this may not be so in other areas of the country.

Caulk

Caulk is used as an air barrier under bottom plates, in corners, behind flashing, etc. Fire retardant caulk has the additional role of reducing the chance of fire moving from the attic or crawl space to the living space.

Thermoply®

Thermoply® sheathing comes in 4’x8’ sheet form, and is installed behind bathtubs on exterior walls. It provides an additional air barrier.
General Instructions For Insulation

Avoid permanently compressing insulation, as this will reduce energy savings. Also, avoid gaps in insulation for the same reason.

Energy Star Ratings

Charlotte Region Habitat builds its houses to Energy Star Standards. Much of the requirements are met during insulation, though some are found in other building details (i.e. solid framing for exterior corners). Each house is inspected not just to pass local code, but for strict compliance to these higher standards. In return for the extra effort, the homeowners can see a reduction in their power usage as well as a guarantee from the Energy Star that their monthly bills will not exceed a guaranteed maximum. (The details are explained in a contract between the homeowner and Energy star or its representative.)

Energy Star Quality Control

It takes an outstanding and professional insulation job to obtain an Energy Star inspector’s approval. Keep a close eye on the following items. These are just some of the items that, if not met, can cause a job to fail its inspection:

- Insulation Batts cut tight and neat to outlets, plumbing boxes, framing, ladders, and blocking.
- Face of insulation flush with face of stud (i.e. don’t push insulation into cavity).
- Insulation cut square and tight to all corners. No gaps or pushed down corners.
- Even small voids are unacceptable to Energy Star
- Cardboard Baffles installed to outside of cap plate.
**Caulk Bottom Plates of Exterior Walls**

Run a heavy bead of caulk along the inside edge of the bottom plate on exterior walls. Push the caulk under the plate as far as possible. Do not let the bead get so wide or sloppy that it will later interfere with placing spacer blocks against plate for baseboard.

**Caulk Corners on Exterior Walls**

Run a heavy bead of caulk along the inside of all exterior wall corners from the floor to the top of the cap plate. Push the caulk between the framing far as possible. Do not let the bead get so wide or sloppy that it will later interfere with drywall.
Caulk Ceiling & Floor Penetrations

All ceiling and floor penetrations must be insulated. Penetrations are typically found in the bottom plates and top plates where subcontractors have drilled for plumbing or wiring.

Fill the penetrations with fire retardant caulk. If the penetrations are large, first pack them with scrap pieces of insulation. Install insulation into the hole in the floor behind the tub faucet.

Note: Inform new crew members that holes for wire and plumbing that run horizontally through studs on the interior of the house do not need insulating or caulk. Only penetrations that lead to unheated space require fire blocking.

Insulate Around Windows and Doors

Insulate around all windows and exterior doors between the unit’s frame and the wall framing. Do this by pushing small pieces of insulation into the crevices with either a shim or a screw-driver. This is often called “chinking”. Do not pack the insulation tight. For very small gaps, caulk may be used.
**Insulate Exterior Walls**

R-15 is installed on exterior walls. Fiberglass insulation usually comes in rolls that are pre-cut to 93" lengths. For irregular sized cavities, cut the batt 3/4" wider than the space. To cut insulation, compress with a straight board and use a utility knife.

Do not split batts to fit on both sides of electrical wiring or pipes, but custom cut them. It will be necessary to place scraps of insulation behind electrical boxes, wires, and pipes. Cut closely and neatly around electrical boxes.

Custom cut batts to fit between all blocking. Split in half small pieces and place behind horizontal blocking such as found in ladders and in kitchen and bathrooms.

Note: Habitat Charlotte typically installs faced insulation only behind the bathtub and under the attic floor. If, however, the insulation comes with a paper vapor barrier, install the insulation so that the paper is facing the interior of the house. The paper will be wider than the insulation. This tab must be unfolded and stapled to the face of each stud. If the paper is stapled correctly, the entire wall will be covered and no studs will be visible. Avoid stapling the tabs to the sides of the studs.

*This wall is ready for the vapor barrier.*

*These walls are ready for a poly vapor barrier. Notice that the corner has been caulked.*

*Compressing insulation makes it easier to cut a straight line.*
The gap in the upper left corner might cause this house not to pass the Energy Star requirements.

Cut out insulation neat and tight to electrical boxes.

Faced R-30 has been neatly installed around this return.

Install insulation neatly around plumbing penetrations.

“NO JOB IS SO IMPORTANT THAT IT CAN’T BE DONE SAFELY”

Utility knives - keep your hand out of the blade’s path. Retract blade when not in immediate use. A sharp blade is safer than a dull one. Safely dispose of used blades.
Check Insulation Behind Shower Unit(s)

R-15 insulation, vapor barrier, and Thermoply® should have been installed behind the shower/ bathtub unit during framing. This applies only to shower units that are against outside walls. Thermoply® extends from the floor to the ceiling and the entire width of the tub wall.

Install Polyethylene Vapor Barrier on Walls

If the insulation does not come with a paper facing, install a 4 to 6 mil. polyethylene film over all exterior walls. Measure the wall length and cut the poly from the roll several inches longer than this measurement. Then, unfold the poly and staple it to the cap plate, studs and sill plate. If necessary, trim after stapling. Do not roll over wall intersections as it impedes drywall installation.

Roll right over windows and doors, which can be cut out after the poly is stapled into place. Make all cuts neat and close, especially around windows and outlets.

Insulate Under Attic Floor

Faced batts of R-30 are installed under the attic floor before drywall. Install with paper vapor barrier face down. Staple the paper tabs neatly across the face of the framing. The next batt’s tab will lay over the first tab, creating an air barrier.
Install Cardboard Baffle Boards
Cardboard baffle boards keep the airway open between the soffit vents and the ridge vent. Baffle boards, per Energy Star, must be installed tight against the outside of the cap plates so that insulation can cover the top of the wall.

Cardboard baffle boards keep insulation from getting in the way of the air flowing from soffit vents to the ridge vent.

Insulate Crawl Spaces
Crawl space in houses in Charlotte Region are typically encapsulated so that there is no insulation in the floor joists. All encapsulation and insulation is handled by the subcontractor.
Install Vapor Barrier in Crawl Space
Install a 6 mil poly vapor barrier in the crawl space. Cover the ground 100% and overlap joints a minimum of 12”.

Attic Insulation
An insulation subcontractor will blow R-30 into the attic after the ceilings are in place. Cardboard measuring sticks are stapled onto the trusses for depth reference. Verify that the porch baffles are 12” above the tops of the cap plates and that the attic stair baffles are in place.
OSB baffle boards on the porch keep the insulation in the attic. They extend 12” above the top of the cap plate.