

Plan Check & Field Inspection Guide

1998 IECC and 2000 IECC

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Plan Check

Building plans and specifications must be submitted with each building application unless the submission is waived by the building official. This section gives guidance on the code-related information that should be documented and submitted for plan review. For simplicity, this section refers to the "plans." However, this reference can be loosely interpreted to allow the same information to be provided on specifications, schedules, and/or other documents accepted by your jurisdiction.

Prior to performing a plan check, verify that the code requirements apply to the building under consideration (see *What Buildings Must Comply?* in the *Introduction to REScheck*). You should also be familiar with the basic requirements outlined in the *Basic Requirements Guide*.

Building Envelope

An applicant may use any of the three compliance approaches to demonstrate compliance with the code insulation and window requirements – the prescriptive package approach, the trade-off approach, or the software approach. The requirements listed under the *General* section (directly below) apply to all three of these approaches. Requirements specific to a given approach are listed next, each under their own section.

General

- Verify that the general information section of the compliance forms have been filled out and signed by the applicant. Note the name and phone number of the compliance author if the builder did not complete the forms. The author will be a valuable source of information if questions arise concerning compliance.

- Verify that the location on the compliance form agrees with the actual building location.
- Verify that all proposed R-values and U-factors on the compliance form correspond to the values listed on the plans. These values are usually found in the building sections and construction details. The actual proposed R-values and U-factors are required on the plans, not the weighted average R-values and U-factors.
- Verify that the insulation levels specified on the compliance forms, plans, and/or specifications will fit into the framing cavities without compressing the insulation. For example, R-19 fiberglass batt insulation (6-inch thickness) will not fit in a 2x4 stud cavity (3 ½ in. depth) without compressing the insulation. Insulation ratings are based on uncompressed insulation – compressed insulation has a lower R-value. Thus, credit cannot be taken for manufacturer rated R-values in the calculations if the insulation is compressed. Where loose fill insulation is proposed, the plans should specify the material to be used and the minimum depth required to meet the proposed R-value.
- Verify that the plans indicate the type of insulation to be used. For example, if proposed R-values for walls or ceilings are based on cavity insulation plus insulating sheathing, verify that the R-values of both materials are identified.
- Verify that the U-factors for windows, skylights, and doors are less than or equal to the U-factors indicated on the compliance forms. U-factors for all windows, skylights, and doors should be written on the building plans or a window schedule. This notation will help the field inspector verify that fenestration with the correct U-factor are installed in the building. If default glazing or door U-factors from the default U-factor tables in Appendix B of the *REScheck Workbook* are used, verify that the features (frame type, number of panes, and thermal break) are written on the plans.
- In Zones 1-7, verify that the area-weighted average solar heat gain coefficient (SHGC) of all windows, glazed doors, and skylights indicated on the plans does not exceed 0.4. If default SHGC values from the default SHGC table in Appendix B of the *REScheck Workbook* are used, verify that the features (frame type, number of panes, and tint) are written on the plans. If exterior shading devices (such as sunscreens) are proposed, verify that the make and model number are included on the plans in addition to an adjusted SHGC value.

Prescriptive Package Approach

Check the following additional items if the Prescriptive Package approach is used.

- Verify that the *Prescriptive Package Worksheet* has been submitted.
- Verify that the values in the *Minimum R-Value* column and *Maximum U-Factor* column on the right side of the *Prescriptive Package Worksheet* correspond to the values specified in the prescriptive package selected by the applicant (the applicant must record the package number at the top of the worksheet). Only one value for each component type may be listed in the *Minimum R-Value* and *Maximum U-Factor* columns. If the required values on the right side of the worksheet differ from the values specified in the selected prescriptive package, have the applicant correct the form.
- Additions less than 500 ft² (46.5 m²) of conditioned floor area may meet the prescriptive envelope requirements given in Appendix A of the *REScheck*

Workbook. To use this alternative prescriptive approach for additions, the total area of windows, doors, and skylights cannot exceed 40% of the gross wall and roof area of the addition.

- All insulation R-values in the *Proposed R-Value* column on the left side of the worksheet must be greater than or equal to corresponding values in the *Minimum R-Value* column on the right. All U-factors in the *Proposed U-Factor* column of the worksheet must be less than or equal to the corresponding values in the *Maximum U-Factor* column. In some cases, more than one insulation level will be installed in the same component (e.g., flat ceilings and vaulted ceilings). Unless all insulation levels exceed the requirement, the applicant must verify that the area-weighted average R-value for the component meets or exceeds the required R-value (or U-factor for windows and doors) by completing the *R-Value/U-Factor Weighted Average Worksheet*. Verify that the average R-value or U-factor was copied to the *Prescriptive Package Worksheet* and that the *R-Value/U-Factor Weighted Average Worksheet* is attached. If the proposed values on the left side of the worksheet differ from the values specified on the plans, have the applicant explain and/or correct the form.
- If a raised truss is installed as part of the roof assembly, R-30 batt insulation may be used to meet an R-38 requirement and R-38 batt insulation may be used to meet an R-49 requirement. To receive this credit, the insulation must extend to the full thickness over the plate lines of exterior walls, and the plans must be clearly marked to show the truss type.

PROPOSED				REQUIRED	
Prescriptive Package Worksheet					
International Energy Conservation Code (IECC)					
Builder Name		CAREFUL BUILDERS, INC.	Date	12/12/00	Enforcement Agency: Permit # Checked By Date
Builder Address		120 "W" ST., GREENSBORO, NORTH CAROLINA 27411			
Building Address		1010 CONSTRUCTION AVE. GREENSBORO, NORTH CAROLINA			
Zone Number	8	Package Number	5	IECC Edition	
Submitted By		JOHN DOE CAREFUL	Phone Number	704-321-9445	
Glazing Area					
$100 \times \frac{288}{\text{Glazing Area} + 1923} = \frac{15.0}{\text{Gross Wall Area} + \text{Proposed Glazing Area}} \%$				15 % Maximum Glazing Area	
R-Value					
Description	Comments	Proposed R-Value	Minimum R-Value		
Ceiling		R- 30	R- 30		
Wall		R- 13	R- 13		
Floor Over Unconditioned Space		R- 19	R- 19		
Floor Over Outside Air		R- 30	R- 30		
Basement Wall		R- N/A	R- 8		
Slab Floor	Unheated, 24" Depth	R- 8	R- 5		
Crawl Space Wall		R- N/A	R- 10		
U-Factor					
Description	Comments	Proposed U-Factor	Maximum U-Factor		
Glazing	See back	U- 0.50	U- 0.50		
Opaque Door	Front door exempt	U- 0.35	U- 0.35		
Equipment Efficiency (This section may be left blank if Normal is selected on the right.)					
Heating	AFUE/HSPF		Check One <input checked="" type="checkbox"/> Normal <input type="checkbox"/> High Heating <input type="checkbox"/> High Cooling <input type="checkbox"/> High Heating & Cooling		
Cooling	SEER				
		Efficiency	Make & Model Number		
Statement of Compliance: The proposed building design represented in these documents is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the requirements of the International Energy Conservation Code.					
Builder/Designer		John Doe Careful	Company Name	Careful Builders, Inc.	Date
					12/12/00

Figure 1. Example Prescriptive Package Worksheet

- Verify that the area of the glazing assemblies shown on the plans matches the *Glazing Area* specified on the worksheet. Verify that the gross wall area shown on the plans matches the *Gross Wall Area* specified on the worksheet. Verify that the *Proposed Glazing Area* percentage specified on the worksheet is equal to or less than the *Maximum Glazing Area* percentage.
- If the chosen package requires high-efficiency equipment, the efficiency of the proposed unit must be specified on the worksheet in the space(s) labeled *Efficiency* and the make and model number(s) must be specified in the spaces(s) labeled *Make & Model Number*. The building plans should include a note designating the make, model number, and efficiency of any credited equipment. High-efficiency heating equipment must have an AFUE of at least 90% or an HSPF of at least 7.8, and high-efficiency cooling equipment must have a SEER of at least 12. AFUE, HSPF, and SEER ratings can be obtained from manufacturer data sheets or certified product directories (such directories published by the Air Conditioning and Refrigeration Institute (ARI) or the Gas Appliance Manufacturers Association (GAMA)).

Trade-Off Approach

Check the following additional items if the trade-off approach is used.

- Verify that the *Trade-Off Worksheet* has been submitted.
- The proposed U-factors listed on the left side of the *Trade-Off Worksheet* must come from Tables 1 through 8 of the *Trade-Off Worksheet User's Guide* unless derived through an alternative test procedure or calculation procedure accepted by your local jurisdiction. If alternative U-factors are used, ask the applicant to submit supporting documentation. When U-factors from Tables 1 through 8 are used, verify that the U-factors listed on the worksheet match the U-factors in these tables, given the proposed R-values and framing indicated on the plans. Window and door U-factors must be tested and documented by the manufacturer in accordance with the NFRC test procedure or taken from Table 9 and 10 of the *Trade-Off Worksheet User's Guide*.
- Verify that all building envelope components are included on the worksheet and that the proposed building areas on the plans agree with those listed on the worksheet.
- Verify that the U-factors in the *Required U-Factor (/F-Factor)* column of the worksheet are correct for the building location (zone number). These values come from Table 11 of the *Trade-Off Worksheet User's Guide*. The climate zone numbers referred to in Table 11 can be found in Appendix E of the *REScheck Workbook* or on the state map included with the prescriptive packages.
- Values in the *Area* column on the right side of the worksheet should be equal to the sum of the proposed component areas on the left side for a given assembly type (i.e., ceilings, walls, or floors/foundations). For example, the wall area on the right side of the worksheet is the sum of the opaque wall, window, and door components listed on the left side.
- The *Total Proposed UA* for the proposed building must be less than or equal to the *Total Required UA*. Verify that both totals are calculated correctly by spot-checking the UA calculations.

Trade-Off Worksheet

International Energy Conservation Code (IECC)

Enforcement Agency:
 Permit # _____
 Checked By _____
 Date _____

Builder Name CAREFUL BUILDERS, INC. Date 12/12/00
 Builder Address 120 "W" ST., GREENSBORO, NORTH CAROLINA 27411
 Building Address 1010 CONSTRUCTION AVE., GREENSBORO, N.C.
 Zone # 8 IECC Edition 2000
 Submitted By JOHN DOE CAREFUL Phone Number 704-321-9445

PROPOSED					REQUIRED				
U-factors and F-factors can be found in Tables 1 through 10.					Required U-factors can be found in Table 11.				
Ceilings, Skylights, and Floors Over Outside Air									
Description	Insulation R-Value	U-Factor	x Area	= UA	Required U-Factor	x Area	= UA		
Ceiling w/Attic	R-38	0.030	729 ft ²	21.9	0.036	1353 ft ²	48.7		
Floor Over Outside Air	R-30	0.033	32 ft ²	1.1					
Skylight	—		ft ²						
Ceiling, Vaulted	R-30	0.035	592 ft ²	20.7					
			ft ²						
Ceilings: Total Area			1353 ft ²						
Walls, Windows, and Doors									
Description	Insulation R-Value	U-Factor	x Area	= UA	Required U-Factor	x Area	= UA		
Wall w/ Sheath	R-13+6	0.060	1339 ft ²	80.3	0.16	1923 ft ²	307.7		
Window	—	0.45	204 ft ²	91.8					
Door Entry	—	0.54	20 ft ²	10.8					
Sliding Glass Door	—	0.61	84 ft ²	51.2					
Wall w/o Sheath	R-13	0.082	258 ft ²	21.2					
Door/Garage	—	0.35	18 ft ²	6.3					
			ft ²						
Walls: Total Area			1923 ft ²						
Floors and Foundations									
Description	Insulation Depth	Insulation R-Value	U-Factor or F-Factor	Area or Perimeter	= UA	Required U-Factor or F-Factor	Area or Perimeter	= UA	
Floor Over Unconditioned		R-19	0.047	938 ft ²	44.1	0.05	938 ft ²	46.9	
Basement Wall				ft ²			ft ²		
Unheated Slab	24 in.	R-8	0.78	82 ft	64.0	0.82	82 ft	67.2	
Heated Slab	in.			ft			ft		
Crawl Wall	in.			ft ²			ft ²		
Total Proposed UA				413.4	Total Required UA				470.5
Total Proposed UA must be less than or equal to the Total Required UA.									
Statement of Compliance: The proposed building design represented in these documents is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the requirements of the International Energy Conservation Code.									
John Doe Careful		Careful Builders, Inc.		12/12/00					
Builder/Designer		Company Name		Date					

Figure 2. Example Trade-Off Worksheet

Software Approach

Check the following additional items if the software approach is used.

- Verify that the software report has been submitted and that the code edition listed on the report is the correct code for the jurisdiction.
- Verify that the proposed building component areas on the plans agree with the areas listed on the software report. Verify that the insulation and sheathing R-values and window and door U-factors in the software report are shown on the plans. The applicant must correct inaccurate information and resubmit the software report.

	Permit Number																		
REScheck Compliance Report																			
REScheck Software Version 3.0 Release 1 2000 IECC Edition	Checked By/Date																		
TITLE: North Meadows Development																			
CITY: Greensboro STATE: North Carolina HDD: 3865 CONSTRUCTION TYPE: Single Family																			
DATE: 05/11/00 DATE OF PLANS: 3/17/00																			
PROJECT INFORMATION: 1010 Construction Ave. Greensboro, North Carolina Guilford County																			
COMPANY INFORMATION: Careful Builders, Inc. 120 W. St. Greensboro, NC 27411																			
COMPLIANCE: Passes																			
Maximum UA = 466 Your Home = 415																			
	<table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center;">Gross</td> <td style="text-align: center;">Cavity</td> <td style="text-align: center;">Cont.</td> <td style="text-align: center;">Glazing</td> <td style="text-align: center;">UA</td> </tr> <tr> <td></td> <td style="text-align: center;"><u>Area or</u></td> <td style="text-align: center;"><u>R-Value</u></td> <td style="text-align: center;"><u>R-Value</u></td> <td style="text-align: center;"><u>or Door</u></td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;"><u>Perimeter</u></td> <td></td> <td></td> <td style="text-align: center;"><u>U-Factor</u></td> <td></td> </tr> </table>		Gross	Cavity	Cont.	Glazing	UA		<u>Area or</u>	<u>R-Value</u>	<u>R-Value</u>	<u>or Door</u>			<u>Perimeter</u>			<u>U-Factor</u>	
	Gross	Cavity	Cont.	Glazing	UA														
	<u>Area or</u>	<u>R-Value</u>	<u>R-Value</u>	<u>or Door</u>															
	<u>Perimeter</u>			<u>U-Factor</u>															
Ceiling 1: All-Wood Joist/Rafter/Truss	729	38.0	0.0		22														
Ceiling 2: All-Wood Joist/Rafter/Truss	592	30.0	0.0		21														
Exterior Wall 1: Wood Frame, 16" o.c.	1339	13.0	6.0		82														
Window 1: Vinyl Frame, Double Pane with Low-E	204			0.450	92														
Door 1: Glass	84			0.610	51														
Door 2: Opaque	20			0.540	11														
Exterior Wall 2: Wood Frame, 16" o.c.	258	13.0	0.0		21														
Door 3: Opaque	18			0.350	6														
Floor 1: All-Wood Joist/Truss, Over Unconditioned Space	938	19.0	0.0		44														
Floor 2: All-Wood Joist/Truss, Over Outside Air	32	30.0	0.0		1														
Slab 1: Unheated	82		8.0		64														
COMPLIANCE STATEMENT: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2000 IECC requirements in REScheck Version 3.5 Release 1.																			
Builder/Designer _____			Date _____																

Figure 3. Example Software Compliance Report

- If high-efficiency heating or cooling equipment is indicated in the software report, verify that the plans designate equipment that meets or exceeds what is claimed in the software report. AFUE, HSPF, and SEER ratings can be obtained from manufacturer data sheets or certified product directories (such as directories published by the Air Conditioning and Refrigeration Institute [ARI] or the Gas Appliance Manufacturers Association [GAMA]).
- Verify that the software report shows that the building passed.

Heating and Cooling

Heating and cooling system requirements must be called out on the plans. These requirements include thermostats, duct and piping insulation R-values, and the make, model, and efficiency of the heating and/or cooling equipment if credit is taken for high-efficiency equipment.

- Verify that at least one thermostat is planned for each system in one- and two-family buildings and that a separate thermostat is planned for each dwelling unit in multifamily buildings.
- Verify that a heat pump thermostat is specified on the building plans for all heat pump systems.
- Verify that the duct insulation levels documented on the plans match the insulation levels specified in Table 3 of the *Basic Requirements Guide*. If any insulation levels differ, note the correct level on the plans.
- All piping associated with HVAC systems installed in unconditioned spaces and conveying fluid at temperatures greater than 105°F or chilled fluids at less than 55°F must be insulated to the levels specified in Table 4 of the *Basic Requirements Guide*. Verify that pipe sizes, insulation thicknesses, and R-values are documented on the plans.

Service (Potable) Water Heating

If a swimming pool is to be installed, verify a time clock for the pump has been indicated on the plans. If heated, verify that the plans call for an on/off pool heater switch and a pool cover. *Exception:* A pool cover is not required if over 20% of the heating energy is from non-depletable sources.

Circulating hot water systems require pump controls and pipe insulation to the levels specified in Table 5 of the *Basic Requirements Guide*. Verify that the controls and insulation levels are specified on the plans.

Electrical

Verify that each dwelling unit in a multifamily building is equipped with a separate electric meter. These should be individual service meters or, where allowed by the utility, one master meter to the building and individual submeters to each unit. Check the electric plans for the location and number of electric meters.

Field Notes

All new residences must comply with the basic requirements discussed in the *Basic Requirements Guide*. Many of these requirements cannot be verified during plan check and must, instead, be verified during field inspection. Field notes should be included on the plans as a reminder to field inspectors. These might include the following:

- insulation type and R-value
- a window schedule listing window sizes, U-factors, SHGC and exterior shading devices (Zones 1-9), and make and model numbers
- heating and cooling equipment efficiency and make and model number
- duct locations and insulation levels
- HVAC piping locations and insulation levels

- circulating hot-water piping locations and insulation levels
- recessed light IC rating requirement.

The *Summary of Basic Requirements* included with the *Basic Requirements Guide* (or a similar list of applicable requirements) can be included on the building plans as a reminder to the field inspector.

You should also initiate the *Field Inspection Checklist* included with this guide. Transfer the proposed R-values from the plans to the appropriate location on the checklist. All of the basic requirements specified in the *Basic Requirements Guide* are summarized on this checklist. These requirements should be included on the plans and compliance forms. The field inspector should have the compliance forms during the inspection process.

Field Inspection

Field inspections are necessary to ensure that required materials and equipment are properly installed at the site and are in accordance with the approved building plans and/or specifications. This section provides guidance to field inspectors performing site inspections on residential buildings that must comply with the code. Because the number and types of inspections vary throughout the country, you are encouraged to customize these guidelines for your jurisdiction.

This section at times refers to code-related information that was documented and submitted prior to plan review. The code requires this information be provided on the plans and specifications. For simplicity, this section refers to "plans." However, this same information can instead be provided on specifications, schedules, and/or other documents accepted by your jurisdiction.

Four separate site inspections are commonly used to inspect energy features:

- foundation inspection
- framing inspection
- insulation inspection
- final inspection.

These should coincide with site visits typically required for general structural/mechanical/electrical inspections. The insulation inspection, however, is best done after installation of the electrical and plumbing systems and before the insulation is covered, and may require a separate trip.

You can use the *Field Inspection Checklist* provided with this guide to verify energy features. The checklist is divided into sections that reflect the four separate inspection visits and identifies the items to be inspected on each of these visits. For example, the section entitled *Foundation Inspection* identifies slab-edge, basement wall, and crawl space wall insulation as items that should be inspected during the foundation inspection.

Pre-Inspection

Before beginning the field inspection, verify that the approved building plans and specifications are on site and that the REScheck forms (or alternate forms that provide the same information) are attached to the plans. The building plans, specifications, and compliance forms should provide you with all the information necessary to perform a field inspection properly.

Field Inspection Checklist			
2000 International Energy Conservation Code (IECC)			
Numbers in parenthesis refer to applicable sections in the 2000 IECC.			
Requirement	Installed (Y/N)	Comments	
Pre-Inspection			
• Approved Building Plans on Site (104.1)	_____	_____	_____
Foundation Inspection			
	Inspection Date _____	Approved: Yes ___ No ___ Init. _____	
• Slab-Edge Insulation (502.2.1.4)	_____	_____	Depth: _____
• Basement Wall Exterior Insulation (502.2.1.6)	_____	_____	Depth: _____
• Crawl Space Wall Insulation (502.2.1.5)	_____	_____	Depth: _____
Framing Inspection			
	Inspection Date _____	Approved: Yes ___ No ___ Init. _____	
• Floor Insulation (502.2.1.3)	_____	_____	_____
• Glazing and Door Area (502.2.1.1)	_____	_____	_____
• Mass Walls (502.2.1.1.2)	_____	_____	_____
• Caulking/Sealing Penetrations (502.1.4.2)	_____	_____	_____
• Duct Insulation (503.3.3.3)	_____	_____	_____
• Duct Construction (503.3.3.4)	_____	_____	_____
• HVAC Piping Insulation (503.3.3.1)	_____	_____	_____
• Circulating Hot-Water Piping Insulation (504.5)	_____	_____	_____
Insulation Inspection			
	Inspection Date _____	Approved: Yes ___ No ___ Init. _____	
• Wall Insulation (502.2.1.1)	_____	_____	_____
• Basement Wall Interior Insulation (502.2.1.6)	_____	_____	Depth: _____
• Ceiling Insulation (502.2.1.2)	_____	_____	_____
• Glazing and Door U-Factors (502.2.1.1)	_____	_____	_____
• Glazing SHGC Values (502.1.5)	_____	_____	_____
• Vapor Retarder (502.1.1)	_____	_____	_____
Final Inspection			
	Inspection Date _____	Approved: Yes ___ No ___ Init. _____	
• Heating Equipment (102.1)	_____	_____	_____
Make and Model Number	_____	_____	_____
Efficiency (AFUE or HSPF)	_____	_____	_____
• Cooling Equipment (102.1)	_____	_____	_____
Make and Model Number	_____	_____	_____
Efficiency (SEER)	_____	_____	_____
• Multifamily Units Separately Metered (505.1)	_____	_____	_____
• Thermostats for Each System (503.3.2.1)	_____	_____	_____
• Heat Pump Thermostat (503.3.2.3)	_____	_____	_____
• Weatherstripping at Doors/Windows (502.1.4.2)	_____	_____	_____
• Equipment Maintenance Information (102.3)	_____	_____	_____

Version 3.0 / April 2000 / U.S. Dept. of Housing and Urban Development / Rural and Economic Development / U.S. Dept. of Energy / Pacific Northwest National Laboratory

Figure 4. Field Inspection Checklist for the 2000 IECC

Foundation Inspection

Slab-Edge Insulation

If slab-edge insulation is indicated on the compliance forms or the building plans, verify the installed R-value is greater than or equal to the specified R-value. The insulation R-value should be stamped on the slab insulation. This will usually be listed as R-value per inch thickness. If the R-value is not shown, the installation contractor should provide verification of the insulation R-value. If the insulation is to be installed as part of the foundation form, the R-value should be verified prior to pouring concrete.

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Slab-edge insulation must be protected from physical damage and ultraviolet light deterioration when installed on the exterior of the footing.

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When installed on the exterior of the footing, slab-edge insulation must have a rigid, opaque, and weather-resistant covering that prevents the degradation of the insulation's performance and protects it from physical damage. The protective covering must cover the exposed (above-grade) area of the insulation and extend to a minimum of 6 in. (153 mm) below grade.

The required slab insulation depth will vary depending on the building location and the compliance approach. The insulation must extend from the top of the slab down to at least the bottom of the slab, and then optionally it may extend in under the slab or out away from the slab. The total vertical plus horizontal distance of the slab insulation must be at least as great as indicated on the plans or compliance forms. Insulation that extends horizontally away from the slab must be covered by pavement or at least 10 in. of soil. The top edge of slab insulation installed between the exterior wall and the interior slab can be cut at a 45° angle away from the exterior wall.

Basement Wall Exterior Insulation

When the insulation is installed on the outside of the basement wall, verify that the R-value is greater than or equal to the R-value specified on the compliance forms or the building plans. (Interior basement insulation is usually checked during the insulation inspection.) The prescriptive package and trade-off compliance approaches require basement walls to be insulated from the top of the basement wall to 10 ft below ground level or to the basement floor, whichever is less. The software approach allows the insulation depth to vary – the required depth will be indicated on the software report.

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The insulation should be securely fastened to the foundation wall and protected from weather and ultraviolet degradation. If possible, observe backfilling to make sure the insulation is evenly applied and not damaged.

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The insulation should be securely fastened to the foundation wall and must have a rigid, opaque, and weather-resistant covering that prevents the degradation of the insulation's performance. The protective covering must cover the exposed (above-grade) area of the insulation and extend to a minimum of 6 in. (153 mm) below grade. If possible, observe backfilling to make sure the insulation is evenly applied and not damaged.

Crawl Space Wall Insulation

Crawl spaces below insulated floors do not require insulation or a vapor retarder to be installed on the walls. If the crawl space is not directly ventilated to the outdoors, the builder may choose to insulate the crawl space walls instead of the floor above the crawl space. In this case, verify that no vents have been installed in the crawl space walls. Also verify that the crawl space wall insulation R-value is greater than or equal to the R-value specified on the plans and that it extends the required distance. The prescriptive package and trade-off approaches require the crawl space wall insulation to extend from the top of the wall to the inside finished grade. If the inside grade is less than 12 inches (305 mm) below the outside finished grade or the vertical wall insulation stops less than 12 inches below the outside grade, the insulation must extend vertically and horizontally a minimum of 24 linear inches (601 mm) from the outside grade level. The *REScheck* software approach allows the depth of insulation to be traded off, and the required depth will be printed on the software report.

If the insulation is to be installed as part of the foundation form, the R-value should be verified prior to pouring concrete. Ask for manufacturer literature if the R-value is not printed on the insulation. The insulation should be securely attached to the foundation wall to ensure that it will remain in place. The insulation must be flush with the top of the foundation wall.

Framing Inspection

Floor Insulation

If the building has a raised floor and the floor insulation has been installed, verify that the installed insulation matches the plans. If the floor insulation has not yet been installed, it may be inspected during the insulation inspection. Insulation R-values are marked on the insulation either with an R-value designation (e.g., R-19) or striping. Table 1 lists stripe codes developed by the North American Insulation Manufacturers Association (NAIMA) as a voluntary guideline for identification of insulation R-values.

Properly installed floor insulation should be flush against the subfloor, with the vapor retarder (where required) against the subfloor. The insulation should be adequately and uniformly supported with supports such as furring running perpendicular to the joists, piano wire stapled to the joists, or "tiger teeth." The insulation should not sag away from the floor.

Table 1. Stripe Codes on Unfaced Fiberglass Batts

Labeled R-Value	Number of Stripes
R-11	3
R-13	4
R-15 HP	2
R-19	5
R-21 HP	4
R-22	6
R-25	1
R-26	1
R-30	2
R-30 HP	2
R-38	4
R-38 HP	1
HP = High performance and/or high density insulation.	

Glazing and Door Area

Openings for windows, doors, and skylights will be roughed out during the framing inspection. Verify that the rough openings for these assemblies correspond to what is shown on the plans. Note any increase in area. If an increase is noted, the applicant must complete new compliance forms to show that the building is still in compliance.

Mass Walls

In some locations, the code specifies less-stringent requirements for above-grade heavy mass walls than for wood- or steel-frame walls. Masonry, concrete, and log walls are examples of mass walls that are sometimes eligible to receive this credit. Check the framing details, floor plans, and structural plans to ensure that any mass walls shown on the plans are installed in the building and that insulation levels and location match those indicated.

Joists and Penetrations

Openings and joints in the building envelope must be caulked or sealed with appropriate sealants (such as caulking or foam) to ensure there is a continuous seal (no daylight is showing). Penetrations should be sealed on both the inside and outside when sidings or veneers are used. Caulking and weatherstripping must be installed in accordance with the manufacturer's installation instructions.

See Air Leakage in the *Basic Requirements Guide* for potential air leakage points to check.

Duct Insulation

Ducts installed outside the building and in unconditioned spaces are subject to the minimum duct insulation R-value requirements given in Table 3 of the *Basic Requirements Guide*. Check the mechanical plans (if available) or the compliance forms to ensure that the minimum insulation level has been installed.

Ducts located in unconditioned spaces include ducts located in attics, ventilated crawl spaces, unheated basements and garages, and inside building envelope assemblies (e.g., exterior wall, ceiling, and floor cavities). When ducts are located in exterior building cavities, either

- the full insulation R-value requirement for that building component must be installed between the duct and the building exterior, in which case the ducts do not require insulation, or
- the ducts must be insulated to the duct R-value requirement given in Table 3 of the *Basic Requirements Guide* and the duct area must be treated as a separate component on the compliance documentation.

For flexible ductwork, verify that the R-value printed on the jacket meets or exceeds the R-value listed on the plans and the compliance forms. Fiberglass ductwork may have the R-value printed on the outside of the material.

Duct Construction

Verify that ducts located in unconditioned spaces are fastened and sealed with welds, gaskets, mastics, mastic-plus-embedded-fabric, or tapes. Pressure-sensitive tape may be used for fibrous ducts. Duct tape is not permitted.

1998 Verify that all ducts are supported properly and duct runs have no sags. Also verify that the installed ducts are not crimped or constricted.

2000 Verify that ducts are supported every 10 ft or in accordance with the manufacturer's instructions, that cooling ducts with exterior insulation are covered with a vapor retarder, and that air filters are provided in the return air system. Also verify that the installed ducts are not crimped or constricted.

HVAC Plumbing Insulation

All HVAC system piping installed in unconditioned spaces and conveying fluid temperatures greater than 120°F or chilled fluids less than 55°F must be insulated to the levels specified in Table 4 of the *Basic Requirements Guide*. Pipes located in unconditioned spaces include those located inside building envelope assemblies and those located outside of the building. The pipe sizes, insulation thicknesses, and R-values must be identified on the plans. The installed insulation R-value must be greater than or equal to that shown on the plans.

Circulating Hot Water Systems

Circulating hot water systems must have manual or automatic controls that allow pumps to be conveniently turned off when the system is not in operation. If the pump is conveniently located (such as in a garage) the on/off switch may be located on or near the pump. If the pump is located in an inaccessible location (such as under the house or in an attic) the control must be located in a more convenient location – not on the pump.

Check the plans for the required insulation R-value to be installed on circulation loop piping and verify that piping is insulated to the required level.

Insulation Inspection

All insulation materials must be installed in accordance with the manufacturer's installation instructions.

Wall Insulation

Verify that the R-value of the installed wall insulation is greater than or equal to that specified on the building plans and compliance forms. The R-value is usually marked on the insulation by an R-value designation or striping (see Table 1). Refer to the installer's insulation certificate for blown insulation. For the prescriptive package and trade-off compliance approaches, the cavity insulation R-value and the R-value of exterior rigid insulation may be added together to make a composite R-value which meets the wall requirement. In these cases, both insulation R-values should be marked on the plans or compliance forms. The software approach lists exterior rigid insulation (sheathing) separately on the software report. Some wall constructions may have rigid insulation on the interior of the framing.

Batt insulation must evenly fill the wall cavity. When kraft-faced batts are used, they should be properly stapled on the face of the studs to serve as a vapor retarder. Vapor retarders must be placed between the conditioned space and the insulation, except in exempted locations (see the *Basic Requirements Guide, Vapor Retarders*).

Wall cavity insulation must extend into the perimeter floor joist (rim joist) cavities along the same plane as the wall (Figure 5). Verify that exterior walls behind bathtubs and showers, kitchen cabinets, and stairwells are fully insulated and that the vapor retarder is installed. Batts must be cut around switch and outlet boxes and split around plumbing and wiring to ensure that the insulation is not compressed and there are no gaps or holes in the insulation.

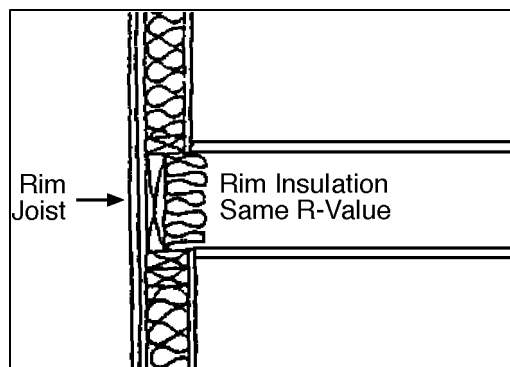


Figure 5. Wall Insulation Between Floors

Basement Wall Interior Insulation

When applicants use the prescriptive package approach or the trade-off approach, basement walls below uninsulated floors must be insulated from the top of the basement wall to 10 ft below ground level or to the basement floor, whichever is less. The software approach enables the user to select an alternate insulation depth, which is indicated on the software report. If basement wall insulation is installed on the wall interior, it can be inspected during the insulation inspection. Interior insulation typically consists of fiberglass batt or rigid board installed between furring strips or framing. Verify that the R-value of the installed basement wall insulation is at least that specified on the plans.

Ceiling Insulation

For fiberglass batt insulation, verify that the R-value printed on the batt is greater than or equal to that specified on the plans. Loose-fill insulation must be distributed evenly within the attic space. It is important that the insulation be installed to manufacturer specifications to minimize settling. Because of variations in material used for loose-fill insulation, the R-value may not be universally determined by direct measurement of installed depth. There should be clearly visible thickness markers installed about once every 300 ft². Verify that the depth and type of insulation matches what is indicated on the plans. Some jurisdictions may require that the installer provide a label at the attic access certifying the type of insulation used, the maximum coverage per bag at the installed R-value, the minimum thickness, and the number of bags installed.

Recessed lights that are not IC rated must be installed inside an air-tight assembly with a 0.5 inch (12.7 mm) clearance from any combustible material and a 3 inch (76 mm) clearance from insulation material. Verify that insulation clearances from appliances meet manufacturer specifications and comply with any local restrictions. Insulation should be kept away from vents, or baffling should be installed to direct the vent air up and over the ceiling insulation.

If the applicant has taken credit for a raised truss, verify that the insulation achieves its full insulation depth over the plate lines of exterior walls.

Glazing and Door U-Factors

If glazing and door assemblies are labeled, ensure that the labeled U-factors are equal to or less than the U-factors marked on the plans or window schedule. If not labeled, verify that the make and model numbers of the installed assemblies match those specified on the plans or window schedule. If the glazing assembly U-factors were obtained from the default U-factor tables in Appendix B of the *REScheck Workbook*, the installed features (frame type, number of panes, and thermal break) must match the features described on the plans. Likewise, if door U-factors were obtained from Appendix B, the door features must correspond to the features described on the plans. If the assemblies do not match the plans, the applicant must demonstrate that the replacements are equivalent (area and U-factors are less than or equal to the originally specified products) or they must resubmit the compliance documentation based on the new assemblies.

The appropriate time to inspect glazing and door assemblies will vary depending on when they are installed and the types of inspections conducted in your jurisdiction.

Glazing SHGC

In Zones 1-7, ensure that the label SHGC values are equal to or less than the SHGC values marked on the plans or schedules. If glazing is not labeled, verify that the make and model numbers of the installed assemblies match those specified on the plans or window schedule. If the glazing assembly SHGC values were obtained from the default glazing SHGC table in Appendix B of the *REScheck Workbook*, the installed features

(frame type, number of panes, and tint) must match the features described in the plans. If exterior shading devices (such as shade screens) are indicated on the plans, ensure that they are installed on the windows.

Vapor Retarder

Vapor retarders having a perm rating of no more than 1.0 must be installed in all unvented frame walls, floors, and ceilings, except in exempted locations (refer to the *Basic Requirements Guide* for exemptions to this requirement). For example, sealed floor cavities (such as floors of overhangs) require a vapor retarder, but floors over a ventilated crawl space do not. Floor vapor retarders will typically be inspected during the framing inspection. The vapor retarder must be placed between the conditioned space and the insulation.

Final Inspection

Heating, Cooling, and Water-Heating Equipment

If high-efficiency heating or cooling equipment is claimed, the equipment must be designated on the plans. To find the make and model number of an installed furnace, remove the front cover of the heating unit. The information is sometimes printed on the nameplate or may be found in the manufacturer's literature. If the numbers do not match, the installer must show that the installed unit meets the required efficiency. Where equipment efficiencies are not available, verify that the installed equipment make and model numbers match what is indicated on the plans. If high-efficiency equipment was not claimed, you do not need to verify equipment make, model number, or efficiency.

Water heaters with vertical pipe risers must have a heat trap on both the inlet and outlet unless the water heater has an integral heat trap or is part of a circulating system. Heat traps can be verified in one of two ways: 1) if the heat trap is built into the water heater, check the manufacturer's literature or a water heater directory; 2) if there is no integral heat trap, look for "S" bends in the inlet and outlet water piping.

Mechanical and water heating equipment must be installed in accordance with the manufacturer's installation instructions.

Electric Meters

Inspect the electrical service to each multifamily dwelling unit and make sure an electric meter is provided for each individual dwelling unit.

Thermostats

Each heating and cooling system must have a thermostat capable of manually or automatically reducing the temperature. Heat pumps must include a heat pump thermostat that can prevent the back-up heat from turning on when the heating requirements can be met by the heat pump alone. A two-stage thermostat that controls the back-up heat on its second stage meets this requirement. If the thermostat is not clearly marked as a heat pump thermostat, check the manufacturer's operating instructions.

Weatherstripping

Verify that all doors between conditioned and unconditioned spaces have door boots and weatherstripping. Weather stripping must be installed around attic and crawlspace access panels if the panels are located in a conditioned room.

Equipment Maintenance and Operation Information

Manufacturer manuals must be provided for installed heating and cooling equipment and service water heating equipment. This information must be available at the building site during the final inspection.

Materials Information

If the *Energy Label* included in Appendix D of the *REScheck Workbook* is posted in the building to meet the requirements for materials identification, verify that the insulation levels and equipment efficiencies reported on the label correspond to what was actually installed.

Field Inspection Checklist

1998 International Energy Conservation Code (IECC)

Numbers in parenthesis refer to applicable sections in the 1998 IECC.

<u>Requirement</u>	<u>Installed (Y/N)</u>	<u>Comments</u>
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Pre-Inspection

- Approved Building Plans on Site (104.1) _____

Foundation Inspection

Inspection Date _____ *Approved: Yes ___ No ___ Init.* _____

- Slab-Edge Insulation (502.2.1.4) _____
Depth: _____
- Basement Wall Exterior Insulation (502.2.1.6) _____
Depth: _____
- Crawl Space Wall Insulation (502.2.1.5) _____
Depth: _____

Framing Inspection

Inspection Date _____ *Approved: Yes ___ No ___ Init.* _____

- Floor Insulation (502.2.1.3) _____
- Glazing and Door Area (502.2.1.1) _____
- Mass Walls (502.1.1) _____
- Caulking/Sealing Penetrations (502.3.2) _____
- Duct Insulation (503.3.3.3) _____
- Duct Construction (503.3.3.4) _____
- HVAC Piping Insulation (503.3.3.1) _____
- Circulating Hot-Water Piping Insulation (504.7) _____

Insulation Inspection

Inspection Date _____ *Approved: Yes ___ No ___ Init.* _____

- Wall Insulation (502.2.1.1) _____
- Basement Wall Interior Insulation (502.2.1.6) _____
Depth: _____
- Ceiling Insulation (502.2.1.2) _____
- Glazing and Door U-Factors (502.2.1.1) _____
- SHGC Values (502.4) _____
- Vapor Retarder (502.1.2) _____

Final Inspection

Inspection Date _____ *Approved: Yes ___ No ___ Init.* _____

- Heating Equipment (102.1.1)
 - Make and Model Number _____
 - Efficiency (AFUE or HSPF) _____
- Cooling Equipment (102.1.1)
 - Make and Model Number _____
 - Efficiency (SEER) _____
- Multifamily Units Separately Metered (505.1) _____
- Thermostats for Each System (503.3.2.1) _____
- Heat Pump Thermostat (503.3.2.3) _____
- Weatherstripping at Doors/Windows (502.3.2) _____
- Equipment Maintenance Information (102.2) _____

Field Inspection Checklist

2000 International Energy Conservation Code (IECC)

Numbers in parenthesis refer to applicable sections in the 2000 IECC.

Requirement	Installed (Y/N)	Comments
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Pre-Inspection

- Approved Building Plans on Site (104.1)

_____	_____	_____
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Foundation Inspection

Inspection Date _____ Approved: Yes ___ No ___ Init. _____

- Slab-Edge Insulation (502.2.1.4)
- Basement Wall Exterior Insulation (502.2.1.6)
- Crawl Space Wall Insulation (502.2.1.5)

_____	_____	Depth: _____
_____	_____	Depth: _____
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Framing Inspection

Inspection Date _____ Approved: Yes ___ No ___ Init. _____

- Floor Insulation (502.2.1.3)
- Glazing and Door Area (502.2.1.1)
- Mass Walls (502.2.1.1.2)
- Caulking/Sealing Penetrations (502.1.4.2)
- Duct Insulation (503.3.3.3)
- Duct Construction (503.3.3.4)
- HVAC Piping Insulation (503.3.3.1)
- Circulating Hot-Water Piping Insulation (504.5)

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Insulation Inspection

Inspection Date _____ Approved: Yes ___ No ___ Init. _____

- Wall Insulation (502.2.1.1)
- Basement Wall Interior Insulation (502.2.1.6)
- Ceiling Insulation (502.2.1.2)
- Glazing and Door U-Factors (502.2.1.1)
- Glazing SHGC Values (502.1.5)
- Vapor Retarder (502.1.1)

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Final Inspection

Inspection Date _____ Approved: Yes ___ No ___ Init. _____

- Heating Equipment (102.1)
 - Make and Model Number
 - Efficiency (AFUE or HSPF)
- Cooling Equipment (102.1)
 - Make and Model Number
 - Efficiency (SEER)
- Multifamily Units Separately Metered (505.1)
- Thermostats for Each System (503.3.2.1)
- Heat Pump Thermostat (503.3.2.3)
- Weatherstripping at Doors/Windows (502.1.4.2)
- Equipment Maintenance Information (102.3)

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