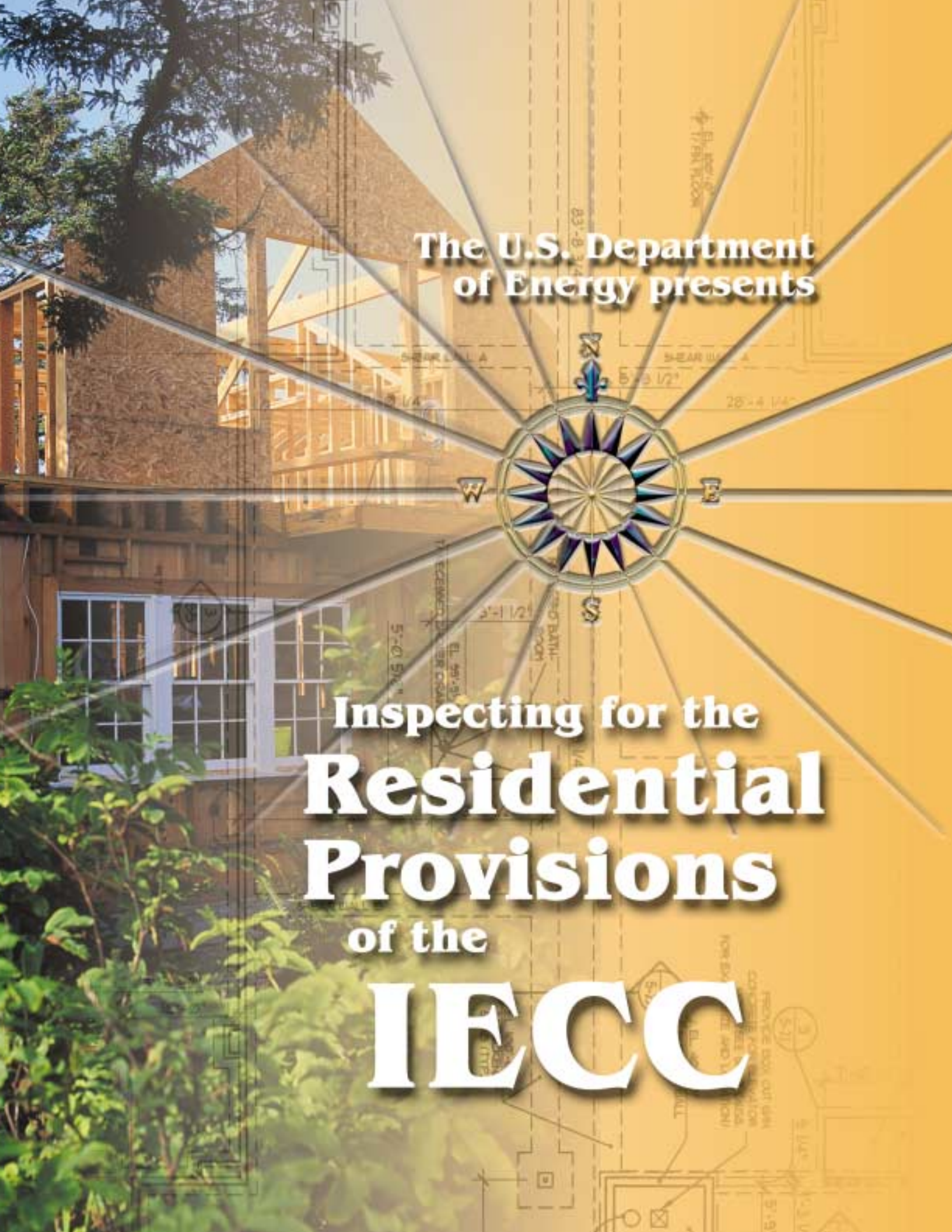
The U.S. Department of Energy presents
Inspecting for the
Residential Provisions
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Inspecting for the Residential Provisions of the IECC Workbook

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Foreword

The purpose of this video and workbook training program is to acquaint you with the code provisions involving the inspection of the residential provisions of the 2000 *International Energy Conservation Code®*.

The video and workbook will lead you through an inspection for the energy features required in the 2000 IECC® and demonstrate how this additional inspection will fit into your typical inspection process. The following inspections will be highlighted within the video and workbook:

- Foundation inspection
- Framing inspection
- Insulation inspection
- Final inspection

This workbook may be reviewed either before or after viewing a particular segment of the accompanying video training tape. This workbook may be used as a resource guide in your inspections, plans review or design project.

Objectives

The materials in this reference manual are designed to assist you in determining acceptable or unacceptable installations for energy conservation features as they relate to the 2000 IECC. After completing the video and workbook training program you will be able to:

1. Inspect for the required insulation levels in the building envelope and verify that the insulation has been installed properly.
2. Inspect for HVAC requirements and verify that the ducts have been sealed and insulated properly.
3. Verify that the glazing with the correct rated U-factor has been installed in a residence and know where to go if the NFRC label is not on the glazing.
4. Understand the energy impact of improperly installed energy features within a residence.

Suggestions

To benefit fully from the video and workbook training program it is recommended that you have the following:

1. The ability to read and understand basic construction drawings
2. A basic knowledge of construction methods and materials
3. A copy of the *International Energy Conservation Code*

Several tables that appear in the text of the IECC are referenced in both the video and workbook. The workbook also has a listing of the applicable code provisions for each item that is discussed, making the IECC a valuable part of your code book library.

Review questions will be found at the end of this workbook. After viewing the video you should answer these questions.

You will need a pencil or pen in order to complete the questions. Please allow approximately 2 hours to complete this video training tape.

Once you have viewed this video training tape and receive a passing score upon completion of the accompanying examination, you will be eligible for 0.2 Continuing Education Units (CEUs). Members of the American Institute of Architects (AIA) will receive 2 Health, Safety and Welfare (HSW) Learning Units (LUs). To receive this credit, you must complete the examination. Instructions for completing the exam and submitting your response to ICBO may be found in the examination section of this workbook.

Glossary

The following terms should be reviewed before viewing the video and reading the workbook. This will help maximize the benefit of using the training tool. The terms that are presented are common to residential energy code inspection and design.

Annual fuel utilization efficiency (AFUE) – The ratio of annual output energy to annual input energy, which includes any nonheating season pilot input loss and for gas or oil-fired furnaces or boilers does not include electrical energy.

Approved – Approved by the code official or other authority having jurisdiction as the result of investigation and tests conducted by said official or authority, or by reason of accepted principles or tests by nationally recognized organizations.

Basement wall – The opaque portion of a wall which encloses one side of a basement and having an average below-grade area greater than or equal to 50 percent of its total wall area, including openings (see "Gross area of exterior walls").

Btu – Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound (0.454 kg) of water 1°F (0.56°C), (1 Btu = 1,055 J).

Building envelope – The elements of a building that enclose conditioned spaces through which thermal energy is capable of being transferred to or from the exterior or to or from spaces exempted by the provisions of Section 101.4.1

Condensing unit – A specific refrigerating machine combination for a given refrigerant, consisting of one or more power-driven compressors, condensers, liquid receivers (when required), and the regularly furnished accessories.

Cooled space – Space within a building that is provided with a positive cooling supply (see "Positive cooling supply").

Crawlspace wall – The opaque portion of a wall that encloses a crawl space and is partially or totally below grade.

Degree day, heating – A unit, based on temperature difference and time, used in estimating heating energy consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual heating degree days (HDD) are the sum of the degree days over a calendar year.

Duct – A tube or conduit used for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

Duct system – A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans, and accessory air-handling equipment and appliances.

Exterior wall – An above-grade wall enclosing conditioned space. Includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and basement walls with an average below grade-wall area that is less than 50 percent of the total opaque and nonopaque area of that enclosing side.

Fenestration – Skylights, roof windows, vertical windows (whether fixed or moveable), opaque doors, glazed doors, glass block, and combination opaque/glazed doors.

Glazing area – Total area of the glazed fenestration measured using the rough opening and including sash, curbing, or other framing elements that enclose conditioned space. Glazing area includes the area of glazed fenestration assemblies in walls bounding conditioned basements. For doors where the daylight opening area is less than 50 percent of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the rough opening area for the door including the door and the frame.

Heat pump – A refrigeration system that extracts heat from one substance and transfers it to another portion of the same substance or to a second substance at a higher temperature for a beneficial purpose.

Heat trap – An arrangement of piping and fittings, such as elbows, or a commercially available heat trap, that prevents thermosyphoning of hot water during standby periods.

Heated slab – Slab-on-grade construction in which the heating elements or hot air distribution system is in contact with or placed within the slab or the subgrade.

Heated space – Space within a building that is provided with a positive heat supply (see "Positive heat supply"). Finished living space within a basement with registers or heating devices designed to supply heat to a basement space shall automatically define that space as heated space.

Heating seasonal performance factor (HSPF) – The total heating output of a heat pump during its normal annual usage period for heating, in Btu, divided by the total electric energy input during the same period, in watt hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures and based on Region 4.

Infiltration – The uncontrolled inward air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind or the effect of differences in the indoor and outdoor air density or both. ARI 310/380.)

Insulating sheathing – An insulating board having a minimum thermal resistance of R-2 of the core material.

Labeled – Devices, equipment, appliances, assemblies, or materials to which have been affixed a label, seal, symbol, or other identifying mark of a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and by whose label the manufacturer attests to compliance with applicable nationally recognized standards.

Listed – Equipment, appliances, assemblies, or materials included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment, appliances, assemblies, or material, and whose listing states either that the equipment, appliances, assemblies, or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

Positive cooling supply – Mechanical cooling deliberately supplied to a space, such as through a supply register. Also, mechanical cooling indirectly supplied to a space through uninsulated surfaces of space-cooling components, such as evaporator coil cases and cooling distribution systems which continually maintain air temperatures within the space of 85°F (29°C) or lower during normal operation. To be considered exempt form inclusion in this definition, such surfaces shall comply with the insulation requirements of this code.

Positive heat supply – Heat deliberately supplied to a space by design, such as a supply register, radiator or heating ele-

ment. Also, heat indirectly supplied to a space through uninsulated surfaces of service water heaters and space-heating components, such as furnaces, boilers and heating and cooling distribution systems which continually maintain air temperature within the space of 50°F (10°C) or higher during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of this code.

Residential building, Type A-1 – Detached one- and two-family dwellings.

Residential building, Type A-2 – A building containing multiple (i.e., three or more) dwelling units where the occupants are primarily permanent in nature, such as town-houses, row houses, apartment houses, convents, monasteries, rectories, fraternities and sororities, dormitories, and rooming houses, all of which are three stories or less in height above grade.

Roof assembly – A roof assembly shall be considered to be all roof/ceiling components of the building envelope through which heat flows, thus creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses conditioned space. The gross area of a roof assembly consists of the total interior surface of all roof/ceiling components, including opaque surfaces, dormer and bay window roofs, treyed ceilings, over-head portions of an interior stairway to an unconditioned attic, doors and hatches, glazing and skylights exposed to conditioned space that are horizontal or sloped at an angle less than 60 degrees (1.1 rad) from the horizontal (see "Exterior wall"). A roof assembly or portions thereof having a slope of 60 degrees (1.1 rad) or more from horizontal shall be considered to be in the gross area of exterior walls and thereby excluded from consideration in the roof assembly. Skylight shaft walls 12 inches (305 mm) in depth or greater (as measured from the ceiling plane to the roof deck) shall be considered to be in the gross area of exterior walls and are thereby excluded from consideration in the roof assembly.

Seasonal energy efficiency ratio (SEER) – The total cooling output of an air conditioner during its normal annual usage period for cooling, in Btu/h (W), divided by the total electric energy input during the same period, in watt-hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures.

Standard truss – Any construction that does not permit the roof/ceiling insulation to achieve the required R-value over the exterior walls.

Slab-on-grade floor insulation – Insulation around the perimeter of the floor slab or its supporting foundation when the top edge of the floor perimeter slab is above the finished grade or 12 inches (305 mm) or less below the finished grade.

Thermal conductance – Time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady conditions (Btu/h × ft^2× °F) [W/(m^2 × K)].

Thermal resistance (*R*) – The reciprocal of thermal conductance (h × ft^2 × °F/Btu) [(m^2 × K)/W].

Thermal transmittance (*U*) – The coefficient of heat transmission (air to air). It is the time rate of heat flow per unit area and unit temperature difference between the warm-side and cold-side air films (Btu/h × ft^2 × °F) [W/(m^2 × K)]. The *U*-factor applies to combinations of different materials used in series along the heat flowpath, single materials that comprise a building section, cavity airspaces and surface air films on both sides of a building element.

Thermostat – An automatic control device actuated by temperature and designed to be responsive to temperature.

Chapter 1

Introduction

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, specifications, or documentation. This section provides guidance to field inspectors performing site inspections on residential buildings that must comply with the 2000 *International Energy Conservation 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 to be provided on the plans and specifications *(see Section 104.2 of IECC)*. For simplicity, the workbook refers to "plans." However, this same information can instead be provided on specifications, schedules, and/or other documents accepted by your jurisdiction.

Five separate site inspections are commonly used to survey energy features:

- Pre-inspection
- Foundation inspection
- Framing inspection
- Insulation inspection
- Final inspection

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

You can use the *Field Inspection Checklist* provided with this workbook 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 crawlspace wall insulation as items that should be inspected at the same time. The checklist is designed to be used during both plan review and field inspection. During the plan review process, specific information pertaining to energy code compliance can be recorded. The inspector can then use the inspection form as a guide to ensure that each of the features used to make the building comply with the code is verified.

Chapter 2

Pre-Inspection

Before beginning the field inspection, verify that the approved building plans, specifications, or documentation are on site. Ensure that the plans and documentation have been checked for compliance with the energy code. The following minimum information should be included on the building plans:

- Insulation *R*-values
- Window *U*-factors
- Window solar heat gain coefficient values (if applicable)
- Rough openings for windows and skylights
- Equipment efficiencies (if credit has been taken for high efficiency heating and cooling systems
- Duct insulation *R*-values
- Plan notes containing information about:
  - Duct sealing
  - Air sealing for the building envelope
  - Circulation loop pipe insulation for water heating
  - IC rated / air-tight recessed can lights

The best place for this information is on the building plans but you may also find this in attached compliance documentation or specifications. The building plans, specifications, and compliance forms should provide you with all the information necessary to perform a field inspection properly.

As an alternative, an energy sheet can be added to the plan set that contains all the information necessary for energy code compliance.

Chapter 3

Foundation Inspection

The first energy feature to be inspected should be the foundation. Based on the type of foundation and placement of insulation, the following items will be inspected:

- Slab-edge insulation
- Basement wall exterior insulation
- Crawlspace wall insulation

Slab-Edge Insulation

The best time to inspect for slab-edge insulation is before the insulation is covered with either backfill or concrete. The inspector must ensure that the correct insulation *R*-value has been installed with the proper vertical and horizontal distance *(see IECC Section 502.2.1.4 or 602.1.6)*.

To verify that the correct *R*-value has been installed, compare the *R*-value printed on the insulation with that called out on the building plans or compliance documentation (See Figure 1). This information can be found on a building cross-section or foundation detail. The *R*-value of the insulation must meet or exceed that shown on the plans.

Figure 1

This will usually be listed as *R*-value per inch thickness, or the installed *R*-value will be printed on the insulation. 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.

There are several ways that insulation may be installed on the slab edge. The insulation may be placed on the inside of the foundation stem wall or on the exterior of the wall. The insulation must extend from the top of the slab downward or downward and horizontally for the required minimum distance (see Figure 2). Check the plans and compliance documentation to determine the depth. Insulation that extends horizontally, away from the slab, must be covered by either pavement or a minimum 10 inches of soil. The top edge of slab insulation installed between the exterior wall and the interior slab can be cut at a 45 degree angle away from the exterior wall.

The code also requires exterior slab-edge insulation that is exposed to air be covered with a rigid, opaque, and weather-resistant protective covering *(see IECC Section 102.4.1)*. This cover will prevent the degradation of the insulation's thermal performance. The cover must extend 6 inches below the grade. Materials that can be used include exterior grade plastic, fiberglass, galvanized metal or aluminum flashing, or a cementitious coating (see Figure 3).

Basement Wall Exterior Insulation

A basement wall is any wall that is at least 50 percent on average below grade. Basement walls have lower insulation *R*-value requirements than above-grade walls *(see IECC Section 502.2.1.6, 502.2.3.6 and 602.1.5)*. If the entire wall is at least

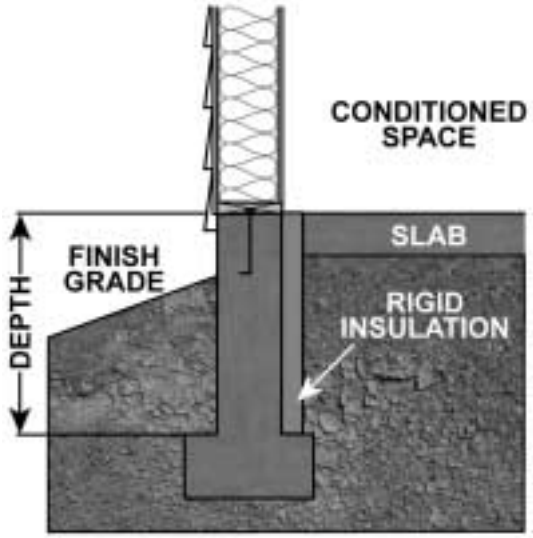

Figure 2

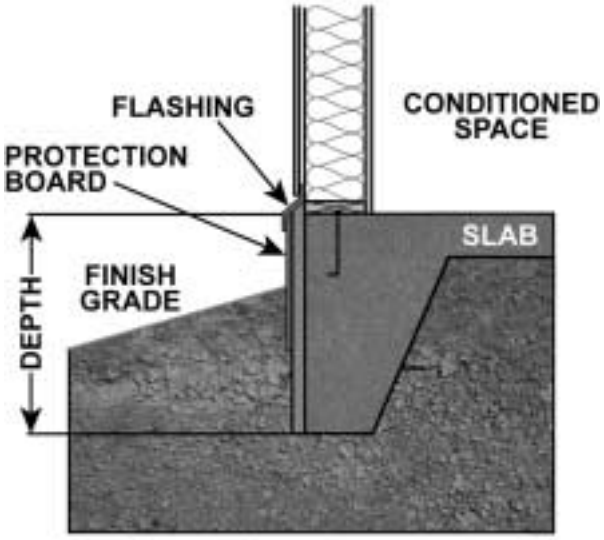

Figure 3

50 percent below grade the entire wall must meet the basement wall requirement regardless of how the wall is constructed (see Figure 4). For example, a basement wall that is part poured-in-place concrete and part wood stud must meet the *R*-value requirements for a basement wall. If in doubt, check the grade line shown on the building plans and compare this with the actual grade line on site.

Figure 4

Basement insulation can be installed on the interior of the wall or on the exterior as foam boards. Insulation installed on the interior of the wall is typically installed between studs and checked during the Insulation Inspection. In all cases the insulation must start at the top of the foundation wall. The perimeter joist directly connected to the foundation wall must also be insulated. Verify that the *R*-value of the installed insulation matches what is called for on the plans or the compliance documentation. For insulation installed on the exterior of the basement wall, check the *R*-value printed on the face of the exterior foam boards and compare that to what is called for on the plans or documentation (see Figure 5). This will usually be listed as *R*-value per inch thickness or the rated *R*-value for the product will be printed on the foam board. If the *R*-value is not shown, the installation contractor should provide verification of the insulation *R*-value. Types of insulation installed on the exterior of the wall include extruded polystyrene boards, molded expanded polystyrene (MEPS) boards, and fiberglass or MEPS drainage boards.

Crawl Space Wall Insulation

Installing insulation on the inside surface of the foundation stemwall is common practice in many cold parts of the country. This practice eliminates the need to install insulation in the raised floor over the crawlspace. There are a few criteria that must be met in order to use this insulation method:

- The crawlspace may not have ventilation openings that communicate directly with outside air
- The crawlspace must be mechanically ventilated or supplied with conditioned air
- The crawlspace floor must be covered with an approved vapor retarder material.

The *International Residential Code®* and *International Building Code®* allow the construction of unventilated crawlspaces. To meet the requirements, the crawlspace walls must be insulated to the *R*-value specified in the energy code *(see IECC Section 502.1.5 and 602.1.7)*. The crawlspace must either be provided with conditioned air or mechanical ventilation.

If mechanical ventilation is selected, the crawlspace must be ventilated at 1 cfm per 50 square feet. In all cases the ground surface must be covered with an approved vapor retarder material. To eliminate moisture from the crawlspace, the sill plate and perimeter joist should be sealed. Also, while not a code requirement, all joints in the vapor retarder should be overlapped and taped to prevent ground moisture from entering the crawlspace. This includes the connection between the vapor retarder and crawlspace wall.

Compare the *R*-value of the installed insulation with that called out on the plans or documentation. The *R*-value should meet or exceed what is called out on the plans. 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. Also, check to make sure that the insulation is securely fastened to the foundation wall. The insulation will either be rigid board insulation installed on either the interior or exterior of the stemwall, or fiberglass batt insulation draped down the inside of the stemwall or installed between framing. The code requires 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 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 from the outside grade level.

Figure 5

Chapter 4

Framing Inspection

Several of the energy features required by the IECC can be examined during the framing inspection. They include:

- Air sealing
- Glazing area, *U*-factor and solar heat gain coefficient
- HVAC ductwork insulation and installation
- HVAC equipment efficiency
- Recessed can lights

It is best to inspect for these features prior to the installation of insulation and sheetrock. This will allow any change outs in the field to be completed with minor disruptions to other parts of the building assembly.

Air Sealing

There is no specific code language that dictates exactly how an air leak should be sealed or the quality of the seal. But proper air sealing will not only decrease the energy use of the building, but it will also increase the comfort of the homeowner and the durability of the home.

Air leaking into and out of the wall, ceiling, and floor systems can carry water vapor that will condense within the framing cavities. Air movement carries significantly more moisture than vapor diffusion. This condensed water can then cause mold growth and rot within the cavities, shortening the life span of the structure.

All penetrations in the building envelope between conditioned and unconditioned space or outside the building must be sealed with durable caulking materials or closed with gasketing materials *(see IECC Section 502.1.4.2 and 602.1.10)* (see Figure 6). The code also allows the use of vapor-permeable house-wrap as an air barrier. To spot a potential air leakage site, look along

Figure 6

cracks in the building envelope for daylight. If you see daylight, you have an air leak. Air leaks can be introduced at any stage of construction.

There are several places where air leakage can occur.

- Around all plumbing and electrical penetrations, including between the sheet-rock and electrical boxes and where the wiring penetrates the box
- Between the duct boot and the subfloor or sheetrock
- At the attic and crawlspace panels
- Between the top and bottom plates and also around the perimeter joist on a floor assembly between two conditioned floors
- Around tubs and showers
- At recessed lights

There are several types of material that can be used to seal air leaks. They include durable caulking materials, foam backer rod, expanding foam products, and other foam products. Fiberglass batt insulation is not an effective air sealant. Caulking and weatherstripping must be installed in accordance with the manufacturer's installation requirements. Also, check the manufacturer's warranty on window products to ensure

that the use of certain sprayed-in foam products does not void the warranty.

Floor Insulation

If the building has a raised floor over an unconditioned space and the floor insulation has been installed, verify that the installed insulation *R*-value matches the approved plans *(see IECC Section 502.2.1.3, 502.2.4.8 and 602.1.4)*. If the floor insulation has not yet been installed, it may be inspected during the insulation inspection. Insulation *R*-values must be marked on the insulation with an *R*-value designation.

Properly installed floor insulation should be flush against the subfloor, with the vapor retarder (where required) against the subfloor. Vapor retarders are only required in unvented floor spaces and must have a perm rating of 1.0 or less. The insulation should be adequately and uniformly held by 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 (see Figure 7).

Figure 7

Glazing and Door *U*-factors

Glazing plays a major role in energy code compliance. More glass typically means greater insulation levels or a need for more efficient windows to offset the energy use resulting from the glazing. Three key elements need to be inspected:

- Glazing area
- Glazing *U*-factor
- And in some areas of the country, solar heat gain coefficient

Let's take a look at glazing area first. Openings for windows, glass doors, and skylights will be roughed out during the framing inspection. Compare the installed glazing or roughed out opening with what is shown on the approved plans. Look for added windows, skylights, glass doors, or windows larger than those shown on the plans. Any increase in window area could cause non-compliance. New documentation will need to be submitted *(see IECC Section 502.2.4.3)*.

The glazing *U*-factor is the next item to check. The *U*-factor is a measure of the efficiency of the window. The lower the *U*-factor the greater the efficiency. As an example, an aluminum window with two panes of glass may have a *U*-factor of 0.87. Vinyl or wood, on the other hand, have U-factors less than 0.55.

The code requires windows, glass doors, and skylights to be rated by the National Fenestration Rating Council and have labels that contain the rated *U*-factor for the glazing unit *(see IECC Section 102.5.2)*. These labels make it easy for an inspector to verify that the installed window unit meets the *U*-factor requirement called out on the plans or documentation (see Figure 8).

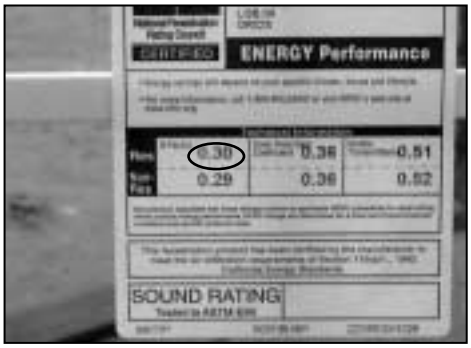

Figure 8

To verify compliance in the field, compare the installed glazing *U*-factor with the compliance documentation or approved building plans. If the *U*-factor is less than or equal to what is on the plans, the window complies.

If the windows and glass doors are not rated, Table 102.5.2(1), *U*-Factor Default Table for Windows, Glazed Doors and Skylights, can be used. By using the frame material, the number of panes of glass and the operation of the window (either fixed or operable) you can determine the default *U*-factor for a window, glass door, or skylight. For example, a vinyl framed, double glazed, operable window has a default *U*-factor of 0.55 (see Figure 9).

TABLE 102.5.2(1)
***U*-FACTOR DEFAULT TABLE FOR WINDOWS, GLAZED DOORS AND SKYLIGHTS**

FRAME MATERIAL AND PRODUCT TYPE[a]	SINGLE GLAZED	DOUBLE GLAZED
Metal without thermal break		
Operable (including sliding and swinging glass doors)	1.27	0.87
Fixed	1.13	0.69
Garden window	2.60	1.81
Curtain wall	1.22	0.79
Skylight	1.98	1.31
Site-assembled sloped/overhead glazing	1.36	0.82
Metal with thermal break		
Operable (including sliding and swinging glass doors)	1.08	0.65
Fixed	1.07	0.63
Curtain wall	1.11	0.68
Skylight	1.89	1.11
Site-assembled sloped/overhead glazing	1.25	0.70
Reinforced vinyl/metal clad wood		
Operable (including sliding and swinging glass doors)	0.90	0.57
Fixed	0.98	0.56
Skylight	1.75	1.05
Wood/vinyl/fiberglass		
Operable (including sliding and swinging glass doors)	0.89	0.55
Fixed	0.98	0.56
Garden window	2.31	1.61
Skylight	1.47	0.84

a. Glass block assemblies with mortar but without reinforcing or framing shall have a *U*-factor of 0.60.

Figure 9

Glazing Solar Heat Gain Coefficient

Climates with less than 3,500 heating degree days (HDD) require glazing to have a solar heat gain coefficient (SHGC) of 0.40 or less *(see IECC Section 502.1.5)*. The SHGC is a measure of how much heat or solar gain is transmitted through the window by solar radiation (see Figure 10). The lower the number, the lower the amount of heat that passes into the building through the glazing. A glazing unit with a low SHGC will help to reduce air conditioning energy use during the cooling season.

The NFRC labels also include SHGC ratings for many windows, glass doors, and skylights (see Figure 11). Compare the SHGC on the installed windows with those called out on the plans. If the values are less than or equal to those on the plans or documentation, the window complies with the code. The code does allow for the use of permanent exterior solar shading devices to meet the requirements. This would include shade screens and overhangs. If exterior shading devices are indicated on the plans, make certain they are installed on the windows.

Duct Insulation

Inspecting the HVAC system for compliance with the IECC can also be done during the framing inspection. Many of the provisions also fall within the normal mechanical code inspection.

The IECC requires that all supply and return air ducts be insulated to specified levels and sealed to minimize the amount of duct leakage within the heating and cooling system *(see IECC Section 503.3.3.3)*. The *R*-value for duct insulation is based on Table 503.3.3.3 of the IECC (see Figure 12). The approved plans should call out the duct insulation *R*-values for ducts in unconditioned spaces and ducts located outside of the building. Ducts in unconditioned spaces will typically be required to use an R-5 insulation.

Ducts considered to be in unconditioned spaces would include those located in:

- vented attics
- vented crawlspaces

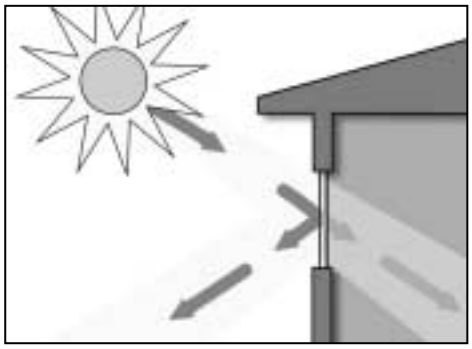

Figure 10

Figure 11

TABLE 503.3.3.3
MINIMUM DUCT INSULATION[a]

DUCT LOCATION	COOLING[b]		HEATING[c]	
	Annual cooling degree days	Insulation *R*-value[g] ($h \cdot ft^2 \cdot °F$)/Btu	Annual heating degree days	Insulation *R*-value[g] ($h \cdot ft^2 \cdot °F$)/Btu
Exterior of building	Below 500	3.3	Below 1,500	3.3
	500 to 1,150	5.0	1,500 to 4,500	5.0
	1,151 to 2,000	6.5	4,501 to 7,500	6.5
	Above 2,000	8.0	Above 7,500	8.0
In unconditioned spaces[d]				
TD[e] ≤ 15	—	None required	—	None required
40 ≥ TD[e] > 15	—	3.3	—	3.3
TD[e] > 40	—	5.0[f]	—	5.0[f]

For SI: 1 foot = 304.8 mm, °C = |(°F)-32| = 1.8, 1 ($h \cdot ft^2 \cdot °F$)/Btu = 0.176 ($m^2 \cdot K$)/W.

a. Insulation *R*-values shown are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and condensation. Where control of condensation is required, additional insulation, vapor retarders, or both, shall be provided to limit vapor transmission and condensation. For ducts that are designed to convey both heated and cooled air, duct insulation shall be as required by the most restrictive condition. Where exterior walls are used as plenum walls, wall insulation shall be as required by the most restrictive condition of this section.

b. Cooling ducts are those designed to convey mechanically cooled air or return ducts in such systems.

c. Heating ducts are those designed to convey mechanically heated air or return ducts in such systems.

d. Unconditioned spaces include ventilated crawl spaces, ventilated attics, and framed cavities in those floor, wall and ceiling assemblies which (a) separate conditioned space from unconditioned space or outside air, and (b) are uninsulated on the side facing away from conditioned space.

e. TD is defined as the temperature difference at design conditions between the space within which the duct is located and the design air temperature in the duct.

f. Insulation resistance for runouts to terminal devices less than 10 feet in length is not required to exceed 3.3 (($h \cdot ft^2 \cdot °F$)/Btu.

g. Insulation resistance measured on a horizontal plane in accordance with ASTM C 518, at a mean temperature of 75°F at the installed thickness.

Figure 12

- garages
- unconditioned basements
- any framing cavity that separates conditioned space from unconditioned space; for example, a duct located in an exterior wall.

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 503.3.3.3 and the duct area must be treated as a separate component on the compliance documentation.

The code also requires that the *R*-value be printed on the duct insulation every 10 feet, so it should be easy to compare the installed duct insulation *R*-value with what is shown on the plans (See Figure 13). Please note the *International Mechanical Code®* (IMC) and *International Residential Code®* (IRC) specify that ducts must be labeled every 3 feet. If the jurisdiction has adopted either of these codes in addition to the IECC, the IRC or IMC requirement would take precedence over the IECC.

Figure 13

Duct Sealing

Ducts are also required to be sealed. All longitudinal and transverse joints, seams, and connections of supply and return ducts are required to be properly sealed *(see IECC Section 503.3.3.4.3 and 603.1)*. Sealing the ducts ensures that the conditioned air reaches spaces intended for space conditioning and does not end up conditioning the vented attic or crawlspace. This may be one of the most important conservation features to check. A properly sealed duct system will help increase the comfort of the home and lower the energy use of the building.

Supply and return ducts are required to be sealed with:

- welds
- gaskets
- mastics
- mastic-plus-embedded-fabric systems
- approved tapes

Duct tape, or any other unapproved tape, is not permitted as a sealant on any ducts. Ducts in conditioned and unconditioned spaces, including outside the building envelope, are required to be sealed. It is important to note that return ducts formed by stud cavities and between solid floor joists are considered part of the duct system as are supply and return plenums located at the air handler (see Figure 14). These are areas that are commonly missed during the air sealing process and must all be sealed with the approved sealing methods.

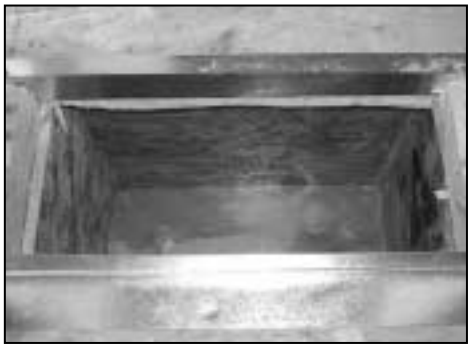

Figure 14

Heating and Cooling Efficiency

The IECC requires that heating and cooling equipment installed in residential buildings meets minimum efficiency requirements *(see IECC Section 503.2 and 603.1)*. Verifying equipment efficiency is only an issue when trading off lower insulation or glazing requirements for higher efficiency equipment.

Compare the installed make and model number with what was called out on the approved plans or documentation. *If either piece of information is not available,* request that the contractor supply the manufacturer's specifications for the installed equipment that list the rated efficiency. If the rated efficiency is greater than or equal to what is called out in the documentation the equipment complies with the code. The minimum efficiency requirements for typical residential heating and cooling equipment are listed in Table 503.2 (see Figure 15).

Recessed Can Lights

The installation of recessed can lighting has become common practice in residential construction. Can lights installed in the building envelope, for example an insulated ceiling, may be a major source of air leakage and energy loss within a residence. The IECC has certain requirements for can lights installed in the building envelope *(see IECC Section 502.1.3)*.

First, the can lights must either be Type IC rated or have a sealed box installed over the top of the fixture with at least 3 inches of clearance from insulation. The IC rating is visible on the inside of the installed can light. IC stands for "insulation contact," so an IC rating means the fixture is safe to be in contact with insulation. If a sealed box is used to meet the requirements, all electrical wire penetrations in the box should be sealed. In addition, the box should be sealed to the attic floor.

Second, the can lights must be air tight to reduce air movement and associated energy loss. The fixtures must either pass the ASTM E 283 test for air leakage or must be manufactured with no penetrations between the inside of the recessed fixture ceiling cavity, and sealed or gasketed to prevent air leakage into the unconditioned space. A recessed can light installed inside a sealed box will also meet the requirements of the code. Look for labels on the fixtures that designate the fixtures as sealed or air tight (see Figure 16).

HVAC Plumbing Insulation

All HVAC system piping installed and conveying fluid temperatures greater than 120°F or chilled fluids less than 55°F must be insulated to the levels specified in Table 503.3.3.1 included in Figure 17 *(see IECC Section 503.3.3.1 and 603.1)*. This would include piping from the condensing unit to the coil in the air handler and piping from a boiler leading to a surface used for radiant heat. 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. Note that the insulation thickness must be increased by ½ inch for all pipe exposed to outside air.

TABLE 503.2
MINIMUM EQUIPMENT PERFORMANCE

EQUIPMENT CATEGORY	SUB-CATEGORY[e]	REFERENCED STANDARD	MINIMUM PERFORMANCE
Air-cooled heat pumps heating mode < 65,000 Btu/h cooling capacity	Split systems	ARI 210/240	6.8 HSPF [a,b]
	Single package		6.6 HSPF [a,b]
Gas-fired or oil-fired furnace < 225,000 Btu/h	—	DOE 10 CFR Part 430, Subpart B, Appendix N	AFUE 78%[b] E_t 80%[c]
Gas-fired or oil-fired steam and hot-water boilers < 300,000 Btu/h	—	DOE 10 CFR Part 430, Subpart B, Appendix N	AFUE 80%[b,d]
Air-cooled air conditioners and heat pumps cooling mode < 65,000 Btu/h cooling capacity	Split systems	ARI 210/240	10.0 SEER[b]
	Single package		9.7 SEER[b]

For SI: 1 Btu/h = 0.2931 W.

a. For multicapacity equipment, the minimum performance shall apply to each capacity step provided. Multicapacity refers to manufacturer-published ratings for more than one capacity mode allowed by the product's controls.

b. This is used to be consistent with the National Appliance Energy Conservation Act (NAECA) of 1987 (Public Law 100-12).

c. These requirements apply to combination units not covered by NAECA (three-phase power or cooling capacity 65,000 Btu/h).

d. Except for gas-fired steam boilers for which the minimum AFUE shall be 75 percent.

e. Seasonal rating.

Figure 15

Mass Walls

In some locations, the code specifies less-stringent requirements for above-grade heavy mass walls than for wood- or steel-frame walls *(see IECC Section 502.2.1.1.2, 502.2..4.17 and 602.1.1.1)*. 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.

Mass wall insulation can be installed on the exterior of the wall, on the interior of the wall between the wall and the conditioned space, or integrated with the wall system. Placement will dictate the insulation *R*-value requirement, so it is important that the installed assembly match the approved building plans.

Steel Stud Framed Walls

Steel is typically less efficient from an energy standpoint. A wall constructed using wood framing will require less insulation than that constructed with steel using the same nominal thickness. Steel framing cannot be substituted for wood framing unless new energy code compliance documentation is submitted. Walls that use steel framing will need to either increase the thickness of the wall framing (for example, change from a 4-inch nominal stud to a 6-inch nominal stud) or use continuous rigid board insulation over the face of the studs *(see IECC Section 502.2.1.1.1, 502.4.16 and 602.1.1.2)*.

If the building was made to comply using steel studs in the wall system, verify that the installed insulation *R*-value is correct and check the building plans to determine if rigid board insulation is required to be installed over the face of the studs.

Figure 16

TABLE 503.3.3.1
MINIMUM PIPE INSULATION
(thickness in inches)

PIPING SYSTEM TYPES	FLUID TEMPERATURE RANGE, °F	PIPE SIZES[a]					
		Runouts up to 2"[b]	1 and less	1.25" to 2"	2.5" to 4"	5" to 6"	8" and larger
HEATING SYSTEMS							
Steam and hot water:							
High pressure/temperature	306-450	1 1/2	2 1/2	2 1/2	3	3 1/2	3 1/2
Medium pressure/temperature	251-305	1 1/2	2	2 1/2	2 1/2	3	3
Low pressure/temperature	201-250	1	1 1/2	1 1/2	2	2	2
Low temperature	120-200	1/2	1	1	1 1/2	1 1/2	1 1/2
Steam condensate (for feed water)	Any	1	1	1 1/2	2	2	2
COOLING SYSTEMS							
Chilled water, refrigerant and brine:	40-55	1/2	1/2	3/4	1	1	1
	Below 40	1	1	1 1/2	1 1/2	1 1/2	1 1/2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F)-32]/1.8.
a. For piping exposed to outdoor air, increase insulation thickness by 0.5 inch.
b. Runouts not exceeding 12 feet in length to individual terminal units.

Figure 17

Chapter 5

Insulation Inspection

During the insulation inspection we are going to verify the following:

- wall insulation *R*-values and installation
- that a vapor retarder for unvented walls, floors, and roof assembles, is installed
- floor insulation *R*-values and installation
- cathedral insulation *R*-value and installation

It is important to inspect the insulation prior to covering it with sheetrock to ensure that it has been installed properly and that it has the correct *R*-value. This is the last chance to see the insulation before it is covered and this inspection could have a lasting impact on the energy bills for the homeowner for the life span of the residence.

Wall Insulation

The best time to inspect wall and raised floor insulation is before the sheetrock is installed in the building. Two questions need to be answered during this inspection. First, has the right level of insulation been installed? And second, has it been installed correctly? All walls between conditioned space and the outdoors or unconditioned space (see Figure 18) must be insulated *(see IECC Section 502.2.1.1, 502.2.4.1 and 602.1.1)*. This includes:

- exterior walls
- kneewalls in attics
- perimeter joists
- the walls between the house and the garage
- skylight wells

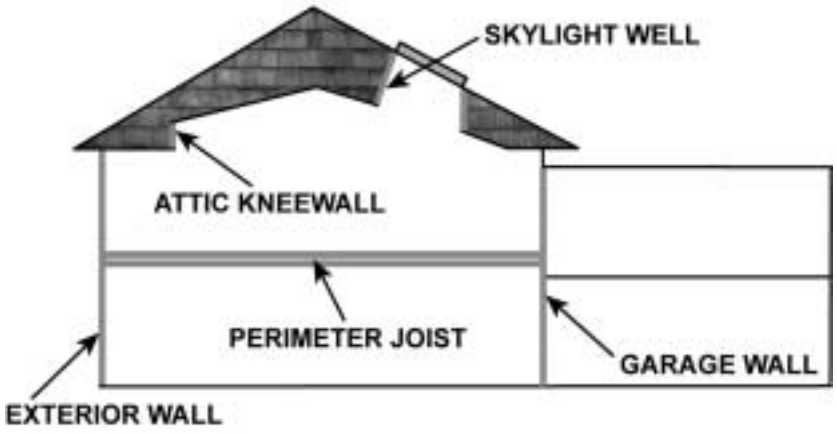

Figure 18

Check the approved plans or the compliance documentation for the required R-values for the insulation.

Fiberglass batts, rigid foam boards, and blown-in insulation are different types of insulation that you may encounter in the field. Fiberglass insulation *R*-values are required to be printed on the craft backing of the insulation or on the insulation itself for unfaced batts. For blown-in or sprayed insulation, the installer is required to provide a certification of the installed density and *R*-value. This certification must be posted at the job site. Rigid foam insulation will usually be listed as *R*-value per inch of thickness.

Ensuring that the insulation is installed properly is important in the overall energy performance of the house and can also affect the durability of the wall structure. Here are a few areas that are commonly missed and that should be checked during the insulation inspection. Check behind tub and shower enclosures for insulation. Also check behind kitchen cabinets on exterior walls. While not a code requirement, in some climates it is important to install insulation in exterior corners and on, or in headers over doors and windows. This can eliminate excess heat transfer through the surfaces. The perimeter joist between floors must also be insulated to the required *R*-value. Walls between the house and garage should also be insulated as well as attic kneewalls and pony walls.

Check for uniformity and support for the installed insulation (see Figure 19). Insulation must completely fill the voids in all exterior walls and should be split to go around wiring and plumbing and not be compressed. The insulative value is significantly reduced if the insulation is compressed within the wall system. Rigid board insulation installed over the face of the studs should be continuous with no holes or gaps between the insulation boards, and the joints should be taped or sealed.

Figure 19

Vapor Retarder

While inspecting the wall insulation, make sure that a vapor retarder has been installed *(see IECC Section 502.1.1)*. Vapor retarders control the entry of water vapor into building assemblies (see Figure 20). The IECC requires the vapor retarder to be installed in the "warm-in-winter" side of the insulation. That typically means between the insulation and the inside of the residence. The IECC defines certain climates within the country as hot and humid, and structures there will not be required to have a vapor retarder. In such locations, a vapor retarder may be detrimental to the wall system because it will trap moisture inside the wall cavity. Check the IECC to determine if a vapor retarder is required in your location.

Vapor retarders are required for all unvented wall, floor, and ceiling assemblies. Foil and craft-backed insulation (see Figure 21), polyethelene sheathing, or vapor retarder paints will work as vapor retarders as long as they have a *maximum* perm rating of 1.0. Vapor retarders should be installed with no holes or gaps that allow moisture to migrate into the unvented wall cavities and damage the integrity of the structure over time.

The code also allows the use of other methods for avoiding condensation in unventilated spaces. Any alternative method must be approved by the building official.

Vaulted Ceiling Insulation

Vaulted ceiling insulation may be installed prior to the assembly being covered by sheetrock. Typically fiberglass batt insulation is installed in these assemblies. When checking the insulation, verify that it fills the entire ceiling joist cavity and extends down over the top of the exterior walls. The insulation must not block vent openings in the eaves and must have a minimum 1-inch space between the insulation and the roof sheathing at the location of the vent *(see IRC Section R806.3)*. Verify that the installed insulation *R*-value meets or exceeds the *R*-value called out on the plans or documentation.

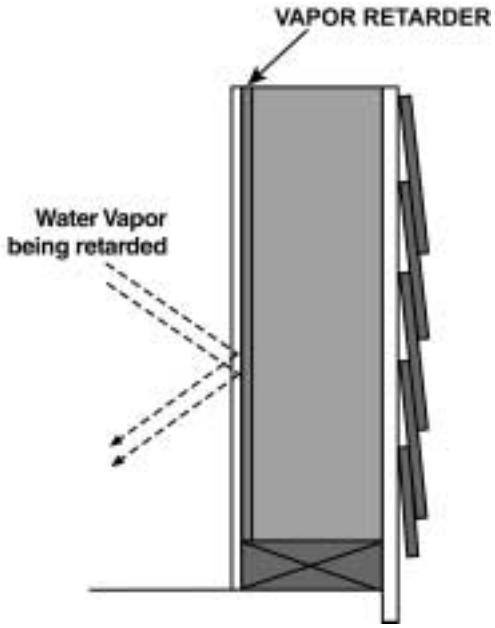

Figure 20

Figure 21

Basement Wall Interior Insulation

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 *(see IECC Section 502.2.1.6, 502.2.3.6, 502.2.4.9 and 602.1.5)*. See the discussion on inspecting for wall insulation for further details.

Raised Floor Insulation

If the floor insulation has not been installed until the insulation inspection, verify that the insulation *R*-value matches the approved plans *(see IECC Section 502.2.1.3, 502.2.3.3, 502.2.4.8 and 602.1.4)*. Insulation *R*-values must be marked on the insulation with an *R*-value designation: (e.g., R-19).

Properly installed floor insulation should be flush against the subfloor, with the vapor retarder (where required) against the subfloor. Vapor retarders are only required in unvented floor spaces and must have a perm rating of 1.0 or less. The insulation should be adequately and uniformly installed with supports such as furring running perpendicular to the joists, twine, metal rods, netting, piano wire stapled to the joists, or "tiger teeth." The insulation should not sag and should have no air gap next to the floor.

Floors over garages must also be insulated to the same level as a raised floor. Floors cantilevered over the outside air must also be insulated. Check the approved plans or documentation for the insulation *R*-value. Also, if the cantilevered floor is unventilated it must have a vapor retarder between the insulation and the inside of the house, if required by code *(see IECC Section 502.1.1)*.

Chapter 6

Final Inspection

During the final inspection you can inspect the energy features that were not installed or could not be verified during the other inspections. It is also a good time to reinspect a few of the energy features installed earlier that could have been damaged during the course of construction. This includes raised floor insulation, ductwork installed in the crawlspace, insulation installed on the crawlspace walls, and insulation installed in the attic kneewalls.

The following items will be checked during the final inspection:

- Attic insulation
- Heat traps on water heaters
- Heat pump thermostats

Now, let's take a look at the roof/ceiling insulation.

Roof / Ceiling Insulation

Either fiberglass batts or blown-in insulation will typically be used to insulate a roof ceiling assembly. The first thing to look for as you enter the attic is that the attic access hatch is insulated to the same *R*-value as that shown on the plans *(see IECC Section 502.2.1.2)*. Also, as you enter the attic, ensure that weatherstripping has been installed around the access hatch to reduce infiltration.

If fiberglass batt insulation is to be used in the attic, verify that the insulation level marked on the face of the batt meets or exceeds the required insulation level on the approved plans or documentation. The IECC requires the faced or unfaced batt to be marked with the *R*-value. The fiberglass batts should extend over the top of exterior walls and there should be no gaps in the insulation.

The IECC includes provisions that will make inspecting for blown-in insulation quick and easy *(see IECC Section 102.5.1.1)*. First, check for the attic insulation certificates near the opening of the attic. This certificate will include the following information:

- *R*-value of the installed thickness
- Initial installed thickness
- Settled thickness
- Coverage area
- Number of bags installed

Verify that the *R*-value listed on the certificate meets or exceeds the *R*-value called for on the approved plans. Then verify that the correct thickness has been installed. This can be done by checking the insulation markers installed in the attic (see Figure 22).

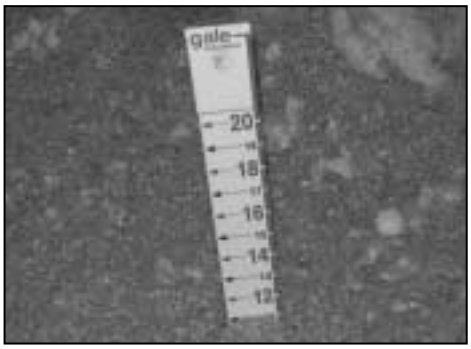

Figure 22

These markers are required to be spaced every 300 square feet and are marked with the minimum initial installed thickness and the minimum settled thickness. Insulation manufacturers will typically provide markers for use with their insulation. Check to see if the insulation is installed uniformly to an even thickness throughout the attic and that it extends over the top of the exterior wall.

Figure 23

Check to see that baffles are installed at each of the soffit, eave, or cornice vents to direct ventilation air up and over the insulation (see Figure 23).

These baffles will prevent windwashing. For blown-in installations with a high thickness of insulation (e.g., an R-49), it might be necessary to extend the baffles up and over the insulation. Credit can be taken for raised heel or oversized trusses that allow insulation to extend to full height over the exterior wall *(see IECC Section 502.2.4.5 and 602.1.2)*. Utilizing higher density insulation to achieve a higher *R*-value over the exterior wall line is also an option to reduce the required insulation *R*-value. If the approved plans call for raised or oversized trusses, or a different insulation arrangement, verify that what is installed matches the approved building plans.

Water Heating

Water heating can be a major energy user in residential buildings. The IECC requires that heat traps be installed on all noncirculating water heaters *(see IECC Section 504.7 and 604.1)*. A heat trap is a device or an arrangement of piping that keeps buoyant hot water from circulating through a piping distribution system through natural convection. These may be either installed internally by the manufacturer, as an after market add-on, or site-fabricated (see Figure 24). Check the manufacturer's literature if there is any question of an internal heat trap.

Piping for circulating systems must be insulated. Table 504.5 in Figure 25 lists the required insulation levels for the circulating piping. You should expect to see at least ½ inch of insulation on all circulating piping.

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 *(see IECC Section 504.4 and 604.1)*. 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 in an inaccessible location (such as under the house or in an attic) the control must be placed in a more convenient location - not on the pump.

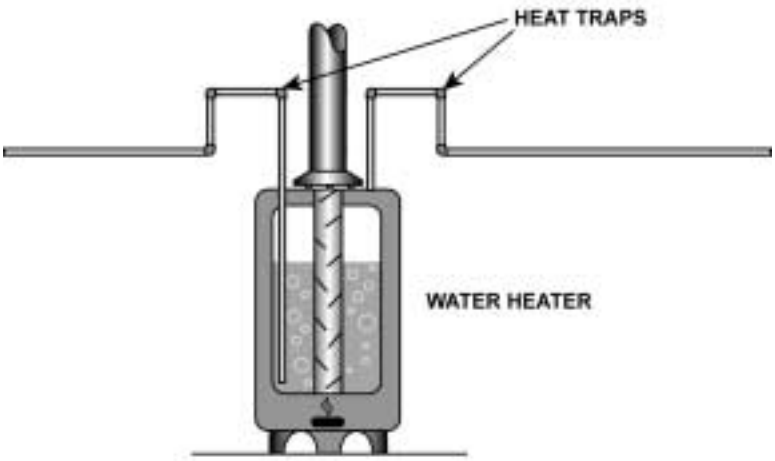

Figure 24

Heating, Cooling, and Water-Heating Equipment

All heating and cooling systems must have a thermostat to control the temperature and turn the system on and off *(see IECC Section 503.2.2 and 603.1)*. Heat pumps require a special heat pump thermostat that prevents supplementary electric resistance heat from coming on when the heat pump can handle the load *(see IECC Section 503.3.2.3)*. This allows the system to use the efficient heat pump for heating instead of using the less efficient electric resistance back-up. A two stage thermostat that controls the back-up heat on its second stage meets this requirement. If in doubt, ask for the manufacturer's specifications for the thermostat.

TABLE 504.5
MINIMUM PIPE INSULATION
(thickness in inches)

SERVICE WATER-HEATING TEMPERATURES (°F)	PIPE SIZES[a]			
	Noncirculating runouts	Circulating mains and runouts		
	Up to 1″	Up to 1.25″	1.5″ to 2″	Over 2″
170-180	0.5	1.0	1.5	2.0
140-169	0.5	0.5	1.0	1.5
100-139	0.5	0.5	0.5	1.0

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8,
1 Btu/h/inch · ft^2 · °F = 0.144 W/(m · K).

a. Nominal iron pipe size and insulation thickness. Conductivity, $k \cong 0.27$

Figure 25

Appendix

FIELD INSPECTION CHECKLIST
2000 *International Energy Conservation Code®* (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)			
• Glazing and Door U-factors (502.2.1.1)			
• Glazing SHGC Values (502.1.5)			
• 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)			
• Heat Traps (504.7)			
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)			
• 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 Efficiency (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)			

Examination

Instructions and Procedures

1. Study the video training tape and workbook carefully and in full.
2. You may use the *International Energy Conservation Code®* or other literature referenced in this publication to answer the questions.
3. Choose your preferred method: on-line (www.icbo.org under Training) or paper/pencil.
4. You must complete the exam on your own without the help or assistance of others.
5. The questions are final as they appear and no further clarifications will be provided by ICBO.
6. Choose only one answer: the correct or the best possible answer from the choices provided.
7. ICBO will provide a pass/fail report for your exam instantaneously when taken online and within 30 days of receiving your answers when taken in paper/pencil format.
8. Passing scores will receive a certificate, awarding the number of CEUs and/or LUs noted in the suggestions section of the workbook.
9. Failing score reports will be returned to you with a new answer sheet for an exam retake. Please note that each retest will cost $10.
10. You should retain your score reports for your records and for submission to any registration boards that require continuing professional development for license maintenance.
11. Your score reports will be maintained by ICBO for seven years and will be made available only to you or as directed by you (to send to registration board, etc.).
12. Duplicate copies of your score report will be made available for a fee of $15.
13. Our training department may be contacted by mail at the address below, or by phone at (800) 423-6587, x3418.

Answer sheet (on page 33) must be returned to:

International Conference of Building Officials
5360 Workman Mill Road
Whittier, California 90601-2298
Attention: Training Department

Important: Passing scores will receive a certificate, awarding the number of CEUs and/or LUs noted in the suggestions section of the workbook.

Examination for Inspecting for the Residential Provisions of the IECC

(Note: Please provide all code references)

1. What is the *U*-value for a nonlabeled, double-glazed sliding-glass door having a wood frame?

   A. 0.55
   B. 0.57
   C. 0.65
   D. 0.89

   Ref: _____

2. What is the solar heat gain coefficient (SHGC) for a nonlabeled, operable, vinyl frame window double-glazed with clear glass?

   A. 0.44
   B. 0.45
   C. 0.46
   D. 0.55

   Ref: _____

3. The term, "approved," means approved by_____.

   A. the builder as meeting the plans and specifications.
   B. building scientists as meeting the intent of the code.
   C. the building official or other authority having jurisdiction.
   D. the licensed design professional as meeting the intent of the code.

   Ref: _____

4. Glazing area refers to the interior surface area of_____.

   A. all windows including sash, curbing, and frame.
   B. the glass portion of all windows and glazed doors.
   C. all glazed areas including sash, curbing, and frame.
   D. all glazed areas excluding sash, curbing, and frame.

   Ref: _____

5. The word infiltration describes air that _____.

   A. leaks out around windows and doors.
   B. is purposely brought inside the thermal envelope.
   C. is uncontrolled inward leakage through cracks and interstices.
   D. is controlled inward leakage to provide air for combustion appliances.

   Ref: _____

6. Frame walls, floors, and ceilings not ventilated to allow moisture to escape must be_____.

   A. disapproved.
   B. provided with a vapor retarder.
   C. provided with a vapor retarder and properly air sealed.
   D. provided with a vapor retarder having a maximum rating of 1.0 perm.

   Ref: _____

7. In locations having heating degree-days (HDD) less than 3,500, what is the maximum combined SHGC (the area-weighted average) of all glazed fenestration products in the building?

   A. 0.1
   B. 0.2
   C 0.3
   D. 0.4

   Ref: _____

8. When installed in the building envelope, type IC-rated recessed lighting fixtures, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity, must be_____.

   A. installed within a sealed box.
   B. according to plans and specifications.
   C. sealed or gasketed to prevent air leakage into the conditioned space.
   D. sealed or gasketed to prevent air leakage into the unconditioned space.

   Ref: _____

9. Water heaters with vertical risers and no integral heat traps that are not part of a circulating system must have_____.

   A. a time clock.
   B. pipe insulation.
   C. a heat trap on the inlet of the water heater.
   D. a heat trap on both the inlet and outlet of the water heater.

   Ref: _____

10. A duct system for a residential building includes which of the following.

    A. ductwork
    B. duct fittings
    C. plenums
    D. all of the above

    Ref: _____

EXAMINATION ANSWER SHEET

Inspecting for the Residential Provisions of the IECC

Circle the correct answer.

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D
9.	A	B	C	D
10.	A	B	C	D

Name: _____

Address: _____

Phone Number: _____

AIA Membership Number (if applicable): _____

(only if you would like your passing score reported to the AIA)

Mail answer sheet to:

International Conference of Building Officials
5360 Workman Mill Road
Whittier, California 90601-2298
Attention: Training Department