Chapter 4
Residential Energy Efficiency

[Residential structures include R-3 buildings; R-2 and R-4 buildings three stories or less in height built to the *International Building Code* (see IBC classifications)]

INSPECTIONS FOR ENERGY PROVISIONS GENERALLY CONSIST OF FIVE MAJOR INSPECTIONS:

1. **PREINSPECTION**
2. **FOUNDATION INSPECTION**
3. **FRAMING INSPECTION**
4. **INSULATION INSPECTION**
5. **FINAL INSPECTION**

1. PREINSPECTION

The preinspection meeting might be a phone call or meeting between the field inspection staff and plan reviewer in charge of the project. The primary purpose of the preinspection meeting is to determine whether there might be any preexisting conditions or unique circumstances the

Tips and Hints

Verify that the plans and documentation have been checked for compliance with the *International Energy Conservation Code* (IECC). Minimum information should include:

- **Insulation *R*-values**
- **Window *U*-factors**
- **Window Solar Heat Gain Coefficient (applicable to Zones 1 through 3)**
- **Equipment efficiencies for all heating and cooling systems and**
- **Duct insulation *R*-values.**

Plan notes should contain information about:

- **Duct sealing**
- **Air sealing of the building envelope**
- **Circulation loop pipe insulation for water heating**
- **IC (insulation contact) rated/airtight recessed can lights and**
- **Others as determined during plan review and by the code.**

inspector should be aware of. A good plan review will make the field inspector's job much easier. That is why good communication between the plans examiner and the field inspector is very important.

Note: Up to 15 square feet of glazed fenestration per dwelling unit shall be permitted to be exempt from the *U*-factor and SHGC requirements in Section 402.1.1. This exemption does not apply when using the *U*-factor alternative approach in Section 402.1.3 or the total UA alternative in Section 402.1.4. **402.3.3**

Thermally isolated sunroom *U*-factor – Thermally isolated sunrooms shall have a maximum fenestration *U*-value of 0.50 and a maximum skylight *U*-factor of 0.75 in Zones 4 through 8. New windows and doors separating the sunroom from the conditioned space shall meet the building thermal envelope requirements. **402.3.5**

Replacement fenestration – Replacement fenestration shall meet the requirements of Table 402.1.1 *Insulation and Fenestration Requirements by Component* based on climate zone. **402.3.6**

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

NOTES FOR TABLE 402.1.1

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2 × 6 framing cavity such that the *R*-value is reduced by R-1 or more shall be marked with the compressed batt *R*-value in addition to the full thickness *R*-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. “15/19” means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. “10/13” means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. “13+5” means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

i. The second R-value applies when more than half the insulation is on the interior of the mass wall.

j. For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code* or Section 1608.1.2 of the *International Building Code*, the maximum *U*-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

Tips and Hints

Computing *R*-values – Insulation materials used in layers shall be summed to compute the required *R*-value, but shall not include *R*-values of other building materials or air films. **402.1.2**

***U*-factor Alternative –** An assembly with a *U*-factor equal to or less than that specified in Table 402.1.3, *Equivalent U-Factors*, shall be permitted as an alternative to the *R*-value in Table 402.1.1. See exceptions. **402.1.3**

Total UA Alternative – Calculating the total building thermal envelope UA is an alternative to complying with Table 402.1.1. The calculation shall be done using ASHRAE *Handbook of Fundamentals* methodology and shall include the effects of thermal bridging on the framing materials. The SHGC requirement shall be met in addition to UA requirements. **402.1.4**

Mass walls – The second *R*-value requirement for mass walls applies when more than 50 percent of the required insulation *R*-value is on the interior of the wall. Items considered as mass walls are defined in this section. **402.2.4**

Steel-framed ceilings, walls and floors – These shall meet the insulation requirements of Table 402.2.5 *Steel-frame Ceiling, Wall and Floor Insulation (*R-*Value)* or meet the *U*-factor requirement of Table 402.1.3. **402.2.5**

Systems **403**

Controls – At least one thermostat shall be installed for each separate heating and cooling system. Programmable thermostat required if forced air furnace is the primary heating system. **403.1**

Mechanical Ventilation (Mandatory) – Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating. **403.5**

Ducts **403.2**

Duct Insulation (Prescriptive) – Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6. Also see exception for ducts located completely inside the building's thermal envelope. **403.2.1**

Duct Sealing (Mandatory) – Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed (see Figures 2 through