

COMMERCIAL ENERGY EFFICIENCY

Commercial buildings are all buildings that are not detached one- or two-family dwellings, multiple single-family dwellings (townhouses), or Group R-2, R-3 or R-4 buildings three stories or less in height above grade plane.

Tips

The path selected for complying with the commercial energy requirements should be spelled out in the construction documents and identified during plan review. Inspections should verify the prescriptive and mandatory requirements of the code as applicable and that construction matches the approved construction documents.

Approved construction documents should include:

- Building envelope system information including
 - Insulation R -values
 - Fenestration U -factors
 - Glazing solar heat gain coefficient (SHGC) values
 - Size of windows and skylights
 - Information on air sealing and vapor retarders as applicable.
- Mechanical system information including
 - Duct sealing and insulation R -values
 - Mechanical system controls
 - Equipment schedule listing the make and model of the equipment and other pertinent information
- Service water heating system information including
 - Piping insulation levels
 - Heat trap requirements
 - Circulation loop system controls
- Lighting system information including
 - Switching and control diagrams
 - Lighting schedule with fixture, lamp and ballast type, number of lamps per fixture and fixture wattage
 - Exterior lighting lamp and ballast type, and type of control

Performance requirements are typically achieved through an engineered design. Inspections for compliance with the commercial energy provisions typically coincide with building component inspections as follows:

- Building envelope—structural, framing and final inspections, or dedicated insulation and air sealing inspections
- Mechanical systems—mechanical rough-in and final inspections
- Service water heating systems—plumbing and mechanical rough-in and final inspections
- Lighting systems—electrical rough-in and final inspections

I PREINSPECTION

- **Application**—Commercial buildings shall comply with one of the following:
 1. The requirements of ANSI/ASHRAE/IES Standard 90.1.
 2. The prescriptive path requirements of Sections C402, C403, C404 and C405. In addition, commercial buildings shall comply with one of the following:
 - Efficient HVAC performance provisions in Section C406.2
 - Efficient lighting system provisions in Section C406.3 or
 - On-site renewable energy provisions in Section C406.4
 3. The requirements of the “Total Building Performance” provisions of Section C407, including the applicable references to other sections. The building energy cost shall be equal to or less than 85 percent of the standard reference design building. **C401.2**
- **Application to existing buildings**—Additions, alterations and repairs to existing buildings shall comply with one of the following:
 1. The prescriptive path provisions of Sections C402, C403, C404 and C405; or
 2. ANSI/ASHRAE/IES Standard 90.1. **C401.2.1**
- **Change in occupancy or use**—Where the use in a space changes to a use with a different interior lighting power allowance, the installed lighting wattage must comply with Section C405.5 for the new occupancy or use. **C101.4.4**

II ENVELOPE INSPECTION

- A. Vapor retarders
- B. Building envelope
- C. Insulation
- D. Fenestration
- E. Air leakage

A. Vapor retarders

- **Vapor retarders**—The *International Building Code* requires a Class I or II vapor retarder on the interior side of frame walls in Climate Zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
 2. Below-grade portion of any wall.
 3. Construction where moisture or its freezing will not damage the materials. **IBC 1405.3**
- **Class III vapor retarders**—Class III vapor retarders are permitted under prescribed conditions using vented cladding or insulated sheathing. **IBC 1405.3.1**
 - **Material vapor retarder class**—The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly. The following shall be deemed to meet the class specified:
Class I: Sheet polyethylene, nonperforated aluminum foil.
Class II: Kraft-faced fiberglass batts or paint with a perm rating greater than 0.1 and less than or equal to 1.0.
Class III: Latex or enamel paint. **IBC 1405.3.2**

B. Building envelope

- **Insulation and fenestration criteria**—The building thermal envelope shall meet the requirements of Table C402.2 for the opaque thermal envelope requirements and Table C402.3 for the fenestration requirements based on the climate zone. **C402.1.1**
- **R-values**—The “Group R” column of Table C402.2 applies to commercial buildings that include Group R occupancies. **C402.1.1**
- **Limits on fenestration area**—Buildings with a fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IES Standard 90.1. **C402.1.1**
- **U-factor alternative**—An assembly with a *U*-factor, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-value in Table C402.2. **C402.1.2**

TABLE C-02.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS^a

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.044	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.039	U-0.052	U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	U-0.064	U-0.045	U-0.045
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, Below Grade																
Below-grade wall ^b	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass	U-0.322	U-0.322	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066	U-0.066	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-Grade Floors																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55

a. Use of opaque assembly U-factors, C-factors, and F-factors from ANSI/ASHRAE/IESNA 90.1 Appendix A shall be permitted, provided the construction complies with the applicable construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.

b. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.

- **Mass walls**—Mass walls shall include walls weighing at least:
 - 35 psf of wall surface area. Any 8-inch (203 mm) nominal, medium-weight aggregate CMU or precast, concrete wall type (integrally insulated or not) will meet this definition. Note, however, that light-weight aggregate (LWA), also known as auto-claved concrete block, will likely require submittal of a cut-sheet or manufacturer's details on the weight ratio to receive suitable credit; or
 - 25 psf of the wall surface area if the material weight is not more than 120 pcf—for example, solid timbers or logs. **C402.2.3**
- **Mass floors**—Mass floors shall include floors weighing at least:
 - 35 psf of floor surface area; or
 - 25 psf of floor surface area if the material weight is not more than 120 pcf. **C402.2.5**

C. Insulation

- **Specific insulation requirements**—Opaque assemblies shall comply with Table C402.2 based on climate zone. **C402.2**