

Errata & Approved changes by City Council after 1st Printing
2008 Houston Commercial Energy Conservation Code

Note: Highlighted portions indicate change

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5.4.3.5 Cool roofs. Low slope *roofs* up to 2:12 shall be provided with a roof covering where the exterior surface has:

- (a) a minimum total solar reflectance of 0.70 when tested in accordance with one of the solar reflectance test methods listed below, and
- (b) a minimum thermal emittance of 0.75 when tested in accordance with one of the thermal emittance test methods listed below.

Solar Reflectance Test Methods: ASTM C1549, ASTM E903, ASTM E1175, or ASTM E1918.

Thermal Emittance Test Methods: ASTM C835, ASTM C1371, or ASTM E408.

Exceptions to 5.4.3.5:

- (a) The portion of the *roof* that is covered by a rooftop deck covering 1/3 or less of the aggregate area of the roof, or a rooftop garden, or green roof, is exempt from the requirements of this section.
- (b) An area including and adjacent to rooftop photovoltaic and solar thermal equipment, totaling not more than three times the area that is covered with such equipment, is exempt from the requirements of this section.

TABLE 5.5-2 Building Envelope Requirements For Climate Zone 2 (A,B)*

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
Insulation Entirely above Deck	U-0.063	R-15.0 ci	U-0.063	R-15.0 ci	U-0.218	R-3.8 ci
Metal Building	U-0.065	R-19.0	U-0.065	R-38.0	U-0.167	R-13.0
Attic and Other	U-0.034	R-30.0	U-0.027	R-19.0	U-0.081	R-6.0
<i>Walls, Above-Grade</i>						
Mass	U-0.580	NR	U-0.089	R-5.7 ci ^a	U-0.580	NR
Metal Building	U-0.113	R-13.0	U-0.113	R-13.0	U-0.184	NR
Steel-Framed	U-0.089	R-13.0	U-0.124	R-13.0	U-0.292	NR
Wood-Framed and Other	U-0.124	R-13.0	U-0.151 ^a	R-13.0	U-0.352	R-6.0
<i>Wall, Below-Grade</i>						
Below-Grade Wall	C-1.140	NR	C-1.140	NR	C-1.140	NR
<i>Floors</i>						
Mass	U-0.137	R-4.2 ci	U-0.107	R-6.3 ci	U-0.282	NR
Steel-Joist	U-0.107	R-19.0	U-0.051	R-19.0	U-0.350	NR
Wood-Framed and Other	U-0.051	R-19.0	U-0.052	R-19.0	U-0.322	NR
<i>Slab-On-Grade Floors</i>						
Unheated	F-1.020	NR	F-0.730	NR	F-1.020	NR
Heated	F-0.730	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-0.730	R-7.5 for 12 in.
<i>Opaque Doors</i>						
Swinging	U-0.700		U-0.700		U-0.700	
Non-Swinging	U-1.450		U-1.450		U-1.450	
Fenestration	Assembly Max. U (Fixed/Operable)	Assembly Max. SHGC (All Orientations/ North-Oriented)	Assembly Max. U (Fixed/Operable)	Assembly Max. SHGC (All Orientations/ North-Oriented)	Assembly Max. U (Fixed/Operable)	Assembly Max. SHGC (All Orientations/ North-Oriented)
<i>Vertical Glazing, % of Wall^b</i>						
0-10.0%	U _{oper} ^{-1.27} U _{fixed} ^{-1.22}	SHGC _{all} ^{-0.25} SHGC _{north} ^{-0.61}	U _{oper} ^{-1.27} U _{fixed} ^{-1.22}	SHGC _{all} ^{-0.39} SHGC _{north} ^{-0.61}	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-NR} SHGC _{north} ^{-NR}
10.1-20.0%	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.25} SHGC _{north} ^{-0.61}	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.25} SHGC _{north} ^{-0.61}	U _{oper} ^{-1.27} U _{fixed} ^{-1.22}	SHGC _{all} ^{-NR} SHGC _{north} ^{-NR}
20.1-30.0%	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.25} SHGC _{north} ^{-0.61}	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.25} SHGC _{north} ^{-0.61}	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-NR} SHGC _{north} ^{-NR}
30.1-40.0%	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.25} SHGC _{north} ^{-0.61}	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.25} SHGC _{north} ^{-0.61}	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-NR} SHGC _{north} ^{-NR}
40.1-50.0%	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.17} SHGC _{north} ^{-0.44}	U _{fixed} ^{-1.22} U _{oper} ^{-1.27}	SHGC _{all} ^{-0.17} SHGC _{north} ^{-0.43}	U _{fixed} ^{-0.98} U _{oper} ^{-1.02}	SHGC _{all} ^{-NR} SHGC _{north} ^{-NR}
<i>Skylight with Curb, Glass, % of Roof</i>						
0-2.0%	U _{all} ^{-1.98}	SHGC _{all} ^{-0.36}	U _{all} ^{-1.98}	SHGC _{all} ^{-0.19}	U _{all} ^{-1.98}	SHGC _{all} ^{-NR}
2.1-5.0%	U _{all} ^{-1.98}	SHGC _{all} ^{-0.19}	U _{all} ^{-1.98}	SHGC _{all} ^{-0.19}	U _{all} ^{-1.98}	SHGC _{all} ^{-NR}
<i>Skylight with Curb, Plastic, % of Roof</i>						
0-2.0%	U _{all} ^{-1.90}	SHGC _{all} ^{-0.39}	U _{all} ^{-1.90}	SHGC _{all} ^{-0.27}	U _{all} ^{-1.90}	SHGC _{all} ^{-NR}
2.1-5.0%	U _{all} ^{-1.90}	SHGC _{all} ^{-0.34}	U _{all} ^{-1.90}	SHGC _{all} ^{-0.27}	U _{all} ^{-1.90}	SHGC _{all} ^{-NR}
<i>Skylight without Curb, All, % of Roof</i>						
0-2.0%	U _{all} ^{-1.36}	SHGC _{all} ^{-0.36}	U _{all} ^{-1.36}	SHGC _{all} ^{-0.19}	U _{all} ^{-1.36}	SHGC _{all} ^{-NR}
2.1-5.0%	U _{all} ^{-1.36}	SHGC _{all} ^{-0.19}	U _{all} ^{-1.36}	SHGC _{all} ^{-0.19}	U _{all} ^{-1.36}	SHGC _{all} ^{-NR}

*The following definitions apply: ci = continuous insulation (see Section 3.2), NR = no (insulation) requirement.

^a Exception to A3.1.3.1 applies.

^b Alternate to fenestration: Insulated low E glass having a SHGC of .35 will be acceptable in lieu of the table values for up to 40% glazing, provided the U Factor does not exceed 0.70. In the absence of a manufacturer's rated U Factor for insulated low E glass, use 0.70 as a default. For up to 50% glazing, insulated low E glass having a SHGC of 0.28 and a U Factor of 0.70 is acceptable.

TABLE 6.4.4.1.1 Insulation of Ducts ^{a, b}

Duct Location	Insulation Types Mechanically Cooled and Outside Air	Insulation Types Heating Only
1. On roof or exterior of building	R-8, V, W	R-8, W
2. Attics, garages, inside walls, floor-ceiling spaces and crawl spaces (located inside the building envelope)	R-6, V	R-6
3. Attics, garages, outside walls, and crawl spaces (located outside the building envelope)	R-8, V	R-8

- a. When the temperature difference between the interior and the exterior of the duct does not exceed 15° F (8° C) duct insulation is not required.
- b. Where ducts are used for both heating and cooling, the insulation requirements shall comply with the most restrictive condition.

NOTES:

V. Vapor retarders: Material with a perm rating not exceeding 0.5 perm (29 ng/Pa•s•m²). Vapor retarders shall be installed on cooling supply ducts in spaces vented to the outside in geographic areas where the summer dew point temperature exceeds 60°F (16°C) at the 2 ½ percent summer design dry-bulb with mean coincident wet-bulb temperature. All joints to be sealed.

W. Approved weatherproof barrier.

9.4.1.1 Automatic Lighting Shutoff. Interior lighting in *buildings* larger than 5000 ft² shall be controlled with an *automatic control device* to shut off *building* lighting in all spaces. This *automatic control device* shall function on either

- (a) a scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times—an independent program schedule shall be provided for areas of no more than 25,000 ft² but not more than one floor—or
- (b) an *occupant sensor* that shall turn lighting off within 30 minutes of an occupant leaving a space—or
- (c) a signal from another control or alarm system that indicates **the area is unoccupied**.

TABLE 11.3.1 (continued) Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

No.	Proposed Building Design (Column A) Design Energy Cost (DEC)	Budget Building Design (Column B) Energy Cost Budget (ECB)
5. Building Envelope	<p>All components of the building envelope in the <i>proposed design</i> shall be modeled as shown on architectural drawings or as installed for <i>existing building</i> envelopes. <i>Exceptions:</i> The following building elements are permitted to differ from architectural drawings.</p> <p>(a) Any envelope assembly that covers less than 5% of the total area of that assembly type (e.g., exterior walls) need not be separately described. If not separately described, the area of an envelope assembly must be added to the area of the adjacent assembly of that same type.</p> <p>(b) Exterior surfaces whose azimuth orientation and tilt differ by no more than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers.</p> <p>(c) For exterior roofs other than roofs with ventilated attics, the roof surface may be modeled with a reflectance of 0.45 if the reflectance of the proposed design roof is greater than 0.70 and its emittance is greater than 0.75. The reflectance and emittance shall be tested in accordance with 5.4.3.5. All other roof surfaces shall be modeled with a reflectance of 0.3. Manually operated fenestration shading devices such as blinds or shades shall not be modeled. Permanent shading devices such as fins, overhangs, and light shelves shall be modeled.</p> <p>(d) Manually operated fenestration shading devices such as blinds or shades shall not be modeled. Permanent shading devices such as fins, overhangs, and lightshelves shall be modeled.</p>	<p>The <i>budget building design</i> shall have <i>identical conditioned floor area</i> and identical exterior dimensions and orientations as the <i>proposed design</i>, except as noted in (a), (b), and (c) in this clause.</p> <p>(a) Opaque assemblies such as roof, floors, doors, and walls shall be modeled as having the same heat capacity as the <i>proposed design</i> but with the minimum U-factor required in 5.5 for new buildings or <i>additions</i> and 5.1.3 for <i>alterations</i>.</p> <p>(b) Roof albedo— Low slope roofs shall be modeled using section 5.4.3.5. All other roof surfaces shall be modeled with a reflectivity of 0.3.</p> <p>(c) Fenestration—No shading projections are to be modeled; fenestration shall be assumed to be flush with the exterior wall or roof. If the fenestration area for new buildings or <i>additions</i> exceeds the maximum allowed by 5.5.4.2, the area shall be reduced proportionally along each exposure until the limit set in 5.5.4.2 is met. Fenestration U-factor shall be the minimum required for the climate, and the solar heat gain coefficient shall be the maximum allowed for the climate and orientation. The fenestration model for envelope <i>alterations</i> shall reflect the limitations on area, U-factor, and solar heat gain coefficient as described in 5.1.3.</p> <p><i>Exception:</i> When trade-offs are made between an <i>addition</i> and an <i>existing building</i> as described in Exception to 4.2.1.2, the envelope assumptions for the <i>existing building</i> in the <i>budget building design</i> shall reflect existing conditions prior to any revisions that are part of this permit.</p>

INFORMATIVE APPENDIX E INFORMATIVE REFERENCES

Subsection	Reference	Title/Source
5.9	ASHRAE Guideline 0 – 2005	The Commissioning Process
5.9	NIBS Guideline 3 – 2006	Exterior Enclosure Technical Requirements for Commissioning Process
6.4.2	2001 ASHRAE Handbook—Fundamentals	ASHRAE
6.4.4.1.1	MICA Insulation Standards - 1999	National commercial and industrial insulation standards
6.4.4.2.1	SMACNA Duct Construction Standards - 1995	HVAC duct construction standards, metal and flexible
6.4.4.2.2	SMACNA Duct Leakage Test Procedures - 1985	HVAC Air Duct Leakage Test Manual
6.7.2.3.1	NEBB Procedural Standards - 1999	Procedural standards for building systems commissioning
6.7.2.3.1	AABC 2002	Associated Air Balance Council Test and Balance procedures
6.7.2.3.1	ASHRAE Standard 111 - 1988	Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration
6.7.2.2	ASHRAE Guideline 4 - 1993	Preparation of Operating and Maintenance Documentation for Building Systems
6.7.2.4	ASHRAE Guideline 1 - 1996	The HVAC Commissioning Process
6.9	NIBS Guideline 3 – 2006	Exterior Enclosure Technical Requirements for Commissioning Process
7.4.1 and 7.5	2003 ASHRAE Handbook—HVAC Applications	Chapter 49, Service Water Heating
11.2.1	DOE-2	Support provided by Lawrence Berkeley National Lab at the referenced web site
11.2.1	BLAST	University of Illinois
11.2.2	IWEC	International Weather for Energy Calculations
11.2.2	TMY 2 Data	Typical Meteorological Year