



COOL ROOF GUIDELINES

BACKGROUND

The 2009 Houston Commercial Energy Conservation Code with local Amendments, effective September 2, 2011, contains mandatory cool roofing provisions for new commercial buildings and alterations to existing commercial buildings. Cool roofs are highly reflective and limit heat absorption in a roof to reduce temperatures as much as 60 degrees lower than a typical roof. According to the *Cool Roof Rating Council* <http://www.coolroofs.org/>, there are hundreds of products that have been tested to meet the Houston criteria and more continue to be tested. Qualified roof covering materials include a broad spectrum from coatings to modified bitumen, metal, single ply, and the exposed surface of a built-up roof.

DEFINITIONS

Building Envelope. The exterior plus the semi-exterior portions of a building. For the purposes of determining building envelope requirements, the classifications are defined as follows:

Building Envelope, Exterior: the elements of a building that separate conditioned spaces from the exterior.

Building Envelope, Semi-exterior: the elements of a building that separate conditioned space from unconditioned space or that enclose semi heated spaces through which thermal energy may be transferred to or from the exterior, or to or from unconditioned spaces, or to or from conditioned spaces.

Positive Roof Drainage. The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation. **(IBC 2012)**

Roof. The upper portion of the building envelope, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60° from horizontal. For the purposes of determining building envelope requirements, the classifications are defined as follows:

- a. ***attic and other roofs:*** all other roofs, including roofs with insulation entirely below (inside of) the roof structure (i.e., attics, cathedral ceilings, and single rafter ceilings), roofs with insulation both above and below the roof structure, and roofs without insulation but excluding metal building roofs.
- b. ***metal building roof:*** a roof that is constructed with:
 1. a metal, structural, weathering surface,
 2. has no ventilated cavity, and
 3. has the insulation entirely below deck (i.e., does not include composite concrete and metal deck construction nor a roof framing system that is separated from the superstructure by a wood substrate) and whose structure consists of one or more of the following configurations:
 - (a) metal roofing in direct contact with the steel framing members or
 - (b) insulation between the metal roofing and the steel framing members or
 - (c) insulated metal roofing panels installed as described in 1 or 2.
- c. ***roof with insulation entirely above deck:*** a roof with all insulation:
 1. installed above (outside of) the roof structure and
 2. continuous (i.e., uninterrupted by framing members).
- d. ***single-rafter roof:*** a subcategory of attic roofs where the roof above and the ceiling below are both attached to the same wood rafter and where insulation is located in the space between these wood rafters.

Roof Assembly. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering. **(IBC 2012)**

Roof Covering. The covering applied to the roof deck for weather resistance, fire classification or appearance. **(IBC 2012)**

Roof Recover. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering. **(IBC 2012)**

Roof Replacement. The process of removing the existing roof covering, repairing any damaged substrate & installing a new roof covering. **(IBC 2012)**

Reroofing. The process of recovering or replacing an existing roof covering. See “Roof recover” and “Roof replacement.” (IBC 2012)

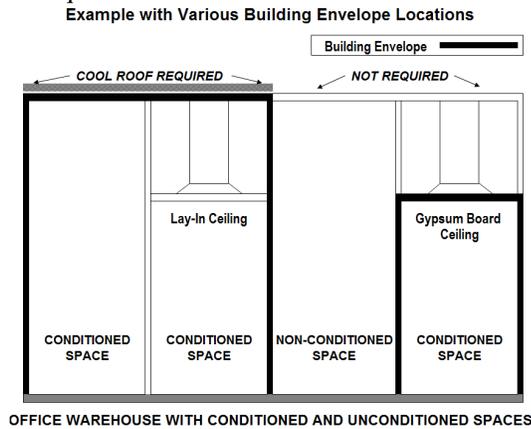
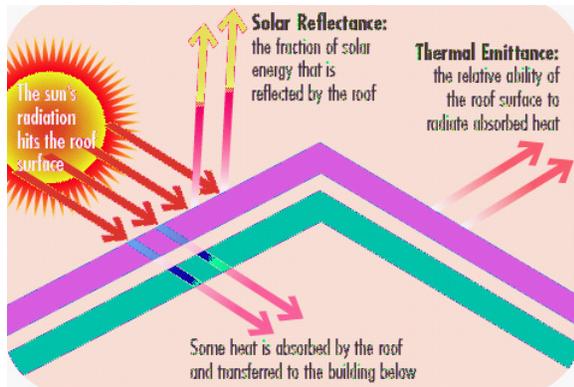
Roof Repair. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance. (IBC 2012)

REQUIREMENT

There are two (2) basic tests which classify the roof covering material. Results range from 0.0 to 1.0:

Solar Reflectance: the ratio of the light reflected by a surface to the light incident upon it. Minimum 0.70 required.

Thermal Emittance: the ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions. Minimum 0.75 required.



EXISTING BUILDING ENVELOPE

When there is no change to the status of an existing roof building envelope it does not need to meet the new guidelines. If the roof is already a building envelope and is not being reconstructed it may remain. For example, where a retail strip center has a change of occupancy to a restaurant and the roof is unaffected, it is not required to meet new provisions. If the existing roof was not a building envelope, and will not become part of the building envelope due to changing the space below to conditioned space, the existing roof may remain.

APPLICABILITY

Commercial Buildings or Multi-Family Residential Buildings over 3 stories, with a roof slope up to 2:12 pitch when any of the following occur:

- New building** (or addition) enclosing conditioned space where the roof serves as a portion of the building envelope.
- Conversion of a building** (or space) from unconditioned to conditioned space where the roof serves as a portion of the building envelope.
- Alteration or Repair** (re-roof) to existing roofs where the roof serves as a portion of the building envelope. Alterations made to an existing roof that affect the existing building envelope must comply and those that do not affect an existing building envelope may remain. There are several situations that affect whether the cool roof requirement applies:

SCOPE OF WORK	EXISTING ROOF COVERING	EXISTING INSULATION	REQUIREMENT
1. COMPLETE REMOVAL OF ROOF MATERIALS TO DECK	Removed	Above Deck Removed	Roof Insulation and Cool Roof
		Below Deck Remains	No Requirement
2. REPLACE PORTIONS OF ROOF FULL DEPTH (THICKNESS) ^a	Patches Edge-to-edge, and Corner-to-corner NOT an Edge-to-edge, or Corner-to-corner but > 50 % total area	Patches	Repair affected area to existing
		Removed	Replace that portion of the roof insulation and cool roof
		Removed	Roof Insulation and Cool Roof
3. REPLACE ROOF COVERING ONLY (RECOVER)	Removed	Exposed	Roof Insulation and Cool Roof
		Not Exposed	No Requirement
4. APPLY COATINGS ONLY	Remains	Remains or None	No Requirement

a. The roof area will be between expansion joints or between area dividers such as parapet s or edges.

EXEMPTIONS

The provisions of this code do not apply to: (a) single-family houses, multi-family structures of three stories or fewer above grade, manufactured houses (mobile homes) and manufactured houses (modular), (b) buildings that do not use either electricity or fossil fuel, or (c) equipment and portions of building systems that use energy primarily to provide for industrial, manufacturing, or commercial processes. *When a space is conditioned solely for process energy needs, including product storage requirements such as humidity control or refrigeration, it is not required to meet the cool roof provisions.*

REFERENCES

Insulation

The Houston Commercial Energy Conservation Code requires roof insulation to be installed meeting the following criteria based on where the insulation is to be installed and the type of building or space as follows:

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.063	R-20 ci	U-0.063	R-20 ci	U-0.218	R-3.8 ci
Metal Building (with R5 Thermal Blocks)	U-0.065	R-13 + R-13	U-0.065	R-13 + R-13	U-0.167	R-13.0
Attic and Other	U-0.034	R-38	U-0.027	R-38	U-0.081	R-6.0

Gravel Roofs

Crushed stone and gravel roof coverings are prohibited in the City of Houston. This does not apply to ballast rock with minimum 1 ½ inch diameter.

Lay-in Ceilings

Lay-in ceilings with insulation are not considered part of the building envelope because they allow air infiltration.

Re-roofs

Roof covering replacements require positive drainage.

Cool Roof Code Language

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

1. *A minimum total solar reflectance of 0.70 when tested in accordance with one of the solar reflectance test methods listed below, and*
2. *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.

The values for solar reflectance and thermal emittance shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the Cool Roof Rating Council CRRC-1 Product Rating Program, and shall be labeled and certified by the manufacturer.

See Appendix A for guideline.

Exceptions to 502.5:

1. *The portion of the roof that is a rooftop garden, or green roof or covered by a rooftop deck covering 1/3 or less of the aggregate area of the roof, is exempted from the requirements of this section.*
2. *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.*