ANSI/ASHRAE Addendum *f* to
ANSI/ASHRAE Standard 90.2-2001

ASHRAE® STANDARD

Energy-Efficient Design of Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee January 25, 2003; by the ASHRAE Board of Directors January 30, 2003; and by the American National Standards Institute April 10, 2003.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines are given at the back of this document and may be obtained in electronic form from ASHRAEís Internet Home Page, *http://www.ashrae.org*, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard and printed copies of a public review draft may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: *orders@ashrae.org*. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in U.S. and Canada).

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SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as ìsubstantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution.î Compliance with this standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Manager of Standards of ASHRAE should be contacted for:

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard,
d. permission to reprint portions of the Standard.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process.)

FOREWORD

The following proposal represents work conducted by the SSPC 90.2 Envelope Subcommittee Reflective Roof Task Group, a task group organized to address new research information concerning high-albedo roof benefits in low-rise residential construction. These proposed changes allow a residential structure to consider the use of high-albedo roofs in hot and humid climates in order to reduce air-conditioning energy use; this, in turn, contributes to reducing the heat island effect in or near urban centers.

Unless otherwise noted, underlining indicates addition and strikethrough indicates deletion.

ANSI/ASHRAE ADDENDUM f to 90.2-2001

Section 5.3.1.1 ***(Existing text to remain. Add the following exception.)***

Exception to 5.3.1.1: For roofs where the exterior surface has either of the following:

a. a minimum total solar reflectance of 0.65 when tested in accordance with ASTM E903[69] or E1918[70] and a minimum thermal emittance of 0.75 when tested in accordance with ASTM E408[71] or C1371[72] or

b. a minimum solar reflectance index (SRI) of 75 calculated in accordance with ASTM E1980[73] for medium wind-speed conditions,

the U-factor of the proposed ceiling shall be permitted to be adjusted using Equation 5-3.1 for demonstrating compliance.

$$U_{ceiling\_adj} = U_{ceiling\_proposed} \times Multiplier \qquad (5\text{-}3.1)$$

where

$U_{ceiling\_adj}$ = adjusted ceiling U-factor for use in demonstrating compliance

$U_{ceiling\_proposed}$ = U-factor of the proposed ceiling, as designed

Multiplier = ceiling U-factor multiplier from Table 5.3.1

Section 5.3.1.2 ***(Existing text to remain. Add the following exception.)***

Exception to 5.3.1.2: For roofs where the exterior surface has either of the following:

a. a minimum total solar reflectance of 0.65 when tested in accordance with ASTM E903[69] or E1918[70] and has a minimum thermal emittance of 0.75 when tested in accordance with ASTM E408[71] or C1371[72] or

b. a minimum solar reflectance index (SRI) of 75 calculated in accordance with ASTM E1980[73] for medium wind-speed conditions,

the U-factor of the proposed ceiling shall be permitted to be adjusted using Equation 5-3.1 for demonstrating compliance.

$$U_{ceiling\_adj} = U_{ceiling\_proposed} \times Multiplier \qquad (5\text{-}3.1)$$

where

$U_{ceiling\_adj}$ = adjusted ceiling U-factor for use in demonstrating compliance

$U_{ceiling\_proposed}$ = U-factor of the proposed ceiling, as designed

Multiplier = ceiling U-factor multiplier from Table 5.3.1

Section 5.5.1.1 ***(Existing text to remain. Add the following exception.)***

Exception to 5.5.1.1: For roofs where the exterior surface has either of the following:

a. a minimum total solar reflectance of 0.65 when tested in accordance with ASTM E903[69] or E1918[70] and a minimum thermal emittance of 0.75 when tested in accordance with ASTM E408[71] or C1371[72] or

b. a minimum solar reflectance index (SRI) of 75 calculated in accordance with ASTM E1980[73] for medium wind-speed conditions,

the U-factor of the proposed ceiling shall be permitted to be adjusted using Equation 5-3.1 for demonstrating compliance.

$$U_{ceiling\_adj} = U_{ceiling\_proposed} \times Multiplier \qquad (5\text{-}3.1)$$

where

$U_{ceiling\_adj}$ = adjusted ceiling U-factor for use in demonstrating compliance

$U_{ceiling\_proposed}$ = U-factor of the proposed ceiling, as designed

Multiplier = ceiling U-factor multiplier from Table 5.3.1

Section 5.5.1.2 ***(Existing text to remain. Add the following exception.)***

Exception to 5.5.1.2: For roofs where the exterior surface has either of the following:

a. a minimum total solar reflectance of 0.65 when tested in accordance with ASTM E903[69] or E1918[70] and a minimum thermal emittance of 0.75 when tested in accordance with ASTM E408[71] or C1371[72] or

b. a minimum solar reflectance index (SRI) of 75 calculated in accordance with ASTM E1980[73] for medium wind-speed conditions,

the U-factor of the proposed ceiling shall be permitted to be adjusted using Equation 5-3.1 for demonstrating compliance.

$$U_{ceiling\_adj} = U_{ceiling\_proposed} \times Multiplier \qquad (5\text{-}3.1)$$

where

$U_{ceiling\_adj}$ = adjusted ceiling U-factor for use in demonstrating compliance

$U_{ceiling\_proposed}$ = U-factor of the proposed ceiling, as designed

Multiplier = ceiling U-factor multiplier from Table 5.3.1

(Add the following table)

TABLE 5.3.1
Ceiling U-Factor Multiplier

HDD 65	(HDD18)	Ceilings with Attics	Ceilings without Attics
0-360	(0-200)	1.50	1.30
361-900	(201-500)	1.30	1.30
901-1800	(501-1000)	1.20	1.30
1801-2700	(1001-1500)	1.15	1.30
2701-3600	(1501-2000)	1.10	1.20
≥ 3600	(≥ 2000)	1.00	1.00

Section 8.8.3.1 ***(Add new text and add note)***

8.8.3.1 Exterior Absorptivity. Since the colors are subject to change over the life of the building, the exterior absorptivity of all walls and roofs shall be 0.5 regardless of color, and the exterior absorptivity of roofs shall be 0.2 regardless of color. If unconditioned spaces such as garages are not modeled, walls between them and conditioned space shall be treated as exterior walls with an absorptivity of zero.

Note: For low absorptivity roofs, the reference house may employ Exceptions 5.3.1.1 or 5.3.1.2 or 5.5.1.1 or 5.5.1.2.

Add the following references to Section 10:

69. ASTM E 903-96, *Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres*, West Conshokocken, PA, American Society of Testing and Materials.

70. ASTM E1918-97, *Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field*, West Conshokocken, PA, American Society of Testing and Materials.

71. ASTM E408-71 (Reapproved 1996), *Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques*, West Conshokocken, PA, American Society of Testing and Materials.

72. ASTM C 1371-98, *Standard Test method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers*, West Conshokocken, PA, American Society of Testing and Materials.

73. ASTM E 1980-98, *Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces*, West Conshokocken, PA, American Society of Testing and Materials.

Add the following after Section 10:

(This bibliography is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process.)

BIBLIOGRAPHY

ASHRAE. 1998. *Energy Savings of Reflective Roofs*, ASHRAE Technical Data Bulletin, Volume 14, Number 2, January. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta, GA.

Akbari, H., and S. Konopacki. 1999. Calculations for Reflective Roofs in Support of Standard 90.2. A Technical Note Prepared for the Reflective Roofs Task Group, June.

Akbari, H., and S. Konopacki. 1999. Reflective Roofs Task Group—ASHRAE SSPC 90.2, Progress Report—June, 1999 ASHRAE Annual Meeting, Seattle, WA. A Report Prepared to the Reflective Roofs Task Group, June.

POLICY STATEMENT DEFINING ASHRAEíS CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its membersí activities on both the indoor and outdoor environment. ASHRAEís members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAEís short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its ***Handbook***, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the systemís intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAEís primary concern for environmental impact will be at the site where equipment within ASHRAEís scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.