Reroofing Requirements in the 2015 International Codes

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**Abstract**

Reroofing is one of the most common construction projects. In order to fully understand the code requirements for reroofing projects, it is necessary to review three separate codes. The IBC contains the basic material requirements for roof covering assemblies. Other provisions for reroofing can be found in the International Existing Building Code (IEBC) and the International Energy Conservation Code (IECC). Recent clarifications to the codes for reroofing have improved their clarity, but given the need to coordinate the provisions across three codes, many will benefit from a reroofing review.

**Speaker**

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Michael Fischer, an industry professional for 33 years, has held management positions in regulatory affairs, manufacturing, and marketing. A member of the International Code Council (ICC), the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), and ASTM International, he is the code consultant for the Polyisocyanurate Insulation Manufacturers Association. Fischer has testified before code, regulatory, and legislative bodies and helped lead successful strategic client efforts from product standards through code and regulatory development. He is a respected contributor to trade publications and a frequent presenter at building industry events and conferences.
Reroofing Requirements in the 2015 International Codes

BACKGROUND
The International Code Council (ICC) promulgates a family of model codes that address a wide variety of construction requirements. With a combination of narrowly focused codes and more comprehensive codes, the International Codes provide state and local jurisdictions with a complete set of construction codes to address the vast majority of construction in the U.S. The ICC was created in the late 1990s with the merger of three so-called legacy code councils. Prior to this merger, the Building Officials and Code Administrators (BOCA), the Southern Building Code Congress International (SBCCI), and the International Conference of Building Officials (ICBO) each developed and maintained separate building codes. While there was significant cooperation between these three groups, including the maintenance of codes for one- and two-family dwellings and energy efficiency, the basic building codes were maintained in separate processes.

The model code congresses determined that it was in the best interests of the construction industry to join together and publish a single family of building codes to streamline the development process, foster better education and enforcement, and safeguard public safety. While this merger also allowed the consolidation of product approval entities previously managed as subsidiaries of the various bodies, it was the concept of a single set of construction codes that gained support of the broader stakeholders in the construction industry, including governmental entities, building designers, contractors, and building products manufacturers.

The creation of the ICC facilitated the development of the 2000 International Building Code (IBC). The 2000 IBC thus became the first truly national building code and paved the way for the development of other "I-codes." Today, the ICC publishes a full family of codes, including the following:

- International Existing Building Code
- International Fire Code
- International Fuel Gas Code
- International Green Construction Code
- International Mechanical Code
- ICC Performance Code
- International Plumbing Code
- International Private Sewage Disposal Code
- International Property Maintenance Code
- International Residential Code
- International Swimming Pool and Spa Code
- International Wildland Urban Interface Code
- International Zoning Code

The I-Codes are intended to work together as “overlay” codes, meaning that the requirements across the codes that address similar topics, products, and materials ensure that all of these provisions can be easily interpreted and enforced. In order to review the requirements for reroofing, we must necessarily determine which codes directly affect roofing requirements for existing buildings. For the purposes of this paper, and after reviewing the ICC code collection, we will concern ourselves with the International Building Code (IBC), the International Energy Conservation Code (IECC), and the International Existing Building Code (IEBC). The International Residential Code (IRC) also addresses reroofing provisions, but the IRC provisions are coordinated and consistent with the IBC.

REROOFING
Historically, the I-Codes’ development has tended to focus on new construction projects, with comprehensive requirements for zoning, site development, permitting, construction, inspections, and everything in between. For most building products and systems, new building construction is the rule. For certain products, however, renovations of existing buildings represent a much larger share of the market, and thus, the codes require a specific focus on
the requirements for building renovations. For example, window replacement projects are governed by specific code requirements scattered throughout the codes. Roof replacement is another example of the need for detailed and specific construction codes.

According to a study by the Center for Environmental Innovation in Roofing (Hoff, 2009), about 4 billion sq. ft. of roof coverings are installed each year in the U.S. Of that market, about 3 billion square feet are applied on existing buildings. (See Figure 1.) For roofing projects, it becomes clear that reroofing is the rule, and new building installation is the exception. While the share of the roofing market that is allocated to existing buildings fluctuates depending on overall construction activity, the retrofit market as a percentage of total roofing activity within a given market area is relatively stable. It would be helpful, however, to revisit the data to identify any trends in share.

Because roof coverings are intended to last for decades, the installation of a new roof serves as a rare opportunity to update the structure to comply with current codes and standards. The IBC has recognized this market need with the inclusion of a separate section for reroofing. The reroofing requirements in the IBC govern product and material requirements, testing, and installation. Before code requirements for reroofing can be interpreted and applied, a thorough understanding of the definitions related to reroofing and reroofing projects is necessary.

These definitions are included in Chapter 2 of the IBC, IEBC, and IECC:

**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.

**ROOF COVERING.** The covering applied to the roof deck for weather resistance, fire classification, or appearance.

**ROOF DECK.** The flat or sloped surface constructed on top of the exterior walls of a building or other supports for the purpose of enclosing the story below, or sheltering an area, to protect it from the elements, not including its supporting members or vertical supports.

**ROOF REPAIR.** Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

**REROOFING.** The process of recovering or replacing an existing roof covering. See “Roof re-cover” and “Roof replacement.”

**ROOF RE-COVER.** The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

**ROOF REPLACEMENT.** The process of removing the existing roof covering, repairing any damaged substrate, and installing a new roof covering.

Note that the term “reroofing” includes two vastly different renovation processes: roof re-cover and roof replacement. Roof re-cover governs those projects where a new roof covering is applied without modification to the existing covering, except perhaps the preparation of the existing roof covering in order to facilitate a proper new covering installation.

Roof replacement governs the removal of the existing roof covering. By this definition, any damaged substrate that is part of the roof assembly or the supporting structure must be repaired prior to proceeding with the new roof installation. As mentioned above, it is necessary to consider all requirements to fully capture the intent of the code. In this case, the reroofing provisions in Section 1511.3 of the IBC provide additional instruction:

**1511.3 Roof Replacement.** Roof replacement shall include the removal of all existing layers of roof coverings down to the roof deck.

The IBC definition of roof replacement includes the caveat that any damaged substrate be repaired; Section 1511.3 makes it clear that the code intends that roof replacement include exposing the roof deck by the removal of the existing materials and roof covering layers. An exception to this requirement was added to the IBC to address the issue of removing ice barrier membranes; these materials form a bond with wood decks, and their removal could result in unnecessary damage to the roof deck:

**Exception to IBC 1511.3:** Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

**ROOF RE-COVERING.**

Roof re-covering is governed by several sets of requirements in the IBC. Typically, the number of roof covering layers is limited to two, but there are exceptions. For example, the application of additional layers of protective coatings over spray polyurethane roof systems is not limited to two layers. Because these coatings have little if any impact on roof dead loads, it makes no sense to require the removal of an entire roof system when additional coatings can provide the necessary weatherproofing.

**Exception 3 to IBC Section 1511.3:** The application of a new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tear off of existing roof coverings.

It is anticipated that this exception will be expanded to include coatings on additional substrates in future versions of the code. Other exceptions address specific issues with certain roof covering systems, including structural provisions for standing-seam systems and application of new systems over existing wood shake roofs.

Another provision added to the IBC in 2015 provides an additional option where a product manufacturer develops an approved system. Under IBC definitions, the term “approved” indicates that the code official has the final say on acceptance of the system. This provision is intended to foster innovation while maintaining the intent of the code.

**Exception 1 to IBC Section 1511.3:** Where the new roof covering is installed in accordance with the roof covering manufacturer’s approved instructions.
There are other provisions affecting roof recovering in the IECC. In the 2012 IECC, roof re-covering projects were exempt from energy-efficiency measures via an exception found in C101.4.3

**Exception 5 to C101.4.3:** Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

Note the use of the term “reroofing” in the above text. The 2012 IECC did not contain definitions for reroofing, roof re-cover, or roof replacement, but a strict reading of the above exception with consideration of the IBC definitions provides a full understanding of the exception. The 2015 IECC includes the necessary definitions and a specific exception from the energy code requirements for roof recovery, provided the energy use of the building is not increased. That caveat would typically apply only in southern climate zones where reflective roof requirements and existing building conditions trigger a review of the new roof covering reflectance.

It is also important to note that these energy code provisions apply when the roof assembly is part of the building thermal envelope. Another change in the 2015 IECC exempts roof re-cover and roof replacement projects from air barrier requirements. Given the use of blower door testing to validate air leakage performance of buildings, a reroofing project in and of itself will likely improve the building tightness, but should not trigger a review and possible upgrade of the entire building envelope.

### ROOF REPLACEMENT

The 2012 IECC Exception 5 (see above) also includes a provision that roof replacement projects (that are part of the building thermal envelope) are not exempt from the roof insulation requirements of the IECC. That exception is muddy; it uses “sheathing” instead of “roof deck” and refers to a “cavity” without specifically indicating whether it is a cavity within the roof assembly or an attic or plenum cavity. Despite the confusion, the exception does include a requirement buried in the exception that when the sheathing (or deck) is exposed, the roof shall be insulated. While it is not proper code formatting to have an exception to an exception, the intent is clear: For the replacement of roofs that are part of the thermal envelope, and where the insulation is above the deck, the code requirements apply.

The IEBC also includes guidance on renovation projects. For example, Section 708.1 of the IEBC includes the following text:

> Level 1 alterations to existing buildings or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the International Energy Conservation Code or International Residential Code. The alterations shall conform to the energy requirements of the International Energy Conservation Code or International Residential Code as they relate to new construction only.

Roof replacement projects meet the definition of Level 1 alterations in the IEBC. In fact, Section 706, addressing “reroofing” was added to the 2015 IEBC, along with the necessary definitions governing roofing as listed above.

In order to clarify the roof replacement requirements, the 2015 IECC was updated to include specific guidance for roof replacement projects where the roof assembly contained “insulation entirely above deck.” A new section was added to the code:

**C503.3.1 Roof replacement.** Roof replacements shall comply with Table C402.1.3 or C402.1.4 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

While this clarification does not address all roof replacement configurations, it does address a significant portion of the roofing market. This provision requires that roof replacement projects consider energy-efficiency requirements when the roof assembly has insulation above the deck and is part of the thermal envelope. The provisions provide two options for compliance: R-Value (Table C402.1.3) or assembly U-Factor (Table C402.1.4). Those two tables are consolidated in *Figure 2*.

### ASHRAE REQUIREMENTS

Note that *Figure 2* refers to ASHRAE Standard 90.1-2013. ASHRAE 90.1 is an alternative to the IECC provisions. The IECC addresses specific compliance alternatives:

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**Figure 2 – Minimum thermal insulation R-Value requirements.**

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy</td>
<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
<td>Group R</td>
</tr>
<tr>
<td>U-Factor</td>
<td>U-.048</td>
<td>U-.039</td>
<td>U-.039</td>
<td>U-.039</td>
<td>U-.039</td>
<td>U-.032</td>
<td>U-.032</td>
<td>U-.032</td>
</tr>
</tbody>
</table>
**C401.1 Scope.** The provisions in this chapter are applicable to commercial buildings and their building sites.

**C401.2 Application.** Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C407. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

In the 2015 IECC, the R-Value and U-Factor requirements for thermal envelope provisions contain the same values. For roof replacement projects, which are the rule and not the exception, this consistency is important. Differences in various envelope provisions for a new building may not be an issue when the overall building efficiency is comparable between the IECC and ASHRAE 90.1, but roof replacement projects often consist of only one envelope alteration.

**MATERIAL AND INSTALLATION ISSUES**

The IBC default requirement for reroofing assumes that the provisions of the code for material and installation of roof assemblies in new buildings prevail for reroofing projects. In IBC Section 1511.1, the code calls out the entire roofing chapter:

**1511.1 General.** Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

There are exceptions to these requirements, however. The IBC does recognize some limitations for existing buildings, and specifically exempts roof slope and secondary roof drain requirements, provided the new installation establishes positive roof drainage. It is important to note that notwithstanding these exemptions, the structural provisions for ponding detailed in Chapter 16 of the IBC remain in place.

With the above reference to Chapter 15, all of the roof assembly requirements detailed in Chapter 15 apply to the installation of new materials during reroofing projects. Those requirements include weather protection, roof performance requirements (such as wind resistance), fire classification, material, and roof covering (and other components, including underlayment materials) requirements, roof insulation, radiant barriers, and rooftop structures and equipment, including solar photovoltaic panels and modules.

The IBC includes specific detailed provisions for the application of roofing materials, but also relies heavily on material and application standards developed by other consensus bodies, including ASTM International. In many cases, roof-covering provisions governed by these referenced standards are detailed in lists or tables. For example, IBC Table 1508.2 lists specific types of roof insulation with the corresponding applicable referenced standard. (See Figure 3.)

**STRUCTURAL CONCERNS**

The IEBC also contains a specific provision for roof replacements in high-wind areas:

**707.3.2 Roof diaphragms resisting wind loads in high-wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm or section of a building located where the ultimate design wind speed, \( V_{ult} \), determined in accordance with Figure 1609.3(1) of the International Building Code, is greater than 115 mph (51 m/s) or in a special wind region, as defined in Section 1609 of the International Building Code, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the International Building Code, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting at least 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the International Building Code.

This provision garnered considerable attention during the 2016 IBC hearings; the update to ASCE-7 2016 includes significant wind uplift pressure requirements for many roof assembly systems governed by the component and cladding loads. The 75% threshold included above will likely be triggered under the 2018 IEBC with the inclusion of the increased loads under the ASCE-7 update. In high wind areas, this IEBC provision will require a structural evaluation be performed for all roof replacement projects, and may necessitate enhanced structural connections, including roof-to-wall. If connection upgrades are required on a specific project, the project will likely require additional crews to perform the necessary modifications to the

<table>
<thead>
<tr>
<th>[BF] Table 1508.2</th>
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<tbody>
<tr>
<td><strong>Material Standards for Roof Insulation</strong></td>
</tr>
<tr>
<td>Cellular glass board</td>
</tr>
<tr>
<td>Composite boards</td>
</tr>
<tr>
<td>Expanded polystyrene</td>
</tr>
<tr>
<td>Extruded polystyrene</td>
</tr>
<tr>
<td>Fiber-reinforced gypsum board</td>
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<tr>
<td>Glass-faced gypsum board</td>
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<tr>
<td>Mineral fiber insulation board</td>
</tr>
<tr>
<td>Perlite board</td>
</tr>
<tr>
<td>Polysisocyanurate board</td>
</tr>
<tr>
<td>Wood fiberboard</td>
</tr>
</tbody>
</table>

*Figure 3 – 2015 IBC Table 1508.2.*
building structure. Projects that would have been simple roof replacement may need to include other trades; the potential for the disruption of building operations due to the need for crews to work within the building, as opposed to just rooftop activity, should not be dismissed.

**FUTURE CODE PROVISIONS**

During the development of the 2018 IECC, a proposal (CE287-16) was submitted by the National Roofing Contractors Association (NRCA). CE 287 contained a proposed exception (underlined below) to the requirement in C503.3.1:

**C503.3.1 Roof replacement.** Roof replacements shall comply with Table C402.1.3 or C402.1.4 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

**Exception:** Where the required R-value cannot be provided because of the thickness limitations presented by existing rooftop conditions, including heating, ventilating and air-conditioning equipment, low door or glazing heights, parapet heights and roof flashing heights, the maximum thickness of insulation compatible with the available space and existing uses shall be installed.

The IECC committee voted to recommend disapproval of CE287-16 during the IECC committee hearings in April 2016. During debate, the committee expressed concern with the broad nature of the exception and the commensurate impact on energy efficiency, primarily because the proposed exception could apply to an entire building when the condition that triggered the exception is limited to only one portion of the roof. One of the committee members suggested that a review by the code official would be one way to ensure that the intent of the code would be met when applying the proposed exception. Other concerns were raised during testimony about basing the proposed exception on insulation thickness instead of R-Value, which could conflict with the intent of the code.

The committee reason statement for recommending disapproval read as follows:

**Committee Reason:** This text needs to defer to the AHJ for determination or should specify a minimum R-value. The exception could be used as justification to do nothing to improve the roof insulation.

In response to some of the committee concerns, NRCA submitted a public comment to CE287-16 for consideration in the IECC Public Comment Hearing in October 2016. RCI submitted the same public comment, which included a modified version of the exception with required approval by the code official.

**C503.3.1 Roof replacement.** Roof replacements shall comply with Table C402.1.3 or C402.1.4 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

**Exception:** Where the required R-value cannot be provided because of the thickness limitations presented by existing rooftop conditions, including heating, ventilating and air-conditioning equipment, low door or glazing heights, parapet heights and roof flashing heights, the maximum thickness of insulation compatible with the available space and existing uses shall be installed where approved by the code official.

Testimony during debate on the provision included a consensus that the proposed modification did, in fact, improve the original proposal, but there was a disagreement regarding the technical provisions. It was also noted that the public comment solved one of the issues raised by the IECC committee but failed to address scopings, thickness, and R-Value concerns, and the overall impact of such a broad exception on energy efficiency.

IECC requires that public comment language receive two-thirds of the assembly vote during the public comment hearing in order to be considered during the ICC Online Governmental Consensus Vote (OGCV), and then be ratified by a two-thirds majority of the OGCV. CE298-16 did receive the required two-thirds during the public comment hearing, but did not receive the two-thirds required vote in the OGCV. The 2018 IECC will thus contain the same provisions for roof replacement as the 2015 IECC. It seems likely that there will be additional discussions surrounding this requirement in future ICC code development proceedings.

**STATE CODE ADOPTIONS**

The ICC publishes the model I-Codes, but these codes are often modified at the state level. Some states have modified the requirements for roof replacement, while others have exempted some classes of buildings from the provisions. As the 2018 I-Codes are adopted during state and local updates, it should be expected that the issue of the structural and energy-efficiency requirements will be revisited.

Proposals to provide a remedy for the structural triggers of the IEBC are being developed for consideration by the Florida Building Commission in February of 2017. If successful, it is expected that they will be proposed with other state code adoptions in high-wind regions. The Florida proposal will likely focus on additional exceptions to the IEBC structural trigger, focusing the requirement on older buildings constructed prior to the first edition of the Florida Building Code. While this option is available only in Florida, due to the state’s history of code development, it may provide a template for other states.

**CODE DEVELOPMENT PARTICIPATION**

The ICC develops and maintains codes in a hybrid consensus model. While the public comment and final action voting are limited only to the ICC governmental members who represent their local or state jurisdiction, the remainder of the process is open to all interested parties. Anyone can submit code proposals and public comments, and testify during the code hearings. Industry and public interest ICC members are included on the code development committees. In this manner, ICC is able to tap into available knowledge and research from both the public and private sectors.

Participating stakeholders in the ICC process include product manufacturers,
trade associations and professional societies, construction consultants, building designers, contractors, and, in fact, any party interested in construction codes and standards. RCI is an active participant within the ICC process; RCI members and all industry consultants are encouraged to engage with ICC code development by joining the ICC, learning the process, and bringing their experience and knowledge to the table.

**CONCLUSION**

The I-Codes provide a comprehensive set of requirements governing reroofing projects. When evaluating the roofing market, which consists of a three-to-one ratio of reroofing to new building, the importance of applying code requirements for roof assemblies on existing buildings cannot be overstated. The opportunity to upgrade roofing to meet current provisions for weatherization, fire safety, structural provisions, and energy efficiency should not be missed, or it will likely be decades in the future before these kinds of building enhancements can be made. Despite the progress made at the model code level, additional work on other aspects of reroofing requirements to clean up the code provisions is necessary. In fact, industry stakeholders and participants in the ICC and ASHRAE code process are already collaborating on the next cycle of code development.