

Choosing an Energy Code Compliance Path

One challenge that awaits any building designer is choosing the appropriate compliance path through the applicable building energy code. This is not a trivial decision—energy codes are marvels of flexibility, offering multiple compliance paths to suit all types of designers.

Each path has its own pluses and minuses, which may include differences in stringency, complexity, and potentially even limitations on building designs. This topic brief focuses on the compliance paths that are available in the following model codes and standards:

- 2009 International Energy Conservation Code (IECC) and 2012 IECC for low-rise residential buildings
- ANSI/ASHRAE/IESNA Standards 90.1-2007 and 90.1-2010 for commercial and high-rise multi-family residential buildings
- 2009 IECC and 2012 IECC for commercial and high-rise multi-family residential buildings

These codes are the main focus of this brief because they are referenced specifically in the American Recovery and Reinvestment Act of 2009.

Compliance Path Definition and Identification

The first step in discussing compliance paths is defining what a compliance path is. A compliance



path in an energy code is the series of sections of the code that are used to show that a building design meets the requirements of the code. All current model energy codes and standards have multiple compliance paths that are described in the following compliance path tables. In addition, some may have “options.” For example, the 2012 IECC for low-rise residential buildings clearly defines two paths—mandatory plus prescriptive and mandatory plus performance. In addition, the envelope requirements in the prescriptive path show three distinct options—R-value approach, U-factor approach, and envelope tradeoff approach. In the discussion, these options will be noted as “different ways to show compliance.”

There are also compliance paths that are explicitly defined in the energy codes and “deemed to comply” compliance paths such as those based on the U.S. Department of Energy’s (DOE’s) REScheck™ and



COMcheck™ software programs. These software programs follow the basic requirements of energy codes and generally follow one or more compliance paths that are explicitly laid out in the energy codes, but may require some simplifications or modifications that make the code easier to use. “Deemed to comply” means that a compliance path is only allowed if approved by the authority having jurisdiction (AHJ) or the code official. A map of where REScheck may be used is shown at www.energycodes.gov/images/states-can-use-rescheck-show-compliance. A similar map showing where COMcheck may be used is shown at www.energycodes.gov/simages/states-can-ues-comcheck-show-compliance.

There are also compliance paths based on above-code programs that are deemed to comply with the code by a code official or an AHJ. The IECC specifically allows this type of compliance path and code officials could choose to deem a Home Energy Rating System (HERS) or a green building rating program such as the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) to comply with the code.

The second step in discussing compliance paths is deciding what energy code is applicable in a state or local jurisdiction so that the following discussions on compliance paths in each code can be used. DOE’s Building Energy Codes Program (BECP) provides an up-to-date listing of the energy codes adopted in states and some local jurisdictions at www.energycodes.gov/adoption/states/. Other information may also be obtained from the Building Codes Assistance Project’s (BCAP) Online Code Environment and Advocacy Network (OCEAN) at www.energycodesocean.org/code-status. Another useful source of IECC adoption data is the International Code Council’s (ICC) list of code adoptions at www.iccsafe.org/gr/Pages/default.aspx.

Terminology

Mandatory requirements — Requirements that must be met by every building unless there is a specific exception in the code.

Prescriptive requirements — Requirements that must be met by every building unless an approved tradeoff is utilized or unless there is a specific exception in the code.

Performance approach — An overall performance requirement for the building that replaces the individual prescriptive requirements for building systems and components.

Low-Rise Residential Compliance Paths in the 2009 IECC and 2012 IECC

Section 401.2 of the 2009 IECC and Section R401.2 of the 2012 IECC outline the two low-rise residential compliance paths that are available in these codes. There is also an allowance for use of mandatory requirements in the code plus an above-code program in Section 102.1.1 of the 2009 IECC (Section R102.1.1 of the 2012 IECC). Section 402.1 of the 2009 IECC (Section R402.1 of the 2012 IECC) also defines three prescriptive envelope options that provide some additional flexibility. The options a designer has to show compliance with the various portions of the 2009 and 2012 IECC are shown in Table 1.

Table 1. Low-Rise Residential Compliance Options in the 2009 and 2012 IECC

Section*	Compliance Path
402 (R402) Building Thermal Envelope	1. Mandatory + R-value 2. Mandatory + U-factor alternative 3. Mandatory + Total UA alternative
403 (R403) Systems	Mandatory + prescriptive
404 (R404) Electric Power and Lighting Systems	Prescriptive only
405 (R404) Simulated Performance Alternative	Performance

*2012 IECC section numbers shown in parentheses.

The compliance paths within each section were combined into unique whole-building compliance paths in Table 2. The whole-building compliance paths are identified with the code (IECC), a building type (res or com), and a number or the phrase “above code.”

Table 2. Low-Rise Residential Compliance Paths in the 2009 and 2012 IECC

Compliance Path Number with Options	Compliance Path Description
ICC-IECC-Res-1a*	Mandatory + prescriptive R-value + prescriptive systems + prescriptive lighting
ICC-IECC-Res-1b*	Mandatory + prescriptive U-factor + prescriptive systems + prescriptive lighting
ICC-IECC-Res-1c*	Mandatory + prescriptive total UA + prescriptive systems + prescriptive lighting
ICC-IECC-Res-2	Mandatory + performance
ICC-IECC-Res-Above Code	Mandatory + above-code program deemed by code official or other AHJ to exceed the energy efficiency required by the 2009 or 2012 IECC. (May not be available in all jurisdictions.)

*Indicates RES *check* can be used to show compliance if approved by the jurisdiction having authority.

Choosing a Low-Rise Residential Compliance Path in the IECC

How should designers decide which path to choose in the 2009 or 2012 IECC for low-rise residential buildings? The answer depends on how much time and effort they are willing to put into the compliance documentation and what specific building systems and components are being used in the design. Any of the compliance paths is legal and acceptable. Designers can choose from the following compliance paths.

1. Mandatory + one of the prescriptive paths (2-4 below) if they wish to minimize effort in documenting compliance. *The performance path involves whole-building tradeoffs and requires a higher level of documentation.*
2. The R-value envelope approach if standard opaque envelope assemblies are being used. For example, if a 2 in. by 4 in. wood stud wall is being used and R-13 fiberglass batts are being installed in that wall and that is the wood frame wall R-value requirement in the code, there is no need to consider the U-factor approach or the envelope tradeoff or the performance approach.
3. The U-factor approach for less common assemblies like structurally insulated panels (SIPs) or insulated concrete forms (ICFs) that are not “standard” construction techniques. The R-value requirements in the IECC are typically based on “standard” or “common” construction technologies.
4. The total UA alternative if the building design calls for using one or more envelope components that do not perform as well as required by the prescriptive requirements in favor of one or more components that perform better than required by the prescriptive tables. For example, a designer may wish to use better performing windows to make up for lower wall

insulation.

5. The performance approach if the building design calls for using one or more building components (envelope, systems, or lighting) that do not perform as well as required by the prescriptive requirements in favor of one or more building components that perform better than required by the prescriptive requirements. For example, a designer might wish to use more high-efficacy lamps in a home than required to reduce the performance required for the roofs or walls.



6. The above-code program path if the building is being built as part of an above-code program such as the HERS program and if that above-code program is approved for compliance in the jurisdiction in which the home is being built.

The REScheck software is one easy way for a designer to determine how to comply and document compliance with the 2009 and 2012 IECC. The REScheck software can be used to show compliance with all mandatory requirements, with all three prescriptive envelope options¹, and with the mechanical and lighting prescriptive requirements. The REScheck software does have a limited performance option as well that assesses the benefits of orientation and SHGC, but the software cannot be used in conjunction with above-code programs.

Commercial and High-Rise Multi-family Residential Compliance Paths in ASHRAE Standards 90.1-2007 and 90.1-2010

ASHRAE Standards 90.1-2007 and 90.1-2010 contain six technical sections, each with its own compliance paths, plus a separate performance path. The compliance paths for each section are shown in Table 3.

Table 3. Commercial and High-Rise Multi-family Residential Compliance Options by Section in ASHRAE Standard 90.1-2007 and ASHRAE Standard 90.1-2010

Section of ASHRAE Standard 90.1-2007 or ASHRAE Standard 90.1-2010	Compliance Paths
5. Building Envelope (5.2)	<ol style="list-style-type: none"> 1. Mandatory + prescriptive (R-value) 2. Mandatory + prescriptive (U-factor) 3. Mandatory + envelope tradeoff
6. Heating, Ventilating, and Air Conditioning (6.2)	<ol style="list-style-type: none"> 1. Simplified Approach Option 2. Mandatory + prescriptive
7. Service Water Heating (7.2)	<ol style="list-style-type: none"> 1. Mandatory + prescriptive
8. Power (8.2)	<ol style="list-style-type: none"> 1. Mandatory
9. Lighting (9.2)	<ol style="list-style-type: none"> 1. Mandatory + building area 2. Mandatory + space-by-space
10. Other Equipment (10.2)	<ol style="list-style-type: none"> 1. Mandatory
11. Energy Cost Budget Method (11.1.4)	<ol style="list-style-type: none"> 1. Mandatory requirements from Sections 5-10 plus use of Energy Cost Budget (ECB) Method

The total number of possible combinations of compliance paths within sections for meeting the requirements of ASHRAE Standard 90.1-2007 is 13. The compliance paths within each section were combined into unique whole-building compliance paths in Table 4. The whole-building compliance paths are identified with the code (ASH-90.1), and a number or the phrase “above code.”

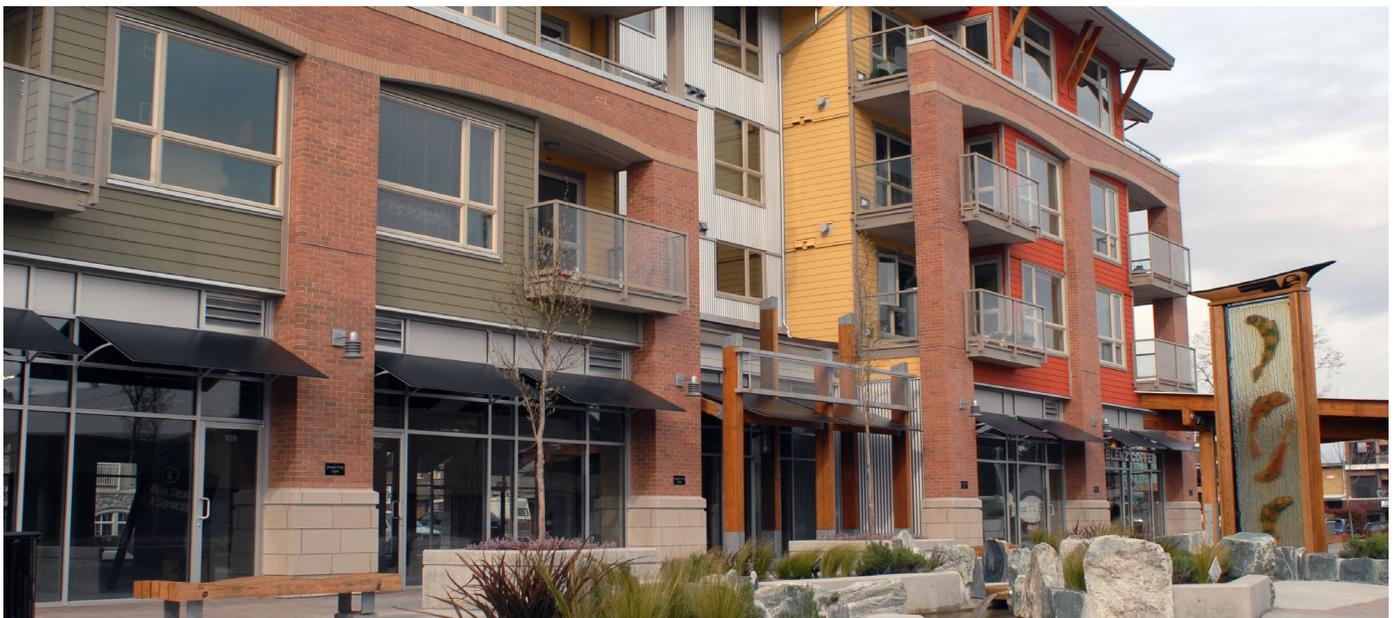
¹ Nominally, the REScheck software’s main function for the envelope requirements is to implement the tradeoff approach. However, users may also insert envelope prescriptive R-values and U-factors from the tables into the software and use REScheck primarily as an automated checklist without making use of the envelope tradeoff features.

Table 4. Commercial and High-Rise Multi-family Residential Compliance Paths in ASHRAE Standard 90.1-2007

Compliance Path Number	Building Envelope	Heating, Ventilating, and Air Conditioning	Service Water Heating	Power	Lighting	Other Equipment	Energy Cost Budget Method
ASH-90.1-1*	M + P (R)	SAO	M + P	M	M + BA	M	NA
ASH-90.1-2*	M + P (R)	SAO	M + P	M	M + SBS	M	NA
ASH-90.1-3*	M + P (R)	M + P	M + P	M	M + BA	M	NA
ASH-90.1-4*	M + P (R)	M + P	M + P	M	M + SBS	M	NA
ASH-90.1-5*	M + P (U)	SAO	M + P	M	M + BA	M	NA
ASH-90.1-6*	M + P (U)	SAO	M + P	M	M + SBS	M	NA
ASH-90.1-7*	M + P (U)	M + P	M + P	M	M + BA	M	NA
ASH-90.1-8*	M + P (U)	M + P	M + P	M	M + SBS	M	NA
ASH-90.1-9*	M + ET	SAO	M + P	M	M + BA	M	NA
ASH-90.1-10*	M + ET	SAO	M + P	M	M + BA	M	NA
ASH-90.1-11*	M + ET	M + P	M + P	M	M + BA	M	NA
ASH-90.1-12*	M + ET	M + P	M + P	M	M + SBS	M	NA
ASH-90.1-13	M	M	M	M	M	M	Required

*Indicates COMcheck can be used to show compliance if approved by jurisdiction having authority.

M – Mandatory, P- Prescriptive, ET- Envelope Tradeoff, SAO – Simplified Approach Option, BA – Building Area method, SBS – Space-by-Space method, NA – Not Applicable.



Choosing a Commercial and High-Rise Multi-family Residential Compliance Path in ASHRAE Standard 90.1

How should designers decide which path to choose in ASHRAE Standard 90.1-2007 or ASHRAE Standard 90.1-2010 for commercial and high-rise multi-family residential buildings? The answer depends on how much time and effort they are willing to put into the compliance documentation and what specific building systems and components are being used in the design. Any of the compliance paths is legal and acceptable. Designers can choose:

- 1) One of the mandatory + prescriptive paths if they wish to minimize effort in documenting compliance. The performance path involves whole-building tradeoffs and requires a higher level of documentation and more data input into the whole-building simulation tool.
- 2) A path with the R-value envelope option if standard opaque envelope assemblies are being used. For example, if a 2 in. by 4 in. wood stud wall is being used and R-13 fiberglass batts are being installed in that wall and that is the wood frame wall R-value requirement in the code, there is no need to consider other compliance approaches.
- 3) A path with the U-factor option for less common assemblies like structurally insulated panels (SIPs) or insulated concrete forms (ICFs) that are not “standard” construction techniques. The requirements in the codes are typically based on “standard” or “common” construction technologies.
- 4) A path including the envelope tradeoff option if the building design calls for using one or more envelope components that do not perform as well as required by the prescriptive tables in favor of one or more components that perform better than required by the prescriptive tables. For example, a designer may wish to use better performing windows to make up for lower wall insulation. Or a designer may wish to increase the allowable window-to-wall ratio beyond what is allowed in the prescriptive path.
- 5) A path including the Simplified Approach Option for HVAC systems if the system qualifies. This option requires consideration of fewer HVAC requirements and may be simpler to document. However, the prescriptive requirements for HVAC systems will be necessary for more complex systems.
- 6) A path including the space-by-space method for lighting if the building is not a “typical” office building or retail building or school or any of the other building types covered by the whole-building lighting criteria. The space-by-space method results in a more customized interior lighting power budget for unique buildings. However, the whole-building method may be simpler to document.
- 7) The performance approach if the building design calls for using one or more building components (envelope, systems, or lighting) that do not perform as well as required by the prescriptive requirements in favor of one or more building components that perform better than required by the prescriptive requirements. For example, a designer might wish to use higher efficiency HVAC equipment in a building than required to reduce the performance required for the roofs or walls.
- 8) The above-code program path if the building is being built as part of an above-code program such as the USGBC LEED program and if that above-code program is approved as a compliance path in the jurisdiction in which the building is being built.

The *COMcheck* software is one easy way for a designer to determine how to comply and document compliance with ASHRAE Standards 90.1-2007 and 90.1-2010, where approved by the jurisdiction having authority. The *COMcheck* software can be used to show compliance with all mandatory requirements, with all three prescriptive envelope options, and with the mechanical and lighting prescriptive options as well.² The *COMcheck* software does not have a performance option and cannot be used with the performance path. The *COMcheck* software also cannot be used in conjunction with above-code programs.

Commercial and High-Rise Multi-Family Residential Compliance Paths in the 2009 IECC and 2012 IECC

Section 501.2 of the 2009 IECC and Section C401.2 of the 2012 IECC outline the two commercial and high-rise multi-family residential compliance paths that are available in either IECC. These paths and the compliance options associated with each path are outlined in Table 5.

² Nominally, the *COMcheck* software's main function for the envelope requirements is to implement the tradeoff approach. However, users may also insert envelope prescriptive R-values and U-factors from the tables into the software and use *COMcheck* primarily as an automated checklist without making use of the envelope tradeoff features.

Table 5. Commercial and High-Rise Multi-family Residential Compliance Options by Section in the 2009 and 2012 IECC

Section of 2009 IECC or 2012 IECC	Compliance Paths
502 Building Envelope Requirements (502.1)	<ol style="list-style-type: none"> 1. Mandatory + prescriptive (R-value) 2. Mandatory + prescriptive (U-factor)
503 Building Mechanical Systems (503.1)	<ol style="list-style-type: none"> 1. Mandatory + simple systems 2. Mandatory + complex systems
504 Service Water Heating (Mandatory)	<ol style="list-style-type: none"> 1. Mandatory
505 Electrical Power and Lighting	<ol style="list-style-type: none"> 1. Mandatory + prescriptive
506 Total Building Performance (506.2 and 506.3)	<ol style="list-style-type: none"> 1. Performance



There is also an allowance for use of mandatory IECC requirements plus an above-code program in Section 102.1.1 of the 2009 IECC (C102.1.1 of the 2012 IECC). However, Sections 501.1 and 501.2 of the 2009 IECC (C401.1 and C401.2 of the 2012 IECC) also adopt by reference ASHRAE Standard 90.1 (ASHRAE Standard 90.1-2007 for the 2009 IECC and ASHRAE Standard 90.1-2010 for the 2012 IECC) and can be used as well. That means that users of the 2009 or 2012 IECC have a possible choice of 19 different compliance paths available to them. These compliance paths are listed in Table 6.

Table 6. Commercial and High-Rise Multi-family Residential Compliance Paths in the 2009 IECC and ASHRAE Standard 90.1

Compliance Path Number	Compliance Path Description
ICC-IECC-Com-1*	Sections 502 (R-value), 503 (simple), 504, and 505 of the 2009 IECC
ICC-IECC-Com-2*	Sections 502 (R-value), 503 (complex), 504, and 505 of the 2009 IECC
ICC-IECC-Com-3*	Sections 502 (U-factor), 503 (simple), 504, and 505 of the 2009 IECC
ICC-IECC-Com-4*	Sections 502 (U-factor), 503 (complex), 504, and 505 of the 2009 IECC
ICC-IECC-Com-5*	Sections 506, 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6, and 505.7 of the 2009 IECC
ICC-IECC-Com-Above Code	Mandatory + above-code program deemed by code official or other AHJ to exceed the energy efficiency required by the 2009 IECC. (May not be available in all jurisdictions.)
ASH-90.1-1*	90.1 Compliance Path 1 from Table 4
ASH-90.1-2*	90.1 Compliance Path 2 from Table 4
ASH-90.1-3*	90.1 Compliance Path 3 from Table 4
ASH-90.1-4*	90.1 Compliance Path 4 from Table 4
ASH-90.1-5*	90.1 Compliance Path 5 from Table 4
ASH-90.1-6*	90.1 Compliance Path 6 from Table 4
ASH-90.1-7*	90.1 Compliance Path 7 from Table 4
ASH-90.1-8*	90.1 Compliance Path 8 from Table 4
ASH-90.1-9*	90.1 Compliance Path 9 from Table 4
ASH-90.1-10*	90.1 Compliance Path 10 from Table 4
ASH-90.1-11*	90.1 Compliance Path 11 from Table 4
ASH-90.1-12*	90.1 Compliance Path 12 from Table 4
ASH-90.1-13	90.1 Compliance Path 13 from Table 4

*Indicates COMcheck can be used to show compliance.

Choosing a Commercial and High-Rise Multi-Family Residential Compliance Path in the IECC

How should designers decide which path to choose in the 2009 or 2012 IECC for commercial and high-rise multi-family residential buildings? The answer depends on how much time and effort they are willing to put into the compliance documentation and what specific building systems and components are being used in the design. Any of the compliance paths is legal and acceptable. The reasons designers may choose a compliance path for commercial and high-rise multi-family residential buildings in the IECC are the same as those for ASHRAE Standard 90.1, however, designers have some additional choices to make. Specifically, designers should:

- 1) Closely compare options within the 2009 or 2012 IECC and within ASHRAE Standards 90.1-2007 or 90.1-2010. A number of the options are almost the same but not identical and there may be exceptions to certain requirements in the IECC that are not found in ASHRAE Standard 90.1. For example, ASHRAE Standard 90.1-2007 contains three independent sets of envelope requirements for nonresidential, residential, and semi-heated spaces. The 2009 IECC contains only two of those sets for nonresidential and residential buildings. A designer wishing to make use of the less stringent semi-heated space requirements will need to use an envelope option that involves ASHRAE Standard 90.1-2007. It is good design practice to check requirements in both the IECC and ASHRAE Standard 90.1 to see if a building can be built more efficiently or less expensively under one or the other set of requirements.
- 2) Consider that under the IECC, it is assumed that the electrical power requirements in ASHRAE Standard 90.1 are covered by the National Electrical Code (NFPA 70).
- 3) Consider that under the IECC, it is assumed that the mechanical ventilation requirements are addressed by the International

Mechanical Code (IMC). ASHRAE Standard 90.1 assumes use of ASHRAE Standard 62.1 and while the IMC contains mechanical ventilation criteria similar to ASHRAE Standard 62.1, they are not necessarily identical.

- 4) One specific example of buildings that must be designed under one of the ASHRAE Standard 90.1-2007 paths rather than a 2009 IECC path are buildings with more than 40% of the gross wall area in vertical fenestration or more than 3% of the gross roof area in skylights. A new clause in the 2012 IECC specifically mandates that these buildings must be shown to comply under ASHRAE Standard 90.1-2010.

The COMcheck software is one easy way for a designer to comply with and document compliance with the 2009 and 2012 IECC, where approved by the jurisdiction having authority. The COMcheck software can be used to show compliance with all mandatory requirements, with all three prescriptive envelope options³, and with the mechanical and lighting prescriptive options. The COMcheck software does not have a performance option, and cannot be used with the performance path. The COMcheck software also cannot be used in conjunction with above-code programs.

³ Nominally, the COMcheck software's main function for the envelope requirements is to implement the tradeoff approach. However, users may also insert envelope prescriptive R-values and U-factors from the tables into the software and use COMcheck primarily as an automated checklist without making use of the envelope tradeoff features.