

# Energy Simulation Tool Approval Technical Assistance Manual

2017 Florida Building Code, Energy Conservation



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## DISCLAIMER

Compliance software programs must be consistent with the Florida Building Code, but software developers may achieve consistency by any means that they are able to demonstrate. The techniques described within this Technical Assistance Manual are neither binding nor comprehensive, and are intended solely to act as an aid.

The material in this Technical Assistance Manual is intended to act as an optional resource for the development of compliance software programs; it is not intended to be used directly in the field by building officials, contractors, or design professionals for code enforcement or compliance purposes.

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## Introduction

As part of the new Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) the Florida Building Commission is charged with the responsibility of approving code compliance software tools.

This Manual explains the guidelines for approval of the compliance tools (also referred to as compliance software programs) used to demonstrate compliance with the Florida Building Code, Energy Conservation—the “Energy Code” for residential and nonresidential building designs. A “compliance tool” is defined by the Energy Code as an approved software program or calculation-based methodology that projects the annual energy use of a building or calculation-based methodology that verifies the minimum prescriptive requirements and/or other procedures referred to in the code. Compliance software programs are used to demonstrate compliance with the Florida Building Code, Energy Conservation 6<sup>th</sup> Edition (2017) by the performance or prescriptive approaches for building design. Hereafter, the Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) is referred as the “Florida Energy Code” or “FEC”. The Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) also allows the use of ASHRAE 90.1-2013 as an alternative option for commercial building compliance. ASHRAE 90.1-2013 compliance methods, which are alternative compliance options in the Florida Energy Code, are hereafter referred to as “ASHRAE 90.1”. The requirement for residential compliance by the Simulated Performance Alternative is specified in Section R405 of the 2017 Florida Energy Code, or Energy Rating Index alternative compliance method is specified in Section R406 of the 2017 Florida Energy Code. The commercial (and residential high-rise) requirements for compliance are specified by C407 Total Building Performance of the Florida Energy Code, or as an alternate option, the Cost Budget Method of ASHRAE 90.1.

The Appendix primarily includes descriptions of test suites, software output and reporting requirements, and sample output forms for each of the residential compliance methods. The 2017 Technical Assistance Manual report forms that are common across the residential compliance methods such as user input summary, Energy Performance Level display card, Mandatory requirements, and air barrier and insulation installation criteria are located in a common Appendix section for cross-referencing. The sample Forms are used for new construction dwelling units and additions. These changes were made to avoid duplicate information.

## 1. Overview of Process

The purpose of this Technical Assistance Manual (“this Manual”) is to outline the Florida Building Commission’s approval process for compliance software programs and to define the procedures, guidelines, and assumptions against which compliance software programs should be evaluated. The performance compliance requirements and procedures apply to both residential and nonresidential buildings. An alternative compliance procedure to that described in this document is acceptable as long as such alternative is approved by the Commission and designed to preserve the integrity of the performance Energy Code compliance process.

The reference procedures and method described in this Manual establish the basis of comparison for all Energy Code compliance software. The approval process, as outlined in this Manual,

ensures that a minimum level of energy conservation is achieved regardless of the compliance software used. This is accomplished by:

- having candidate compliance software pass a series of industry standard tests;
- identifying minimum input that may be used to generate the *Standard Reference Design*;
- defining standard reports output requirements; and
- describing the certification process for the compliance software vendor.

## 1.1 Special Terms and Definitions

There are other special terms that are used in this Manual. The Commission approves the use of compliance software programs for Energy Code compliance. Commission approval means that the Commission accepts the applicant's certification that a compliance software program meets the requirements of the Energy Code and this Manual.

- **Compliance** - when a building design in an application for a building permit complies with the Florida Building Code and meets the requirements described for building design standards
- **Compliance supplement** - an independent user's manual for the compliance software program
- **Florida Energy Code** - the Florida Building Code – Energy Conservation 6<sup>th</sup> Edition (2017)
- **ASHRAE 90.1** - the ANSI/ASHRAE 90.1-2013 compliance procedure that is included as an alternative compliance method in the 2017 Florida Energy Code
- **Energy simulation tool** - defined by the Florida Building Code as an approved software program or calculation-based methodology that projects the annual energy use of a building
- **Proposed Design** - a description or computer representation of the proposed building used to estimate annual energy use for determining compliance based on total building performance or design energy cost
- **Standard Reference Design (also referred to as baseline design or budget design)** - a version of the Proposed Design that meets the minimum requirements of the Florida Energy Code and is used to determine the maximum annual energy use requirement for compliance based on total building performance
- **Standard 140** - the ANSI/ASHRAE Standard 140 – 2011 Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.
- **Vendor** - the proponent of a candidate compliance software program.

## 1.2 Approval Guidelines

For the vendor, the process of receiving approval of a compliance software program includes preparing an application, working with the Commission staff to answer questions from either Commission staff or the public, and providing any necessary additional information regarding the

application. The application includes the four basic elements outlined below. The Commission staff evaluates the compliance software program based on the completeness of the application and its overall responsiveness to staff and public comment.

The basic requirements for approval include:

1) Minimum compliance capabilities:

Compliance software programs shall have all the required capabilities identified in the Florida Energy Code for commercial and residential sections. The requirement for residential compliance is specified in Chapter 4 Residential Energy Efficiency Sections R401-R406 of the Florida Energy Code. The nonresidential requirements are specified in Chapter 4 Commercial Energy Efficiency Section C401-C407 of the Florida Energy Code.

2) Accuracy of energy simulation tool:

The compliance software program shall demonstrate acceptable levels of accuracy by performing and passing the required certification tests discussed in Chapters 6 (residential section) and 7 (commercial section) of this Manual, as modified by the vendor to address Florida's specific climate conditions.

The compliance software program vendor performs the certification tests in Chapters 6 or 7, respectively, for residential or commercial projects. The vendor conducts the specified tests, evaluates the results, and certifies in writing that the compliance software program passes the tests. The Commission may perform spot checks and may require additional tests to verify that the proposed compliance software program is appropriate for Florida Energy Code compliance purposes. Vendors are required to submit all the test inputs used to generate their results with the compliance software evaluation application.

When energy analysis techniques are compared, two potential sources of discrepancies could be 1) the differences in user interpretation when entering the building specifications, and 2) the differences in the compliance software program's algorithms (mathematical models) for estimating energy use. The approval tests minimize differences in interpretation by providing explicit detailed descriptions of the test buildings that must be analyzed.

3) User's Manual or help system:

The vendor shall develop a user's manual and/or help system that meets the specifications in Chapter 4 of this Manual.

4) Program support and reporting forms:

The vendor shall provide ongoing user and enforcement agency support, as described in Chapter 3 of this Manual. In addition to explicit and technical criteria, Commission approval may also depend on the Commission's evaluation of:

- enforceability in terms of reasonably simple, reliable, and rapid methods of verifying compliance;
- application of energy conservation features modeled by the compliance software;
- inputs used to characterize those features by the compliance software users; and
- dependability of the energy savings features modeled by the compliance software program.

### 1.3 Optional Capabilities

Optional capabilities are a special class of capabilities and user inputs that are not required of all compliance software, but may be included at the option of the vendor. Additional optional capabilities may be proposed by vendors. For both cases, the Commission reserves the right to disapprove the certification application for a specific optional capability if there is not compelling evidence presented in the public process showing that the optional capability is sufficiently accurate and suitable to be used for compliance with the Energy Code. In addition, energy conservation measures modeled by optional capabilities shall be capable of being verified by local enforcement agencies.

The Commission's purpose in approving additional optional capabilities is to accommodate new modeling algorithms and new technologies that have only begun to penetrate the market. Optional capabilities that evaluate measures already in relatively common use shall have their standard design for the measure based on the common construction practice for that measure; common practice is the inherent basis for all measures not explicitly regulated. For example, the Commission has no interest in an optional capability that evaluates the energy impacts of dirt on windows unless a new technology produces substantial changes in this aspect of a building relative to buildings without this technology. The burden of proof that an optional capability should be approved lies with the vendor.

## 2. Types of Approval

This Manual addresses two types of compliance software program approval: full program approval (including amendments to programs that require approval), and approval of new program features and updates.

The Commission shall re-approve the compliance software if vendors make any change to their programs. These changes include:

- any compliance software change that affects the energy use calculations for compliance;
- the modeling capabilities for compliance;
- the format and/or content of compliance forms; or
- any other changes that would affect a building's compliance with the Energy Code.

Changes that do not affect compliance with the Energy Code, such as program changes to the user interface, may follow a simplified or streamlined procedure for approval of the changes. To comply with this simpler process, the compliance software program vendor shall a) certify to the Commission that the new program features do not affect the results of any calculations performed by the program, b) shall notify the Commission of all changes and, c) shall provide the Commission with one updated copy of the program and user's manual. Examples of such changes include fixing logical errors in computer program code that do not affect the numerical results (bug fixes) and new interfaces.

### 2.1 Full Approval of Compliance Software

The Commission requires program approval when a candidate compliance software program has never been previously approved by the Commission, when the compliance software vendor makes changes to the program algorithms, or when any other change occurs that in any way affects the compliance results. The Commission may also require that all currently approved compliance software programs be approved again whenever substantial revisions are made to the Energy Code or to the Commission's approval process.

The Commission may change the approval process and require that all compliance software programs be approved again for reasons including:

- If the Energy Code undergoes a major revision that alters the basic compliance process, then compliance software would have to be updated and re-approved for the new process.
- If new analytic capabilities become widespread use, then the Commission may declare them to be required compliance software capabilities and may require all compliance software vendors to update their programs and submit them for re-approval.

When re-approval is necessary, the Commission will notify all compliance software vendors of the timetable for renewal.

A compliance software program must be re-approved for new optional modeling capabilities when the vendor adds those optional capabilities. The vendor shall provide a list of the new optional capabilities and demonstrate that those capabilities are documented in revised user documentation. This may not include previously submitted computer runs.

Re-approval shall be accompanied by a cover letter explaining the type of amendment(s) requested and copies of other documents as necessary. The timetable for re-approval of amendments is the same as for full program approval.

## 2.2 Approval of New Features and Updates

Modifications to previously approved compliance software, including new features and program updates, are subject to the following procedure:

- The compliance software vendor shall prepare an addendum to the compliance supplement or compliance software user's manual when new features or updates affect the outcome or energy conservation measure choices, describing the changes to the compliance software. If the change is a new modeling capability, the addendum shall include instructions for using the new modeling capability for compliance. The compliance software vendor shall notify the Commission by letter of the change that has been made to the compliance software program. The letter shall describe in detail the nature of the change and why it is being made. The notification letter shall be included in the revised Compliance Supplement or compliance software user's manual.
- The compliance software vendor shall provide the Commission with an updated copy of the compliance software program and include any new forms created by the compliance software (or modifications to the reports).
- The Commission may approve the change, request additional information, reject the change, or require that the compliance software vendor make specific changes to either the Compliance Supplement addendum or the compliance software program itself.
- With Commission approval, the vendor may issue new copies of the compliance software with the Compliance Supplement addendum and notify compliance software program users and building officials.

## 2.3 Challenging Compliance Software Approval

Any challenge to software approval by the Florida Building Commission shall be in accordance with Chapter 120, Florida Statutes.

### 3. Vendor Requirements

Commission approval of compliance software is intended to provide flexibility in complying with the Energy Code. However, in achieving this flexibility, the compliance software program shall not degrade or evade the intent of the Energy Code to achieve the required level of energy conservation.

The vendor has the burden of proof to demonstrate the accuracy and reliability of the compliance software relative to the test methods and to demonstrate the conformance of the software to the requirements of this Manual and the Florida Energy Code.

Each compliance software vendor shall meet all of the following requirements as part of the approval process and as part of an ongoing commitment to users of their particular compliance software.

#### 3.1 Vendor Certification Statement

The vendor shall follow the procedure described in this document to certify to the Commission that the compliance software meets the requirements of the Florida Energy Code and the criteria in this document for:

- accuracy and reliability as compared to the standard tests;
- ability to generate the required *Standard Reference Design* from user inputs;
- suitability in terms of accurate calculation of the correct energy/cost budget, the printing of standardized reports; and
- documentation on how the program demonstrates compliance.

#### ***Availability to Commission***

All compliance software vendors are required to submit at least one fully working program version of the compliance software to the Commission's staff and also to provide the Commission's Energy Technical Advisory Committee and interest groups access to the software for review during the approval process.

#### ***User Support***

Software vendors shall provide technical support on how to use their program for energy code compliance calculations.

#### ***Compliance Software Demonstration***

The Commission may request compliance software vendors to physically demonstrate their program's capabilities. One or more demonstrations may be requested before approval is granted. The Commission may hold one or more workshops with public and vendor participation to allow for public review of the vendor's application. Such workshops may identify problems or discrepancies that may necessitate revisions to the application.

## 3.2 Application Checklist

The compliance software application checklists are given separately for commercial and residential applications. It is possible for a vendor to apply for approval for a specific compliance method. Therefore, for flexibility in the application processes, the checklist is summarized separately for commercial and residential applications.

### ***Commercial Application Checklist***

The following items shall be included in an application package submitted to the Commission for commercial code compliance software approval:

- The cover sheet “Request for Approval” shown in [Appendix A](#). The vendor shall sign the checklist, certifying that the compliance software meets the requirements, including accuracy and reliability when used to demonstrate compliance with the Florida Energy Code and the requirements of this Technical Assistance Manual.
- Computer Run Reports  
The required format for building information reports is electronic Portable Document File (PDF). Reports shall be automatically generated by the software. Each page of the report shall have a header with the software name, revision, and date per the requirements of Section 7.4.
- Compliance Supplement and User's Manual  
The vendor shall submit a complete copy of their compliance software program’s user manual, including material on the use of the software for compliance purposes and an executable copy of the software for random verification.
- For software supporting Performance Based Compliance:  
Performance Method Test Results Spreadsheet: The vendor shall submit the compliance software’s evaluation spreadsheet file “*CommercialPerformanceMethodsResults.xls*” to the building commission. This spreadsheet file is designed to demonstrate the software’s compliance using the performance based methods per the Florida Energy Code or ASHRAE 90.1 option for the test suite by climate zone. The spreadsheet contains the *standard reference design* building requirements and those generated by the vendor’s software for the performance based methods. The compliance software vendor is responsible for generating and entering the software’s reference design requirements and demonstrating that the compliance software results match the standard reference building design for each case of the test cases. The spreadsheet, details of the procedure, and compliance requirements are described in Section 7.3.1.
- For software supporting Performance Based Compliance:  
ASHRAE Standard 140 Test Certification  
The compliance software provider shall submit a certificate to the commission indicating that the code compliance software engine meets the requirements of the Standard 140 tests.
- For software supporting Prescriptive Based Compliance  
Prescriptive Method Test Results Spreadsheet: The vendor shall submit the compliance software’s evaluation spreadsheet file “*CommercialPrescriptiveMethodsResults.xls*” to the



building commission. This spreadsheet is designed to demonstrate the software’s compliance using the prescriptive compliance methods per the Florida Energy Code or ASHRAE 90.1 option for subset of the test suite by climate zone. The *Standard Reference Design* prescriptive requirements are created based on the commercial code compliance requirements of the Florida Energy Code and ASHRAE 90.1 option. The compliance software vendor is responsible for generating the software’s prescriptive requirements and populating the columns next to the *Proposed Design* building element inputs for side-by-side comparison. Also, vendors must enter the “Pass” or “Fail” results of their software depending on whether the prescriptive requirement was met or not for each element of the test cases. The spreadsheet, details of the procedure, and compliance requirements are described in Section 7.3.2.

- For software supporting Envelope Trade-Off Option Results Spreadsheet Envelope Trade-Off Option Results Spreadsheet: The Vendor shall submit the compliance software’s evaluation spreadsheet file “**CommercialEnvelopeTradeOffMethodResults.xls**” to the building commission. The spreadsheet is designed to demonstrate the software’s compliance using the Envelope Trade-Off Option method per the ASHRAE 90.1 by climate zone. The spreadsheet, details of the procedure, and compliance requirements are described in Section 7.3.3.
- For software supporting Component Performance Alternative Method Results Spreadsheet Component Performance Alternative Results Spreadsheet: The Vendor shall submit the compliance software’s evaluation spreadsheet file “**CommercialComponentPerformanceMethodResults.xls**” to the building commission. The spreadsheet is designed to demonstrate the software’s compliance using the Component Performance Alternative Method per the Florida Energy Code by climate zone. The spreadsheet, details of the procedure, and compliance requirements are described in Section 7.3.4.
- A letter describing any differences between the expected results or any other requirements listed in this document and their software.

### ***Residential Application Checklist***

The following items shall be included in an application package submitted to the Commission for residential code compliance software approval:

1. The cover sheet “Request for Approval” shown in [Appendix A](#). The vendor shall sign the checklist, certifying that the compliance software meets the requirements, including accuracy and reliability when used to demonstrate compliance with the Florida Energy Code and the requirements of this Technical Assistance Manual.
2. Computer Run Reports  
The required format for building information reports is electronic Portable Document File (PDF). Reports will be automatically generated by the software based on the type of compliance chosen. Each page of the report will have a header with the software name, revision, and date. See report requirements in Section 6.3 through 6.7.

3. **Compliance Supplement and User's Manual**  
The vendor shall submit a complete copy of their compliance software program's user manual, including material on the use of the compliance software for compliance purposes and an executable copy of the compliance software program for random verification of compliance analyses.
4. **Code Compliance Test Results Spreadsheets**  
The vendor shall submit the compliance software's evaluation spreadsheet file(s) indicated in Chapter 6 for the compliance methods the software is to perform (up to three prescriptive, one performance method and Energy Rating Index Alternative Method). The spreadsheet files are designed to demonstrate the software's compliance using the indicated method per the Florida Energy Code. Details in Sections 6.3 through 6.7 describe the tests and files to be completed.
5. A letter describing any differences between the expected results or any other requirements listed in this document and their software.

### ***Where to Send Application***

Two copies of the full application package should be sent to:

Florida Building Commission  
2601 Blair Stone Road  
Tallahassee, Florida 32399

Following submittal of the application package, the Commission may request additional information. This additional information is often necessary due to complexity of compliance software. Failure to provide such information in a timely manner may be considered cause for rejection or disapproval of the application. A re-submission of a rejected or disapproved application will be considered a new application.

## 4. User's Manual and Help System Requirements

Each compliance software vendor is required to publish a supplement or an independent user's manual that explains how to use the software for compliance with the Energy Code. The manual may also be accessed in electronic form, either on the user's workstation or through the web. The document should deal with compliance procedures and user inputs to the compliance software. Both the program user's manual and help system should positively contribute to the user's ability and desire to comply with the Energy Code and to the enforcement agency's ease of verifying compliance. The Commission may reject a compliance software certification submittal whose user's manual and help system does not serve or meet these objectives.

In addition, the user's manual and help system should:

- describe the specific procedures for using the compliance software for compliance with the Energy Code;
- provide instructions for preparing the building input, using the correct inputs, and using each of the approved optional capabilities (or exceptional methods) for which the compliance software is approved; and
- explain how to generate the compliance reports and related compliance documentation. A sample of properly prepared compliance documentation shall be included as part of the manual or help system.

The compliance software user's manual and help system serve two major purposes:

- It helps building permit applicants and others use the software correctly. It also guides them in preparing complete compliance documentation to accompany building permit applications.
- It helps enforcement agency staff check permit applications for compliance with the Energy Code.

The compliance software user's manual and help system should contain a chapter or section on how to model buildings for compliance and how to prepare a building input file for a compliance run.

The following are examples of topics to include:

- what surfaces to model (exterior, interior floors, etc.);
- how to enter data about these surfaces;
- how to model exterior shading (fins, overhangs, etc.);
- appropriate zoning for compliance modeling;
- selection of correct occupancy types;
- how to model similar systems;
- how to model buildings or portions of a building with no heating or cooling;
- requirements for written justification and additional documentation on the plans and in the specifications for exceptional items; and
- program modeling limitations.

All program capabilities should be described in sufficient detail to eliminate possible confusion as to their appropriate use. While references to the compliance software program's regular user's

manual are acceptable, a complete listing of all inputs and/or commands necessary for compliance should be included in the compliance software program user's manual and help system.

The compliance software program user's manual and help system should include the following:

- description of the value or values associated with each input;
- restrictions on each variable;
- listing of the range beyond which inputs are unreasonable for any variable;
- description of options for any user-defined variable; and
- chapter or section that covers each output report.

Appendices, as needed, to provide any additional background information that is not crucial in explaining the basic functioning of the program for compliance.

For example:

- an appendix may contain variations of compliance forms as described above.
- an appendix may include a series of construction assembly forms to aid the compliance software program user.
- an appendix may reprint important sections of the manual that are crucial to modeling buildings correctly for compliance with the compliance software program.
- although the organizational format is not fixed, all information contained in the compliance software program user's manual and help system should be easy to find through use of a table of contents, an index, or through a context sensitive help system.

## 4.1 Statement

The following statement shall appear, in a box, within the first several pages of the compliance software program user's manual and help system:

[Insert Name of Calculation Method] may be used to show compliance with the Florida Energy Code only when the following reference documents are readily available to the program user:

- Florida Energy Code
- Energy Simulation Tool Approval: Technical Assistance Manual (TAM 2017-1.0)

## 5. Managing User Inputs

This section addresses the processes of data entry and the validation of user input data that can be performed prior to and independent of the code compliance calculation and building energy simulation.

### 5.1 Building Descriptor Inputs and Restrictions

The building inputs in the software shall have restrictions based on the code compliance method and building type. If the software provides a means for the user to enter building descriptors listed as optional, then all input conditions and restrictions in the Florida Energy Code pertaining to those building descriptors shall be met.

Four levels of restrictions are specified for building descriptors:

1. The most limiting restriction is a prescribed value. This is an input that must be used in all instances, with no variation.
2. A critical default may be overridden, but when it is, the user must provide special documentation.
3. A default is provided for convenience and may be overridden by the user with no special documentation.
4. For many inputs, there are no restrictions.

#### ***Commercial Building Inputs Restrictions***

All inputs shall conform to the input conditions and restrictions stated in Chapter 4 Commercial Energy Efficiency Section of the Florida Energy Code. The relevant sections are as follows:

- For building envelope inputs, restrictions shall be per Building Envelope Requirements Section C402 or ASHRAE 90.1 option.
- For building mechanical systems, the input restrictions shall be per Section C403 Building Mechanical Systems or ASHRAE 90.1 option.
- For service water heating, the input restrictions shall be per Section C404 Service Water Heating or ASHRAE 90.1 option.
- For electrical power and lighting systems, the input restrictions shall be per Section C405 Electrical Power and Lighting Systems or ASHRAE 90.1 option.
- For performance based methods compliance criteria, input restrictions shall be per Section C407 Total Building Performance or ASHRAE Cost Budget Section of ASHRAE 90.1 option, or Building Envelope Trade-Off Option of Section 5.6 of ASHRAE 90.1.

#### ***Residential Building Inputs Restrictions***

All inputs shall conform to the input conditions and restrictions stated in Chapter 4 Residential Energy Efficiency Section of the Florida Energy Code.

- For building envelope inputs, restrictions shall be per Section R402 Building Thermal Envelope.

- For cooling, heating, controls, mechanical ventilation, ductwork, hot water, hot water distribution, systems serving multiple dwelling units and swimming pools, the input restrictions shall be per Section R403 Systems.
- For lighting, the input restrictions shall be per Section R404 Electrical Power and Lighting Systems.
- For performance-based method compliance criteria, input restrictions shall be per Section R405 Simulated Performance Alternative.
- For Energy Rating Index-based method compliance criteria, input restrictions shall be per Section R406 Energy Rating Index Compliance Alternative.

## 5.2 User Interface

The compliance software is not required to provide a means for users to enter data for building descriptors designated as prescribed (e.g., thermostat set points) in Sections C407 and R405 of the Florida Energy Code. However, if the user is permitted to enter values for prescribed inputs (perhaps for other features the software offers), the software must enforce the prescribed value when making the code calculation and report.

No restrictions are specified for unsanctioned inputs (e.g., inside visible reflectance). If the software uses unsanctioned inputs, the software documentation or help system shall specify the applicability of the building descriptors, its definition, the units in which it is expressed, restrictions on input for the *Proposed Design* building, and, if applicable, how the building descriptor is defined for the *Standard Reference Design* building.

Compliance software programs must allow the user to enter the proposed building parameters that are not prescribed (fixed) in the energy code. The software may assist the user in describing the *Proposed Design* by displaying typical values for building descriptors, provided deliberate action by the user is necessary before a displayed value is used.

### ***Compulsory Input Checks***

The compliance software shall check to ensure that valid entries have been made for all compulsory building descriptors (e.g., wall type) before the user is permitted to proceed with the next step in the compliance process. Sections C407, R406 and R405 of the Florida Energy Code specifies the compulsory building descriptors.

### ***Handling Missing Inputs***

If a required input is missing or invalid, then the compliance software shall:

- notify the user that the input is missing;
- identify the input field(s) with missing or invalid data; and
- prevent the user from moving to the next step of the compliance process.

The software may provide additional information designed to help the user correct the deficiency.

### ***Handling Invalid Input***

When invalid data is entered, the compliance software shall:

- notify the user of the invalid input;
- identify the nonconforming input field; and
- prevent execution of the next step of the compliance process.

The compliance software may provide additional information designed to assist the user to correct the invalid data.

### ***Handling Inconsistent Inputs***

If the *Proposed Design* building fails a consistency check, the compliance software shall:

- notify the user that an inconsistency exists;
- identify the specific consistency check that has been failed;
- identify the inconsistent input fields, if feasible; and
- prevent execution of the next step of the compliance process.

The software may provide additional information designed to help the user correct the inconsistent input.

### ***Validity Checks***

The compliance software shall check all user inputs to ensure that the following conditions are met:

- limits-Inputs not to exceed the minimums or maximums values for the parameters permitted by the simulation engine;
- compliance Rule Limits - Inputs not to be outside the limits for the descriptors specified in the Florida Energy Code;
- simulation Tool Discrete Options-Inputs correspond with valid discrete or list options for parameters available in the simulation engine; and
- compliance Rule Discrete Options-Inputs correspond with valid discrete options provided for in the Florida Energy Code.

### ***Consistency Checks***

The consistency checks described above are intended to identify errors and oversights in user input and thereby help ensure that the building description is complete and interpretable by the energy analysis engine. Examples of consistency checks include that windows should not exceed the areas of wall where they are contained and that the necessary plant equipment has actually been connected to the secondary HVAC systems. The compliance software may include additional consistency checks provided these additional checks are clearly documented in the user documentation or online help.

## 6. Residential Energy Compliance Software Programs

### 6.1 General Requirements

The residential code has three prescriptive, one performance, and one Energy Rating Index compliance methodologies. Two prescriptive methods, the R-value and U-factor Alternative, compare the home's component thermal characteristics against prescriptive measures. Software may not be required for those prescriptive methods but some software vendors may choose to include the methodology. If software is created to comply with these methods, the guidelines of this TAM shall be used to submit documentation of accurate compliance to the Florida Building Commission.

The Total UA Alternative Method allows trade-offs between envelope components by comparing the sum of the area times U-factors against the sum of the same areas times code specified U-factors in Table R402.1.4. Software designed to perform this calculation shall submit to the Florida Building Commission the test results and reports specified by this document.

The residential performance method of the Florida Energy code requires simulation results showing a proposed home (*Proposed Design*) to have an annual normalized, modified energy load that is less than or equal to the annual energy load of the *Standard Reference Design* as specified in Section R405.3 of the Florida Energy Code. The *Standard Reference Design* and *Proposed Design* utilized by the energy simulation tool shall be configured and analyzed as specified in Table R405.5.2(1) of the Florida Energy Code. In accordance with Section R401.2 of the Florida Energy Code, compliance software programs shall designate that the mandatory Energy Code provisions are met as well as any relevant performance criteria in Section R405. The compliance software shall accept inputs that describe the thermal envelope and equipment for the *Proposed Design*. The software shall use the proposed building inputs to create a *Standard Reference Design* building based on the *Proposed Design* building.

The residential Energy Rating Index (ERI) of the Florida Energy Code specified in Section R406 is an alternative simulation based compliance method. The *ERI* alternative compliance method requires simulation results showing that the *ERI rated design* to be less than or equal to the *maximum Energy Rating Index* listed in Table R406.4 of the Florida Energy Code, and complying with mandatory and thermal envelope efficiency level requirements in Section R406.2. The compliance software shall determine the *ERI reference design* using only the inputs for the rated design. The software shall not allow the user to directly modify the building component characteristics of the *ERI reference design* and the *ERI* shall include all energy used in the residential dwelling unit.

If software is to be used to comply with the prescriptive, performance or ERI paths, there are reports that shall be produced and tests that the vendor shall make to indicate correct computation and reporting. The vendor shall enter the test homes (Prescriptive test home characteristics file), produce the reports, and complete the spreadsheet (Prescriptive Software Compliance Tests) for the prescriptive methods the software covers. There are six test homes, three with the Tampa climate representing climate zone 2 in the code (T01 –T03) and three for the Miami climate representing climate zone 1 in the code (M01 –M03). Performance method compliance software vendor shall conduct the ASHRAE Standard 140, HERS BESTEST, Florida Reference Home



Autogen, HVAC, Distribution System Efficiency (DES), Domestic Hot Water (DHW), and Florida e-Ratio tests described in Appendix R-5 of this Manual.

There are two sets of test suites for the ERI alternative method compliance software evaluation described in Appendix R-6 of this Manual. The first set of tests is defined by RESNET Software Verification Committee to determine HERS software tool accuracy and compatibility (RESNET, 2017). Since compliance software can be approved for only one of the five residential Florida Energy Code compliance methods, the same HRES software tool accuracy and compatibility tests defined by RESNET Software Verification Committee is used for both performance and ERI compliance methods. The ERI method software verification tests include: ASHRAE Standard 140-2011, Class II, Tier 1 building loads tests, HERS reference home auto-generation tests, hot water system performance tests, HVAC tests, duct distribution system efficiency tests, and the HERS method tests. The second set of tests is intended to evaluate the software's capability to verify the Florida Energy Code requirements for Florida homes, including the ERI-value, thermal envelope efficiency and mandatory code requirements. There are four test cases formulated for the second ERI method test suite.

Each compliance method requires a cover sheet and specific reports as indicated here and in the code. The building official shall require that an EPL Display Card be completed and certified by the builder to be accurate and correct before final approval of the building for occupancy. Florida law (Section 553.9085, *Florida Statutes*) requires the EPL Display Card to be included as an addendum to each sales contract for both presold and non-presold residential buildings. The EPL Display Card contains information indicating the energy performance level and efficiencies of components installed in a dwelling unit. The building official shall verify that the EPL Display Card completed and signed by the builder accurately reflects the plans and specifications submitted to demonstrate compliance for the building.

Software tools are expected to provide help within the software that pertains to aspects of the building code where code language provides specific guidelines for determining a value. For example, for insulation inputs the code section R402.1.3 shall be referenced: "Insulation material used in layers, such as framing cavity insulation, or continuous insulation shall be summed to compute the corresponding component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films."

## 6.2 Residential Florida Energy Code Requirements Summary

The 6<sup>th</sup> Edition (2017) Florida Energy Code requirements of the residential section are summarized in Table 6.2-1. This table summarizes the mandatory, the three prescriptive, the performance and the ERI compliance methods requirements. The mandatory section applies to the five residential code compliance methods. The prescriptive requirements may apply to the R-value, U-factor alternative, or total UA alternative. Also the table entails summary of the code section that applies to the simulation based performance compliance method and the ERI compliance method. This table is a concise guide of the Florida residential Energy Efficiency Code requirements by compliance method.

Table 6.2-1 Residential Florida energy code requirements summary

Code	Title	Mandatory	Prescriptive Compliance Methods			Simulated Performance Alternative	ERI Compliance Alternative
			R-Value	U-Factor Alternative	Total UA Alternative		
R401.2	Compliance		x	x	x	x	x
R401.3	Energy performance level (EPL) display card	x					
R402.1	General		x	x	x		
R402.1.1	Vapor retarder		x	x	x		
R402.1.2	Insulation and fenestration criteria		x	x	x		
R402.1.3	R-value computation		x				
R402.1.4	U-factor alternative			x			
R402.1.5	Total UA alternative				x		
R402.2	Specific insulation requirements		x	x	x		
R402.2.1	Ceilings with attic space		x				
R402.2.2	Ceilings without attic space		x				
R402.2.3	Eave baffle		x	x	x		
R402.2.4	Access hatches and doors		x	x	x		
R402.2.5	Mass walls		x	x	x		
R402.2.6	Steel-frame ceilings, walls and floors		x	x	x		
R402.2.7	Walls with partial structural sheathing		x				
R402.2.8	Floors		x	x	x		
R402.2.9	Basement walls		x	x	x		
R402.2.10	Slab-on-grade floors		x	x	x		
R402.2.11	Crawl space walls		x	x	x		
R402.2.12	Masonry veneer		x	x	x		
R402.2.13	Sunroom insulation		x	x	x		
R402.2.14	Common walls/ceilings/floors	x					
R402.3	Fenestration		x	x	x		
R402.3.1	U-factor		x	x	x		
R402.3.2	Glazed fenestration SHGC		x	x	x		
R402.3.3	Glazed fenestration exemption		x				
R402.3.4	Opaque door exemption		x				
R402.3.5	Sunroom fenestration		x	x	x		
R402.4	Air leakage	x					
R402.4.1	Building thermal envelope	x					
R402.4.1.1	Installation	x					
R402.4.1.2	Testing	x					
R402.4.2	Fireplaces	x					
R402.4.3	Fenestration air leakage	x					
R402.4.4	Rooms containing fuel-burning appliances	NA					
R402.4.5	Recessed lighting	x					
R403.1	Controls						
R403.1.1	Thermostat provision	x					
R403.1.2	Programmable thermostat		x	x	x		
R403.1.3	Heat pump supplementary heat	x					
R403.2	Hot water boiler outdoor temperature setback		x	x	x		
R403.3	Ducts						
R403.3.1	Insulation		x	x	x		
R403.3.2	Sealing	x					
R403.3.3	Duct testing		x	x	x		x
R403.3.4	Duct leakage		x	x	x		
R403.3.5	Building cavities	x					
R403.3.6	Air-handling units		x	x	x	x	
R403.4	Mechanical system piping insulation	x					
R403.4.1	Protection of piping insulation	x					
R403.5	Service hot water						
R403.5.1	Heated water circulation and temperature maintenance system	x					
R403.5.1.1	Circulation systems	x					
R403.5.1.2	Heat trace systems	x					
R403.5.2	Demand circulation system						
R403.5.3	Hot water pipe insulation		x	x	x		x
R403.5.4	Drain water heat recovery units						
R403.5.5	Heat traps	x					
R403.5.6	Water heater efficiencies	x					
R403.5.6.1	Storage water heater temperature controls	x					
R403.5.6.2	Water-heating equipment	x					

Table 6.2-1 Residential Florida energy code requirements summary (continued)

Code	Title	Mandatory	Prescriptive Compliance Methods			Simulated Performance Alternative	ERI Compliance Alternative
			R-Value	U-Factor Alternative	Total UA Alternative		
R403.6	Mechanical ventilation	x					
R403.6.1	Whole-house mechanical ventilation system fan efficiency	x					
R403.6.2	Ventilation air	x					
R403.7	Heating and cooling equipment	x					
R403.7.1	Equipment sizing	x					
R403.7.1.1	Cooling equipment capacity	x					
R403.7.1.2	Heating equipment capacity	x					
R403.7.1.3	Extra capacity required for special occasions	x					
R403.8	Systems serving multiple dwelling units	x					
R403.9	Snow melt and ice system controls	x					
R403.10	Pools and permanent spa energy consumption	x					
R403.10.1	Heaters	x					
R403.10.2	Time switches	x					
R403.10.3	Covers	x					
R403.10.4	Gas- and oil-fired and spa heaters	x					
R403.10.5	Heat pump pool heaters	x					
R403.11	Portable spa	x					
R403.12	Residential pools and permanent residential spa	x					
R404.1	Lighting equipment	x					
R404.1.1	Lighting equipment	x					
R405.1	Scope						
R405.2	Mandatory requirements					x	
R405.2.1	Ceiling insulation					x	
R405.3	Performance-based compliance					x	
R405.4	Documentation					x	
R405.5	Calculation Procedure					x	
R405.6	Calculations software tools					x	
R405.7	Requirements specific to credit options					x	
R406.1	Scope						
R406.2	Mandatory requirements						x
R406.3	Energy Rating Index						x
R406.4	ERI-based compliance						x
R406.5	Verification by approved agency						x
R406.6	Documentation						x
R406.7	Calculation software tools						x

## 6.3 Prescriptive R-Value Method

### 6.3.1 Prescriptive R-Value Reports

Software including compliance by this prescriptive method shall produce a report that mimics Florida Building Code, Energy Conservation Form R402-2017 as found in [Appendix R-2](#) of this Manual. This report shall include:

- 1) a name of the component consistent with those listed in Table R402.1.2 for each component (e.g., ceiling, mass walls, frame walls, etc.);
- 2) the area of the component with those thermal characteristics;
- 3) the insulation R-value (or for windows, skylights and doors U-factor) to be installed; and
- 4) a pass or fail indication for each item based on information provided in Table R402.1.2 for the climate zone selected. For fenestrations, the software shall consider the exceptions provided for skylights, impact glass, and exceptions listed in section R402.3 prior to indicating a failure. If any item fails, the report shall indicate that the home fails. The word “FAIL” shall be no smaller than 16-point font, be bold, and be in an obvious location. If the home meets all criteria of Table R402.1.2, the report shall state “User entries meet requirements of Table R402.1.2.” The house also has to meet other requirements described in the Florida Energy Code.

Along with the printout of the report, another page shall be printed to be submitted to the code official. This page shall include the following information (see [Appendix R-2](#) for an example):

### *RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST*

#### *Residential R-Value Computation Prescriptive Method*

*Applications for compliance with the Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) via the Residential R-value computation prescriptive method shall include:*

- 1) *this checklist;*
- 2) *Form R402-2017, which includes the parameters of Table R402.1.2 (two pages);*
- 3) *input summary checklist report (usually 4 pages/may be greater);*
- 4) *Energy Performance Level (EPL) Display Card (one page);*
- 5) *HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7; and*
- 6) *mandatory requirements (five pages).*

*Required prior to CO for the R-value computation method:*

- 7) *a completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page);*
- 8) *a completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See Appendix R-11 in this Manual; and*
- 9) *a completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located within the building thermal envelope. See Appendix R-12 in this Manual.*

#### **6.3.2 Software Testing for Building Commission Approval of the R-Value Method**

A pdf file shall be prepared that includes the following:

- 1) software reports (Reports 1 – 3 listed above) for prescriptive test houses T01 – T03 and M01 – M03;
- 2) the completed R-Value Method portion of each tab in the spreadsheet with the software results for each test house (procedures are provided in [Appendix R-2](#)); and
- 3) if the results computed by the software fall outside the range indicated in the excel report and the vendor believes that their value is correct, they may include an explanation.

## **6.4 Prescriptive U-Factor Alternative**

### **6.4.1 Prescriptive U-Factor Alternative Reports**

If the software is to calculate the residential U-Factor Alternative method, it shall generate a report for code compliance submittal that includes:

For any assembly, list:

- 1) *the U-factor and the ASHRAE methodology used to obtain the U-factor;*
- 2) *include the list of components and any inputs, such as conductivity, thickness, R-value relevant to developing a U-factor;*
- 3) *indicate if any of the assembly components are software defaults or user specified; and*
- 4) *for any assembly with different thermal paths (e.g., a wall with framing members, or concrete block walls with insulated cores), list the fraction of each used to compute the assembly U-factor.*

If any assembly component U-factor is greater than shown on Table R402.1.4, then indicate the assembly has failed.

If any assembly component has failed, the word “FAIL” shall be shown no smaller than 16-point font, be bold, and be in an obvious location. If every assembly in the home is less than or equal to the U-factors listed in Table R402.1.4, the report shall state “User entries meet requirements of U-factor Alternative in Table R402.1.4.” The house also has to meet other requirements described in the Florida Energy Code.

The software name and version shall be printed on the report.

The software shall also provide a cover sheet for submittal that includes the following (vendor may change page number count based on their typical output):

### *RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST*

#### *Residential U-factor Alternative Prescriptive Method*

*Applications for compliance with the Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) via the Residential U-factor Alternative prescriptive method shall include:*

- 1) *this checklist;*
- 2) *U-factor prescriptive report that includes the information in Table R402.1.4 (two pages);*
- 3) *input summary checklist report (usually 4 pages/may be greater);*
- 4) *Energy Performance Level (EPL) Display Card (one page);*
- 5) *HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7; and*
- 6) *mandatory requirements (five pages).*

*Required prior to CO for the prescriptive U-factor alternative method:*

- 5) *a completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page);*
- 6) *a completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See Appendix R-11 in this Manual; and*

- 7) *a completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located with the building thermal envelope. See Appendix R-12 in this Manual.*

#### *6.4.2 Software Testing for Building Commission Approval of the Prescriptive U-Factor Alternative Method*

A pdf file shall be prepared that includes the following:

- 1) software reports (Reports 1 – 4 listed above) for prescriptive test houses T01–T03 and M01–M03;
- 2) the completed U-factor Alternative portion of each tab in the spreadsheet with the software results for each test house (procedures are provided in [Appendix R-3](#)); and
- 3) if the results computed by the software fall outside the range indicated on the excel report and the vendor believes that their value is correct, they may include an explanation.

## 6.5 Prescriptive Total UA Alternative Method

### 6.5.1 Prescriptive Total UA Alternative Reports

The software shall allow entries of the home's components and/or assemblies and areas. The software shall calculate the baseline Total UA (maximum allowed value by code) by using the same building component areas (walls, windows, floors, etc.) of the proposed home, but with U-factors from Table R402.1.4.

If the software is to calculate the residential Total UA Alternative method, it must generate a report for code compliance submittal that includes these items:

For any assembly, list:

- 1) the area and overall U-factor and the ASHRAE methodology used to obtain the U-factor;
- 2) include the list of components and any inputs, such as conductivity and thickness, relevant to developing a U-factor;
- 3) indicate if any of the assembly components are software defaults or user specified;
- 4) for any assembly with multiple thermal paths (e.g., a wall with framing members, or block walls with fill in concrete blocks), list the fraction of each used to compute the assembly U-factor; and
- 5) show the Total UA of the proposed home and the baseline Total UA next to one another.

If the proposed home Total UA is greater than the baseline Total UA, the word "FAIL" shall be shown no smaller than 16 -point font, be bold, and be in a very obvious location. If the proposed home Total UA calculated according to the code is equal or less than the Baseline UA calculated using the U-factors in Table R402.1.4, the report shall state "User entries meet requirements of Total UA". The house also has to meet other requirements described in the Florida Energy Code.

The software name and version shall be printed on the report.

The software shall also provide a cover sheet for submittal that includes the following (vendor may change page number count based on their typical output):

#### *RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST*

##### *Residential Total UA Prescriptive Method*

*Applications for compliance with the Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) via the Residential Total UA Alternative prescriptive method shall include:*

- 1) *this checklist;*
- 2) *total UA Report including Total UA Alternative Prescriptive Requirements Checklist (two pages);*
- 3) *input summary checklist report (usually 4 pages/may be greater);*
- 4) *Energy Performance Level (EPL) Display Card (one page);*
- 5) *HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7; and*

6) *mandatory requirements (five pages).*

*Required prior to CO for the Total UA alternative method:*

- 7) *a completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page);*
- 8) *a completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See Appendix R-11 in this Manual; and*
- 9) *a completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located with the building thermal envelope. See Appendix R-12 in this Manual.*

### *6.5.2 Software Testing for Building Commission Approval of the Prescriptive UA Alternative Method*

A pdf file shall be prepared that includes the following:

- 1) software reports (reports 1-4 listed above) for prescriptive test houses T01–T03 and M01–M03;
- 2) the completed Total UA portion of each tab in the spreadsheet with the software results for each test house (procedures are provided in [Appendix R-4](#)); and
- 3) if the results computed by the software fall outside the range indicated on the excel report and the vendor believes that their value is correct, they may include an explanation.



## 6.6 Performance Method

### 6.6.1 Minimum Capabilities

Compliance software programs (energy simulation tools) shall be capable of calculating the annual energy consumption of all building elements that differ between the *Standard Reference Design* and the *Proposed Design* and shall include the following capabilities (Section R405.6.1 of the Florida Energy Code).

- Computer generation of the *Standard Reference Design* using only the input for the *Proposed Design*. The calculation procedure shall not allow the user to directly modify the building component characteristics of the *Standard Reference Design*.
- Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the *Standard Reference Design* residence in accordance with Section R403.7 of the Florida Energy Code.
- Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating, and air-conditioning equipment based on climate and equipment sizing.

Printed reports to include a cover sheet; Energy Performance Level (EPL) display card; performance test reports for envelope leakage and air distribution system leakage as required; and Form R405.5.2(1), a *Building Code official* inspection checklist listing each of the *Proposed Design* component characteristics determined by the analysis to provide compliance, along with their respective performance ratings (e.g., orientation, *R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER, EF, etc.)

### 6.6.2 Compliance Report

Compliance software program provisions and overall stringency shall be as described in Section R405 of the Florida Energy Code. The software shall produce the following cover sheet for submittal with each report (vendor may change page number count based on their output). See report samples in [Appendix R-5](#) of this Manual.

#### *RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST*

##### *Residential Performance Method*

*Applications for compliance with the Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) via the Residential performance method shall include:*

- 1) *this checklist;*
- 2) *a Form R405 report that documents that the Proposed Design complies with Section R405.3 of the Florida Energy Code. This form shall include a summary page indicating home address, e-Ratio, and the pass or fail status along with summary areas and types of components, whether the home was simulated as a worst-case orientation, name and version of the compliance software tool, name of individual completing the compliance report (one page) and an input summary checklist report that can be used for field verification (usually four pages/may be greater);*

- 3) *Energy Performance Level (EPL) Display Card (one page);*
- 4) *HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7; and*
- 5) *mandatory requirements (five pages).*

Required prior to CO for the Performance method:

- 6) *a completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page);*
- 7) *a completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See Appendix R-11 in this Manual; and*
- 8) *if Form R405-2017 indicates anything other than default duct leakage, then a completed Form 2017 Duct Leakage Test Report (usually one page). See Appendix R-12 in this Manual.*

### 6.6.3 Climate Data for the Performance Method

The compliance software program shall perform simulations using hourly values of climate data, such as temperature and humidity, derived from TMY3 (Typical Meteorological Year) climate data. The compliance software program shall calculate solar radiation on exterior surfaces on an hourly basis from the values of direct normal irradiance and diffuse horizontal irradiance contained in the climate data, taking ground reflectance into account. Climate criteria for the performance-based building code compliance methods are determined by climate data from all Florida TMY3 weather data collection stations. Energy Code calculations shall use the data collection site for the nearest city with respect to the building's site location.

### 6.6.4 Implementing Florida "Credit" options for the Performance Method

#### 6.6.4.1 Radiant Barrier and IRCC

When the specified code criteria is met, apply the emissivity to the underside of the roof decking if software is capable of accurately modeling interior radiation, or if not, apply an R-value to the roof decking of 6.77 for a radiant barrier and 2.185 for an IRCC, based on a standard R-value of 0.728 with no radiant coating.

#### 6.6.4.2 Cool Roof Option

When the specified code criteria for the tested product is met, apply the roof reflectance provided to the roof surface. Otherwise, the default roof reflectance (0.04, i.e., solar absorbance of 0.96) is to be used.

#### 6.6.4.3 Unvented Attic Option

Normally a vented attic joined to the conditioned space ceiling should be modeled. It has ventilation to the outside determined by a user entered (and reported) ventilation rate. The software should provide an option for a sealed (unvented) attic through one or more inputs (e.g., setting attic ventilation rate to none). The software should provide the user with the option to indicate insulation at the roof deck and gables and soffits through the same or more entries. The software must model the thermal behavior of attic space correctly under each condition and any ductwork in

the attic must account for the attic conditions. Unless the air leakage rate of the sealed attic is tested, a default leakage rate of sealed attic spaces should be modeled as 0.12 times the rate used for attics with ventilation opening of 1/300.

#### 6.6.4.4 Cross Ventilation Option

Normal open window ventilation shall be modeled at 5 air changes per hour, or adjusted based on open area (see Equation 6.6-1), whenever the following conditions are met:

- Outdoor temperature is between 71°F and 75°F
- Indoor temperature remains below 75°F

Use an algorithm that only allows ventilation to begin after some time period (for example, three hours) after heating or cooling has been called or until the outdoor temperature is reasonably below the cooling set point.

If modeling is done in a simple fashion for projects achieving the criteria in the Florida Energy Code, Section R405.7.4, increase the window ventilation from 5 air changes per hour to 7 air changes per hour. The ventilation condition (windows open or closed) shall be set to not change between midnight and 6 a.m. to reflect most typical operating conditions.

##### 6.5.4.4.1 Programs Using DOE2 to Model Cross Ventilation

In DOE2-based software, apply the undocumented method of adding a -4 to the end of the schedule to allow DOE2 to determine typical conditions prior to opening windows:

VENTING = SCHEDULE THRU DEC 31 (ALL) (1, 24) (-4).

$$FVA = \left( 0.25 \times \frac{A_w}{A_{cfa}} \right) \cdot (0.85 \times DisCoef) \quad 6.6-1$$

Where:

- $FVA$  = the fraction of ventilation area
- $A_w$  = the sum of all the window areas in the conditioned part of the home
- $A_{cfa}$  = the sum of all the conditioned floor areas in the home
- $DisCoef$  = the coefficient of the discharge rate of air, set to 0.60 for standard ventilation, 0.25 and 0.85 are factors for window area open and screens

In DOE2 programs, the vent method should be set to use the Sherman and Grimsrud method: (VENT-METHOD = S-G) and the max vent rate should be set to 20 (MAX-VENT-RATE = 20). If other hourly modeling engines are used, they should use the model closest to the DOE2 method described here.

When the specified Florida Energy Code, Section R405.7.4 criteria for cross ventilation credit is met, the software should increase the window ventilation discharge coefficient from 0.6 to 0.75 compared to standard window ventilation.

### 6.6.4.5 Whole House Fan Option

When the specified code criteria in R405.7.5 for whole house fan is met, either a default of 300W per hour, or a user specified and reported energy use value from the installed whole house fan unit, shall be included in the cooling energy performance when the unit runs. The software shall check to make sure the entered power use and cfm are within the range of current fans available. An air change rate of 20 air changes per hour shall be modeled during times when the whole house fan is operated or a larger value is entered by the user. The operation (on or off) of the unit shall not change from midnight to 6 a.m.

### 6.6.4.6 Ceiling Fan Credit

The software shall apply a 2% reduction in cooling energy use for the proposed design if the proposed design meets the criteria of section R405.7.6 of the code.

### 6.6.4.7 Water Heat Recovery Credit

The model should simulate a heat recovery unit. If the model is not capable of modeling a heat recovery unit, simply adjust the *Effectiveness Factor* (EF) of the main water heater using the factors in Table 6.6-1 (e.g., a 0.86 factor represents 14% savings) for annual energy use calculations.

Table 6.6-1 Heat recovery unit effectiveness factor

	North	Central	South
Effectiveness Factor	0.86	0.78	0.61

### 6.5.4.7.1 Programs Using DOE2 to Model Water Heat Recovery Credit

If using DOE-2, the COOL\_WASTE\_HEAT should be set to 0.07, the HEAT\_WASTE\_HEAT should be set to 0.09, and the DHW-TYPE = DESUPERHEAT.

### 6.6.4.8 Dedicated Heat Pump Option

To allow this option, the model has to be able to simulate a heat pump water heater. Also, the cooling dumped to the zone the heat pump water heater is located (e.g., garage) shall be added to the heat balance of that space.

### 6.6.4.9 Water Heating Load

The expected water heating load shall be calculated using Equation 6.6-2:

$$HW_{load} = GPD \times 8.3 \times (T_{set} - T_{main}) \cdot \frac{365}{1000} \quad 6.6-2$$

Where:

- $HW_{load}$  = amount of heating needed in kBtu/year
- $GPD$  = gallons per day =  $30 + 10 \times N_{br}$
- $N_{br}$  = the number of bedrooms in the house

$T_{set}$  = hot water temperature set point = 120°F  
 $T_{main}$  = temperature of entering water from Table 6.6-2 and 8.3 is the conversion for Btu/gallon and 365 is days in the year and 1000 is Btu/kBtu.

#### 6.6.4.10 Solar Water Heating Option

The solar water heating effective efficiency for systems installed according to R403.5.6.2.1 shall be calculated using the following procedure.

First, calculate the effective solar efficiency:

$$ESE = SEF \cdot (a + (b \cdot N_{br}) + (c \cdot N_{br}^2)) \quad 6.6-3$$

Where:

$ESE$  = effective solar efficiency  
 $SEF$  = the published Florida Solar Energy Factor  
 $a, b, c$  = coefficients as given in Table 6.6-2 by climate zone

Table 6.6-2 Coefficients of equation for calculating effectiveness of solar water heater

	$a$	$b$	$c$	$T_{main}$ (°F)
North	1.7595	-0.2767	0.0170	73.72
Central	1.9585	-0.3486	0.0212	77.88
South	2.2077	-0.4451	0.0287	82.13

The North, Central and South climate zone classification of Florida by counties for solar water heating efficiency calculation are provided in Table 6.6-3. The Florida climate zones classification map by counties came from (Kung, 2004). This classification was used when solar water heaters efficiency factors were originally developed.

Second, calculate the expected hot water heating load using Equation 6.6-2.

Third, estimate an expected standard electric resistance system annual energy use according to Equation 6.6-4:

$$ESS_e = HW_{load} \times \frac{0.293}{EF_e} \quad 6.6-4$$

Where:

$ESS_e$  = energy use of Standard System-Electric in kWh  
 $HW_{load}$  = hot water load calculated in Equation 6.6-2  
 $EF_e$  = 0.95

Fourth, calculate the expected solar system electric energy use according to Equation 6.6-5:

$$Solar_e = HW_{load} \times \frac{0.293}{ESE} \quad 6.6-5$$

Where:

- $Solar_e$  = energy use of Solar System with Electric backup in kWh
- $HW_{load}$  = hot water load calculated in Equation 6.6-2
- $ESE$  = effective solar efficiency calculated in Equation 6.6-3

The fifth step is to calculate the solar fraction for electric and fossil fuel systems:

$$SE_e = \left( \frac{ESS_e - Solar_e}{ESS_e} \right) \quad 6.6-6$$

$$SF_f = SE_e \times \frac{EF_f}{0.90} \quad 6.6-7$$

Where:

- $SF_e$  = solar fraction for electric
- $SF_f$  = solar fraction for non-electric
- $EF_f$  = efficiency of the gas, propane, oil or other non-electric back up heater (fraction between 0 and 1)

This solar fraction can then be used to modify any annual detailed water heating algorithm that should be run for the non-solar backup as though there was no solar system.

$$ADHW = (ADHW_c - (1 - SF)) \quad 6.6-8$$

Where:

- $ADHW$  = annual hot water energy use for the proposed home
- $ADHW_c$  = annual hot water energy use of the conventional, non-solar back-up system fully modeled
- $SF$  = the appropriate solar fraction,
- $SF_e$  or  $SF_f$  = calculated in the previous step

Table 6.6-3 Florida climate zones classification for solar water heating option

ID	County	Climate Zones	ID	County	Climate Zones
1	Alachua County	North	35	Lee County	South
2	Baker County	North	36	Leon County	North
3	Bay County	North	37	Levy County	Central
4	Bradford County	North	38	Liberty County	North
5	Brevard County	Central	39	Madison County	North
6	Broward County	South	40	Manatee County	Central
7	Calhoun County	North	41	Marion County	Central
8	Charlotte County	South	42	Martin County	South
9	Citrus County	Central	43	Miami-Dade County	South
10	Clay County	North	44	Monroe County	South
11	Collier County	South	45	Nassau County	North
12	Columbia County	North	46	Okaloosa County	North
13	DeSoto County	Central	47	Okeechobee County	Central
14	Dixie County	North	48	Orange County	Central
15	Duval County	North	49	Osceola County	Central
16	Escambia County	North	50	Palm Beach County	South
17	Flagler County	North	51	Pasco County	Central
18	Franklin County	North	52	Pinellas County	Central
19	Gadsden County	North	53	Polk County	Central
20	Gilchrist County	North	54	Putnam County	North
21	Glades County	South	55	St. Johns County	North
22	Gulf County	North	56	St. Lucie County	Central
23	Hamilton County	North	57	Santa Rosa County	North
24	Hardee County	Central	58	Sarasota County	Central
25	Hendry County	South	59	Seminole County	Central
26	Hernando County	Central	60	Sumter County	Central
27	Highlands County	Central	61	Suwannee County	North
28	Hillsborough County	Central	62	Taylor County	North
29	Holmes County	North	63	Union County	North
30	Indian River County	Central	64	Volusia County	Central
31	Jackson County	North	65	Wakulla County	North
32	Jefferson County	North	66	Walton County	North
33	Lafayette County	North	67	Washington County	North
34	Lake County	Central			

#### 6.6.4.11 Multiple Heating Systems

The software must be capable of modeling homes that use dual fuels for space heating (for example natural gas furnace in one part of the home and an electric heat pump in another part), applying the appropriate reference heating system to the standard design home for that portion of the home. Where two or more systems of the same fuel and system type are installed with different levels of efficiency serving different parts of the house, a capacity-weighted performance rating may be used to determine compliance. Alternatively, the area served by each system may be modeled separately.

#### 6.6.4.12 Multiple Cooling Systems

Where two or more systems of the same fuel and system type are installed with different levels of efficiency serving different parts of the house, a capacity-weighted performance rating may be used to determine compliance. Alternatively the area served by each system may be modeled separately.

#### 6.6.4.13 Multiple Water Heating Systems

Where two or more water heating systems are installed with different levels of efficiency, a single efficiency weighted by bedrooms served may be calculated for determining compliance with this code. Alternatively, the area served by each system may be modeled separately.

### 6.6.5 Mechanical Ventilation

The software shall calculate the ASHRAE 62.2 ventilation requirement and not allow the home to pass the code if the mechanical ventilation value is exceeded, as stated in the 6<sup>th</sup> Edition 2017 Florida Building Code, Energy Conservation, Section R403.6.2 bullet item 1. The software shall account for the energy use of the mechanical ventilation fan itself and model the loads from the air brought into the house due to mechanical ventilation. The software shall check to make sure the entered power use and cfm entered are within the range of current ventilation fans available.

### 6.6.6 Residential Energy Performance Method Testing

This section specifies required tests that software designated as doing residential performance method compliance software shall conduct and submit.

Compliance software programs shall account for the energy performance effects of all of the characteristics described in section R405 of the Code.

The modeling procedures and assumptions described in this chapter apply to both the *Standard Reference Design* and *Proposed Design*. The requirements for the standard design include those that the compliance software program shall apply to new features, altered existing features, unchanged existing features, or all of the above.

#### 6.6.6.1 Residential Performance Method Accuracy Test Overview

A specific version of HERS BESTEST for Florida was developed in request to DOE by the Florida Solar Energy Center (FSEC). In its request, FSEC noted that the Florida Building Energy–Efficiency Ratings Act of 1993 requires that Florida’s rating system “be compatible with standard federal rating systems...where applicable....” The relevant proposed federal guidelines (DOE 10



CFR Part 437) will require that energy analysis tools used for energy ratings are tested according to the HERS BESTEST procedure.

The type of software testing used in this Manual is based on inter-model comparisons and is one portion of an overall validation methodology that was first developed by National Renewable Energy Laboratory (NREL) in 1983 (Judkoff et al., 1983/2008). The method has been further refined since then by NREL and others (Judkoff and Neymark 2006).

Comparative testing, as applied in the HERS Building Energy Simulation Test (HERS BESTEST) (Judkoff and Neymark 1995) and Florida HERS BESTEST (Judkoff and Neymark 1997) methods, includes a set of public domain reference programs that have already been subjected to extensive analytical, empirical, and inter-model testing.

#### 6.6.6.2 Performance Method Reference Test Cases

The software verification test suite found in Section 3.2 of the RESNET document “Procedures for Verification of International Energy Conservation Code Performance Path Calculation Tools” dated March 2014 shall be utilized to verify the accuracy of the program.

- Tier 1 of the “ASHRAE Standard 140-2011, Class II, Tier 1 building loads tests” and Florida HERS BESTEST as described below.
- The Florida Energy Code Reference Home AutoGen Tests shall be used to verify the ability of the software tool to automatically generate the Florida Building Code’s Standard Reference Design Home. The test document is in Appendix R-5 of this Manual.
- HVAC tests – These tests verify the accuracy and consistency with which software tools predict the performance of HVAC equipment, including furnaces, air conditioners and air source heat pumps.
- Duct distribution system efficiency tests – These tests verify the accuracy with which software tools calculate air distribution system losses. ASHRAE Standard 152 results are used as the basis of acceptance criteria for this test suite.
- Hot water system performance tests – these tests determine the ability of the software to accurately predict hot water system energy use.
- The Florida e-Ratio Method tests are intended to determine the ability of software compliance tools to accurately calculate the Florida Energy Code compliance e-Ratio given a set of *Standard Reference Design End Use Loads (REUL)*, *Standard Reference Design End Use Energy Consumptions (EC\_r)*, *Proposed Home End Use Energy Consumptions (EC\_x)*, and the applicable manufacturer’s equipment performance ratings (MEPR). The e-Ratio calculation procedure is given in *Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) Appendix RC*.

The Tier 1 HERS BESTEST and Florida HERS BESTEST software verification test cases are found in the following documents:

- “Procedures for Verification of RESNET Accredited HERS Software Tools RESNET Publication No. 002-15” [includes ASHRAE Standard 140-2011, Class II, Tier 1 building loads tests] RESNET, July 2015.

[http://www.resnet.us/programs/Revised\\_RESNET\\_Pub\\_002-15.pdf](http://www.resnet.us/programs/Revised_RESNET_Pub_002-15.pdf).

- NREL/TP-472-7332a “Home Energy Rating System Building Energy Simulation Test (HERS BESTEST),” Volume 1 Tier 1 and Tier 2 Tests User’s Manual, November 1995, Judkoff, Ron and Joel Neymark. <http://www.nrel.gov/docs/legosti/fy96/7332a.pdf>.
- NREL/TP-550-23124a “Home Energy Rating System Building Energy Simulation Test for Florida (Florida-HERS BESTEST),” Volume 1 Tier 1 and Tier 2 Tests User’s Manual, August 1997, Judkoff, Ron and Joel Neymark. <http://www.nrel.gov/docs/legosti/fy97/23124a.pdf>.

### 6.6.7 Performance Method Testing Procedures

Using the test cases identified in the reference documents in Section 6.6.6.2 above; simulate the cases as outlined in the reference documents. Record the results using the MS Excel spreadsheets listed in Table 6.6-4 and provided by the Commission.

A Software Vendor shall submit test results for Las Vegas, NV and Colorado Springs, CO (ASHRAE Standard 140) and for Orlando, FL (Florida - HERS BESTEST). The source and data of the reference test results used for comparison must be submitted with the application. Acceptance criteria for the Florida Energy Code Reference Home AutoGen Tests are provided Table R5.3.1 in [Appendix R-5](#).

Results Forms in MS Excel Spreadsheet format are available on the Florida Building Commission’s website, [www.floridabuilding.org](http://www.floridabuilding.org) for the verification tests specified in Section 6.6.6.2 above. Table 6.6-4 summarizes results spreadsheet forms and test types.

Table 6.6-4 Performance method software evaluation results

Results Forms	Test Type
ASHRAE-Std-140_results-form.xlsx	ASHARE Std 140-2011 Class II, Tier 1 Building Loads Tests, RESNET 2014
FL-HERS_BESTEST_results-form.xlsx	Florida HERS BESTEST, Judkoff, R. and J. Neymark 1997
Florida_AutoGen_results-form.xlsx	2017 Florida Energy Code Reference Home AutoGen Tests, See Appendix R-5
HVAC_results-form.xlsx	HVAC Tests, Section 4.3, RESNET 2014
DSE_results-form.xlsx	Duct Distribution System Efficiency (DSE), Section 4.4, RESNET 2014
DHW_results-form.xlsx	Hot Water System Performance Tests, Section 4.5 RESNET 2014
FL_eRatio_results.xlsx	Florida e-Ratio Test, See Appendix R-5

A software tool is considered as successfully passing when its results fall inside the maximum and minimum ranges provided by these results forms.

## 6.7 Energy Rating Index Alternative Method

The Energy Rating Index alternative simulation compliance method shall use the procedures in ANSI/RESNET/ICC 301-2014 “Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index” published on January 15, 2016.

### 6.7.1 Minimum Capabilities

Compliance software program shall be capable of calculating the *ERI* of the *rated design* as described in Section R406.3 and shall meet the following minimum capabilities listed in Section R406.7.1 of the Florida Energy Code.

- The ERI shall consider all energy used in the residential dwelling unit;
- Computer generation of the *ERI reference design* using only the input for the rated design. The software shall not allow the user to directly modify the building component characteristics of the *ERI reference design*;
- Calculation of whole building heating and cooling equipment sizing in the ERI reference design residence in accordance with Section R403.7; and
- Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.

Printed reports to include a cover sheet; Energy Performance Level (EPL) display card; performance test reports for envelope leakage and air distribution system leakage as required; and, a *Building Code official* inspection checklist listing each of the *rated design* component characteristics determined by the analysis to provide compliance, along with their respective performance ratings (e.g., orientation, *R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

### 6.7.2 Energy Rating Index Alternative Method Compliance Report

Compliance software tool must generate a report that documents that the *ERI rated design* complies with Sections R406.3, R406.4 and R406.6. Software including compliance by the ERI method shall produce a report that mimics Florida Building Code, Energy Conservation Form R406-2017. The software shall produce the following cover sheet for submittal with each report (vendor may change page number count based on their output). See report samples in [Appendix R-6](#) of this Manual.

#### *RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST*

##### *Residential Energy Rating Index Method*

*Applications for compliance with the Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) via the Residential Energy Rating Index compliance alternative method shall include:*

- 1) *this checklist;*
- 2) *A Form R406-2017 report that documents that the Rated Design complies with Section R406 of the Florida Energy Code. This form shall include a summary page indicating home address, ERI value and the pass or fail status along with name and version of the compliance*

software tool, name and signature of the third party individual completing the compliance report. The FORM R406-2017 shall indicate whether the home thermal envelope efficiency level is greater than or equal to 2009 IECC Table 402.1.1 or 402.1.3, unless credit has been given for on-site renewable power production in which case it shall be greater than or equal to the efficiency of 2015 IECC Table R402.1.2 or R402.1.4. It shall also indicate if the home complies with 2015 IECC R403.5.3. An ERI submitted at the time of permit should indicate it is projected ERI and indicate any testing required.

- 3) *Input summary checklist report. Sample Form is in Appendix R-7 of this Manual (usually four pages/may be greater)*
- 4) *Energy Performance Level (EPL) Display Card (one page);*
- 5) *mandatory requirements (five pages/may be greater).*

Required prior to CO for the Energy Rating Index alternative method:

- 6) *a completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page);*
- 7) *a completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See Appendix R-11 in this Manual; and*
- 8) *a completed Form 2017 Duct Leakage Test Report. See Appendix R-12 in this Manual.*

### **6.7.3 Software Testing for Building Commission Approval of the Energy Rating Index Alternative Method**

A pdf file shall be prepared that includes the following:

- 1) Complete Software reports (Reports 1 – 7 listed above) for the *ERI* method; and
- 2) Compliance software vendors are required to provide instructions how to generate the additional reporting requirements per Section R406.6.3 of the 2017 Florida Energy Code.

### **6.7.4 Residential Energy Rating Index Method Testing**

This section specifies required tests that software designated as doing residential Energy Rating Index method compliance software shall conduct and submit. Compliance software programs shall account for the energy performance effects of all of the characteristics described in Section R406 of the Code.

The modeling procedures and assumptions described in this chapter apply to both the *reference home* and *rated home*. These procedures and assumptions shall apply to any home whether it is new or remodeled and whether the features of the home are preexisting or new.

#### **6.7.4.1 Residential ERI Method Accuracy Test Overview**

The Florida Building Energy– Efficiency Ratings Act of 1993 requires that Florida’s rating system “be compatible with standard federal rating systems...where applicable...” The relevant proposed federal guidelines (DOE 10 CFR Part 437) will require that energy analysis tools used for energy rating are tested according to the HERS BESTEST procedure.

The type of software testing used in this Manual is based on inter-model comparisons and is one

portion of an overall validation methodology that was first developed by National Renewable Energy Laboratory (NREL) in 1983 (Judkoff et al., 1983/2008). The method has been further refined since then by NREL and others (Judkoff and Neymark 2006).

Comparative testing, as applied in the HERS Building Energy Simulation Test (HERS BESTEST) (Judkoff and Neymark 1995), includes a set of public domain reference programs that have already been subjected to extensive analytical, empirical, and inter-model testing.

#### 6.7.4.2 ERI Method Reference Test Cases

The software verification test suite found in Section 3.2 of the RESNET document “Procedures for Verification of International Energy Conservation Code Performance Path Calculation Tools” dated August 2017 shall be utilized to verify the accuracy of the program. The ERI method test suite and acceptance criteria are documented in Appendix R-6 of this Manual. The first set of tests include:

- Tier 1 of the “ASHRAE Standard 140-2011, Class II, Tier 1 building loads tests” as described in ANSI/ASHRAE Standard 140-2011 (RESNET, 2017).
- HERS Reference Home Auto-Generation Tests shall be used to verify the ability of the software tool to automatically generate the Reference Home for HERS ratings tools.
- HVAC tests – These tests verify the accuracy and consistency with which software tools predict the performance of HVAC equipment, including furnaces, air conditioners and air source heat pumps.
- Duct distribution system efficiency tests – These tests verify the accuracy with which software tools calculate air distribution system losses. ASHRAE Standard 152 results are used as the basis of acceptance criteria for this test suite.
- Hot water system performance tests – these tests determine the ability of the software to accurately predict hot water system energy use.
- The HERS Method tests are intended to determine the ability of software compliance tools to accurately calculate the HERS Index given a set of *Reference Home End Use Loads* (REUL), *Reference Home End Use Energy Consumptions* (EC\_r), *Rated Home End Use Energy Consumptions* (EC\_x), and the applicable manufacturer’s equipment performance ratings (MEPR). And all hot water values shall be calculated according to the procedures in ANSI/RESNET 300-2014 Addendum A-2015.

The Tier 1 HERS BESTEST and Florida HERS BESTEST software verification test cases are found in the following documents:

- “Procedures for Verification of RESNET Accredited HERS Software Tools. RESNET Publication No. 002-17” [includes ASHRAE Standard 140-2011, Class II, Tier 1 building loads tests] RESNET, August 2017. [http://www.resnet.us/programs/FDS-01Pub002-2017\\_final.pdf](http://www.resnet.us/programs/FDS-01Pub002-2017_final.pdf).
- NREL/TP-472-7332a “Home Energy Rating System Building Energy Simulation Test (HERS BESTEST),” Volume 1 Tier 1 and Tier 2 Tests User’s Manual, November 1995, Judkoff, Ron and Joel Neymark. <http://www.nrel.gov/docs/legosti/fy96/7332a.pdf>.
- NREL/TP-550-23124a “Home Energy Rating System Building Energy Simulation Test for

Florida (Florida-HERS BESTEST),” Volume 1 Tier 1 and Tier 2 Tests User’s Manual, August 1997, Judkoff, Ron and Joel Neymark.  
<http://www.nrel.gov/docs/legosti/fy97/23124a.pdf>.

The second set of tests described in Section R6.2 in Appendix R-6 in this Manual are defined to evaluate the software’s capability to verify the Florida Energy Code the ERI-value, thermal envelope efficiency and mandatory requirements.

### 6.7.5 Residential Energy Rating Index Method Testing Procedures

Using the test cases identified in the reference documents in Section 6.7.4.2 above; simulate the cases as outlined in the reference documents. Descriptions of the first set of tests and acceptance criterion are provided in Section R6.1 in Appendix R-6 of this Manual. A Software vendor also shall conduct the second set of ERI method tests described in Section R6.2 for Orlando, Florida, record their results in the spreadsheets provided per the instruction in Section R6.3 in [Appendix R-6](#), and submit the results to the Florida Building Commission for approval. The input files and the test results used for comparison must be submitted with the application. Results Forms in MS Excel Spreadsheet format are available on the Florida Building Commission’s website, [www.floridabuilding.org](http://www.floridabuilding.org) for the verification tests specified in Section 6.7.4.2 above. Table 6.7-1 summarizes results spreadsheet forms and test types.

Table 6.7-1 Energy Rating Index method software evaluation results

Results Forms	Test Type
ASHRAE-Std-140_Results-Form.xlsx	ANSI/ASHARE Std 140-2011 Class II, Tier 1 Tests, Section 4.1, RESNET 2017
2017-HERS_AutoGen_Results-Form.xlsx	2017 HERS Reference Home Auto-generation Tests, Section 4.2, See Appendix R-6
2014_HERS-Method_Results-Form.xlsx	2017 HERS Method Tests, Section 4.3, RESNET 2017
HVACresult_form.xlsx	HVAC Tests, Section 4.4, RESNET 2017
DSEresults_form.xlsx	Duct Distribution System Efficiency (DSE), Section 4.5, RESNET 2017
2017_DHW-Results_form.xlsx	Hot Water System Performance Tests, Section 4.6 RESNET 2017
2017-Florida_ERI-Test_Results-form.xlsx	ERI Method Test, 2017 Florida Energy Code
2017-FLCode_ERIFromEndUses_Results-form.xlsx	ERI Method Test, ERI Calculated from Load and Energy End Uses
FL-HERS_BESTEST_results-form.xlsx	Florida HERS BESTEST, Judkoff, R. and J. Neymark 1997

## 6.8 Submitting Software for Approval by the Building Commission

The software vendor shall include a cover sheet that indicates the software name and pertinent edition/version numbers. If the vendor offers many versions of the software and only some of those versions will calculate energy code compliance, then the submittal must indicate which names, versions, etc. will meet the requirements of their submittal.

The cover page shall also include what type of code compliance the software is designed to handle with a checkbox completed for those items the software covers and leaving the checkbox blank for those items not covered by the software. See [Appendix A](#) of this Manual for a template.

### **Commercial Energy Efficiency Code Compliance**

- FEC Prescriptive Method
- FEC Total Building Performance Method
- FEC Component Performance Alternative Method
- ASHRAE Prescriptive Method
- ASHRAE Energy Cost Budget Method
- ASHRAE Envelope Trade-off Option Method

### **Residential Energy Efficiency Code Compliance**

- Prescriptive R-value method
- Prescriptive U-factor Alternative method
- Prescriptive Total UA Alternative method
- Performance Method
- Energy Rating Index Alternative Method

## 7. Commercial Energy Compliance Software

### 7.1 Requirements Summary

The 2017 Florida Energy Code (FEC) allows six methods of compliance for commercial buildings namely,

1. FEC Prescriptive Method
2. FEC Total Building Performance Method
3. FEC Component Performance Alternative Method
4. ASHRAE Prescriptive Method
5. ASHRAE Envelope Trade-off Method
6. ASHRAE Energy Cost Budget Method

#### **Required Tests**

Compliance software may cover one or more of the commercial code compliance calculation methods listed above. As a result, vendors must comply with the appropriate test(s) designed to verify calculations for each of the methods. Following are the required tests based on the compliance methods supported.

1. FEC Prescriptive Method: Vendor must validate software against tests described in Section 7.3.2.
2. FEC Total Building Performance Method: Vendor must validate software against tests described in Section 7.3.1.
3. ASHRAE Prescriptive Method: Vendor must validate software against tests described in Section 7.3.2.
4. ASHRAE Envelope Trade-off Method: Vendor must validate software against tests described in Section 7.3.3.
5. ASHRAE Energy Cost Budget Method: Vendor must validate software against tests described in 7.3.1.
6. FEC Component Performance Alternative Method: Vendor must validate software against tests described in Section 7.3.4.

#### **Additional Requirements for Performance Methods**

In addition to the above, vendors supporting the FEC Total Building Performance Method and/or the ASHRAE Energy Cost Budget Method must run their software against ASHRAE Standard 140 suite of tests. Modeling guidelines and software requirements for these two performance methods are given in the FEC Section C407 and Section 11 of ASHRAE 90.1, respectively. Vendors must demonstrate that they conform to the requirements stipulated in those sections.

### 7.2 Commercial Code Verification Tests

Several prototype test cases have been developed to assist in the validation of Vendors' software. First, a description of the several test cases are given, followed by their applicability to the different compliance methodology.



### 7.2.1 Prototype Building Test Cases

These set of test suites were formulated to test and verify that the compliance software correctly applied the restrictions and rules per the Florida Energy Code or ASHRAE 90.1 options. The test suite prototype building geometry and some of the inputs assumptions were adopted from COMENT Manual 2010 - *Commercial Buildings Energy Modeling Guidelines and Procedures*. The other inputs of the proposed prototype buildings were formulated based on realistic assumptions, and every effort was made such that the most important aspects of the code compliance calculations were accommodated. Seven proposed prototype buildings listed in Table 7.2-1 labeled as A1, A3, A20, B1, C1, D7 and E1 were designed for commercial code Compliance Software evaluation purposes. The numeric suffixes in the building labels stand for the number of stories. Each test case should be tested for the two Florida climate zones 1 (Miami-Dade) and 2 (Orlando) weather data.

Table 7.2-1 Proposed prototype buildings for compliance software evaluation

Test Suite Buildings	Application	Number of Floors	Total Floor Size, ft <sup>2</sup>
A1	Office	1	22,500
A3	Office	3	67,500
A20	Office	20	450,000
B1	Retail, Supermarket	1	40,000
C1	Manufacturing, Warehouse	1	160,000
D7	Mixed use: Retail, office, and Multifamily	7	179,400
E1	Mixed use: Retail, and Warehouse	1	90,000

The seven prototype buildings inputs summary is provided in the accompanying spreadsheet workbook file named “*CommercialCodeComplianceTestSuite.xls*”. A snapshot of the prototype building inputs from this spreadsheet file is shown in Figure 7.2-1. In this workbook, there are four worksheets: “*Parametric Run*”, “*Prototype Data*”, “*Construction Data*”, and “*DetailsD7*”. The “*Parametric Runs*” worksheet summarizes the simulation runs and test case required for each prototype building, the “*Prototype Data*” worksheet summarizes the proposed building inputs data that includes building geometry, lighting and equipment electric power density, HVAC type, and efficiencies, the “*Construction Data*” worksheet summarizes the proposed prototype building construction material layer defined for each envelope assembly, and the “*DetailsD7*” worksheet summarizes additional information of the mixed use prototype building D7. *The prototype buildings are oriented towards true north with the front side facing south. In all the test suite buildings, multi-layer construction is represented by an equivalent single layer construction for simplicity.*

In addition to this summary, descriptions of the building geometry, HVAC system, service hot water system, lightings, electric power, and other inputs of the proposed prototype building test suite are provided next.

Feature	Units					
<b>Program</b>						
Prototype Name		A1	A3	A20		B1
Occupancy		Office	Office	Office		See Parametric Runs
<b>Form</b>						
Floor Area	ft <sup>2</sup>	22,500	67,500	450,000		40,000
Building Shape	Square		Square	Square	Square	Square
Number of Floors		1	3	20		1
Thermal Zoning		5/floor	5/floor	5/floor		5/floor
Perimeter Zone Depth (ft)		15	15	15		15
Plenum		No	Yes	Yes		Yes
Height Flr-Flr	ft	12	12	12		18
Height Ceiling	ft	8.5	8.5	8.5		14
Height Plenum	ft	3.5	3.5	3.5		4.0
<b>Roof</b>						
Construction	Ref	See Const. Data	See Const. Data	See Const. Data		See Const. Data
Area	ft <sup>2</sup>	22,500	22,500	22,500		40,000
<b>Walls</b>						
Construction	Ref	See Const. Data	See Const. Data	See Const. Data		See Const. Data
Front (south) Area	ft <sup>2</sup>	1,800	5,400	36,000		3,600
Right (east) Area	ft <sup>2</sup>	1,800	5,400	36,000		3,600
Back (north) Area	ft <sup>2</sup>	1,800	5,400	36,000		3,600
Left (west) Area	ft <sup>2</sup>	1,800	5,400	36,000		3,600
Total Area	ft <sup>2</sup>	7,200	21,600	144,000		14,400
<b>Foundation</b>						
Foundation Type		Slab-On-Grade	Slab-On-Grade	Slab-On-Grade		Slab-On-Grade
Construction		See Const. Data	See Const. Data	See Const. Data		See Const. Data
Area	ft <sup>2</sup>	22,500	22,500	22,500		40,000
Perimeter	ft	600	600	600		800
<b>Interior Partitions</b>						
Construction		See Const. Data	See Const. Data	See Const. Data		See Const. Data
Area		4,801	14,404	96,025		10,708

Figure 7.2-1 Proposed prototype buildings test suite input data

## Prototype Building A1

Prototype building A1 has a 22,500 ft<sup>2</sup> floor plan area, is single story, has an aspect ratio of 1.0, and has 550 ft<sup>2</sup> of fenestration area on each orientation for every floor. The building is divided into five thermal zones: four 15 ft deep perimeter zones and an interior zone. The prototype building A1 is designed for office use and is shown in Figure 7.2-2. It has a 12 ft total height; 8 ft 6 in ceiling height and 3 ft 6 in plenum height. The fenestration consists of 10 ft by 5 ft 6 in non-metal fixed frame windows spaced equally around the perimeter at 15 ft. There are 10 windows on each side of the building orientation. The window-to-wall ratio (WWR) is 30.6%. The building is built from wood framed exterior wall, gypsum board interior walls, unheated slab-on-grade floor, and flat built-in roof with insulation entirely above deck construction. The unheated slab-on-grade floor has an F-factor of 0.70 Btu/h-ft-°F. The fenestration is nonmetal fixed framing with reflective double glazing. The proposed prototype building has a uniformly distributed skylights installed over the interior (core) zone and has a total skylight area of 2,250 ft<sup>2</sup>, which is 10.0% of the building roof total area. The skylights glass assembly has a U-factor and SHGC of 1.0 and 0.25, respectively. The opaque surfaces construction materials and surface properties of prototype building A1 are summarized in Table 7.2-2 and Table 7.2-3. Thermal zones internal gain components: electric equipment plug load, lighting, and occupancy density for the prototype building A1 are summarized in Table 7.2-4. This building has continuous lighting dimming and daylighting sensing automatic controls capable of reducing the power of general lighting up to 25% of the maximum allowed.

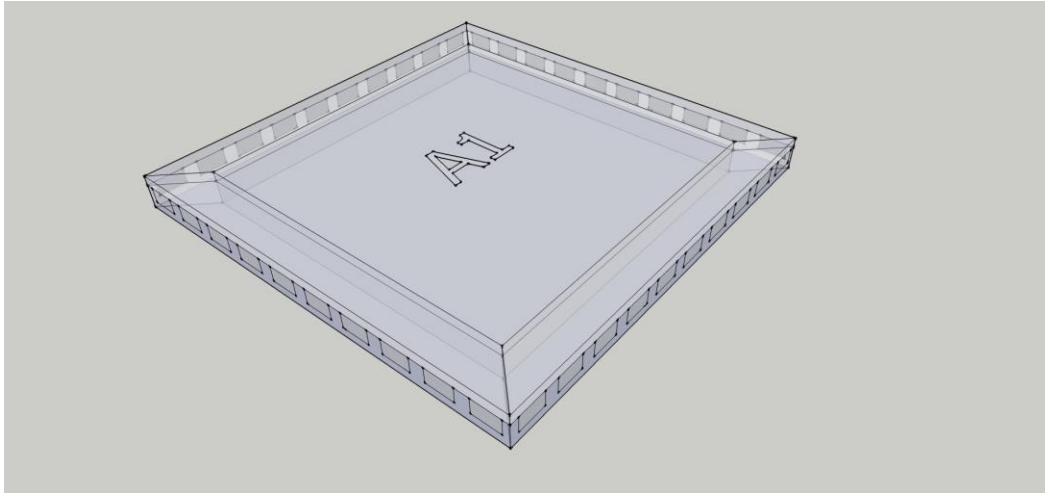


Figure 7.2-2 Prototype building A1

Table 7.2-2 Construction materials for prototype building A1

Composite Layer	Thickness	Conductivity	Density	Specific heat	Thermal Resistance
	Inch	Btu-In/(h-ft <sup>2</sup> ·°F)	lbm/ft <sup>3</sup>	Btu/(lbm·°F)	(h-ft <sup>2</sup> ·°F)/Btu
External Wall					
Built-in Wood Framed Wall	7.87	0.46	26.10	0.23	17.11
Ceiling					
Ceiling Gypsum	0.50	1.11	49.00	0.20	0.45
Roof					
Built-in Roof	6.77	0.37	22.50	0.22	18.30
Partition Wall					
Gypsum Board Wall with Air Gap	1.50	0.67	50.00	0.20	2.24
Floor					
Slab-on-Grade	4.00	9.09	140.00	0.20	0.44

Table 7.2-3 Thermal and optical properties of prototype building A1

	External Wall	Roof	Floor	Partition Wall	Ceiling
Thermal Mass, (Btu/ft <sup>2</sup> ·°F)	3.94	2.79	9.33	1.25	0.41
Solar Reflectance, (-)	0.65	0.60	-	-	-
Solar Absorptance, (-)	0.35	0.40	-	-	-
Emittance, (-)	0.90	0.90	-	-	-

Table 7.2-4 Internal gain components of prototype building A1

Internal Heat Gain Components	Prototype Building A1
Interior Lighting Density, (W/ft <sup>2</sup> )	0.75
Equipment Plug Load, (W/ft <sup>2</sup> )	1.00
Occupancy, People/1000 ft <sup>2</sup>	5.00

Exterior lighting for lighting zone 3 on the building front side only: Exterior lighting base site allowance of 750 W and 0.64 W/linear ft. allowance for walk ways around the front side of the building yields 846 W total exterior lighting power. The exterior lighting is on only when there is no sunlight and is controlled with a timer switch or photo-sensor.

### **Prototype Building A1: Proposed HVAC System**

Each thermal zone is served by a single zone packaged air conditioner with warm air electric furnace. Each packaged single zone AC has a cooling rated SEER value of 19.0 Btu/W-h if the cooling capacity is less than 65 kBtu/h or else has a cooling rated EER value of 12.8 Btu/W-h if the cooling capacity is greater or equal to 65 kBtu/h. The electric warm air furnace thermal efficiency is assumed to be 100%. Each zone is served with a constant speed fan of 60% fan efficiency and 90% electric motor efficiency. Service hot water is provided with storage electric water heater. There are two hot water storage units with rated tank volume of 80 gallons each. The measured volume in the tank is 75 gallons each. The electric water heater has energy factor (EF) of 0.95. Add air economizer depending on climate zone and cooling capacity of the individual fan coil units. The minimum ventilation air requirement per unit floor area for prototype office building A1 is 0.10 cfm/ft<sup>2</sup>. Air infiltration through envelope (walls, fenestration and skylight) normalized per unit gross area of the exterior walls for prototype building A1 is estimated to be 0.0177 cfm/ft<sup>2</sup> at a pressure difference of 0.016 inch w.g.

### **Prototype Building A3**

Prototype building A3 has a 22,500 ft<sup>2</sup> floor plan area, is three story, has an aspect ratio of 1.0, and has 550ft<sup>2</sup> of fenestration area per floor on each orientation. Each floor has five thermal zones; four 15 ft deep perimeter zones and an internal zone. In total, there are 15 thermal zones. The prototype building A3 is designed for office use and is shown in Figure 7.2-3. It has a 12 ft floor-to-floor height and a plenum with a height of 3 ft 6 in. Ceiling height is 8 ft 6 in. The fenestration consists of 10 ft by 5 ft 6 in windows spaced equally around the perimeter at 15 ft. There are 10 windows per floor on each side building orientation. The window-to-wall ratio (WWR) is 30.6%. The fenestration has fixed metal frames and reflective double glazing. The building has no skylights. The building is constructed from a steel-framed exterior wall, gypsum board interior walls, unheated slab-on-grade floor, and flat built-in roof with insulation entirely above deck construction. The unheated slab-on-grade floor has an F-factor of 0.70 Btu/h-ft-°F. The opaque surfaces construction materials and surface properties of the prototype building A3 are given in Table 7.2-5 and Table 7.2-6. Internal gain components: electric equipment plug load, lighting, and occupancy density for the prototype building A3 are summarized in Table 7.2-7.

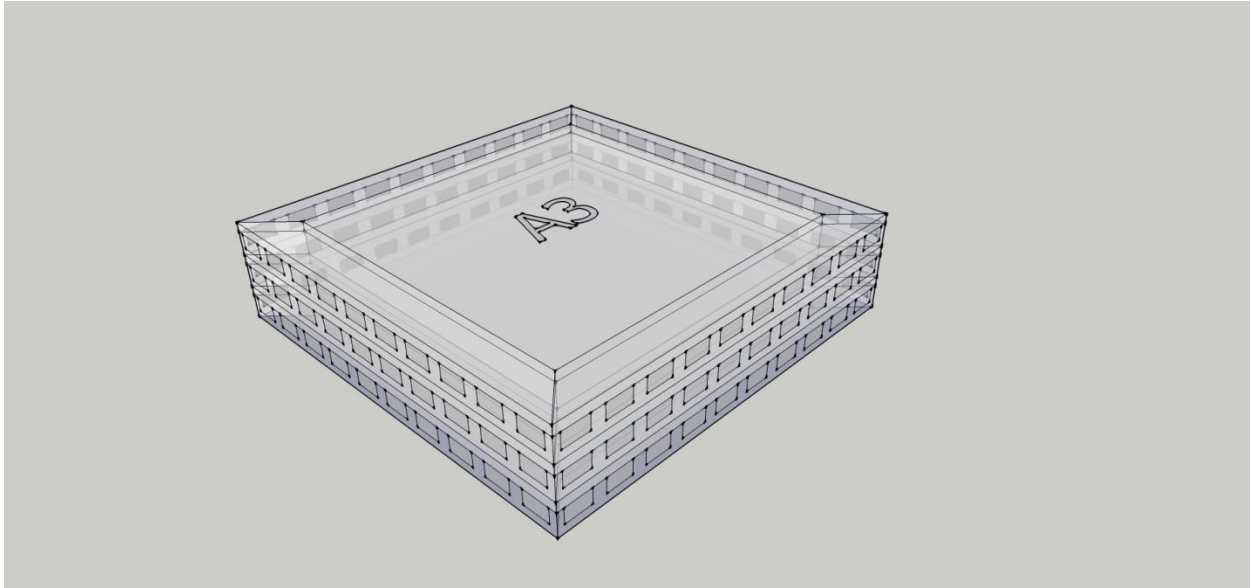


Figure 7.2-3 Prototype building A3

Table 7.2-5 Construction materials of prototype building A3

Composite Layer	Thickness	Conductivity	Density	Specific heat	Thermal Resistance
	Inch	Btu-In/(h-ft <sup>2</sup> ·°F)	lbm/ft <sup>3</sup>	Btu/(lbm·°F)	(h-ft <sup>2</sup> ·°F)/Btu
External Wall					
Composite steel-framed Wall	8.27	0.54	20.50	0.22	15.31
Ceiling					
Gypsum	0.50	1.11	49.00	0.20	0.45
Roof					
Composite Roof	6.46	0.35	23.90	0.21	18.46
Internal Floor					
Int-Floor	8.27	0.62	74.90	0.19	13.34
Partition Wall					
Gypsum Board Wall with Air Gap	1.50	0.67	50.00	0.20	2.24
Floor					
Slab-on-grade	4.00	9.08	140.00	0.20	0.44

Table 7.2-6 Thermal and optical properties of prototype building A3

Properties	External Wall	Roof	Int-Floor	Floor
Thermal Mass, (Btu/ft <sup>2</sup> ·°F)	3.11	2.70	9.81	9.33
Solar Reflectance, (-)	0.65	0.60	-	-
Solar Absorptance, (-)	0.35	0.40	-	-
Emittance, (-)	0.90	0.90	-	-

Table 7.2-7 Internal gain components of prototype building A3

Internal Heat Gain Components	Prototype Building A3
Interior Lighting Density, (W/ft <sup>2</sup> )	0.75
Equipment Plug Load, (W/ft <sup>2</sup> )	1.00
Occupancy, People/1000 ft <sup>2</sup>	5.0
Elevators, Quantity = 2 , Motor Efficiency 88%, Peak Power Each (HP)	7.5

Exterior lighting for lighting zone 3 on the building front side only: Exterior lighting base site allowance of 750 W and 0.64 W/linear ft allowance for walk ways around the front side of the building yields 846 W total exterior lighting power. The exterior lighting is on only when there is no sunlight and is controlled with a timer switch or photo-sensor.

### Prototype Building A3: Proposed HVAC System

Each floor is served by a packaged VAV air conditioner with warm air gas furnace. Each zone is served with VAV terminal air distribution units with gas reheat coil. The system has a cooling rated EER value of 12.8 Btu/W-h. The gas furnace efficiency is 80%. Each VAV system is equipped with a variable speed supply air fan of 60% fan efficiency and 90% electric motor efficiency. Service hot water is provided with condensing gas water heater. There are two hot water storage units with rated tank volume of 80 gallons and 75 gallons measured volume in tank each for every floor. Add air economizer depending on climate zone and cooling capacity of the individual fan coil unit. The minimum ventilation air requirement per unit floor area for prototype office building A3 is 0.10 cfm/ft<sup>2</sup>. Air infiltration through envelope (walls, fenestration, and skylight) normalized per unit gross area of the exterior walls for prototype building A3 is estimated to be 0.0052 cfm/ft<sup>2</sup> at a pressure difference of 0.016 inch w.g.

### Prototype Building A20

Prototype building A20 has a 22,500 ft<sup>2</sup> floor plan area, is twenty story, has an aspect ratio of 1.0, and has 1,275 ft<sup>2</sup> of fenestration area on each orientation for every floor. Each floor has five thermal zones; four 15 ft deep perimeter zones and an internal zone. In total, there are 100 thermal zones. The prototype building A20 is designed for office use and is shown in Figure 7.2-4. It has a 12 floor-to-floor height and a plenum with a height of 3 ft 6 in. Ceiling height is 8 ft 6 in. The fenestration has floor-to-ceiling glass on all sides of the building. The window-wall ratio (WWR) is 70.8%. The fenestration is made from fixed metal frames and reflective double glazing. The building has no skylight. The building is constructed from a steel-framed exterior wall, gypsum board interior walls, unheated slab-on-grade floor, and flat built-in roof with insulation entirely above deck construction. The unheated slab-on-grade floor has an F-factor of 0.70 Btu/h-ft-°F. The opaque surfaces construction materials and surface properties of prototype building A20 are summarized in Table 7.2-8 and Table 7.2-9. Internal gain components: electric equipment plug load, lighting, and occupancy density for the prototype building A20 are provided in Table 7.2-10.

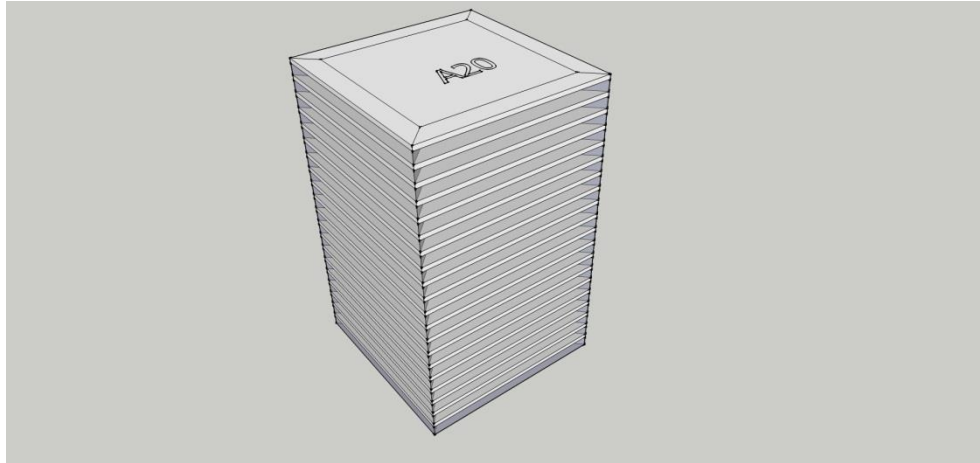


Figure 7.2-4 Prototype building A20

Table 7.2-8 Construction Materials of Prototype Building A20

Compisite Layer	Thickness	Conductivity	Density	Specific heat	Thermal Resistance
	Inch	Btu-In/(h·ft <sup>2</sup> ·°F)	lbm/ft <sup>3</sup>	Btu/(lbm·°F)	(h·ft <sup>2</sup> ·°F)/Btu
External Wall					
Composite steel-framed Wall	8.27	0.54	20.50	0.22	15.31
Ceiling					
Gypsum	0.50	1.11	49.00	0.20	0.45
Roof					
Composite Roof	6.46	0.35	23.90	0.21	18.46
Internal Floor					
Int-Floor	8.27	0.62	74.90	0.19	13.34
Partition Wall					
Gypsum Board Wall with Air Gap	1.50	0.67	50.00	0.20	2.24
Floor					
Slab-on-grade	4.00	9.08	140.00	0.20	0.44

Table 7.2-9 Thermal and optical properties of prototype building A20

Properties	External Wall	Roof	Int-Floor	Floor
Thermal Mass, (Btu/ft <sup>2</sup> ·°F)	3.11	2.70	9.81	9.33
Solar Reflectance, (-)	0.65	0.60	-	-
Solar Absorptance, (-)	0.35	0.40	-	-
Emittance, (-)	0.90	0.90	-	-

Table 7.2-10 Internal gain components of prototype building A20

Internal Heat Gain Components	Prototype Building A20
Interior Lighting Desnity, (W/ft <sup>2</sup> )	0.75
Equipment Plug Load, (W/ft <sup>2</sup> )	1.0
Occupancy, People/1000 ft <sup>2</sup>	5.0
Elevators, Quantity = 6, Motor Efficiency 92%, Peak Power Each (HP)	20.0

Exterior lighting for high activity commercial district (lighting zone 4) on the building front side only: Exterior lighting base site allowance of 1300 W and 0.8 W/linear ft allowance for walk ways around the front side of the building yields 1420 W total exterior lighting power. The exterior lighting is on only when there is no sunlight and is controlled with a timer switch or photo-sensor.

### **Prototype Building A20: Proposed HVAC System**

Each floor is served with a central chilled water VAV system with reheat, and with return plenum zones. Each zone is served with a terminal air distribution unit that has hot water reheat coil. The chiller has an AHRI rated cooling COP of 5.86 (=0.60 kW/ton). The chiller is water cooled and has an electrically operated centrifugal compressor; chiller cooling water loop is controlled using a central cooling tower. Hot water is provided using a central hot water oil-fired boiler with 90% thermal efficiency. Each VAV system is equipped with a variable speed supply air fan of 60% fan efficiency and 90% electric motor efficiency. Service hot water is provided by the central oil fired hot water boiler. Add air economizer depending on climate zone and cooling capacity of the individual fan coil unit. Minimum ventilation air requirement per unit floor area for prototype office building A20 is 0.10 cfm/ft<sup>2</sup>. Air infiltration through envelope (walls, fenestration and skylight) normalized per unit gross area of the exterior walls for prototype building A20 is estimated to be 0.0061 cfm/ft<sup>2</sup> at a pressure difference of 0.016 inch w.g.

### **Prototype Building B1**

Prototype building B1 has a 40,000 ft<sup>2</sup> floor plan area, is single story, has an aspect ratio of 1.0, and has 640 ft<sup>2</sup> of fenestration area on the front side only. The building is divided into five zones: four 15 ft deep perimeter zones and an internal zone. The prototype building B1 is designed for Retail or Supermarket application and is shown in Figure 7.2-5. It has an 18 ft height and a plenum with a height of 4 ft. Ceiling height is 14 ft. The window-wall ratio (WWR) of the front side (south) is 17.78%. The fenestration has fixed metal frames and uncoated double glazing. The front side of the building has a horizontal overhang located at the top of the glazing that extends a distance of 8 ft. This proposed prototype building has distributed skylights installed with a total skylights area of 2,000 ft<sup>2</sup>, which is 5.0% of the building roof total area. The skylights glass has a U-factor and SHGC of 1.0 and 0.25, respectively. The building is constructed from CMU blocks exterior wall, gypsum board interior walls, unheated slab-on-grade floor, and flat built-in roof with insulation entirely above deck constructions. The unheated slab-on-grade floor has an F-factor of 0.70 Btu/h-ft-°F. The opaque surfaces construction materials and surface properties of prototype building B1 are summarized in Table 7-11 and Table 7.2-12. Internal gain components: electric equipment plug load, lighting and occupancy density for the prototype building B1 are provided in Table 7.2-13. This prototype building has stepped multi-level lighting dimming and daylighting sensing automatic controls capable of reducing the power of general lighting up to 30% of the maximum allowed.



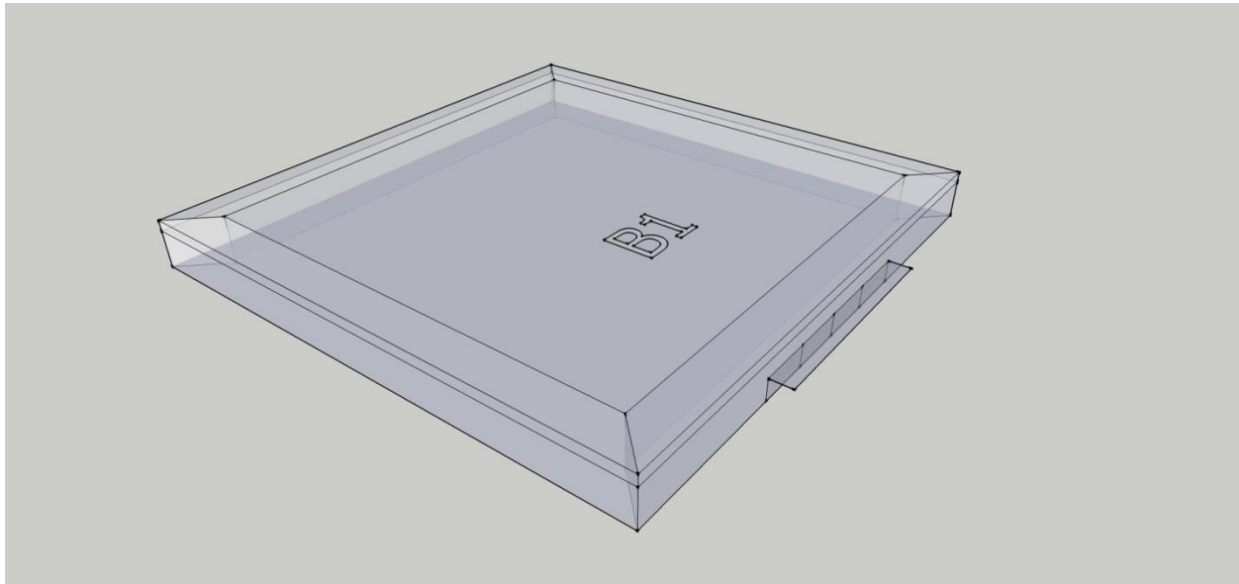


Figure 7.2-5 Prototype building B1

Table 7.2-11 Construction materials of prototype building B1

Layers (outer to inner)	Thickness	Conductivity	Density	Specific heat	Thermal Resistance
	Inch	Btu-In/(h·ft <sup>2</sup> ·°F)	lbm/ft <sup>3</sup>	Btu/(lbm·°F)	(h·ft <sup>2</sup> ·°F)/Btu
External Wall					
CMU Mass Wall	10.00	5.06	129.0	0.20	1.98
Ceiling					
Gypsum Board	0.50	1.11	49.0	0.20	0.45
Roof					
Composite Roof	6.90	0.32	23.4	0.21	21.56
Partition Wall					
Gypsum Board	1.00	1.11	50.0	0.20	0.90
Floor					
Slab-on-grade	4.30	2.61	127.9	0.18	1.65

Table 7.2-12 Thermal and optical properties of prototype building B1

Properties	External Wall	Roof	Slab-on-Grade Floor
Thermal Mass, (Btu/ft <sup>2</sup> ·°F)	21.50	2.83	8.25
Solar Reflectance, (-)	0.65	0.60	-
Solar Absorptance, (-)	0.35	0.40	-
Emittance, (-)	0.90	0.90	-

Table 7.2-13 Internal gain components of prototype building B1

Internal Heat Gain Components	Retail	Supermarket
Interior Lighting Density, (W/ft <sup>2</sup> )	1.90	1.90
Equipment Plug Load, (W/ft <sup>2</sup> )	0.90	1.14
Occupancy, People/1000 ft <sup>2</sup>	13.10	7.24
Refrigerators Power Density, (W/ft <sup>2</sup> )	-	0.14

Exterior lighting for light industrial or neighborhood business area (lighting zone 2) on the building front side only: Exterior lighting base site allowance of 600 W and 0.56 W/linear ft allowance for walk ways around the front side of the building yields 712 W total exterior lighting power. The exterior lighting is on only when there is no sunlight and is controlled with a timer switch or photo-sensor.

### **Prototype Building B1: Proposed HVAC System**

Each zone is served with a packed air-source heat pump and electric supplemental heater. Each packaged heat pump or packaged air conditioner unit has a rated SEER value of 17.0 Btu/W-h if the cooling capacity is less than 65.0 kBtu/h, or else has a cooling rated EER value of 12.6 Btu/W-h if the cooling capacity is greater or equal to 65.0 kBtu/h. The heat pump has a rated HSPF value of 8.4 Btu/W-h if the cooling capacity of the heat pump is less than 65.0 kBtu/h, or else has heating rated COP of 3.5 at 47°F dry-bulb and 43°F wet-bulb outdoor air temperature. Each packaged heat pump is equipped with a variable speed supply air fan of 60% fan efficiency and 90% electric motor efficiency. Service hot water is provided with storage electric water heater. There are two hot water storage units with rated tank volume of 80 gallons and 75 gallons measured volume in tank each. Add air economizer depending on climate zone and cooling capacity of the individual fan coil unit. The minimum ventilation air requirement per unit floor area for supermarket and retail buildings is 0.27 cfm/ft<sup>2</sup>. Air infiltration through envelope (walls, fenestration, and skylight) normalized per unit gross area of the exterior walls for prototype B1 building is estimated to be 0.0092 cfm/ft<sup>2</sup> at a pressure difference of 0.016 inch w.g.

### **Prototype Building C1**

Prototype building C1 has a 160,000 ft<sup>2</sup> floor plan area, is single story, has an aspect ratio of 1.0, and has 1,280 ft<sup>2</sup> of fenestration area on the front side only. The building is divided into five zones: four 15 ft deep perimeter zones and an internal zone. The prototype building C1 is designed for Manufacturing or Warehouse application and is shown in Figure 7.2-6. It has a 24 ft height and has no plenum. The window-wall ratio (WWR) of front side (south) is 13.33%. The fenestration has fixed metal frames and uncoated double glazing. This proposed prototype building has uniformly distributed skylights installed and has a total skylight area of 3,200 ft<sup>2</sup>, which is 2.0% of the building roof area. The skylights glass has a U-factor and SHGC of 1.0 and 0.25, respectively. The front side has a horizontal overhang located at the top of the glazing that extends a distance of 8 ft. The building is constructed from CMU blocks exterior wall, gypsum board interior walls, unheated slab-on-grade floor, and flat built-in roof with insulation entirely above deck construction. The unheated slab-on-grade floor has an F-factor of 0.70 Btu/h-ft-°F. The opaque surfaces construction materials and surface properties of prototype building C1 are summarized in Table 7-14 and Table 7.2-15. Internal gain components: electric equipment plug load, lighting and occupancy density for the prototype building C1 are provided in Table 7.2-16. This prototype building has stepped multi-level lighting dimming and daylighting sensing automatic controls capable of reducing the power of general lighting up to 30% of the maximum allowed. The ratio of visible transmittance to SHGC of the vertical fenestration shall be at least 1.15.

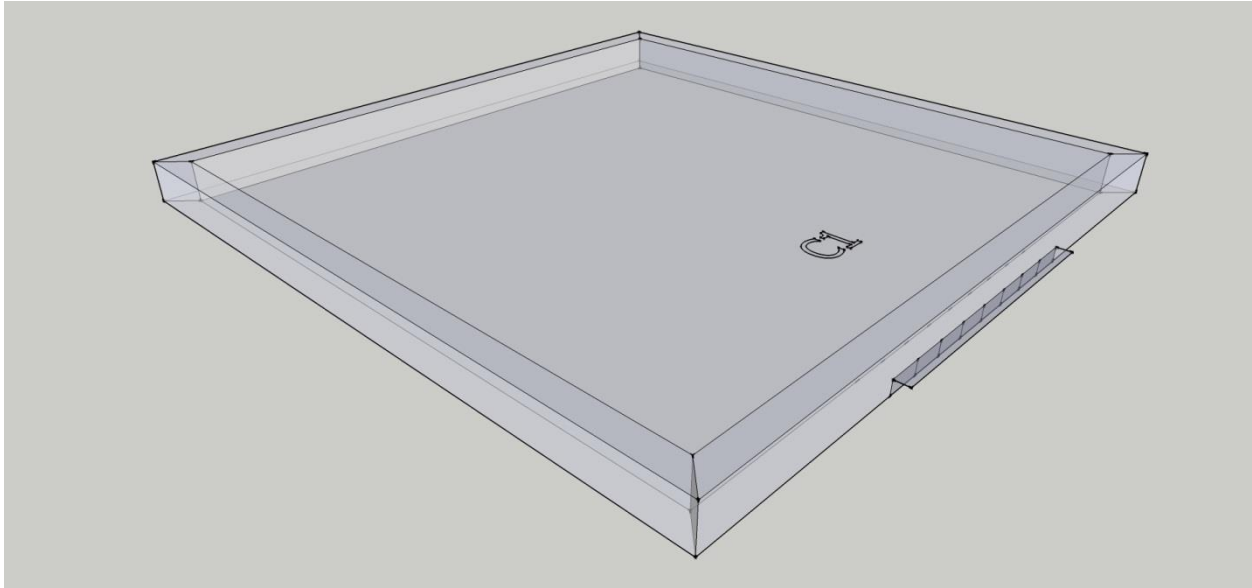


Figure 7.2-6 Prototype building C1

Table 7.2-14 Construction materials of prototype building C1

Layers (outer to inner)	Thickness	Conductivity	Density	Specific heat	Thermal Resistance
	Inch	Btu-In/(h·ft <sup>2</sup> ·°F)	lbm/ft <sup>3</sup>	Btu/(lbm·°F)	(h·ft <sup>2</sup> ·°F)/Btu
External Wall					
CMU Mass Wall	10.00	5.06	129.0	0.20	1.98
Ceiling					
Gypsum Board	0.50	1.11	49.0	0.20	0.45
Roof					
Composite Roof	6.90	0.32	23.4	0.21	21.56
Partition Wall					
Gypsum Board	1.00	1.11	50.0	0.20	0.90
Floor					
Slab-on-grade	4.30	2.61	127.9	0.18	1.65

Table 7.2-15 Thermal and optical properties of prototype building C1

Properties	External Wall	Roof	Slab-on-Grade Floor
Thermal Mass, (Btu/ft <sup>2</sup> ·°F)	21.50	2.83	8.25
Solar Reflectance, (-)	0.65	0.60	-
Solar Absorptance, (-)	0.35	0.40	-
Emittance, (-)	0.90	0.90	-

Table 7.2-16 Internal gain components of prototype building C1

Internal Heat Gain Components	Manufacturing	Warehouse
Interior Lighting Density, (W/ft <sup>2</sup> )	1.00	0.58
Equipment Plug Load, (W/ft <sup>2</sup> )	1.60	1.00
Occupancy, People/1000 ft <sup>2</sup>	1.33	0.10

Exterior lighting for light industrial or neighborhood business area (lighting zone 2) on the building front side only: Exterior lighting base site allowance of 600 W and 0.56 W/linear ft allowance for walk ways around the front side of the building yields 824 W total exterior lighting power. The exterior lighting is on only when there is no sunlight and is controlled with a timer switch or photo-sensor.

### **Prototype Building C1: Proposed HVAC System**

Each zone is served with a packaged air-conditioner and warm air gas furnace or packaged air-source heat pump with electric supplemental heater. Packaged air-conditioner is used for manufacturing building whereas packaged air-source heat pump is used for warehouse building. Each packaged air-conditioner and heat pump unit has a cooling rated SEER value of 15.0 Btu/W-h if the cooling capacity is less than 65.0 kBtu/h or else has a cooling rated EER of 12.2 Btu/W-h if the cooling capacity is greater or equal to 65.0 kBtu/h. The warm air gas furnace has a thermal efficiency of 90%. The heat pump has a rated HSPF of 8.2 Btu/W-h if the cooling capacity of the heat pump is less than 65.0 kBtu/h or else has a heating rated COP of 3.4 at 47°F dry-bulb and 43°F wet-bulb outdoor air temperature if the cooling capacity of the heat pump is greater or equal to 65.0 kBtu/h. Each packaged air-conditioner and heat pump unit has a variable speed supply air fan of 60% fan efficiency and 90% electric motor efficiency. Service hot water is provided with a condensing gas water heater. There are three 80-gallon hot water storage units. Add an air economizer depending on climate zone and cooling capacity of the individual fan coil unit. The minimum ventilation air requirement per unit floor area for Manufacturing and Warehouse buildings is 0.12 cfm/ft<sup>2</sup> and 0.05 cfm/ft<sup>2</sup>, respectively. Air infiltration through envelope (walls, fenestration, and skylight) normalized per unit gross area of the exterior walls for prototype building C1 is estimated to be 0.0073 cfm/ft<sup>2</sup> at a pressure difference of 0.016 inch w.g.

### **Prototype Building D7**

The prototype D7 building is a mixed use seven above ground stories with retail on the first level, office space on levels two and three, and four stories of multi-family housing over the office. Prototype D7 is created by modifying the case study building used in the User's Manual for ASHRAE Standard 90.1-2004. The building's footprint is 150 ft x 90 ft with the long axis oriented due east-west. The prototype building D7 is shown in Figure 7.2-7. The first floor contains retail spaces with large display windows that have horizontal overhangs projecting 10 ft on the south, east, and west exposures. The second and third floors contain offices that have similarly oriented overhangs, although the overhangs project only 5 ft. Floors four through seven are multi-family apartments. To provide more daylight and fresh air, the four floors of apartments have two 20 ft x 30 ft notches taken out of the floor plan; therefore, these levels have 1,200 ft<sup>2</sup> less floor area than floors one, two, and three. The building also has an unconditioned stairwell. The building construction is steel-framed exterior wall, gypsum board interior walls, unheated slab-on-grade floor and flat built-in roof with insulation entirely above deck construction. The unheated slab-on-grade floor has F-factor of 0.70 Btu/h-ft-°F. The opaque surfaces construction materials and surface properties of prototype building D7 are summarized in Table 7-17 and Table 7.2-18. The fenestrations have double glazing and thermally broken metal frames. Only the fenestrations on the residential levels are operable. The Prototype proposed building D7 window-to-wall ratio and fenestration U-value and SHGC are given in Table 7.2-19. The lighting power and equipment electric power densities used in the different sections of the prototype building D7 are summarized in Table 7.2-20. The perimeter zones of the office have automatic daylight dimming controls.

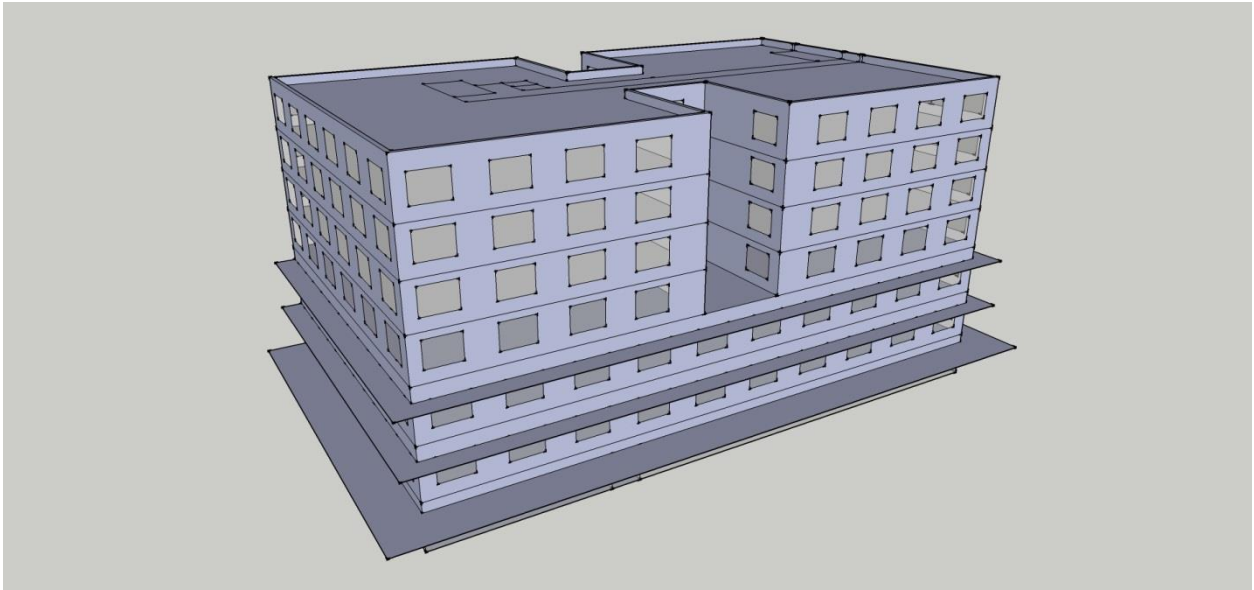


Figure 7.2-7 Prototype building D7

Table 7.2-17 Construction materials of prototype building D7

Compisite Layer	Thickness	Conductivity	Density	Specific heat	Thermal Resistance
	Inch	Btu-In/(h·ft <sup>2</sup> ·°F)	lbm/ft <sup>3</sup>	Btu/(lbm·°F)	(h·ft <sup>2</sup> ·°F)/Btu
External Wall					
Composite steel-framed Wall	11.54	0.67	40.8	0.23	17.33
Ceiling					
Gypsum	0.50	1.11	49.0	0.20	0.45
Roof					
Composite Roof	6.46	0.35	23.9	0.21	18.62
Internal Floor					
Int-Floor	8.35	0.62	74.9	0.19	13.37
Partition Wall					
Gypsum Board	1.00	1.11	50.0	0.20	0.90
Floor					
Slab-on-grade	4.00	9.08	140.0	0.20	0.44

Table 7.2-18 Thermal and optical properties of prototype building D7

Properties	Exterior Wall	Roof	Int-Floor	Floor
Thermal Mass, (Btu/ft <sup>2</sup> ·°F)	9.02	2.70	9.90	9.33
Solar Reflectance, (-)	0.65	0.60	-	-
Solar Absorptance, (-)	0.35	0.40	-	-
Emittance, (-)	0.90	0.90	-	-

Table 7.2-19 Surface areas and fenestration properties of prototype building D7

Space Category	Orientation	Wall Area, ft <sup>2</sup>	Window Area, ft <sup>2</sup>	Window-Wall-Ratio, %	Climate Zone 1 U-Value/SHGC	Climate Zone 2 U-Value/SHGC
Residential	North	6,600	1,728		1.00/0.25	0.60/0.25
	Non-North	30,360	4,800		1.00/0.25	0.60/0.25
Residential Total		36,960	6,528	17.66		
Nonresidential						
Retail	North	1,700	560		0.90/0.56	0.60/0.56
Office	North	3,700	960		0.90/0.25	0.60/0.25
Retail	Non-North	3,972	2,574		0.90/0.56	0.60/0.56
Office	Non-North	8,140	2,112		0.90/0.40	0.60/0.40
Nonresidential Total		17,512	6,206	35.44		

Exterior Lighting for high activity commercial district (lighting zone 4) on the building front side only; exterior lighting base site allowance of 1300 W and 0.8 W/linear ft allowance for walk ways around the front side of the building yields 1420 W total exterior lighting power. The exterior lighting is on only when the sun is off controlled with time switch or photo-sensor. There are two elevators serving the offices and apartment units. The peak electric power draw of each elevator motor is 15 HP and electric motor efficiency of 90%.

Table 7.2-20 Lighting and equipment electric power of prototype building D7

Area Description	Area, ft <sup>2</sup>	Lighting Power		Equipment Power	
		Watts	W/ft <sup>2</sup>	Watts	W/ft <sup>2</sup>
Retail	11,300	15,594	1.38	16,950	1.50
Office	27,000	31,320	1.16	27,000	1.00
Apartment Units	43,600	71,940	1.65	71,940	1.65
Multi-family Hallway	5,600	4,480	0.80	3,920	0.70
Totals	87,500	123,334	1.41	119,810	1.37

**Prototype Building D7: Proposed HVAC System**

A variable air volume (VAV) air-handling system served by a centrifugal chiller and a boiler provides space conditioning in the office levels. The retail spaces and apartments are served by a four-pipe fan coil system so that they can be independently shut down if the stores’ and apartments’ operating hours differ significantly from the offices. The chiller has a water cooled condenser and has an electrically operated constant speed reciprocating compressor with an AHRI rated cooling COP of 5.68 (0.62 kW/ton). These items, along with a central gas boiler, serve all of the cooling loads and heating loads in the building. Service hot water is provided with a central gas-fired hot water boiler of 86% efficiency. Add air economizer depending on climate zone and cooling capacity of the individual fan coil unit for the retail and office floors. Table 7.2-21 summarizes the occupant density and minimum outdoor air requirement per unit floor area for ventilation for prototype building D7. Air infiltration through envelope (walls, fenestration, and skylight) normalized per unit gross area of the exterior walls for prototype building D7 is estimated to be 0.0057 cfm/ft<sup>2</sup> for retail, 0.0051 cfm/ft<sup>2</sup> for office, and 0.0049 cfm/ft<sup>2</sup> for multifamily blocks at a pressure difference of 0.016 inch w.g.

Table 7.2-21 Occupancy and minimum ventilation air requirement of prototype building D7

Area Description	Area, ft <sup>2</sup>	Occupancy		Ventilation Air Requirement	
		Persons	Person / 1000 ft <sup>2</sup>	cfm	cfm/ft <sup>2</sup>
Retail	11,300	148.0	13.10	3,051	0.27
Office	27,000	135.0	5.00	2,700	0.10
Apartment Units	43,600	115.0	2.64	2,180	0.05
Multi-family Hallway	5,600	-	-	280	0.05
Totals	87,500	398.0	4.55	8,211.0	0.09

**Prototype Building E1**

A single story, 90,000 ft<sup>2</sup> floor area mass building was designed to serve 25% retail showroom and 75% warehouse. This test building was created by modifying an example building described in ASHRAE Standard 90.1-2007 User’s Manual (ASHRAE, 2007) and is shown in Figure 7.2-8. Changes were made to the fenestration products, skylights, and construction to make the building applicable to the Florida climate zones. The building is 200 ft by 450 ft with the long axis running east-west. The showroom is on the west end of the building. The exterior wall height is 20 ft at the showroom area and 30 ft at the warehouse. The walls of the warehouse and the showroom are constructed of solid concrete (tilt-up). Vertical fenestration is located only in the showroom. The

west facade has six windows, each measuring 20 ft wide by 10 ft high for a total of 1,200 ft<sup>2</sup> of fenestration. Both the south and north sides of the showroom have two windows also 10ft by 20 ft. The fenestration has an NFRC rated U-factor of 0.89, an SHGC of 0.51 and a light transmission of 0.60.

There are five loading doors on the south side of the building. Each is 20 ft wide by 10 ft high and is insulated with a tested *U-factor* for the entire door (not just the insulated section) of 0.178. The building's exterior walls are 8 inch-thick solid concrete with 1.0 inch stucco on the exterior side. The walls of the building's showroom area are insulated with 3.5 inch deep R-13 on the inside and have U-factor of 0.154. The insulation is supported by metal clips installed at 24 inches on center. The concrete walls in the warehouse portion of the building are not insulated and have *U-Factor* of 0.556. The roofs of both the showroom area and the warehouse are insulated with R-15 rigid foam installed entirely above the structural deck for Climate Zone 1 test (Miami-Dade, FL) and R-20 rigid foam installed entirely above the structural deck for Climate Zone 2 test (Orlando, FL).

The floor is assumed to be slab-on grade with no-insulation and to be modeled using F-factor calculation method with a value of 0.70 Btu/(h-ft<sup>2</sup>·°F). The sales showroom has 256 ft<sup>2</sup> skylight made from glass with U-factor of 0.89, an SHGC of 0.51 and a light transmission of 0.60.

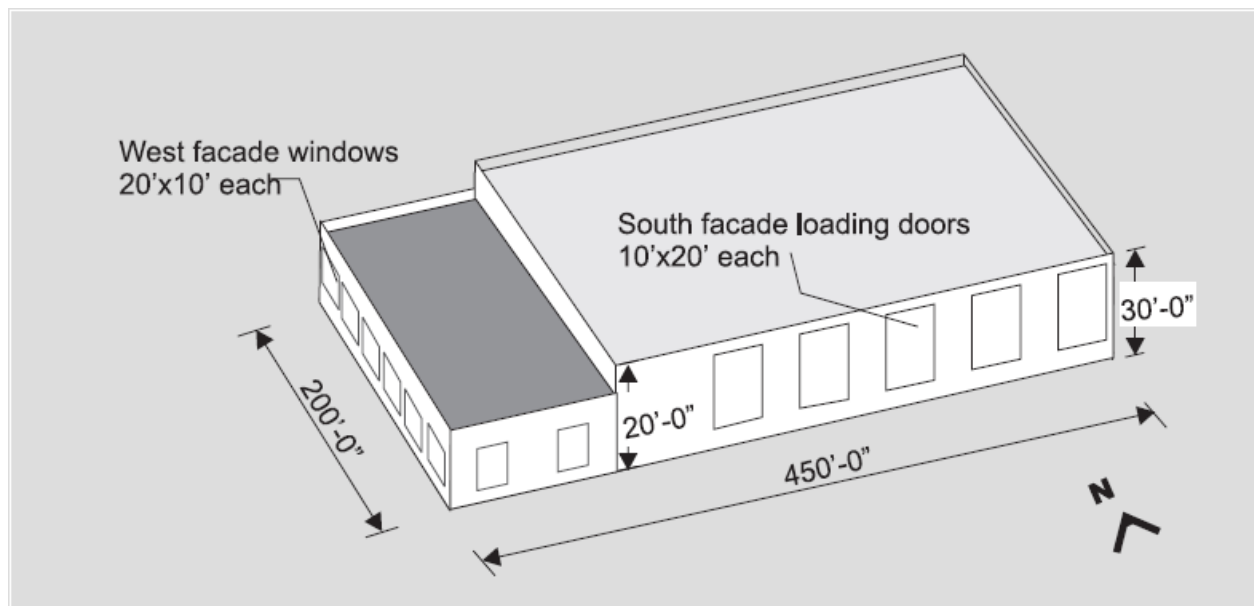


Figure 7.2-8 Prototype building E1 (Source: ASHRAE 90.1-2007 User's Manual)

The opaque surfaces construction materials and surface properties of prototype building E1 are summarized in Table 7.2-22 and Table 7.2-23, respectively. Schedules for occupants, lighting, plug loads, infiltration, cooling and heating setpoints, and peak value of internal gains for miscellaneous loads, ventilation rate, occupant density and occupant heat gain rate shall be taken from sources cited in Section C3.5.4 of ASHRAE 90.1 (ASHRAE Project Committee 90.1).



Table 7.2-22 Construction and materials of prototype building E1

Composite Material	Thickness	Conductivity	Density	Specific heat	Thermal Resistance
	Inch	Btu-In/(h-ft <sup>2</sup> ·°F)	lbm/ft <sup>3</sup>	Btu/(lbm·°F)	(h-ft <sup>2</sup> ·°F)/Btu
Exterior Wall (Warehouse)					
Mass Wall (uninsulated)	9.00	9.48	124.00	0.20	0.95
External Wall (Showroom)					
Mass Wall (insulated)	13.00	2.30	110.07	0.18	5.65
Roof (Climate Zone 1)					
Insulation Above Metal Deck	5.45	0.36	25.23	0.21	15.34
Roof (Climate Zone 2)					
Insulation Above Metal Deck	5.45	0.27	25.23	0.21	20.34
Internal Wall					
Gypsum Board Air Gap	1.50	0.68	49.94	0.26	2.20
Partition Wall					
G05 25mm Wood	1.00	1.04	37.96	0.39	0.96
Floor					
Slab-On-Grade Floor	6.00	13.52	139.84	0.20	0.44

Table 7.2-23 Thermal and optical properties of prototype building E1

Properties	Exterior Wall	Roof	Interior Wall	Floor
Thermal Mass, (Btu/ft <sup>2</sup> ·°F)	18.58	2.38	1.62	13.97
Solar Reflectance, (-)	0.35	0.50	-	-
Solar Absorptance, (-)	0.65	0.50	-	-
Emittance, (-)	0.90	0.90	-	-

### Prototype Building E1: Proposed HVAC System

A constant volume fan, a constant COP air conditioner, and constant efficiency gas furnace serve each of the proposed thermal zones per section C3.5.2 of the Normative Appendix C of ASHRAE 90.1. The DX cooling coils performance curves used for the ASHRAE Envelope Trade-Off compliance method test are provided in the worksheet tab named “HVACDetailsE1” in the workbook “*CommercialCodeComplianceTestSuite.xls*”.

#### *Prototype Buildings used for Performance Methods (FEC & ASHRAE)*

Prototype buildings A1, A3, A20, B1, C1, and D7 are used for validating the performance methods. Each of these buildings was tested for climate zones 1 and 2.

#### *Prototype Buildings used for Prescriptive Methods (FEC & ASHRAE)*

For the prescriptive commercial code compliance software evaluation two prototype buildings A1 and C1 were used. Each of these buildings was tested for climate zone 1 and 2, and prototype building C1 was tested for two different HVAC system types and two building application types. In total there are six test cases for the prescriptive method evaluation.

#### *Prototype Building for ASHRAE Envelope Trade-Off Option (ASHRAE)*

For the envelope trade-off option commercial code compliance software evaluation prototype building E1 only was used. This building was tested for climate zone 1 and 2.

***Prototype Buildings used for Component Performance Alternative Method (FEC)***

For the component performance alternative commercial code compliance software evaluation one prototype buildings A1 was used. This building was tested for climate zone 1 and 2.

## 7.3 Software Evaluation Procedure

The code compliance calculation procedure depends on the compliance method selected; five Commercial code compliance methods are covered in this Manual. The prescriptive methods check whether the minimum requirements of the code are met or not. And it produces “Pass” or “Fail” results for every required building element. Whereas the total building performance and the energy cost budget methods, in addition to meeting the mandatory and some of the minimum requirements, require running simulations of the proposed design and the standard reference design buildings to determine and compare the annual total energy costs. The envelope trade off method requires the envelope performance factor of the proposed building to be less than or equal to the standard reference building performance factors. And geometry and envelope requirements such as U-factors, R-Value, SHGC, thermal capacity, etc. The envelope performance factors are determined using simulation with instructions from Section 5.6 and Normative Appendix C of ASHRAE 90.1. The compliance software vendor applying for verification shall provide the results of the prototype building test suite runs demonstrating that their software generates the minimum requirements of the *Standard Reference Design* building and other requirements. The test suite inputs descriptions are provided in Sections 7.2.1. Commercial code compliance software evaluation step-by-step procedures are explained for the performance, prescriptive and envelope trade-off option methods next.

### 7.3.1 Performance Based Method Evaluation Procedure

The performance based method evaluation is designed to verify whether compliance software is capable of generating the *Standard Reference Design* building inputs using only the *Proposed Design* data. There are sixteen test cases for the performance methods based on six prototype buildings described in Section 7.2.1. Each test case was designed to capture a possible practical design scenario. The spreadsheet workbook file named “**CommercialPerformanceMethodsResults.xls**” contains the *Standard Reference Design* building data for performance based test methods for each of the prototype building test cases created based on the minimum requirements of the Florida Energy Code and ASHRAE 90.1 option. There are two set of data for each test case and climate zone; one based on the Florida Code and another based on ASHRAE 90.1 option. The standard reference building data created for each prototype building type is populated in a single worksheet. The performance method results in this spreadsheet workbook were designed for side-by-side comparison of the *Standard Reference Design* and those to be generated by the compliance software. A snapshot of the prototype building A1 performance based test method *Standard Reference Design* minimum requirements for the Florida Energy Code (FEC) and ASHRAE 90.1 are shown in Figure 7.3-1.

Column “B” represents the component type, column “C” represents the building component description, column “D” represents the units of the building components, column “E” tells whether a component requirement is a maximum value or a minimum value, and column “F” is place holder for component sizing values. HVAC and service water systems require sizing results for specifying the standard minimum efficiency requirements. Where entering sizing values are required nominal values are provided. Vendors shall use sizing values determined by their compliance software. In addition to the *Standard Reference Design* data, the spreadsheet “**CommercialPerformanceMethodsResults.xls**” contains place holder for the corresponding values to be generated by the compliance software for each prototype building test case by climate zone. Column “G” and “I” are place holders for the *Standard Reference Design* inputs created per the

standard ASHRAE 90.1 option and the Florida Energy Code (FEC), respectively. Column “H” and “J” in the worksheet “Prototype A1” are place holders for the reference building input requirements to be generated by the compliance software and filled by the vendor. For instance, for prototype building A1, the compliance software reference results generated using ASHRAE 90.1 option for climate zone 1 will be populated in column “H” and shall match the *Standard Reference Design* minimum requirements data set in column “G”. Similarly, the compliance software’s reference design results generated using the Florida Energy Code (FEC) for climate zone 1 will be populated in column “J” by the software vendors and shall match the *Standard Reference Design* minimum requirements data set in column “I”. For the performance based compliance methods envelope requirements are based on *U-values* for wall and roofs and *F-Factor* method for slab-on-grade floors.

TYPE	Description of Components	UNITS	MIN / MAX	Sizing Results	Reference Results for Baseline model (ASHRAE)	Compliance Software Baseline Model Results (ASHRAE)
<b>Envelope Components</b>						
Wall	Exterior Wall: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.089	
Wall	Exterior Wall: Thermal Capacity	(Btu/ft <sup>2</sup> -°F)			3.94	
Wall	Exterior Wall: Solar Reflectance	-	MIN		NA	
Wall	Exterior Wall: Solar Absorptance	-	MAX		NA	
Wall	Exterior Wall: Thermal Emittance	-	MIN		NA	
Floor	Floor Slab-on-grade: Unheated F-factor	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.73	
Floor	Floor Slab-on-grade: Thermal Capacity	(Btu/ft <sup>2</sup> -°F)			9.33	
Roof	Exterior Roof: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.048	
Roof	Exterior Roof: Thermal Capacity	(Btu/ft <sup>2</sup> -°F)			2.79	
Roof	Exterior Roof: Solar Reflectance	-	MIN		0.60	
Roof	Exterior Roof: Solar Absorptance	-	MAX		NR	
Roof	Exterior Roof: Thermal Emittance	-	MIN		0.90	
Fenestration	Exterior Window: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.50	
Fenestration	Exterior SEW Window: SHGC	-	MAX		0.25	
Fenestration	Exterior N Window: SHGC	-	MAX		0.25	
Fenestration	Exterior Window: WWR	(%)	Max		40.0	
Skylight	Skylight: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.75	
Skylight	Skylight: SHGC	-	MAX		0.35	
Skylight	Skylight: Skylight-Roof Ratio	(%)	MAX		3.0	
<b>Interior Lighting</b>						
Lighting	LPD: Building Area Method	W/ft <sup>2</sup>	MAX		0.82	
<b>Exterior Lighting</b>						
Lighting	Total Lighting Allowance	W	MAX		870	
<b>Internal Loads</b>						
Equipment	Internal Electric Power Density	W/ft <sup>2</sup>	-		1.0	
<b>HVAC System</b>						
	HVAC System Type				Packaged Roof Top Heat Pump	

Figure 7.3-1 Performance method envelope requirements for prototype building A1

The standard reference building HVAC and service hot water systems minimum efficiency requirements depend on the capacity and system type. Therefore, a separate capacity entry row is required for each compliance method by climate zone; one for ASHRAE 90.1 option and another for the Florida Energy Code (FEC) as shown in Figure 7.3-2. For every equipment type the software vendors are expected to enter the capacity under the designated cell depending on the compliance method and climate zone. Then the VBA code in the spreadsheet automatically populates the *Standard Reference Design* minimum efficiency requirement based on the specified capacity in the appropriate cell addresses. The units of capacity for all cooling and heating equipment category is in kBtu/h whereas Chillers use tons.

It is possible that different compliance software may yield slightly different sizing results due to variation in some of the underlying assumptions. The sizing values provided in this spreadsheet are nominal and shall not be used, instead each compliance software vendor shall enter the sizing results generated by their own software. The sizing values in the cells between rows 47 – 60 in column “F” in Figure 7.3-2, represents capacity of a cooling Fan Coil unit for climate zone 1 determined using the *Standard Reference Design* building data of the ASHRAE 90.1 option and the Florida Energy Code (FEC). The software vendors shall enter their sizing results by overriding the nominal values shown in the cells in “Yellow” background. The cooling capacities shown between cell rows 64-77, which are linked to the capacities in the cells above, are used to determine the air-economizer requirements per the standards. Only when the *Standard Reference Design* building data provided in this spreadsheet workbook and the corresponding *Standard Reference Design* data generated by the vendor’s software match that the software is said to have met the State of Florida commercial code compliance software requirement. The compliance software evaluation is performed and approved by the Florida Building Commission.

CommercialPerformanceMethodsResults - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER ADD-INS LOAD TEST TEA

C37 : HVAC System Type

	A	B	C	D	E	F	G	H
1								
2	Output Results for Performance Based Code Compliance Reference Design Tests (Envelope Requirements shall use U-Factor for walls and Roofs, and							
3								
4								Test Run 1 (Climate
5		TYPE	Description of Components	UNITS	MIN / MAX	Sizing Results	Reference Results for Baseline model (ASHRAE)	Compliance Software Baseline Model Results (ASHRAE)
63		Cooling DX	East Zone System Efficiency: ASHRAE	SEER	MIN	59.0	14.0	
64		Cooling DX	East Zone System Efficiency: FEC	SEER	MIN	59.0		
65								
66		Cooling DX	West Zone System Efficiency: ASHRAE	SEER	MIN	44.0	14.0	
67		Cooling DX	West Zone System Efficiency: FEC	SEER	MIN	44.0		
68								
69		Cooling DX	Core Zone System Efficiency: ASHRAE	EER / IEER	MIN	306.0	9.5 / 10.6	
70		Cooling DX	Core Zone System Efficiency: FEC	EER / IEER	MIN	308.0		
71								
72								
73			Air Economizer (Yes, or No):					
74		Air Economizer	North Zone System Economizer: ASHRAE	-	-	36.0	No	
75		Air Economizer	North Zone System Economizer: FEC	-	-	36.0		
76								
77		Air Economizer	South Zone System Economizer: ASHRAE	-	-	37.0	No	
78		Air Economizer	South Zone System Economizer: FEC	-	-	37.0		
79								
80		Air Economizer	East Zone System Economizer: ASHRAE	-	-	59.0	No	
81		Air Economizer	East Zone System Economizer: FEC	-	-	59.0		
82								
83		Air Economizer	West Zone System Economizer: ASHRAE	-	-	44.0	No	
84		Air Economizer	West Zone System Economizer: FEC	-	-	44.0		
85								
86		Air Economizer	Core Zone System Economizer: ASHRAE	-	-	306.0	No	
87		Air Economizer	Core Zone System Economizer: FEC	-	-	308.0		
88								
89								
90		Service Water Heating						
91		SWH	SWH Type				Storage Water Heater	
92		SWH	Fuel Type				Electric	
93		SWH	Thermal Efficiency:					
94		SWH	Size <= 12 kW, Energy Factor (EF)	-	MIN	11.0	0.94	
95		SWH	Size > 12 kW, Size > 20 gal, Standby Loss	%/h	MAX	11.0		
96								

Prototype A1 | Prototype A3 | Prototype A20 | Pro: ...

Figure 7.3-2 Performance method HVAC requirements for prototype building A1

There are sixteen test cases for the performance based code compliance software evaluation but there are two sets of results; one for the Florida Energy Code and another set for ASHRAE 90.1 option. In total there are going to be 32 sets of results to be submitted to the Florida Building Commission for performance method commercial code compliance software evaluation.

### 7.3.2 Prescriptive Method Evaluation Procedure

The prescriptive method evaluation is designed to verify whether compliance software is capable of conducting prescriptive method of commercial code compliance calculations. Prototype buildings A1 and C1 only were used for the prescriptive methods code compliance software evaluation. The prototype buildings used for the prescriptive methods are described in Section 7.2. The prescriptive code compliance calculation evaluation is performed using the results in the spreadsheet workbook “*CommercialPrescriptiveMethodsResults.xls*”. This spreadsheet workbook

contains the *Proposed Design* building inputs and the *Standard Reference Design* for the two prescriptive methods for each of the test cases by climate zone. The *Standard Reference Design* prescriptive requirements are created for the Florida Energy Code (FEC) and ASHARE 90.1 option based on the minimum requirements of the two standards. The *Standard Reference Design* building data created along with the *Proposed Design* building input data for each of the prescriptive test cases of the prototype building are populated in a single worksheet. This worksheet is designed for side-by-side comparison of the *Proposed Design* building inputs to the *Standard Reference Design* building prescriptive code compliance minimum requirements.

The compliance software vendor shall generate list of the *Proposed Design* building elements input and the corresponding prescriptive method minimum requirements along with the decision reached and populate the results in the respective worksheet. The decision is a “Pass” or “Fail” depending on whether the *Proposed Design* input value of a building element meet standard reference minimum prescriptive requirement or not. Snapshot of the proposed prototype building A1 inputs and the prescriptive method test results are shown in Figure 7.3-3. Column “G” contains the *Proposed Design* building input data and column “H” and column “K” hold the prescriptive methods *Standard Reference Design* requirements for climate zone 1 based on ASHARE 90.1 option and the Florida Energy Code (FEC), respectively. The *Standard Reference Design* minimum requirement “Pass” or “Fail” results in column “I” and “L” are created as reference for evaluation purpose only. Column “J” and “M” are place holders for the “Pass” or “Fail” decisions to be generated by the compliance software vendor for this evaluation. The prescriptive methods *Standard Reference Design* requirements in column “J” and “M”, which are to be generated and entered by the compliance software vendor, are expected to be identical to that of column “I” and “L”, respectively.

There are similar set of results in the worksheet named “Prototype C1” for the prototype test building C1. There are two set of test cases; one for Manufacturing building and another for Warehouse building application type. Each building application type is tested for Florida Energy Code and ASHRAE 90.1 compliance options and the two climate zones. There are eight set of prescription test results for prototype building C1 whereas for Prototype Building A1 there are only four set of prescriptive compliance test results. In total there will be twelve sets of prescriptive method commercial code compliance test results to be submitted to the Florida Building Commission for a vendor software evaluation.

For the prescriptive compliance methods building envelope requirements are based on either *U-values* and *F-Factors* or *R-values* but either method shall be used consistently throughout for each test case.

Output Results for Prescriptive Code Compliance Reference Design Qualitative Tests (Envelope Requirements either U-Factor, or R-Values)								
Test Run 1 (Climate Zone 1)								
TYPE	Description of Component	UNITS	MIN / MAX	Sizing Results	ASHRAE's Criteria	Meet ASHRAE's Req. (Pass/Fail)	Software Meets ASHRAE's Req. (Pass/Fail)	
<b>Envelope Components</b>								
Wall	Exterior Wall: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.089	Pass		
Wall	Exterior Wall: Insulation R-Value	(h-ft <sup>2</sup> -°F)/Btu	MIN		R-13	Pass		
Floor	Floor Slab-on-grade: Unheated F-factor	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.73	Pass		
Floor	Floor Slab-on-grade: Insulation R-Value	(h-ft <sup>2</sup> -°F)/Btu	MIN		NR	NR		
Roof	Exterior Roof: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.048	Fail		
Roof	Exterior Roof: Insulation R-Value	(h-ft <sup>2</sup> -°F)/Btu	MIN		R-20 ci	Fail		
Roof	Exterior Roof: Solar Reflectance	-	MIN		0.55	Pass		
Roof	Exterior Roof: Thermal Emittance	-	MIN		0.75	Pass		
Fenestration	Non-North Oriented Exterior Window: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.50	Pass		
Fenestration	Non-North Oriented Exterior Window: SHGC	-	MAX		0.25	Pass		
Fenestration	Non-North Oriented Exterior Window: WWR	(%)	Max		40.0	Pass		
Fenestration	North Oriented Exterior Window: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.50	Pass		
Fenestration	North Oriented Exterior Window: SHGC	-	MAX		0.25	Pass		
Fenestration	North Oriented Exterior Window: WWR	(%)	Max		40.0	Pass		
Skylight	Skylight: U-Value	Btu/(h-ft <sup>2</sup> -°F)	MAX		0.75	Pass		
Skylight	Skylight: SHGC	-	MAX		0.35	Fail		
Skylight	Skylight: Skylight-Roof Ratio	(%)	MAX		3.0	Fail		
<b>Interior Lighting</b>								
Lighting	LPD: Building Area Method	W/ft <sup>2</sup>	MAX		0.82	Pass		
<b>Exterior Lighting</b>								
Lighting	Exterior Total Lighting Allowance	W	MAX		870	Pass		
<b>Internal Loads</b>								
Equipment	Internal Equipment Power Density	W/ft <sup>2</sup>	-		1.0	Pass		
<b>HVAC System</b>								
HVAC	System Type				Single Zone Packaged Airconditioner	Pass		

Figure 7.3-3 Prescriptive compliance method requirements for prototype building A1

### 7.3.3 Envelope Trade-Off Option Method Evaluation Procedure

The building envelope complies with the Building Envelope Trade-Off Option method of the standard ASHRAE 90.1 if:

1. The proposed building satisfies the provisions of Section 5.6 of ASHRAE 90.1: the general requirements per Section 5.1, the mandatory provisions per Section 5.4, submittals of compliance documentations per Section 5.7 and product information and installation requirements per Section 5.8; and,
2. The model geometry and thermal zones of the proposed building satisfies the requirements of Section C3.5.2 of Normative Appendix C of ASHRAE 90.1.



3. The HVAC system of the proposed building shall satisfy the requirements of Section C3.5.8 of Normative Appendix C of ASHRAE 90.1.
4. The base (budget) building satisfies the requirements of Section C3.6 of Normative Appendix C of ASHRAE 90.1.
5. Schedules of operation, lighting power, equipment power, occupant density, load and mechanical system shall be the same for both the proposed building and the budget building and shall meet the requirements of Section C3.5.4 of ASHRAE 90.1.
6. The *Proposed Envelope Performance Factor* of the proposed envelope design building is less than or equal to the *Base Envelope Performance Factor* of the base envelope design building.

Using the test case identified for the Envelope Trade-Off option method in Section 7.2.1 run the code compliance calculation using vendor's compliance software. Record the ASHRAE Building Envelope Trade-Off Option code compliance method reports in the results spreadsheet "*CommercialEnvelopeTradeOffMethodResults.xls*".

A snapshot of the Envelope trade-off option compliance results spreadsheet for Miami, Florida is shown in Figure 7.3-4. This spreadsheet contains the compliance summary of *Envelope Performance Factors (EPF)* generated for the proposed and base envelope design buildings, summary of the user inputs, proposed and base building thermal envelope requirements and HVAC efficiency requirements for verification. The proposed and base building envelope performance factor reference results in the spreadsheet were generated using EnergyPlus V8.8 simulation program. The software vendor shall submit their test results for Miami-Dade, FL and Orlando, FL climate zones.

Vendors of compliance software shall record the results of their compliance simulation side by side to the reference results in the spreadsheet. There are two result worksheets in this workbook "Miami\_ClimateZone1" and "Orlando\_ClimateZone2" representing the Envelope Trade-Off Option code compliance calculation results for Miami and Orlando, Florida. The vendor's software results of proposed and base envelope and HVAC component efficiency are expected to match the reference results in the evaluation spreadsheet. Where there are differences, the compliance software vendors are required to add a brief explanation in the spreadsheet cells labelled as "Note". Vendor's software shall demonstrate whether the test building passes or fails the EPF requirement.

Compliance Summary				Reference EPF Requirement - PASSES			Vendors EPF Requirement - PASSES		
Compliance Summary: Envelope Performance Factor (EPF)				Reference Results (EPF)			Vendor's Software Results (EPF)		
TYPE	Envelope Components	UNITS	User Building	Proposed Building	Base Building	Margin	Proposed Envelope	Base Envelope	Margin
Project	Total Building (EPF)	-	-	46751	46903	151			

Output Results for Envelope Trade-Off Option Method				Reference Results			Vendor's Software Results		
TYPE	Envelope Components	UNITS	User Envelope	Proposed Envelope	Base Envelope	Proposed Envelope	Base Envelope	Note	
Envelope Geometry Summary									
Floor	Floor Area	ft <sup>2</sup>	90000	90000	90000				
Wall	Gross Wall Area:	ft <sup>2</sup>	36750	19500	19500				
Window	Window Area:	ft <sup>2</sup>	2000	2000	2000				
Window	Window Wall Ratio:	%	5.4	10.3	10.3				
Roof	Gross Roof Area:	ft <sup>2</sup>	90000	90000	90000				
Skylight	Skylight Area:	ft <sup>2</sup>	256	256	256				
Skylight	Skylight Roof Ratio:	%	0.28	0.28	0.28				
Door	Door Area	ft <sup>2</sup>	1000	1000	1000				

Opaque Construction Summary				Reference Results			Vendor's Software Results		
TYPE	Envelope Components		User Envelope	Proposed Envelope	Base Envelope	Proposed Envelope	Base Envelope	Note	
Roof	Roof: Insulated: Area	ft <sup>2</sup>	89980	89750	89750				
Roof	Roof: Insulated: Assembly U-Value	Btu/(h-ft <sup>2</sup> -°F)	0.062	0.062	0.048				
Roof	Roof: Insulated: Heat Capacity	(Btu/ft <sup>2</sup> -°F)	NA	NA	NA				
Roof	Roof: Insulated: R-Value	(h-ft <sup>2</sup> -°F)/Btu	R-15 c.i.	R-15 c.i.	R-20 c.i.				
Wall	Exterior Wall: Insulated: Area	ft <sup>2</sup>	6500	5175	5175				
Wall	Exterior Wall: Insulated: Assembly U-Value	Btu/(h-ft <sup>2</sup> -°F)	0.154	0.154	0.580				
Wall	Exterior Wall: Insulated: Heat Capacity	(Btu/ft <sup>2</sup> -°F)	NA	18.99	7.2				
Wall	Exterior Wall: Insulated: R-Value	(h-ft <sup>2</sup> -°F)/Btu	R-13.0	R-13.0	R-13.0				

Figure 7.3-4 Envelope Trade-Off Option compliance method results

### 7.3.4 Component Performance Alternative Method Evaluation Procedure

The component performance alternative method is used for thermal envelope and fenestration compliance. This method is an alternative compliance option in lieu of U-factor, C-factor and F-factor values method per Section C402.1.5. The building envelope complies with the component performance alternative of the 2017 6<sup>th</sup> Edition Florida Energy Code if the building weighed UA values difference between the proposed and the baseline building shall be less or equal to zero.

Using the test case identified for the component performance method in Section 7.2.1 run the code compliance calculation using vendor’s compliance software. Record the results the component performance method code compliance method reports in the results spreadsheet “CommercialComponentPerformanceMethodResults.xls”. A snapshot of the component performance method compliance results spreadsheet for Miami, Florida is shown in Figure 7.3-5. This spreadsheet contains the compliance calculation summary of UA differences

Vendors of compliance software shall record the UA differences for each construction assembly by their category side by side to the reference results in the orange cells range of this spreadsheet. There are two result worksheets in this workbook “Miami\_ClimateZone1” and “Orlando\_ClimateZone2” representing the component performance alternative code compliance calculation results for Miami and Orlando, Florida. The vendor’s software results of proposed and baseline (budget) envelope values are expected to match the reference results.

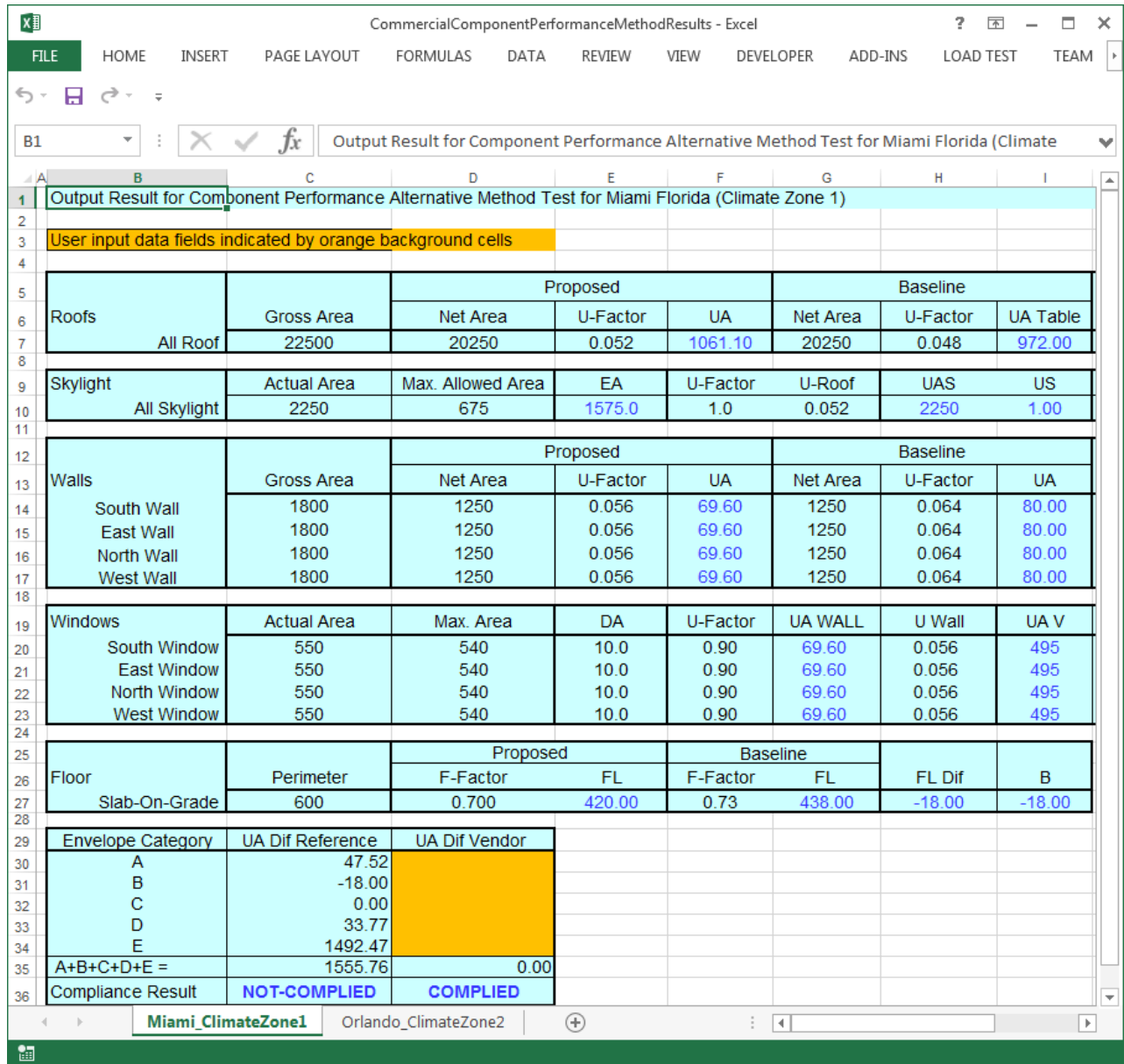


Figure 7.3-5 Component performance alternative method results

## 7.4 Documentation and Compliance Report

Compliance documentation includes the forms, reports and other information that is submitted to the building department with an application for a building permit. The purpose of the compliance documentation is to enable the Florida Building Commission official to verify that software meets the Florida Energy Code requirements.

### Compliance Report

The compliance software shall generate a report that documents and compares the annual energy costs of *Proposed Design* building and the *Standard Reference Design* building for performance-based compliance methods that complies with Section C401.2 and C407.4 of the Florida Energy Code, or Section 11.1.5 of ASHRAE 90.1 option. The required formats for building information

reports are electronic Portable Document File (PDF) and hard copy. Both report formats shall be automatically generated by the compliance software. *Report information details that need to be entailed in the different section of the report forms are shown in Appendix C as guides.*

### ***Forms General Requirements***

- Minimum Required Content and Format shall be per Appendix C
- Name of the individual completing the compliance report
- Name and version of the compliance software tool

### ***Performance Based Methods Report***

The compliance software output report information submitted for the Total Building Performance Method or the Energy Cost Budget Method shall include the following:

- The annual total energy costs of the *Standard Reference (Budget) Design* building and the *Proposed Design* building.
- A check list of the energy-related features included in the *Proposed Design* and on which compliance with the provisions of Sections C401.2 and C407.4 of the Florida Energy Code, or Section 11.3.1 of ASHRAE 90.1 option shall be performed. This list shall document all energy features that differ between the models used in the *Standard Reference (Budget) Design* building and the *Proposed Design* building calculations.
- The input and output report(s) from the compliance software tool shall include a breakdown of energy usage by at least the following components: lights, internal equipment loads, service water heating equipment, space heating equipment, space cooling and heat rejection equipment, fans, and other HVAC equipment (such as pumps). The output reports shall also show the annual load unmet hours for both the *Proposed Design* building and *Standard Reference (Budget) Design* building.
- Explanation of any error message noted in the compliance software output.
- Addition documentation as required by code official described in Section C407.4.2 of the Florida Energy Code.

### ***Prescriptive Methods Report***

The compliance software shall generate a report that documents the minimum and mandatory requirements of Chapter 4 of the Florida Energy Code or ASHRAE 90.1 option. It is to be noted that the Florida Energy Code includes ANSI/ASHRAE Standard 90.1 code compliance method as an alternative option. Prescriptive method test is a “Pass” or a “Fail” check for the mandatory and required building elements by comparing the *Proposed Design* values to the minimum requirements of the reference standard. The prescriptive compliance report shall include list of required building elements containing the *Proposed Design value*, the *Standard Reference Design minimum requirement as a criteria*, and the “Pass” or “Fail” results in a tabular format. The prescriptive requirement shall be categorized by Building Envelope, Lighting, HVAC system and Serve Hot Water.

### ***Envelope Trade-Off Method Report***

The compliance software shall generate a report that documents the *proposed envelope design and the base envelope design* requirements of ASHRAE 90.1 option. It is to be noted that the Florida Energy Code includes ANSI/ASHRAE Standard 90.1 code compliance method as an alternative

option. Envelope trade-off option compliance method test compares the building envelope requirements and performance of the *proposed envelope and base envelope design*. The Envelope Trade-Off Option method compliance report shall include list of required building envelope components containing *the proposed envelope design values, the base envelope design values*, the *Envelope Performance Factor (EPF)*, and the proposed and base building HVAC efficiency generated by the vendor's compliance software. The thermal zone geometry and envelope requirements of the proposed and base building shall be reported by space-condition category and building area type.

### ***Component Performance Alternative Method Report***

The compliance software shall generate a report that documents the UA differences by envelope type categories: opaque construction including above and below grade wall assemblies, roofs and floors, vertical fenestration and skylights. And the UA differences sum for entire building.

## 8. Alternative Compliance Software Tests

Sections 6.5.6.2 and 7.2 of this Manual identify a series of tests to verify that compliance software accurately demonstrate compliance. A compliance software program vendor may propose alternate tests when the vendor believes that one or more of the standard tests are not adequate for the compliance software program under consideration. The Commission will evaluate the alternate tests and will accept them if they are found to reflect acceptable engineering techniques.

If alternate tests are accepted by the Commission, the tests will be available for use by all compliance software programs. An alternate test will coexist with the standard test presented in this Manual until the Manual is revised. When a new version of this Manual is produced, the alternative test may be substituted for the current test or may continue to coexist with the original test.

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**APPENDIX A**  
**Cover sheet for request for approval by the Florida Building Commission as a Compliance Software tool**

Date of Submittal:

Software Company:

Contact Person:

Contact email:

Contact Phone number:

Name of Product (If marketed under different editions or names list all that apply):

Version Number:

**Code Compliance Methods this software calculates:**

**Commercial Energy Efficiency Code Compliance**

- FEC Prescriptive Method
- FEC Total Building Performance Method
- FEC Component Performance Alternative Method
- ASHRAE Prescriptive Method
- ASHRAE Envelope Trade-off Option Method
- ASHRAE Energy Cost Budget Method

**Residential Energy Efficiency Code Compliance**

- Prescriptive R-value Method
- Prescriptive U-factor Alternative Method
- Prescriptive Total UA Alternative Method
- Performance Method
- Energy Rating Index Alternative Method

Exceptions (list building types or other exceptions to the above): \_\_\_\_\_

As an official of the software company named above, I certify the software listed meets the requirements of the 6<sup>th</sup> Edition Florida Building Code, Energy Conservation for the methods indicated and that this submittal includes the required documentation as given in the Energy Simulation Tool Approval – Technical Assistance Manual or as requested by the Florida Building Commission:

\_\_\_\_\_  
 Signature

\_\_\_\_\_  
 Date

\_\_\_\_\_  
 Printed Name

\_\_\_\_\_  
 Title

## APPENDIX R

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## **Appendix R-1 Residential Testing and Reporting Overview**

For software to be approved it must submit test results and reports as required by the method of compliance the software is designed to accomplish. There are three prescriptive and two simulation based compliance methods.

Submissions for approval shall include the cover sheet from [Appendix A](#), the spreadsheet file or files listed under each method and the reports listed. Details for each test and reports are in appendices [R-2](#) through [R-6](#).

## Appendix R-2 Prescriptive R-Value Method

The software must produce a completed Form R402-2017. To comply, the software must report on the results of six houses described in [Section R-2.3](#) of this Manual. Although there are few calculations required for this compliance method, the software must accurately calculate the average window U-factor and SHGC according to the code including any exceptions.

### R2.1 Testing

The software vendor shall download and complete the file titled “Residential Prescriptive Compliance Test 2017.” The file has six yellow-highlighted tabs, one for each house. On each tab is a section for R-Value method (the top of the spreadsheet). Complete each yellow highlighted field. If the value entered is the expected value or result, the green highlighted field adjacent will indicate “Pass.” There is also a box indicating if the software would indicate if the home passes compliance. Again, indicate what the software indicated. If the value is expected the green field will indicate “Pass.” For a house where the expected result is that the home fails to comply, the entered choice of “Fails” will yield a “Pass.” Each yellow highlighted field must be accurate in order for the software to pass the test. If the results computed by the software fall outside the range indicated on the excel report and the vendor believes that their value is correct they may include an explanation. If submitting for multiple prescriptive methods, submit just one spreadsheet file, completing each prescriptive block of entries for each method seeking software approval. Save the file with the name “Residential Prescriptive Compliance Test 2017 –[software name].”

### R2.2 Residential R-Value Method Report

A pdf file shall be prepared and labeled “R-Value Reports from [software name].” It shall include the required reports for house T01, followed by T02, T03, M01, M02 and M03. Sample report formats are provided in section R2.4 of this Manual. For each house include the following:

- 1) Form R402-2017 which includes the parameters of Table R402.1.2
- 2) Input summary checklist report. Sample Form. See [Appendix R-7](#) section of this Manual (usually 4 pages/may be greater)
- 3) Energy Performance Level (EPL) Display Card (one page). Sample Form is in [Appendix R-8](#).
- 4) HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- 5) Mandatory requirements summarized in [Appendix R-9](#) of this Manual (usually five pages/may be greater)

For house T01 also include the following reports from the software:

- 6) A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page). See [Appendix R-10](#) of this Manual.
- 7) A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See [Appendix R-11](#) of this Manual.
- 8) A completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located within the building thermal envelope. See [Appendix R-12](#) of this Manual.

## **R2.3 Prescriptive Home Characteristics for Testing**

The following six pages describe the six test houses. These test houses are used for each prescriptive method. The software must be run for each of the six test houses. Three houses are for climate zone 2 (Tampa) and three are for climate zone 1 (Miami). Each of the tests is designed to test one or more features of the software.

**Prescriptive Test: House T01 (Pr-T01) Characteristics – Location: Tampa, Florida  
Single Family Detached Home with No Attached Garage  
Single Story, Three bedroom**

Parameter	Size	Efficiency Level
Conditioned Floor Area	2000 ft <sup>2</sup>	NA
Slab-on-grade Floor	50x40 perimeter	No insulation
Roof – gable type- 5 in 12 slope No overhangs	2167 ft <sup>2</sup> above 2000 ft <sup>2</sup> conditioned space	0.75 solar absorptance
Ceiling <sup>1</sup> –flat under attic	2000 ft <sup>2</sup>	R 38
Skylight	10 ft <sup>2</sup>	U = 0.65 SHGC=0.25
Wall 1 –faces North, CBS <sup>2</sup>	50 ft wide x 10 ft high	R6 insulated on inside
Door 1 -	24 ft <sup>2</sup>	U = 0.40
Window 1 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.40 SHGC=0.25
Wall 2 –faces East, CBS	40 ft wide x 10 ft high	R6 insulated on inside
Window 2 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.40 SHGC=0.25
Wall 3 –faces South, CBS	40 ft wide x 10 ft high	R6 insulated on inside
Window 3 – Vinyl Frame Low-e Double	15 ft <sup>2</sup>	U = 0.40 SHGC=0.25
Wall 4 –faces South, Wood <sup>3</sup> 2x4 framing fraction =0.25	10 ft wide x 10 ft high	R13
Window 4 – Vinyl Frame Low-e Double	60 ft <sup>2</sup>	U = 0.40 SHGC=0.25
Wall 5 –faces West, CBS	40 ft wide x 10 ft high	R6 insulated on inside
Window 5 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.40 SHGC=0.25
Infiltration	House Volume = 2000 ft <sup>2</sup> x 10 ft height = 20,000ft <sup>3</sup>	ACH50 = 5
Heating – heat pump	21,000 Btu/h	HSPF = 8.2
Cooling – heat pump	21,000 Btu/h	SEER = 14
Ducts – supply in attic	400 ft <sup>2</sup>	R8 insulation
Ducts – return in conditioned space	100 ft <sup>2</sup>	R6 insulation
Duct Tightness		Leakage = 0.04 cfm/square foot post construction
Air Handler – in conditioned space	21,000 Btu/h	Leakage no more than 2% of air flow rate
Mechanical Ventilation	None	N/A
Hot Water System - electric	50 gallon	EF=0.95
All Hot Water Lines	Runs 10 - 35 feet	R3 insulation
Hot Water Circulation -none	NA	NA
Lighting	100 installed fixtures	75% fixtures compact fluorescent
Pool and Spa - none	NA	NA

<sup>1</sup> Layers from outside: Attic air, R38 batt insulation with 2x4 framing with 7% framing fraction, ½” drywall

<sup>2</sup> CBS layers from outside: stucco, lathe, 8” normal density hollow core concrete block, 1 inch R6 insulation board, ¾” airspace with furring at 16” on center, and ½” drywall. Solar absorptance = 0.5.

<sup>3</sup> Wood frame wall layers from outside: stucco, ½” exterior plywood, 2x4 frame with R-13 fiberglass batt insulation with a 25% total framing fraction, and ½” drywall. Solar absorptance = 0.5.

**Prescriptive Test: House T02 (Pr-T02) Characteristics – Location: Tampa, Florida  
 Single Family Detached Home with No Attached Garage  
 Single Story, Three bedroom **red type illustrates rows with differences from T01****

Parameter	Size	Efficiency Level
Conditioned Floor Area	2000 ft <sup>2</sup>	NA
Slab-on-grade Floor	50x40 perimeter	No insulation
Roof – gable type- 5 in 12 slope No overhangs	2167 ft <sup>2</sup> above 2000 ft <sup>2</sup> conditioned space	0.75 solar absorptance
Ceiling <sup>1</sup> –flat under attic	2000 ft <sup>2</sup>	R 38
Skylight	10 ft <sup>2</sup>	U = 0.65 SHGC=0.25
Wall 1 –faces North, CBS <sup>2</sup>	50 ft wide x 10 ft high	R6 insulated on inside
Door 1	24 ft <sup>2</sup>	<b>U = 0.80</b>
Window 1 – Metal Frame Double Clear	75 ft <sup>2</sup>	<b>U = 0.68 SHGC=0.46</b>
Wall 2 –faces East, CBS	40 ft wide x 10 ft high	R6 insulated on inside
Window 2 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	<b>U = 0.27 SHGC=0.17</b>
Wall 3 –faces South, CBS	40 ft wide x 10 ft high	R6 insulated on inside
Window 3 – Metal Frame, Single Pane	15 ft <sup>2</sup>	<b>U = 1.2 SHGC=0.80</b>
Wall 4 –faces South, Wood <sup>3</sup> 2x4 framing fraction =0.25	10 ft wide x 10 ft high	R13
Window 4 – Vinyl Frame Low-e Double	60 ft <sup>2</sup>	<b>U = 0.27 SHGC=0.17</b>
Wall 5 –faces West, CBS	40 ft wide x 10 ft high	R6 insulated on inside
Window 5 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	<b>U = 0.27 SHGC=0.17</b>
Infiltration	House Volume = 2000 ft <sup>2</sup> x 10 ft height = 20,000ft <sup>3</sup>	ACH50 = 5
Heating – heat pump	21,000 Btu/h	HSPF = 8.2
Cooling – heat pump	21,000 Btu/h	SEER = 14
Ducts – supply in attic	400 ft <sup>2</sup>	R8 insulation
Ducts – return in conditioned space	100 ft <sup>2</sup>	R6 insulation
Duct Tightness		Leakage = 0.04 cfm/square foot post construction
Air Handler – in conditioned space	21,000 Btu/h	Leakage no more than 2% of air flow rate
Mechanical Ventilation	None	N/A
Hot Water System - electric	50 gallon	EF=0.95
All Hot Water Lines	Runs 10 - 35 feet	R3 insulation
Hot Water Circulation -none	NA	NA
Lighting	100 installed fixtures	75% fixtures compact fluorescent
Pool and Spa - none	NA	NA

<sup>1</sup> Layers from outside: Attic air, R38 batt insulation with 2x4 framing with 7% framing fraction, ½” drywall

<sup>2</sup> CBS layers from outside: stucco, lathe, 8” normal density hollow core concrete block, 1 inch R6 insulation board, ¾” airspace with furring at 16” on center, and ½” drywall. Solar absorptance = 0.5.

<sup>3</sup> Wood frame wall layers from outside: stucco, ½” exterior plywood, 2x4 frame with R-13 fiberglass batt insulation with a 25% total framing fraction, and ½” drywall. Solar absorptance = 0.5.

**Prescriptive Test: House T03 (Pr-T03) Characteristics – Location: Tampa, Florida  
 Single Family Detached Home with No Attached Garage  
 Single Story, Three bedroom **red type illustrates rows with differences from T01****

Parameter	Size	Efficiency Level
Conditioned Floor Area	2000 ft <sup>2</sup>	NA
Slab-on-grade Floor	50x40 perimeter	No insulation
Roof – gable type- 5 in 12 slope No overhangs	2167 ft <sup>2</sup> above 2000 ft <sup>2</sup> conditioned space	0.75 solar absorptance
<b>Ceiling<sup>1</sup> –flat under attic</b>	2000 ft <sup>2</sup>	<b>R 30</b>
Skylight	10 ft <sup>2</sup>	U = 0.65 SHGC=0.25
<b>Wall 1 –faces North, Wood Frame<sup>2</sup></b>	50 ft wide x 10 ft high	<b>R13 + R5</b>
Door 1 -	24 ft <sup>2</sup>	U = 0.40
<b>Window 1 – Vinyl Frame Low-e Double</b>	75 ft <sup>2</sup>	<b>U = 0.35 SHGC=0.25</b>
<b>Wall 2 –faces East, Wood Frame</b>	40 ft wide x 10 ft high	<b>R13 + R5</b>
<b>Window 2 – Vinyl Frame Low-e Double</b>	75 ft <sup>2</sup>	<b>U = 0.35 SHGC=0.25</b>
<b>Wall 3 –faces South, Wood Frame</b>	40 ft wide x 10 ft high	<b>R13 + R5</b>
<b>Window 3 – Metal Frame, Single Pane</b>	15 ft <sup>2</sup>	<b>U = 1.2 SHGC=0.80</b>
<b>Wall 4 –faces South, Wood Frame</b>	10 ft wide x 10 ft high	<b>R13 + R5</b>
<b>Window 4 – Vinyl Frame Low-e Double</b>	60 ft <sup>2</sup>	<b>U = 0.35 SHGC=0.25</b>
<b>Wall 5 –faces West, Wood Frame</b>	40 ft wide x 10 ft high	<b>R13 + R5</b>
<b>Window 5 – Vinyl Frame Low-e Double</b>	75 ft <sup>2</sup>	<b>U = 0.35 SHGC=0.25</b>
Infiltration	House Volume = 2000 ft <sup>2</sup> x 10 ft height = 20,000ft <sup>3</sup>	ACH50 = 5
Heating – heat pump	21,000 Btu/h	HSPF = 8.2
Cooling – heat pump	21,000 Btu/h	SEER = 14
Ducts – supply in attic	400 ft <sup>2</sup>	R8 insulation
Ducts – return in conditioned space	100 ft <sup>2</sup>	R6 insulation
Duct Tightness		Leakage = 0.04 cfm/square foot post construction test
Air Handler – in conditioned space	21,000 Btu/h	Rated Leakage no more than 2% of air flow rate
Mechanical Ventilation	None	N/A
Hot Water System - electric	50 gallon	EF=0.95
All Hot Water Lines	Runs 10 - 35 feet	R3 insulation
Hot Water Circulation -none	NA	NA
Lighting	100 installed fixtures	75% fixtures compact fluorescent
Pool and Spa - none	NA	NA

<sup>1</sup> Layers from outside: Attic air, R30 batt insulation with 2x4 framing with 7% framing fraction, ½” drywall

<sup>2</sup> Wood frame wall layers from outside: synthetic stucco applied over R5 rigid insulation, #30 asphalt building paper, ½” exterior plywood, 2x4 frame with R-13 fiberglass batt insulation with a 25% total framing fraction, and ½” drywall. Solar absorptance = 0.5.



**Prescriptive Test: House M01 (Pr-M01) Characteristics – Location: Miami, Florida  
Single Family Detached Home with No Attached Garage  
Single Story, Three bedroom**

Parameter	Size	Efficiency Level
Conditioned Floor Area	2000 ft <sup>2</sup>	NA
Slab-on-grade Floor	50x40 perimeter	No insulation
Roof – gable type- 5 in 12 slope No overhangs	2167 ft <sup>2</sup> above 2000 ft <sup>2</sup> conditioned space	0.75 solar absorptance
Ceiling <sup>1</sup> –flat under attic	2000 ft <sup>2</sup>	R 38
Skylight	10 ft <sup>2</sup>	U = 0.75 SHGC=0.25
Wall 1 –faces North, CBS <sup>2</sup>	50 ft wide x 10 ft high	R4 insulated on inside
Door 1 -	24 ft <sup>2</sup>	U = 0.65
Window 1 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.65 SHGC=0.25
Wall 2 –faces East, CBS	40 ft wide x 10 ft high	R4 insulated on inside
Window 2 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.65 SHGC=0.25
Wall 3 –faces South, CBS	40 ft wide x 10 ft high	R4 insulated on inside
Window 3 – Vinyl Frame Low-e Double	15 ft <sup>2</sup>	U = 0.65 SHGC=0.25
Wall 4 –faces South, Wood <sup>3</sup> 2x4 framing fraction =0.25	10 ft wide x 10 ft high	R13
Window 4 – Vinyl Frame Low-e Double	60 ft <sup>2</sup>	U = 0.65 SHGC=0.25
Wall 5 –faces West, CBS	40 ft wide x 10 ft high	R4 insulated on inside
Window 5 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.65 SHGC=0.25
Infiltration	House Volume = 2000 ft <sup>2</sup> x 10 ft height = 20,000ft <sup>3</sup>	ACH50 = 5
Heating – heat pump	21,000 Btu/h	HSPF = 8.2
Cooling – heat pump	21,000 Btu/h	SEER = 14
Ducts – supply in attic	400 ft <sup>2</sup>	R8 insulation
Ducts – return in conditioned space	100 ft <sup>2</sup>	R6 insulation
Duct Tightness		Leakage = 0.04 cfm/square foot post construction
Air Handler – in conditioned space	21,000 Btu/h	Leakage no more than 2% of air flow rate
Mechanical Ventilation	None	N/A
Hot Water System - electric	50 gallon	EF=0.95
All Hot Water Lines	Runs 10 - 35 feet	R3 insulation
Hot Water Circulation -none	NA	NA
Lighting	100 installed fixtures	75 fixtures compact fluorescent
Pool and Spa - none	NA	NA

<sup>1</sup> Layers from outside: Attic air, R38 batt insulation with 2x4 framing with 7% framing fraction, ½” drywall

<sup>2</sup> CBS layers from outside: stucco, lathe, 8” normal density hollow core concrete block, ¾” R4 insulation board, ¾” airspace with furring at 16” on center, and ½” drywall. Solar absorptance = 0.5.

<sup>3</sup> Wood frame wall layers from outside: stucco, ½” exterior plywood, 2x4 frame with R-13 fiberglass batt insulation with a 25% total framing fraction, and ½” drywall. Solar absorptance = 0.5.

**Prescriptive Test: House M02 (Pr-M02) Characteristics – Location: Miami, Florida  
Single Family Detached Home with No Attached Garage  
Single Story, Three bedroom **red type illustrates rows with differences from M01****

Parameter	Size	Efficiency Level
Conditioned Floor Area	2000 ft <sup>2</sup>	NA
<b>Raised Floor<sup>1</sup></b>	2000 ft <sup>2</sup>	<b>R 19</b>
Roof – gable type- 5 in 12 slope No overhangs	2167 ft <sup>2</sup> above 2000 ft <sup>2</sup> conditioned space	0.75 solar absorptance
Ceiling <sup>2</sup> –flat under attic	2000 ft <sup>2</sup>	R 38
Skylight	10 ft <sup>2</sup>	U = 0.75 SHGC=0.25
<b>Wall 1 –faces North, Steel Frame<sup>3</sup></b>	50 ft wide x 10 ft high	<b>R13</b>
Door 1 -	24 ft <sup>2</sup>	U = 0.65
<b>Window 1 – Vinyl Frame Impact Resistance Glass</b>	75 ft <sup>2</sup>	<b>U = 0.75 SHGC=0.25</b>
<b>Wall 2 –faces South, Steel Frame</b>	40 ft wide x 10 ft high	<b>R13</b>
<b>Window 2 – Vinyl Frame Impact Resistance Glass</b>	75 ft <sup>2</sup>	<b>U = 0.75 SHGC=0.25</b>
<b>Wall 3 –faces South, Steel Frame</b>	40 ft wide x 10 ft high	<b>R13</b>
<b>Window 3 – Vinyl Frame Impact Resistance Glass</b>	15 ft <sup>2</sup>	<b>U = 0.75 SHGC=0.25</b>
Wall 4 –faces South, Wood <sup>4</sup> 2x4	10 ft wide x 10 ft high	R13
<b>Window 4 – Vinyl Frame Impact Resistance Glass</b>	60 ft <sup>2</sup>	<b>U = 0.75 SHGC=0.25</b>
<b>Wall 5 –faces West, Steel Frame</b>	40 ft wide x 10 ft high	<b>R13</b>
<b>Window 5 – Vinyl Frame Impact Resistance Glass</b>	75 ft <sup>2</sup>	<b>U = 0.75 SHGC=0.25</b>
Infiltration	House Volume = 2000 ft <sup>2</sup> x 10 ft height = 20,000ft <sup>3</sup>	ACH50 = 5
Heating – heat pump	21,000 Btu/h	HSPF = 8.2
Cooling – heat pump	21,000 Btu/h	SEER = 14
Ducts – supply in attic	400 ft <sup>2</sup>	R8 insulation
Ducts – return in conditioned space	100 ft <sup>2</sup>	R6 insulation
Duct Tightness		Leakage = 0.04 cfm/square foot post construction
Air Handler – in conditioned space	21,000 Btu/h	Rated leakage < 2% of air flow rate
Mechanical Ventilation	None	N/A
Hot Water System - electric	50 gallon	EF=0.95
All Hot Water Lines	Runs 10 - 35 feet	R3 insulation
Hot Water Circulation -none	NA	NA
Lighting	100 installed fixtures	75% fixtures compact fluorescent
Pool and Spa - none	NA	NA

<sup>1</sup> Layers from outside: Air, R19 batt insulation and 2x6 trusses with 15% framing fraction, 3/4" plywood, R2 carpet

<sup>2</sup> Layers from outside: Attic air, R38 batt insulation with 2x4 framing with 7% framing fraction, 1/2" drywall

<sup>3</sup> Steel frame wall layers from outside: stucco, 1/2" exterior plywood, 2x4 steel frame 16" on center, with R-13 fiberglass batt insulation, and 1/2" drywall. Solar absorptance = 0.5.

<sup>4</sup> Wood frame wall layers from outside: stucco, 1/2" exterior plywood, 2x4 frame with R-13 fiberglass batt insulation with a 25% total framing fraction, and 1/2" drywall. Solar absorptance = 0.5.

**Prescriptive Test: House M03 (Pr-M03) Characteristics – Location: Miami, Florida**  
**Single Family Detached Home with No Attached Garage**  
**Single Story, Three bedroom    red type illustrates rows with differences from M01**

Parameter	Size	Efficiency Level
Conditioned Floor Area	2000 ft <sup>2</sup>	NA
Slab-on-grade Floor	50x40 perimeter	No insulation
Roof – gable type- 5 in 12 slope No overhangs	2167 ft <sup>2</sup> above 2000 ft <sup>2</sup> conditioned space	0.75 solar absorptance
<b>Ceiling<sup>1</sup> –flat under attic</b>	2000 ft <sup>2</sup>	<b>R 30</b>
Skylight	10 ft <sup>2</sup>	U = 0.75    SHGC=0.25
<b>Wall 1 –faces North, CBS<sup>2</sup></b>	50 ft wide x 10 ft high	<b>R4 and insulated core</b>
Door 1 -	24 ft <sup>2</sup>	U = 0.65
Window 1 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.65    SHGC=0.25
<b>Wall 2 –faces East, CBS</b>	40 ft wide x 10 ft high	<b>R4 and insulated core</b>
Window 2 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.65    SHGC=0.25
<b>Wall 3 –faces South, CBS</b>	40 ft wide x 10 ft high	<b>R4 and insulated core</b>
Window 3 – Vinyl Frame Low-e Double	15 ft <sup>2</sup>	U = 0.65    SHGC=0.25
Wall 4 –faces South, Wood <sup>3</sup> 2x4 framing fraction =0.25	10 ft wide x 10 ft high	R13
Window 4 – Vinyl Frame Low-e Double	60 ft <sup>2</sup>	U = 0.65    SHGC=0.25
<b>Wall 5 –faces West, CBS</b>	40 ft wide x 10 ft high	<b>R4 and insulated core</b>
Window 5 – Vinyl Frame Low-e Double	75 ft <sup>2</sup>	U = 0.65    SHGC=0.25
Infiltration	House Volume = 2000 ft <sup>2</sup> x 10 ft height = 20,000ft <sup>3</sup>	ACH50 = 5
Heating – heat pump	21,000 Btu/h	HSPF = 8.2
Cooling – heat pump	21,000 Btu/h	SEER = 14
<b>Ducts – supply in attic</b>	400 ft <sup>2</sup>	<b>R6 insulation</b>
Ducts – return in conditioned space	100 ft <sup>2</sup>	R6 insulation
Duct Tightness		Leakage = 0.04 cfm/square foot post construction
Air Handler – in conditioned space	21,000 Btu/h	Leakage no more than 2% of air flow rate
Mechanical Ventilation	None	N/A
Hot Water System - electric	50 gallon	EF=0.95
All Hot Water Lines	Runs 10 - 35 feet	R3 insulation
Hot Water Circulation -none	NA	NA
Lighting	100 installed fixtures	75% fixtures compact fluorescent
Pool and Spa - none	NA	NA

<sup>1</sup> Layers from outside: Attic air, R30 batt insulation with 2x4 framing with 7% framing fraction, ½” drywall

<sup>2</sup> CBS layers from outside: stucco, lathe, 8” normal density perlite insulated core concrete block, ¾” R4 insulation board, ¾” airspace with furring at 16” on center, and ½” drywall. Solar absorptance = 0.5.

<sup>3</sup> Wood frame wall layers from outside: stucco, ½” exterior plywood, 2x4 frame with R-13 fiberglass batt insulation with a 25% total framing fraction, and ½” drywall. Solar absorptance = 0.5.

## **R2.4 Sample Reports for the Prescriptive R-value method**

The following sample reports show recommended formats.

FORM R402-2017

**RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST**

*Florida Department of Business and Professional Regulation  
Residential R-Value Computation Prescriptive Method*

*Applications for compliance with the 2017 Florida Building Code, Energy Conservation via the Residential R-Value computation prescriptive method shall include*

- This Checklist
- Form R402-2017 which includes the parameters of Table R402.1.2 (two pages)
- Input Summary Checklist Report (usually 4 pages/may be greater)
- Energy Performance Level (EPL) Display Card (one page)
- HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- Mandatory requirements (five pages)

*Required prior to CO for the R-Value computation method:*

- A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page)
- A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply
- A completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located entirely within the building thermal envelope.

# R-Value Method-2017 Report - SAMPLE

<b>Florida Building Code, Energy Conservation</b>		
Residential Building Thermal Envelope Approach		
FORM R402-2017	R-Value Computation Method	Florida Climate Zone [X]

**Scope:** Compliance with Section R401.2(1) of the Florida Building Code, Energy Conservation, shall be demonstrated by the use of Form R402 for single- and multiple-family residences of three stories or less in height, additions to existing residential buildings, alterations, renovations and building systems in existing buildings, as applicable. To comply, a building must meet or exceed all of the energy efficiency requirements on Table R402A and all applicable mandatory requirements summarized in Table R402B of this form. If a building does not comply with this method, or by the UA Alternative method, it may still comply under Section R405 of the Florida Building Code, Energy Conservation.

PROJECT NAME: AND ADDRESS:	BUILDER:
OWNER:	PERMITTING OFFICE:
	JURISDICTION NUMBER:
	PERMIT NUMBER:

**General Instructions:**

1. Fill in all the applicable spaces of the "To Be Installed" column on Table R402A with the information requested. All "To Be Installed" values must be equal to or more efficient than the required levels.
2. Complete page 1 based on the "To Be Installed" column information.
3. Read the requirements of Table R402B and check each box to indicate your intent to comply with all applicable items.
4. Read, sign and date the "Prepared By" certification statement at the bottom of page 1. The owner or owner's agent must also sign and date the form.

		Check
1. New construction, addition, or existing building	1.	_____
2. Single-family detached or multiple-family attached	2.	_____
3. If multiple-family, number of units covered by this submission	3.	_____
4. Is this a worst case? (yes/no)	4.	_____
5. Conditioned floor area (sq. ft.)	5.	_____
6. Windows type and area:		
a) U-factor:	6a.	_____
b) Solar Heat Gain Coefficient (SHGC):	6b.	_____
c) Area:	6c.	_____
7. Skylights, type and area:		
a) U-factor:	7a.	_____
b) Solar Heat Gain Coefficient (SHGC):	7b.	_____
c) Skylight area:	7c.	_____
8. Floor type, area or perimeter, and insulation:(Total exposed area = [XXX] sq ft)		
a) Slab-on-grade (R-value)	8a.	_____
b) Wood, raised (R-value)	8b.	_____
c) Wood, common (R-value)	8c.	_____
d) Concrete, raised (R-value)	8d.	_____
e) Concrete, common (R-value)	8e.	_____
9. Wall type, area and insulation:(Total exposed area = [XXX] sq ft)		
a) Exterior: 1. Wood frame (Insulation R-value)	9a1.	_____
2. Masonry (Insulation R-value)	9a2.	_____
b) Adjacent: 1. Wood frame (Insulation R-value)	9b1.	_____
2. Masonry (Insulation R-value)	9b2.	_____
10. Ceiling type, area and insulation:(Total exposed area = [XXX] sq ft)		
a) Attic (Insulation R-value)	10a.	_____
b) Single assembly (Insulation R-value)	10b.	_____
11. Air distribution system:		
a) Duct insulation	11a.	_____
b) AHU location	11b.	_____
c) Total Duct Leakage, Test report attached	11c.	_____
12. Cooling system:		
a) type:	12a.	_____
b) efficiency	12c.	_____
13. Heating system:		
a) type:	13a.	_____
b) efficiency	13b.	_____
14. HVAC sizing calculation: attached	14.	<a href="#">Verify attachment</a>
15. Water heating system:		
a) type	15a.	_____
b) efficiency	15b.	_____

<p>I hereby certify that the plans and specifications covered by this form are in compliance with the <i>Florida Building Code, Energy Conservation</i>.</p> <p>PREPARED BY: _____ Date _____</p> <p>I hereby certify that this building is in compliance with the <i>Florida Building Code, Energy Conservation</i>.</p> <p>OWNER/AGENT: _____ Date _____</p>	<p>Review of plans and specifications covered by this form indicate compliance with the <i>Florida Building Code, Energy Conservation</i> Before construction is complete, this building will be inspected for compliance in accordance with Section 553.908, F.S.</p> <p>CODE OFFICIAL: _____ Date _____</p>
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## R-Value Method-2017 Report - SAMPLE

FORM R402-2017

**TABLE 402A**

**R-Value Calculation Method = [PASS/FAIL]**

BUILDING COMPONENT	PRESCRIPTIVE REQUIREMENTS <sup>1</sup>		INSTALLED VALUES	
	Climate Zone 1	Climate Zone 2	Fens. U-Factor(Ave) = [X.XX]	[PASS/FAIL]
Windows	U-Factor = NR <sup>2</sup>	U-Factor = 0.40 <sup>2</sup>	U-Factor(Avg) = [X.XX]	[PASS/FAIL]
	SHGC = 0.25	SHGC = 0.25	SHGC(Avg) = [X.XX]	[PASS/FAIL]
Skylights	U-Factor = 0.75	U-Factor = 0.65	Not Applicable	[PASS/FAIL]
	SHGC = 0.30	SHGC = 0.30	Not Applicable	[PASS/FAIL]
Doors: Exterior door	U-Factor = NR <sup>3</sup>	U-Factor = 0.40 <sup>3</sup>	U-Factor(Max) = [X.XX]	[PASS/FAIL]
Floors: Slab-on-Grade	NR	NR	Not Applicable	[PASS/FAIL]
Over unconditioned spaces <sup>4</sup>	R-13	R-13	R-Value = [X.XX]	[PASS/FAIL]
Walls: Ext. and Adj.				
Frame	R-13	R-13	R-Value(Min) = [X.XX]	[PASS/FAIL]
Mass(Insulation on wall interior):	R-4	R-6	R-Value(Min) = [X.XX]	[PASS/FAIL]
Mass(Insulation on wall exterior):	R-3	R-4	R-Value(Min) = [X.XX]	[PASS/FAIL]
Common(multifamily):	Fr:R-11, Mass:R-6	Fr:R-11, Mass:R-6	R-Value(Min) = [X.XX]	[PASS/FAIL]
Ceilings: Exposed	R-30	R-38	R-Value = [X.XX]	[PASS/FAIL]
Common	R-11	R-11	Not Applicable	[PASS/FAIL]
Air infiltration:	Blower door test is required on the building envelope to verify leakage ≤ 7 ACH50; Test report provided to code official.		Total leakage(ACH50) = [X.XX]	[PASS/FAIL]
			Test report attached? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Air distribution system <sup>5</sup> :				
Air handling unit	Not allowed in attic Factory Sealed AHU		AHU Location =	[PASS/FAIL]
Duct R-Value	≥ R-8 (duct in unconditioned attics, Diameter ≥ 3 in.) ≥ R-4.2 (Ducts in uncond.(not attics), Diam. < 3 in.) ≥ R-6 (all other unconditioned ducts).		Factory Sealed = [Yes/No]	[PASS/FAIL]
Air Leakage <sup>5</sup> /Duct test	Air handler installed: Total leakage ≤ 4 cfm/100 s.f. Air handler Not installed: Total leakage ≤ 3 cfm/100 s.f.		R-Value(Ducts in unc. attic) =	[PASS/FAIL]
Ducts in conditioned space	Test not required if all ducts and AHU are in conditioned space.		R-Value(Small Ducts in unc) =	[PASS/FAIL]
			R-Value(Others in unc. space) =	[PASS/FAIL]
			Test report required? [Yes/No]	[PASS/FAIL]
			Duct Location =	[PASS/FAIL]
Air conditioning systems:	Minimum federal standard required by NAECA <sup>6</sup>			
Central system ≤ 65,000 Btu/h	SEER=14.0		SEER(Min) = [X.XX]	[PASS/FAIL]
PTAC	EER [from Table C403.2.3(3)]		EER(Min) = [X.XX]	[PASS/FAIL]
Other:	See Tables C403.2.3(1) - (11)			
Heating systems:	Minimum federal standard required by NAECA <sup>6</sup>			
Heating Pump ≤ 65,000 Btu/h	HSPF = 8.2		HSPF(Min) = [X.XX]	[PASS/FAIL]
Gas Furnace, non-weatherized	AFUE 80%		AFUE(Min) = [X.XX]	[PASS/FAIL]
Oil Furnace, non-weatherized	AFUE 83%		AFUE(Min) = [X.XX]	[PASS/FAIL]
Other:				
Water heating system (storage type):	Minimum federal standard required by NAECA <sup>6</sup>			
Electric: <sup>7</sup>	40 gallons: EF=0.948, 50 gallons: EF=0.945		[XX] gallons: EF = [X.XX]	[PASS/FAIL]
Gas fired: <sup>8</sup>	40 gallons: EF=0.615, 50 gallons: EF=0.60		[XX] gallons: EF = [X.XX]	[PASS/FAIL]
Other (describe):				

NR = No requirement

(1) Each component present in the As Proposed home must meet or exceed each of the applicable performance criteria in order to comply with this code using this method.

(2) For impact rated fenestration complying with Section R301.2.1.2 of the Florida Building Code, Residential or Section 1609.1.2 of the Florida Building Code, Building, the maximum U-factor shall be 0.65 in Climate Zone 2. An area-weighted average of U-factor and SHGC shall be accepted to meet the requirements, or up to 15 square feet of glazed fenestration area are exempted from the U-factor and SHGC requirement based on Sections R402.3.1, R402.3.2 and R402.3.3.

(3) One side-hinged opaque door assembly up to 24 square feet is exempted from this U-factor requirement.

(4) R-values are for insulation material only as applied in accordance with manufacturer's installation instructions. For mass walls, the "interior of wall" requirement must be met except if at least 50 percent of the insulation required for the "exterior of wall" is installed exterior of, or integral to, the wall.

(5) Ducts & AHU installed "substantially leak free" per Section R403.3.2. Test required by either individuals as defined in Section 553.993(5) or (7), Florida Statutes, or individuals licensed as set forth in Section 489.105(3)(f), (g) or (i), Florida Statutes. The total leakage test is not required for ducts and air handlers located entirely within the building thermal envelope.

(6) Minimum efficiencies are those set by the National Appliance Energy Conservation Act of 1987 for typical residential equipment and are subject to NAECA rules and regulations. For other types of equipment, see Tables C403.2.3(1-11) of the Commercial Provisions of the Florida Building Code, Energy Conservation.

(7) For electric storage volumes ≤ 55, min. EF = 0.960 – (0.0003 \* volume). For electric storage volumes > 55, min. EF = 2.057 – (0.00113 \* volume).

(8) For natural gas storage volumes ≤ 55, min. EF = 0.675 – (0.0015 \* volume). For natural gas storage volumes > 55, min. EF = 0.8012 – (0.00078 \* volume).

MM/DD/YY HH:MM [AM/PM]

\*\* Software Title and Version Here \*\* - FBC 6<sup>th</sup> Edition (2017) Compliant Software

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## R-Value Method-2017 Report – SAMPLE

FORM R402-2017

TABLE R402B MANDATORY REQUIREMENTS			
Component	Section	Summary of Requirement(s)	Check
Air leakage	R402.4	To be caulked, gasketed, weatherstripped or otherwise sealed per Table R402.4.1.1. Recessed lighting: IC-rated as having $\leq 2.0$ cfm tested to ASTM E 283. Windows and doors: 0.3 cfm/sq. ft. (swinging doors: 0.5 cfm/sf) when tested to NFRC 400 or AAMA/WDMA/CSA 1011/S. 2/A440. Fireplaces: Tight-fitting flue dampers & outdoor combustion air.	
Programmable thermostat	R403.1.2	A programmable thermostat is required for the primary heating or cooling system.	
Air distribution system	R403.3.2 R403.3.4	Ducts shall be tested as per Section R403.3.2 by either individuals as defined in Section 553.993(5) or (7), <i>Florida Statutes</i> , or individuals licensed as set forth in Section 489.105(3) (f), (g) or (i), <i>Florida Statutes</i> . Air handling units are not allowed in attics.	
Water heaters	R403.5	Comply with efficiencies in Table C404.2. Hot water pipes insulated to $\geq R-3$ to kitchen outlets, other cases. Circulating systems to have an automatic or accessible manual OFF switch. Heat trap required for vertical pipe risers.	
Swimming pools & spas	R403.10	Spas and heated pools must have vapor-retardant covers or a liquid cover or other means proven to reduce heat loss except if 70% of heat from site-recovered energy. Off/timer switch required. Gas heaters minimum thermal efficiency is 82%. Heat pump pool heaters minimum COP is 4.0.	
Cooling/heating equipment	R403.7	Sizing calculation performed & attached. Special occasion cooling or heating capacity requires separate system or variable capacity system.	
Lighting equipment	R404.1	At least 75% of permanently installed lighting fixtures shall be high-efficacy lamps.	

MM/DD/YY HH:MM [AM/PM]

\*\* Software Title and Version Here \*\* - FBC 6<sup>th</sup> Edition (2017) Compliant Software

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## Appendix R-3 Prescriptive U-Factor Alternative Method

The software must produce a report that compares the U-factors of the entered house against those that are in Table R402.1.4 of the Florida Energy Code. To comply, the software must report on the results of six houses described in [Section R-2.3](#) of this Manual. The U-factors shall be inclusive of the framing fractions and other materials. The software must accurately calculate the average window U-factor and SHGC according to the code, including any exceptions.

### R3.1 Testing

The software vendor shall download and complete the spreadsheet file titled “Residential Prescriptive Compliance Test 2017.” The file has six yellow-highlighted tabs, one for each house. On each tab is a section for U-Factor Alternative Method. It is the second block of entries on each page –scroll down past the R-Value method. Complete each yellow highlighted field. If the value entered is the expected value or result, the green highlighted field adjacent will indicate “Pass.” There is also a box indicating if the software would indicate if the home passes compliance. Again, indicate what the software indicated. If the value is expected the green field will indicate “Pass.” For a house where the expected result is that the home fails to comply, the entered choice of “Fails” will yield a “Pass.” Each yellow highlighted field must be accurate in order for the software to pass the test. If the results computed by the software fall outside the range indicated on the excel report and the vendor believes that their value is correct they may include an explanation. If submitting for multiple prescriptive methods, submit just one spreadsheet file, completing each prescriptive block of entries for each method seeking software approval. Save the file with the name “Residential Prescriptive Compliance Test 2017 –[software name].”

### R3.2 Residential U-Factor Alternative Method Report

A pdf file shall be prepared and labeled “U-Factor Reports from [software name].” It shall include the required reports for house T01, followed by T02, T03, M01, M02 and M03. Sample report formats are provided in Section R3.3 of this Manual. For each house include the following:

- 1) U-factor prescriptive report that includes the information in Table R402.1.4 for the home
- 2) Input summary checklist report. Sample Form is in [Appendix R-7](#) of this Manual (usually four pages/may be greater)
- 3) Energy Performance Level (EPL) Display Card (one page). Sample Form is in [Appendix R-8](#).
- 4) HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- 5) Mandatory requirements summarized in [Appendix R-9](#) of this Manual (usually five pages/may be greater)

For house T01 also include the following reports from the software:

- 6) A checklist of reports to be submitted;
- 7) A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page). See [Appendix R-10](#) of this Manual.
- 8) A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See [Appendix R-11](#) of this Manual.
- 9) A completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located within the building thermal envelope. See [Appendix R-12](#) of

this Manual.

### **R3.3 Sample Reports for the Prescriptive U-Factor Alternative Method**

The following sample reports show recommended formats.

U-Factor Report-2017

**RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST**

*Florida Department of Business and Professional Regulation  
Residential U-Factor Computation Prescriptive Method*

*Applications for compliance with the 2017 Florida Building Code, Energy Conservation via the Residential U-Factor Alternative prescriptive method shall include*

- This Checklist
- U-Factor Report - 2017 which includes the parameters of Table R402.1.4 (two pages)
- Input Summary Checklist Report (usually 4 pages/may be greater)
- Energy Performance Level (EPL) Display Card (one page)
- HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- Mandatory requirements (five pages)

*Required prior to CO for the U-Factor method:*

- A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page)
- A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply.
- A completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located entirely within the building thermal envelope.

U-Factor Alternative Method-2017 Report - SAMPLE

<b>Florida Building Code, Energy Conservation</b>		
Residential Building Thermal Envelope Approach		
U-Factor Report-2017	U-Factor Alternative Method	Florida Climate Zone [X]

**Scope:** Compliance with Section R401.2(1) of the Florida Building Code, Energy Conservation, shall be demonstrated by the use of U-Factor Alternative Method-2017 for single- and multiple-family residences of three stories or less in height, additions to existing residential buildings, alterations, renovations and building systems in existing buildings, as applicable. To comply, a building must meet or exceed all of the energy efficiency requirements on Table R402U and all applicable mandatory requirements summarized in Table R402B of this form. If a building does not comply with this method, or by the R-Value or by the UA Alternative method, it may still comply under Section R405 of the Florida Building Code, Energy Conservation.

PROJECT NAME: AND ADDRESS:	BUILDER:
OWNER:	PERMITTING OFFICE:
	JURISDICTION NUMBER:
	PERMIT NUMBER:

**General Instructions:**

1. Fill in all the applicable spaces of the "To Be Installed" column on Table R402U with the information requested. All "To Be Installed" values must be equal to or more efficient than the required levels.
2. Complete page 1 based on the "To Be Installed" column information.
3. Read the requirements of Table R402B and check each box to indicate your intent to comply with all applicable items.
4. Read, sign and date the "Prepared By" certification statement at the bottom of page 1. The owner or owner's agent must also sign and date the form.

		Check
1. New construction, addition, or existing building	1. _____	_____
2. Single-family detached or multiple-family attached	2. _____	_____
3. If multiple-family, number of units covered by this submission	3. _____	_____
4. Is this a worst case? (yes/no)	4. _____	_____
5. Conditioned floor area (sq. ft.)	5. _____	_____
6. Windows type and area:		
a) U-factor:	6a. _____	_____
b) Solar Heat Gain Coefficient (SHGC):	6b. _____	_____
c) Area:	6c. _____	_____
7. Skylights, type and area:		
a) U-factor:	7a. _____	_____
b) Solar Heat Gain Coefficient (SHGC):	7b. _____	_____
c) Skylight area:	7c. _____	_____
8. Floor type, area or perimeter, and insulation:(Total exposed area = [XXX] sq ft)		
a) Slab-on-grade (U-Factor)	8a. _____	_____
b) Wood, raised (U-Factor)	8b. _____	_____
c) Wood, common (U-Factor)	8c. _____	_____
d) Concrete, raised (U-Factor)	8d. _____	_____
e) Concrete, common (U-Factor)	8e. _____	_____
9. Wall type, area and insulation:(Total exposed area = [XXX] sqft)		
a) Exterior:		
1. Wood frame (Insulation U-Factor)	9a1. _____	_____
2. Masonry (Insulation U-Factor)	9a2. _____	_____
b) Adjacent:		
1. Wood frame (Insulation U-Factor)	9b1. _____	_____
2. Masonry (U-Factor)	9b2. _____	_____
10. Ceiling type, area and insulation:(Total exposed area = [XXX] sqft)		
a) Attic (U-Factor)	10a. _____	_____
b) Single assembly (U-Factor)	10b. _____	_____
11. Air distribution system:		
a) Duct insulation	11a. _____	_____
b) AHU location	11b. _____	_____
c) Total Duct Leakage, Test report attached	11c. _____	_____
12. Cooling system:		
a) type:	12a. _____	_____
b) efficiency	12c. _____	_____
13. Heating system:		
a) type:	13a. _____	_____
b) efficiency	13b. _____	_____
14. HVAC sizing calculation: attached	14. <a href="#">Verify attachment</a>	_____
15. Water heating system:		
a) type	15a. _____	_____
b) efficiency	15b. _____	_____

I hereby certify that the plans and specifications covered by this form are in compliance with the <i>Florida Building Code, Energy Conservation</i> . PREPARED BY: _____ Date _____	Review of plans and specifications covered by this form indicate compliance with the <i>Florida Building Code, Energy Conservation</i> Before construction is complete, this building will be inspected for compliance in accordance with Section 553.908, F.S.
I hereby certify that this building is in compliance with the <i>Florida Building Code, Energy Conservation</i> . OWNER/AGENT: _____ Date _____	CODE OFFICIAL: _____ Date _____

## U-Factor Alternative Method-2017 Report - SAMPLE

U-Factor Report-2017

**TABLE 402U** U-Factor Alternative Method = [PASS/FAIL]

BUILDING COMPONENT	PRESCRIPTIVE REQUIREMENTS <sup>1</sup>		INSTALLED VALUES	
	Climate Zone 1	Climate Zone 2	Fens. U-Factor(Ave) = [X.XX]	[PASS/FAIL]
Windows	U-Factor = NR <sup>2</sup> SHGC = 0.25	U-Factor = 0.40 <sup>2</sup> SHGC = 0.25	U-Factor(Avg) = [X.XX] SHGC(Avg) = [X.XX]	[PASS/FAIL] [PASS/FAIL]
Skylights	U-Factor = 0.75 SHGC = 0.30	U-Factor = 0.65 SHGC = 0.30	Not Applicable Not Applicable	[PASS/FAIL] [PASS/FAIL]
Doors: Exterior door	U-Factor = 0.50	U-Factor = 0.40	U-Factor(Max) = [X.XX]	[PASS/FAIL]
Floors: Slab-on-Grade Over unconditioned spaces <sup>3</sup>	NR U-Factor = 0.064	NR U-Factor = 0.064	Not Applicable U-Factor(Max) = [X.XX]	[PASS/FAIL] [PASS/FAIL]
Walls: Ext. and Adj. Frame Mass:	U-Factor = 0.084 U-Factor = 0.197	U-Factor = 0.084 U-Factor = 0.165	U-Factor(Max) = [X.XX] U-Factor(Max) = [X.XX]	[PASS/FAIL] [PASS/FAIL]
Common(multifamily):	Fr:R-11, Mass:R-6	Fr:R-11, Mass:R-6	R-Value(Min) = [X.XX]	[PASS/FAIL]
Ceilings: Exposed Common	U-Factor = 0.035 R-11	U-Factor = 0.030 R-11	U-Factor = [X.XX] R-Value(Min) = [X.XX]	[PASS/FAIL] [PASS/FAIL]
Air infiltration:	Blower door test is required on the building envelope to verify leakage $\leq$ 7 ACH50; Test report provided to code official.		Total leakage(ACH50) = [X.XX] Test report attached? <input type="checkbox"/> Yes <input type="checkbox"/> No	[PASS/FAIL]
Air distribution system <sup>4</sup> : Air handling unit  Duct R-Value  Air Leakage <sup>4</sup> /Duct test  Ducts in conditioned space	Not allowed in attic Factory Sealed AHU $\geq$ R-8 (duct in unconditioned attics, Diameter $\geq$ 3 in.) $\geq$ R-4.2 (Ducts in uncond.(not attics), Diam. < 3 in.) $\geq$ R-6 (all other unconditioned ducts). Air handler installed: Total leakage $\leq$ 4 cfm/100 s.f. Air handler Not installed: Total leakage $\leq$ 3 cfm/100 s.f. Test not required if all ducts and AHU are in conditioned space.		AHU Location = [PASS/FAIL] Factory Sealed = [Yes/No] [PASS/FAIL] R-Value(Ducts in unc. attic) = [PASS/FAIL] R-Value(Small Ducts in unc) = [PASS/FAIL] R-Value(Others in unc. space) = [PASS/FAIL] Test report required? [Yes/No] [PASS/FAIL] Duct Location = [PASS/FAIL]	[PASS/FAIL] [PASS/FAIL] [PASS/FAIL] [PASS/FAIL] [PASS/FAIL] [PASS/FAIL]
Air conditioning systems: Central system $\leq$ 65,000 Btu/h PTAC Other:	Minimum federal standard required by NAECA <sup>5</sup> SEER=14.0 EER [from Table C403.2.3(3)] See Tables C403.2.3(1) - (11)		SEER(Min) = [X.XX] EER(Min) = [X.XX]	[PASS/FAIL] [PASS/FAIL]
Heating systems: Heating Pump $\leq$ 65,000 Btu/h Gas Furnace, non-weatherized Oil Furnace, non-weatherized Other:	Minimum federal standard required by NAECA <sup>5</sup> HSPF = 8.2 AFUE 80% AFUE 83%		HSPF(Min) = [X.XX] AFUE(Min) = [X.XX] AFUE(Min) = [X.XX]	[PASS/FAIL] [PASS/FAIL] [PASS/FAIL]
Water heating system (storage type): Electric: <sup>6</sup> Gas fired: <sup>7</sup> Other (describe):	Minimum federal standard required by NAECA <sup>5</sup> 40 gallons: EF=0.948, 50 gallons: EF=0.945 40 gallons: EF=0.615, 50 gallons: EF=0.60		[XX] gallons: EF = [X.XX] [XX] gallons: EF = [X.XX]	[PASS/FAIL] [PASS/FAIL]

NR = No requirement

(1) Each component present in the As Proposed home must meet or exceed each of the applicable performance criteria in order to comply with this code using this method.

(2) For impact rated fenestration complying with Section R301.2.1.2 of the Florida Building Code, Residential or Section 1609.1.2 of the Florida Building Code, Building, the maximum U-factor shall be 0.65 in Climate Zone 2. An area-weighted average of U-factor and SHGC shall be accepted to meet the requirements, or up to 15 square feet of glazed fenestration area are exempted from the U-factor and SHGC requirement based on Sections R402.3.1 and R402.3.2.

(3) U-Factor are for insulation material only as applied in accordance with manufacturer's installation instructions. For mass walls, the "interior of wall" requirement must be met except if at least 50 percent of the insulation required for the "exterior of wall" is installed exterior of, or integral to, the wall.

(4) Ducts & AHU installed "substantially leak free" per Section R403.3.2. Test required by either individuals as defined in Section 553.993(5) or (7), Florida Statutes, or individuals licensed as set forth in Section 489.105(3)(f), (g) or (i), Florida Statutes. The total leakage test is not required for ducts and air handlers located entirely within the building thermal envelope.

(5) Minimum efficiencies are those set by the National Appliance Energy Conservation Act of 1987 for typical residential equipment and are subject to NAECA rules and regulations. For other types of equipment, see Tables C403.2.3(1-11) of the Commercial Provisions of the Florida Building Code, Energy Conservation.

(6) For electric storage volumes  $\leq$  55, min. EF = 0.960 - (0.0003 \* volume). For electric storage volumes > 55, min. EF = 2.057 - (0.00113 \* volume).

(7) For natural gas storage volumes  $\leq$  55, min. EF = 0.675 - (0.0015 \* volume). For natural gas storage volumes > 55, min. EF = 0.8012 - (0.00078 \* volume).

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## U-Factor Alternative Method-2017 Report - SAMPLE

U-Factor Report-2017

TABLE R402B MANDATORY REQUIREMENTS			
Component	Section	Summary of Requirement(s)	Check
Air leakage	R402.4	To be caulked, gasketed, weatherstripped or otherwise sealed per Table R402.4.1.1. Recessed lighting: IC-rated as having $\leq 2.0$ cfm tested to ASTM E 283. Windows and doors: 0.3 cfm/sq. ft. (swinging doors: 0.5 cfm/sf) when tested to NFRC 400 or AAMA/WDMA/CSA 101/I.S. 2/A440. Fireplaces: Tight-fitting flue dampers & outdoor combustion air.	
Programmable thermostat	R403.1.2	A programmable thermostat is required for the primary heating or cooling system.	
Air distribution system	R403.3.2 R403.3.4	Ducts shall be tested as per Section R403.3.2 by either individuals as defined in Section 553.993(5) or (7), <i>Florida Statutes</i> , or individuals licensed as set forth in Section 489.105(3) (f), (g) or (j), <i>Florida Statutes</i> . Air handling units are not allowed in attics.	
Water heaters	R403.5	Comply with efficiencies in Table C404.2. Hot water pipes insulated to $\geq R-3$ to kitchen outlets, other cases. Circulating systems to have an automatic or accessible manual OFF switch. Heat trap required for vertical pipe risers.	
Swimming pools & spas	R403.10	Spas and heated pools must have vapor-retardant covers or a liquid cover or other means proven to reduce heat loss except if 70% of heat from site-recovered energy. Off/timer switch required. Gas heaters minimum thermal efficiency is 82%. Heat pump pool heaters minimum COP is 4.0.	
Cooling/heating equipment	R403.7	Sizing calculation performed & attached. Special occasion cooling or heating capacity requires separate system or variable capacity system.	
Lighting equipment	R404.1	At least 75% of permanently installed lighting fixtures shall be high-efficacy lamps.	

## Appendix R-4 Prescriptive Total UA Alternative Method

The software must produce a report that compares the UA of the entered home to the total UA determined based on the same areas and the U-factors given in Table R402.1.4 of the Florida Energy Code. To comply, the software must report on the results of six houses described in [Section R-2.3](#) of this Manual. The U-factors shall be inclusive of the framing fractions and other materials. The software must accurately calculate the average window U-factor and SHGC according to the code, including any exceptions.

### R4.1 Testing

The software vendor shall download and complete the spreadsheet file titled “Residential Prescriptive Compliance Test 2017.” The file has six yellow-highlighted tabs, one for each house. On each tab is a section for Total UA Alternative Method. It is the third block of entries on each page –scroll down past the R-Value and U-Factor methods. Complete each yellow highlighted field. If the value entered is the expected value or result, the green highlighted field adjacent will indicated “Pass.” There is also a box indicating if the software would indicate if the home passes compliance. Again, indicate what the software indicated. If the value is expected the green field will indicate “Pass.” For a house where the expected result is that the home fails to comply, the entered choice of “Fails” will yield a “Pass.” Each yellow highlighted field must be accurate in order for the software to pass the test. If the results computed by the software fall outside the range indicated on the excel report and the vendor believes that their value is correct they may include an explanation. If submitting for multiple prescriptive methods, submit just one spreadsheet file, completing each prescriptive block of entries for each method seeking software approval. Save the file with the name “Residential Prescriptive Compliance Test 2017 –[software name].”

### R4.2 Residential Total UA Alternative Method Report

A pdf file shall be prepared and labeled “UA-Factor Reports from [software name].” It shall include the required reports for house T01, followed by T02, T03, M01, M02 and M03. Sample report formats are provided in Section R4.3 of this Manual. For each house include the following:

- 1) Total UA Report including Total UA Alternative Prescriptive Requirements Checklist (two pages)
- 2) Input summary checklist report. Sample Form is in [Appendix R-7](#) of this Manual (usually four pages/may be greater)
- 3) Energy Performance Level (EPL) Display Card (one page). Sample Form is in [Appendix R-8](#).
- 4) HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- 5) Mandatory requirements summarized in [Appendix R-9](#) of this Manual (usually five pages/may be greater)

For house T01 also include the following reports from the software:

- 6) A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page). See [Appendix R-10](#) of this Manual.
- 7) A completed Form 2017 Envelope Leakage Test Report (usually one page). See [Appendix R-11](#) of this Manual.
- 8) A completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work

and air handler units are located within the building thermal envelope. See [Appendix R-12](#) of this Manual.

### **R4.3 Sample Reports for the Prescriptive Total UA Alternative Method**

The following sample reports show recommended formats.



Total UA Report-2017

**RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST**

*Florida Department of Business and Professional Regulation  
Residential Total UA Prescriptive Method*

*Applications for compliance with the 2017 Florida Building Code, Energy Conservation via the residential Total UA Alternative prescriptive method should include*

- This Checklist
- Total UA Report including Total UA Alternative Prescriptive Requirements Checklist (two pages)
- Input Summary Checklist Report (usually 4 pages/may be greater)
- Energy Performance Level (EPL) Display Card (one page)
- HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- Mandatory requirements (five pages)

*Required prior to CO for the Total UA method:*

- A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page)
- A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply
- A completed Form 2017 Duct Leakage Test Report (usually one page), unless all duct work and air handler units are located entirely within the building thermal envelope. .

Total UA Alternative Method-2017 Report - SAMPLE

Total UA Report-2017

**FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION**

Residential Total UA Alternative Method

Project Name: 2017_Sample	Builder Name:
Street: Anyplace	Permit Office:
City, State, Zip: [CITY], FL [ZIP]	Permit Number:
Owner:	Jurisdiction:
Design Location: FL, [CITY]	County: [COUNTY] (FL Climate Zone [X])

1. New construction or existing	New (From Plans)	4. Number of Bedrooms	[X]
2. Single family or multiple family	Single-family	5. Conditioned floor area above grade (ft²)	[XXXX]
3. Number of units, if multiple family		6. Conditioned floor area below grade (ft²)	[XXXX]

Proposed UA	
Windows	[XXX.X]
Doors	[XXX.X]
Walls	[XXX.X]
Floor	[XXX.X]
Ceiling	[XXX.X]
Overall UA	[XXX.X]

Baseline UA	
Windows	[XXX.X]
Doors	[XXX.X]
Walls	[XXX.X]
Floor	[XXX.X]
Ceiling	[XXX.X]
Overall UA	[XXX.X]

Compliance Criteria

Overall UA	[XXX.X]	[PASS/FAIL]	
Window-to-Floor Area	[XX.X]%		
SHGC Area Weighted	[X.XX](vert)	[PASS/FAIL]	
Air Handler Location	[LOCATION]	[PASS/FAIL]	
Duct Insulation	[XX.X]		
Duct leakage total	[XX.X]	TEST	Duct leakage total must be tested as substantially leak free
Wall Area (ft²)	[XXX.X]	[PASS/FAIL]	
Ceiling Area (ft²)	[XXX.X]	[PASS/FAIL]	
Floor Area (ft²)	[XXX.X]	[PASS/FAIL]	
Common Wall Mass R		N/A	There are [no] common mass walls in this building
Common Wall Frame R		N/A	There are [no] common frame walls in this building
Common Floor Low R		N/A	There are [no] common floors in this building
Common Ceiling Low R		N/A	There are [no] common ceilings in this building
Window Area (ft²)	[XXX.X]		
Door Area (ft²)	[XXX.X]		

Total UA Alternative Method = [PASS/FAIL]

I hereby certify that the plans and specifications covered by this calculation are in compliance with the Florida Energy Code.

PREPARED BY: \_\_\_\_\_  
DATE: \_\_\_\_\_

I hereby certify that this building, as designed, is in compliance with the Florida Energy Code.

OWNER/AGENT: \_\_\_\_\_  
DATE: \_\_\_\_\_

Review of the plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed this building will be inspected for compliance with Section 553.908 Florida Statutes.



BUILDING OFFICIAL: \_\_\_\_\_  
DATE: \_\_\_\_\_

## Total UA Alternative Method-2017 Report - SAMPLE

### Total UA Report-2017

BUILDING COMPONENT	PRESCRIPTIVE REQUIREMENTS	INSTALLED VALUES
Air infiltration:	Blower door test is required on the building envelope to verify leakage $\leq 7$ ACH50; test report provided to code official.	Total leakage(ACH50) = 5.000 [PASS/FAIL] Test report attached? <input type="checkbox"/> Yes <input type="checkbox"/> No
Air distribution system <sup>1</sup> : Air handling unit  Duct R-Value  Air Leakage <sup>1</sup> : Duct test  Ducts in conditioned space	Not allowed in attic Sealed R-value $\geq$ R-8 (supply in attics) $\geq$ R-4.2 (Ducts in uncond.(not attics), Diam. < 3 in.) $\geq$ R-6 (all other duct locations). Air handler installed: Total leakage $\leq 4$ cfm/100 s.f. Air handler Not installed: Total leakage $\leq 3$ cfm/100 s.f. Test not required if all ducts and AHU are in conditioned space.	Location: Main [PASS/FAIL] Sealed [PASS/FAIL] R-Value(Supply in unc. attic) = None [PASS/FAIL] R-Value(Small Ducts in unc) = None [PASS/FAIL] R-Value(Others in unc. space) = None [PASS/FAIL] 5.00 cfm/100 s.f. [PASS/FAIL] Test report required? No Location: Conditioned
Air conditioning systems: Central system $\leq 65,000$ Btu/h  Room unit or PTAC Other:	Minimum federal standard required by NAECA <sup>2</sup> SEER=14.0 EER [from Table C403.2.3(3)] See Tables C403.2.3(1)-(11)	SEER(Min)=14 [PASS/FAIL]
Heating systems: Heating Pump $\leq 65,000$ Btu/h Gas Furnace, non-weatherized Oil Furnace, non-weatherized Other:	Minimum federal standard required by NAECA <sup>2</sup> HSPF = 8.2 AFUE = 80 % AFUE = 83%	HSPF(Min) = [X.XX] [PASS/FAIL] Not Applicable Not Applicable
Water heating system (storage type): Electric: <sup>3</sup> Gas fired: <sup>4</sup> Other (describe):	Minimum federal standard required by NAECA <sup>2</sup> 40 gallons: EF=0.948, 50 gallons: EF=0.945 40 gallons: EF=0.615, 50 gallons: EF=0.60	[XX] gallons: EF= [X.XXX] [PASS/FAIL] Not Applicable

NR = No requirement.

(1) Ducts & AHU installed "substantially leak free" per Section R403.3.2. Test required by either individuals as defined in Section 553.993(5) or (7), Florida Statutes, or individuals licensed as set forth in Section 489.105(3)(f), (g), or (i), Florida Statutes. The total leakage test is not required if ducts and air handlers are located entirely within the thermal envelope.

(2) Minimum efficiencies are those set by the *National Appliance Energy Conservation Act of 1987* for typical residential equipment and are subject to NAECA rules and regulations. For other types of equipment, see Tables C403.2.3 (1-11) of the Commercial Provisions of the, Florida Building Code, Energy Conservation.

(3) For electric storage volumes  $\leq 55$ , min. EF = 0.96 - (0.0003 \* volume). For electric storage volumes  $> 55$ , min. EF = 2.057 - (0.00113 \* volume).

(4) For other natural gas storage volumes  $\leq 55$ , min. EF = 0.675 - (0.0015 \* volume). For gas storage volumes  $> 55$ , min. EF = 0.8012 - (0.00078 \* volume).

## Appendix R-5 Performance Compliance Method

The software verification test suite found in Section 3.2 of the RESNET document “Procedures for Verification of International Energy Conservation Code Performance Path Calculation Tools” dated March 2014 shall be utilized to verify the accuracy of the program. Also, Tier 1 of the “ASHRAE Standard 140-2011, Class II, Tier 1 building loads tests” and Florida HERS BESTEST as described below. The Florida Energy Code Reference Home AutoGen Tests described in Appendix Sections R5.2 and R5.3 shall be used to verify the ability of the software tool to automatically generate the Florida Building Code’s Standard Reference Design Home.

HVAC tests – The vendor shall also conduct HVAC tests that verify the accuracy and consistency with which software tools predict the performance of HVAC equipment, including furnaces, air conditioners and air source heat pumps. Duct distribution system efficiency tests will verify the accuracy with which software tools calculate air distribution system losses.

ASHRAE Standard 152 results are used as the basis of acceptance criteria for this test suite. Hot water system performance tests determine the ability of the software to accurately predict hot water system energy use. The Florida e-Ratio Method tests described in Appendix section R5.4 are intended to determine the ability of software compliance tools to accurately calculate the Florida Energy Code compliance e-Ratio given a set of Standard Reference Design End Use Loads (REUL), *Standard Reference Design End Use Energy Consumptions (EC\_r)*, *Proposed Home End Use Energy Consumptions (EC\_x)* and the applicable Manufacturer’s Equipment Performance Ratings (MEPR). The e-Ratio calculation procedure is given in 2017 Florida Building Code, Energy Conservation 6<sup>th</sup> Edition Appendix RC.

Using the test cases identified, simulate the cases as outlined in the reference documents. Record the results using the MS Excel spreadsheets listed in Table R-1 and provided by the Commission. A Software Vendor shall submit test results for Las Vegas, NV and Colorado Springs, CO (ASHRAE Standard 140) and for Orlando, FL (Florida- HERS BESTEST). The source and data of the reference test results used for comparison must be submitted with the application. Results Forms in MS Excel Spreadsheet listed in Table R-1 are available on the Florida Building Commission’s website, [www.floridabuilding.org](http://www.floridabuilding.org) for the verification tests specified.

Table R-1 Performance method software evaluation results

Results Forms	Test Type
ASHRAE-Std-140_Results-Form.xlsx	ASHARE Std 140-2011 Class II, Tier 1 Building Loads Tests, RESNET 2014
FL-HERS_BESTEST_results-form.xlsx	Florida HERS BESTEST, Judkoff, R. and J. Neymark 1997
Florida_AutoGen_results-form.xlsx	2017 Florida Energy Code Reference Home AutoGen Tests, See Appendix R-5
HVAC_results-form.xlsx	HVAC Tests, Section 4.3, RESNET 2014
DSE_results-form.xlsx	Duct Distribution System Efficiency (DSE), Section 4.4, RESNET 2014
DHW_results-form.xlsx	Hot Water System Performance Tests, Section 4.5 RESNET 2014
FL_e-ratio_results.xlsx	Florida e-Ratio Test, See Appendix R-5

## R5.1 Minimum Test Reporting Requirements

Software tools applying for verification shall provide evidence that their software meets the requirements of this test suite. The software tool provider or software vendor is responsible for producing the documentation needed to show that the software has been verified through this test suite. In some cases, the data needed to verify accuracy is of no interest or value to the end-user of the software, but in any case, the software tool must generate it. If the reports required in the Technical Assistance Manual do not already include them, at a minimum, software tools applying for accreditation must report the following values for the Standard Reference Design:

- Areas and overall U-factors (or R-values in the case of slab-on-grade construction) for all building components, including ceilings, walls, floors, windows (by orientation) and doors.
- Overall solar-heat gain coefficient (SHGCo)<sup>1</sup> of the windows during heating.
- Overall solar-heat gain coefficient (SHGCo) of the windows during cooling.
- Wall solar absorptance and infrared emittance
- Roof solar absorptance and infrared emittance
- Total internal gains (including 20% latent) to the home (Btu/day)
- ACH50 for the home, as appropriate
- Attic net free ventilation area (ft<sup>2</sup>)
- Crawlspace net free ventilation area (ft<sup>2</sup>), if appropriate
- Exposed masonry floor area and carpet and pad R-value, if appropriate
- Heating system labeled ratings, including AFUE, COP, or HSPF, as appropriate.
- Cooling system labeled ratings, including SEER or EER, as appropriate.
- Thermostat schedule for heating and cooling
- Air distribution system characteristics, including locations of all supply and return ducts and the air handler units, supply and return duct R-values, and supply and return duct air leakage values (in cfm<sub>25</sub>).<sup>2</sup>
- Mechanical ventilation kWh/yr., if appropriate

Software tools must have the ability to recreate or store the test case Standard Reference Designs as if they were Proposed Design such that they also can be simulated and evaluated as the Proposed Design.

## R5.2 Auto-generation Test Case Descriptions

Test Case 1. Case L100 building configured as specified in ASHRAE 140-2011, Section 7, Class II Test Procedures, located in Tallahassee, FL, including a total of 3 bedrooms and the following mechanical equipment: gas furnace with AFUE = 82%, central air conditioning with SEER = 14.0 and tankless gas water heater with EF = 0.83.

Test Case 2. Case L100 configured on an un-vented crawlspace with R-7 crawlspace wall insulation, located in Orlando, FL, including a total of 3 bedrooms and the following mechanical equipment: electric heat pump with HSPF = 9.0 and SEER = 16.0 and 52 gallon heat pump water heater with EF = 2.20.

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<sup>1</sup> The overall solar heat gain coefficient (SHGCo) of a fenestration is defined as the solar heat gain coefficient (SHGC) of the fenestration product taken in combination with the interior shade fraction for the fenestration.

<sup>2</sup> cfm<sub>25</sub> = cubic feet per minute of air leakage to outdoors at a pressure difference between the duct interior and outdoors of 25 Pa.

Test Case 3. Case L304 in Miami, configured as specified in the ASHRAE 140-2011, Section 7, Class II Test Procedures, located in Miami, FL, including a total of 2 bedrooms and the following mechanical equipment: electric strip heating with COP = 1.0 and central air conditioner with SEER = 15.0 and 40 gallon electric water heater with EF = 0.92.

Test Case 4. Case L324 configured as specified as in ASHRAE 140-2011, Section 7, Class II Test Procedures, located in Jacksonville, FL, including a total of 4 bedrooms and the following mechanical equipment: gas furnace with AFUE = 95% and no air conditioning and a 40 gallon gas water heater with EF = 0.67.

Test Case 5. Recreate or store the Standard Reference Design created in Tests 1 through 4 as Proposed Design and simulate and evaluate them.

### **R5.3 Acceptance Criteria R5.3.1 Test Cases 1 - 4**

For test cases 1 through 4 the values contained in Table R5.3.1 shall be used as the acceptance criteria for software tool accreditation. For Standard Reference Design building components marked by an asterisk (\*), the acceptance criteria may include a range equal to  $\pm 0.05\%$  of the listed value. For all other Standard Reference Design components the listed values are exact.

Table R5.3.1 Acceptance Criteria for Test Cases 1 – 4

<b>Standard Reference Design Building Component</b>	<b>Test 1</b>	<b>Test 2</b>	<b>Test 3</b>	<b>Test 4</b>
Above-grade walls ( $U_o$ )	0.084	0.084	0.084	0.084
Above-grade wall solar absorptance ( $\alpha$ )	0.75	0.75	0.75	0.75
Above-grade wall infrared emittance ( $\epsilon$ )	0.90	0.90	0.90	0.90
Basement walls ( $U_o$ )	n/a	n/a	n/a	0.36
Above-grade floors ( $U_o$ )	0.064	0.064	n/a	n/a
Slab insulation R-Value	n/a	n/a	0	0
Ceilings ( $U_o$ )	0.030	0.030	0.035	0.030
Roof solar absorptance ( $\alpha$ )	0.75	0.75	0.75	0.75
Roof infrared emittance ( $\epsilon$ )	0.90	0.90	0.90	0.90
Attic vent area* ( $\text{ft}^2$ )	5.13	5.13	5.13	5.13
Crawlspace vent area* ( $\text{ft}^2$ )	n/a	n/a	n/a	n/a
Exposed masonry floor area* ( $\text{ft}^2$ )	n/a	n/a	307.8	307.8
Carpet & Pad R-Value	n/a	n/a	2.0	2.0
Door Area ( $\text{ft}^2$ )	40	40	40	40
Door U-Factor	0.40	0.40	0.50	0.40
North window area* ( $\text{ft}^2$ )	57.71	57.71	57.71	50.02
South window area* ( $\text{ft}^2$ )	57.71	57.71	57.71	50.02
East window area* ( $\text{ft}^2$ )	57.71	57.71	57.71	50.02
West window area* ( $\text{ft}^2$ )	57.71	57.71	57.71	50.02
Window U-Factor	0.40	0.40	0.50	0.40
Window SHGCo (heating)	0.217	0.217	0.217	0.217
Window SHGCo (cooling)	0.217	0.217	0.217	0.217
ACH50	7.0	7.0	7.0	7.0
Internal gains* (Btu/day)	66,840	66,840	62,736	107,572
Water heater gallons per day	60	60	50	70
Water heater set point temperature	120 F	120 F	120 F	120 F
Water heater efficiency rating	EF = 0.62	EF = 0.94	EF = 0.95	EF = 0.62
Labeled heating system efficiency rating	AFUE = 80%	HSPF = 8.2	HSPF = 8.2	AFUE = 80%
Labeled cooling system efficiency rating	SEER = 14.0	SEER = 14.0	SEER = 14.0	SEER = 14.0
Air Distribution System Efficiency	0.88	0.88	0.88	0.88
Thermostat Type	Manual	Manual	Manual	Manual
Heating thermostat settings	72 F (all hours)	72 F (all hours)	72 F (all hours)	72 F (all hours)
Cooling thermostat settings	75 F (all hours)	75 F (all hours)	75 F (all hours)	75 F (all hours)

Test case 5 requires that each of the Standard Reference Design for test cases 1-4 be stored or recreated in the software tool as Proposed Design and simulated as any other Proposed Design would be simulated. If the resulting Proposed Design is correctly configured to be identical to its appropriate Standard Reference Design, code compliance calculations arising from normal operation of the software tool should produce virtually identical scoring criteria for both the Standard Reference Design and the Proposed Design for this round of tests. For test case 5, the e-Ratio shall be calculated separately using the simulation results for heating, cooling, hot water and the other provisions of Appendix RC of the Florida Energy Code as follows:

$$e\text{-Ratio} = (\text{Proposed Design Normalized Modified Loads}) / (\text{Standard Reference Design Loads})$$

Acceptance criteria for these calculations shall be  $\pm 0.5\%$  of 1.00 as shown in Table R5.3.2. Thus, for each of the preceding test cases (1-4), the e-Ratio resulting from these software tool simulations and the subsequent e-Ratio calculations shall be greater than or equal to 0.995 and less than or equal to 1.005.

Table R5.3.2 e-Ratio Test Acceptance Criteria for Test Cases 1 – 4

Standard Reference Design Building e-Ratio Test	Test 1	Test 2	Test 3	Test 4
e-Ratio Range	0.995 – 1.005	0.995 – 1.005	0.995 – 1.005	0.995 – 1.005



## R5.4 Florida e-Ratio Method Tests

The Florida e-Ratio Method tests are intended to determine the ability of software compliance tools to accurately calculate the Florida Energy Code compliance *e-Ratio* given a set of *Standard Reference Design End Use Loads* (REUL), *Standard Reference Design End Use Energy Consumptions* (EC\_r), *Proposed Home End Use Energy Consumptions* (EC\_x) and the applicable Manufacturer's Equipment Performance Ratings (MEPR).

**5.4.1. Minimum Reporting Requirements.** At a minimum, all software tools must report the following values:

**5.4.1.1. Standard Reference Design End Use Loads (REUL) to the nearest 0.1 MBtu**

- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot water (MBtu)

**5.4.1.2. Standard Reference Design End Use Energy Consumption (EC\_r) to the nearest 0.1 MBtu**

- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot Water (MBtu)

**5.4.1.3. Proposed Home End Use Energy Consumption (EC\_x) to the nearest 0.1 MBtu**

- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot Water (MBtu)

**5.4.1.4. Manufacturer's Equipment Performance Ratings (MEPR)**

- i. Heating system (HSPF, COP, AFUE, or CAFUE)
- ii. Cooling system (SEER, EER or COP)
- iii. Hot Water system (EF or CEF)

**5.4.2. Test Description.** Florida Energy Code compliance for the following cases, located in Orlando, FL, shall be computed, reporting the values listed above.

**5.4.2.1 Case L130A-01:** Using the HERS BESTEST L130 case, create a 3-bedroom Proposed Home containing the following equipment:

- i. Heating system – electric HP with HSPF = 7.7
- ii. Cooling system – electric A/C with SEER = 13.0
- iii. Hot Water – 40 gal electric with EF = 0.92
- iv. All the equipment are to be located inside the conditioned space and heating and air conditioning ductwork are to be located in the conditioned space and have zero (0) air leakage.

**5.4.2.2 Case L130A-02:** Identical to Case L130A-01 except that the hot water heater is changed to a tankless natural gas with EF = 0.82.

**5.4.2.3 Case L130A-03:** Identical to Case L130A-01 except that the space heating system is changed to a natural gas furnace with AFUE = 78%.

**5.4.2.4 Case L130A-04:** Identical to Case L130A-01 except that the space heating system is changed to a high efficiency HP with SEER=17 and HSPF = 10.

**5.4.2.5 Case L130A-05:** Identical to Case L130A-01 except that the space heating system is changed to a high efficiency natural gas furnace with AFUE = 96%.

**5.4.3. Acceptance Criteria.** Using the calculation spreadsheet provided by the Florida Building Commission (FL\_eRatio-results\_form.xlsx), software tools shall demonstrate the following:

**5.4.3.1** That reported *Standard Reference Design End Use Loads* (REULs) vary by less than 0.2% across all cases.

**5.4.3.2** That the difference between the *e-Ratios* calculated by the software tool and the *e-Ratios* calculated by the results spreadsheet provided by the Florida Building Commission is less than 0.5% for all cases.

## **R5.5 Residential Performance Method Report**

For each test case the following software produced reports are required (see section R5.7 for sample forms) in addition to any test specific reports mentioned above:

- 1) A Form R405 as described below
- 2) Input summary checklist report. Sample Form is in [Appendix R-7](#) of this Manual (usually four pages/may be greater)
- 3) Energy Performance Level (EPL) Display Card. See sample Form in [Appendix R-8](#).
- 4) Mandatory requirements summarized in [Appendix R-9](#) of this Manual (usually five pages/may be greater)

Also, provide for one house only, the following reports:

- 5) A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 6<sup>th</sup> Edition (2017) Florida Building Code, Energy Conservation - one page). See [Appendix R-10](#) of this Manual.
- 6) A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See [Appendix R-11](#) of this Manual.
- 7) if Form R405-2017 indicates anything other than default duct leakage, then a completed Form 2017 Duct Leakage Test Report (usually one page). See [Appendix R-12](#) of this Manual.

## **R5.6 Software Output Report Requirements**

In accordance with Section R405.4 of the Florida Building Code, Energy Conservation, the printout from computer programs approved by the Florida Building Commission for use as Energy Code compliance Form R405-2017 for residential applications shall contain all information required to determine Energy Code compliance for low-rise residential buildings, to include but not be limited to the following information. Compliance software program printout Form R405 should be consistent with the format described below. Associated Sample Forms are provided in Appendix R5.7.

A.1 An Administrative page of the printout should contain the following information:

- Form title and headings:
  - Form R405-2017
  - Florida Building Code, Energy Conservation
  - Residential Simulated Performance Alternative
- Project information box
  - Project name
  - Street address/city/state/zip

- Owner
- Design Location
- Builder Name
- Permit Office
- Jurisdiction
- County
- Summary of building components and features
  - New construction or existing
  - Single or multiple-family
  - Number of units should be 1
  - Number of bedrooms
  - Whether it is a worst-case calculation
  - Window U-factor, SHGC and area for all windows in the building. Highest U-factor and SHGC.
  - Floor type, insulation R-value and area (or perimeter if slab)
  - Wall type, insulation R-value and area by type of wall
  - Ceiling types, insulation R-value and area by type of ceiling
  - Duct location, R-value and type for supply, return and air handler
  - Cooling system type, capacity and efficiency
  - Heating system type, capacity and efficiency
  - Hot water system type, capacity and efficiency
  - Any conservation credits provided in the calculation per Section R405.7 of the Energy Code.
- Pass/Fail box
  - Percent glass to conditioned floor area
  - Total Proposed Design loads
  - Total Standard Reference Design loads
  - Whether the building Passes or Fails Energy Code compliance
- Compliance certification box
  - Statement, signature and date by the individual completing the compliance report as follows:
    - Statement: “I hereby certify that the plans and specifications covered by this calculation are in compliance with the *Florida Building Code, Energy Conservation.*”
      - PREPARED BY: \_\_\_\_\_
      - DATE: \_\_\_\_\_
  - Statement, signature and date by the owner of the building
    - Statement: “I hereby certify that this building, as designed, is in compliance with the *Florida Building Code, Energy Conservation.*”
      - OWNER/AGENT: \_\_\_\_\_
      - DATE: \_\_\_\_\_

- Statement, signature and date by the code official reviewing the plans and compliance report:
    - Statement: “Review of the plans and specifications covered by this calculation indicates compliance with the *Florida Building Code, Energy Conservation*. Before construction is completed, this building will be inspected for compliance with Section 553.908, *Florida Statutes*.”
      - BUILDING OFFICIAL: \_\_\_\_\_
      - DATE: \_\_\_\_\_
    - Name and version of the compliance software tool
- A.2 Description of the building. Input Summary Checklist Report to be consistent with the plans may include, but not be limited to:
- Project information
  - Climate zone information by design location
  - Floor type, materials, area or perimeter, R-value
  - Roof type, materials area, solar absorptance, testing radiant barrier system, pitch, other relevant information as required by Energy Code
  - Ceiling type, materials, R-value, area, truss type, framing fraction
  - Wall type, orientation, whether it is exterior or adjacent, R-value, area, sheathing, framing fraction solar absorptance
  - Door type, orientation, U-factor, area
  - Window type(s), orientation, U-factor, SHGC, area, overhang, separation, interior shading, screening or storm windows
  - Infiltration of the building (SLA, CFM, ACH, ELA, EqLA) and forced ventilation of the building (supply CFM, exhaust CFM, run time, fan Watts)
  - Garage area, insulation R-value if conditioned
  - Cooling system type, efficiency, capacity, air flow, SHR, other relevant information
  - Heating system type, efficiency, capacity, other relevant information
  - Hot water system type, efficiency, capacity, any Energy Code-required credit requirements
  - Duct and air handler location, R-value, area, leakage type and percent,  $Q_n$ , RLF
  - Thermostat type and setting
  - Ceiling fan use, if applicable

## **R5.7 Sample Performance Method Reports**

The following reports are samples of reports expected. Although formats from software may vary, large variance is not recommended for ease of building officials.

FORM R405-2017

**RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST**

**Florida Department of Business and Professional Regulation  
Simulated Performance Alternative (Performance) Method**

**Applications for compliance with the 2017 Florida Building Code, Energy Conservation via the residential Simulated Performance Method shall include:**

- This checklist*
- A FORM R405 report that documents that the Proposed Design complies with Section R405.3 of the Florida Energy Code. This form shall include a summary page indicating home address, e-ratio and the pass or fail status along with summary areas and types of components, whether the home was simulated as a worst-case orientation, name and version of the compliance software tool, and name of individual completing the compliance report (one page).*
- Input Summary Checklist Report (usually four pages/may be greater)*
- Energy Performance Level (EPL) Display Card (one page)*
- HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7*
- Mandatory Requirements (five pages)*

**Required prior to CO for the Performance Method:**

- Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 - one page)*
- A completed Form 2017 Envelope Leakage Test Report (usually one page).  
Section R402.4 or R402.4.1.2 exceptions may apply*
- If FORM R405 duct leakage type indicates anything other than "default leakage", then a completed Form 2017 Duct Leakage Test Report (usually one page)*

Performance Method-2017 Report - SAMPLE

FORM R405-2017

**FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION**

Florida Department of Business and Professional Regulation - Residential Performance Method

Project Name: Street: City, State, Zip: [CITY], FL, [ZIP] Owner: Design Location: FL, [CITY]	Builder Name: Permit Office: Permit Number: Jurisdiction: County: [COUNTY] (Florida Climate Zone [X])
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1. New construction or existing [New (From Plans) / Addition / New (Confirmed)] 2. Single family or multiple family [Single-family / Multi-family] 3. Number of units, if multiple family 1 4. Number of Bedrooms [X] 5. Is this a worst case? [Yes/No] 6. Conditioned floor area above grade (ft²) [XXXX] Conditioned floor area below grade (ft²) [XXXX] 7. Windows ([XXXX.X] ft²) Description Area a. U-Factor: Dbl, U=[X.XX] [XXX] ft² SHGC: SHGC=[X.XX] b. U-Factor: N/A [XXX] ft² SHGC: c. U-Factor: N/A ft² SHGC: d. U-Factor: N/A ft² SHGC: Area Weighted Average Overhang Depth: [XX.X] ft. Area Weighted Average SHGC: [X.XX] 8. Floor Types ([XXXX.X] ft²) Insulation Area a. Slab-On-Grade Edge Insulation R=0.0 [XXXX.X] ft² b. Floor Over Other Space R=0.0 [XXXX.X] ft² c. N/A R= ft²	9. Wall Types ([XXXX.X] sqft.) Insulation Area a. Frame - Wood, Exterior R=13.0 [XXXX.X] ft² b. Concrete Block - Int Insul, Exterior R=8.0 [XXXX.X] ft² c. Frame - Wood, Adjacent R=13.0 [XXXX.X] ft² d. N/A R= ft² 10. Ceiling Types ([XXX.X] ft²) Insulation Area a. Under Attic (Vented) R=[XX.X] [XXX.X] ft² b. N/A R= ft² c. N/A R= ft² 11. Ducts R ft² a. Sup: Main, Ret: Main, AH: Main [X] [XXX] b. Sup: Attic, Ret: Attic, AH: 2nd Floor [X] [XXX] 12. Cooling systems kBtu/hr Efficiency a. Central Unit [XX.X] SEER:[XX.X] b. Central Unit [XX.X] SEER:[XX.X] 13. Heating systems kBtu/hr Efficiency a. Electric Heat Pump [XX.X] HSPF:[X.XX] b. Natural Gas Furnace [XX.X] AFUE:[X.XX] 14. Hot water systems a. Electric Cap: [XX] gallons EF: [X.XX] b. Conservation features None 15. Credits None
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Glass/Floor Area: [X.XXX]	Total Proposed Modified Loads: XX.XX [calculated]	<b>PASS</b>
	Total Baseline Loads: XX.XX [calculated]	

I hereby certify that the plans and specifications covered by this calculation are in compliance with the Florida Energy Code.  PREPARED BY: _____ DATE: _____  I hereby certify that this building, as designed, is in compliance with the Florida Energy Code.  OWNER/AGENT: _____ DATE: _____	Review of the plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed this building will be inspected for compliance with Section 553.908 Florida Statutes.  BUILDING OFFICIAL: _____ DATE: _____
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- Compliance requires certification by the air handler unit manufacturer that the air handler enclosure qualifies as certified factory-sealed in accordance with R403.3.2.1.
- Compliance requires an Air Barrier and Insulation Inspection Checklist in accordance with R402.4.1.1 and this project requires an envelope leakage test report with envelope leakage no greater than [X.X] ACH50 (R402.4.1.2).
- Compliance requires a roof absorptance test and a roof emittance test in accordance with R405.7.2
- Compliance with a proposed duct leakage Qn requires a Duct Leakage Test Report confirming duct leakage to outdoors, tested in accordance with ANSI/RESNET/ICC 380, is not greater than [X.XX]Qn for whole house.

## Appendix R-6 Energy Rating Index Alternative Method

The Energy Rating Index alternative simulation compliance method shall use the procedures in ANSI/RESNET/ICC 301-2014 “Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index” published on January 15, 2016. For software to be certified for the Florida Building Commission for the ERI method, it must demonstrate that it has passed all the software tests provided in ANSI/RESNET/ICC 301-2014 as well as the other tests provided in this Manual.

The Energy Rating Index (*ERI*) as stated in the 6<sup>th</sup> Edition Florida Energy Code Section R406.3 shall be a numerical integer value that is based on a linear scale constructed such that the *ERI reference design*, has an Index value of 100 and a residential dwelling unit that uses no net purchased energy has an Index value of 0. The ERI shall include all energy used in the residential dwelling unit using the methods indicated in ANSI/RESNET/ICC 301-2014. The vendor’s compliance software must generate the *ERI reference design* using only the input for the *rated design*. The software shall not allow the user to directly modify the building component characteristics of the *ERI reference design*. The sizing calculation for the heating and cooling equipment in the *ERI reference design* shall be in accordance with Section R403.7.

There are two sets of test suite for ERI alternative method compliance software approval. The first set of test suite described in Section R6.1 of this Manual is defined by RESNET Software Verification Committee to determine HRES software tool accuracy and compatibility (RESNET, 2017). The software verification tests include: ASHRAE Standard 140-2011, Class II, Tier 1 building loads tests, HERS reference home auto-generation tests, hot water system performance tests, HVAC tests, duct distribution system efficiency tests, and the HERS method tests. The first set of tests also includes the Florida HERS BESTEST software verification test cases. The second test suite described in Section R6.1 of this Manual is intended to evaluate the software’s capability to verify the Florida Energy Code maximum ERI-value, thermal envelope efficiency level and mandatory requirements. There are four test cases formulated for the second test set.

The vendor shall conduct the test suite described in Sections R6.1 and R6.2 of this Manual and submit the results to the Florida Building Commission according to the instruction provided in this Manual for each test case. The source and data used for testing must be submitted with the compliance software approval application.

### **R6.1 ERI Method Compliance Software Test Suites**

This section specifies the required tests and acceptance criteria that software seeking for approval for residential ERI method compliance shall conduct and submit. The software verification test suite found in Section 3.2 of the RESNET document “Procedures for Verification of International Energy Conservation Code Performance Path Calculation Tools” dated August 2017 shall be used to verify the accuracy of the compliance software. The following six tests shall be conducted and the results recorded in the spreadsheet provided and submitted to the Building Commission for approval. Also the compliance software vendors shall submit all inputs required to reproduce their results.

#### **R6.1.1 ANSI/ASHRAE Standard 140-2011, Class II, Tier 1 Tests**

ANSI/ASHRAE Standard 140, Class II Tests were developed for testing the accuracy of simulation software for predicting building loads. The ANSI/ASHRAE Standard 140-2011, Class II, Tier 1 test procedure has been adopted by RESNET and is a requirement for all software



programs to be accredited. The acceptance criteria for this suite of tests is provided in the accompanying spreadsheet workbook named “ASHRAE-Std-140\_Results-Form.xlsx”.

### **R6.1.2 HERS Reference Home Auto-Generation Tests**

These four test homes are designed to test the compliance software’s ability to automatically generate accurate *reference home* given only the building characteristics information of the *rated home*. Compliance Software must have the ability to recreate or store the test case reference home as if they were rated home such that they also can be simulated and evaluated as rated homes.

#### **R6.1.2.1 Minimum Test Reporting Requirements**

Software tools applying for verification shall provide evidence that their software meets the requirements of this test suite. The software tool provider or software vendor is responsible for producing the documentation needed to show that the software has been verified through this test suite. At a minimum, software tools applying for accreditation must report the following values for the *reference home*:

- Areas and overall U-factors (or R-values in the case of slab-on-grade construction) for all building components, including ceilings, walls, floors, windows (by orientation) and doors.
- Overall solar-heat gain coefficient (SHGCo)<sup>3</sup> of the windows during heating.
- Overall solar-heat gain coefficient (SHGCo) of the windows during cooling.
- Wall solar absorptance and infrared emittance
- Roof solar absorptance and infrared emittance
- Sensible internal gains to the home (Btu/day)
- Latent internal gains to the home (Btu/day)
- Specific leakage area (SLA) for the building, by zone or as SLAo<sup>4</sup>, as appropriate
- Attic net free ventilation area (ft<sup>2</sup>)
- Crawlspace net free ventilation area (ft<sup>2</sup>), if appropriate
- Exposed masonry floor area and carpet and pad R-value, if appropriate
- Heating system labeled ratings, including AFUE, COP, or HSPF, as appropriate.
- Cooling system labeled ratings, including SEER or EER, as appropriate.
- Thermostat schedule for heating and cooling
- Air Distribution System Efficiency (DSE)
- Mechanical ventilation kWh/y, if appropriate
- DHW pipe length refPipeL (ft)
- DHW loop length refLoopL (ft)

#### **R6.1.2.2 HERS Reference Home Auto-Generation Test Description**

Test Case1. HERS BESTEST case L100 building configured as specified in the HERS BESTEST procedures, located in Baltimore, MD (TMY3 site 724060, BALTIMORE BLT-WASHNGTN INT’L), including a total of 3 bedrooms and the following mechanical equipment: gas furnace with AFUE = 82% and central air conditioning with SEER = 11.0; no whole-dwelling mechanical ventilation; a gas range/oven and clothes dryer; all other appliances are electric.

Test Case 2. HERS BESTEST case L100 configured on an un-vented crawlspace with R-7 crawlspace wall insulation, located in Dallas, TX (TMY3 site 722590, DALLAS-FORT WORTH

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<sup>3</sup> The overall solar heat gain coefficient (SHGCo) of a fenestration is defined as the solar heat gain coefficient (SHGC) of the fenestration product taken in combination with the interior shade fraction for the fenestration.

<sup>4</sup> SLAo is the floor-area weighted specific leakage area of a home where the different building zones (e.g. basement and living zones) have different specific leakage areas.

INTL AP), including a total of 3 bedrooms and the following mechanical equipment: electric heat pump with HSPF = 7.5 and SEER = 12.0; exhaust-only whole-dwelling mechanical ventilation; all appliances are electric.

Test Case 3. HERS BESTEST case L304 in Miami, configured as specified in the HERS BESTEST procedures, located in Miami, FL (TMY3 site 722020, MIAMI INTL AP), including a total of 2 bedrooms and the following mechanical equipment: electric strip heating with COP = 1.0 and central air conditioner with SEER = 15.0; balanced whole-dwelling mechanical ventilation without energy recovery; all appliances are electric.

Test Case 4. HERS BESTEST case L324 configured as specified as in the HERS BESTEST procedures, located in Colorado Springs, CO (TMY3 site 724660, COLORADO SPRINGS MUNI AP), including a total of 4 bedrooms and the following mechanical equipment: gas furnace with AFUE = 95% and no air conditioning; balanced whole-dwelling mechanical ventilation with a 60% heat recovery system; a gas range/oven and clothes dryer; all other appliances are electric.

Test Case 5. Recreate or store the Reference Homes created in Tests 1 through 4 as Rated Homes and simulate and evaluate them.

### **R6.1.2.3 HERS Reference Home Auto-Generation Tests Acceptance Criteria**

For test cases 1 through 4 the values contained in Table R6.1-1 shall be used as the acceptance criteria for software tool evaluation. For *reference home* building components marked by an asterisk (\*), the acceptance criteria may include a range equal to  $\pm 0.05\%$  of the listed value. For all others components the listed value shall be exact match. The results generated by the vendors compliance software shall be recorded in the accompanying spreadsheet workbook named "2017-HERS\_AutoGen\_Results-Form.xlsx".

Test case 5 requires that each of the *reference home* for test cases 1-4 be stored or recreated in the software tool as a *rated home* and simulated as any other rated home would be simulated. If the resulting *rated home* is correctly configured to be identical to its appropriate *reference home*, rating calculations arising from normal operation of the software tool should produce virtually identical scoring criteria for both the *reference home* and the *rated home* for this round of tests. For test case 5, the modified loads e-Ratio shall be calculated separately from the simulation results, as follows:

$$\text{e-Ratio} = (\text{Total normalized Modified Loads}) / (\text{Total Reference Loads})$$

Acceptance criteria for these calculations shall be  $\pm 0.5\%$  of 1.00. Thus, for each of the preceding test cases (1-4), the e-Ratio resulting from these software tool simulations and the subsequent e-Ratio calculations shall be greater than or equal to 0.995 and less than or equal to 1.005. The e-Ratio determined by the compliance software shall be recorded in the spreadsheet workbook named "2017-HERS\_AutoGen\_Results-Form.xlsx".

**Table R6.1-1 HERS Auto-Generation Acceptance Criteria for Test Cases 1 – 4**

<b>Reference Home Building Component</b>	<b>Test 1</b>	<b>Test 2</b>	<b>Test 3</b>	<b>Test 4</b>
Above-grade walls (Uo)	0.082	0.082	0.082	0.060
Above-grade wall solar absorptance ( $\alpha$ )	0.75	0.75	0.75	0.75
Above-grade wall infrared emittance ( $\epsilon$ )	0.90	0.90	0.90	0.90
Basement walls (Uo)	n/a	n/a	n/a	0.059
Above-grade floors (Uo)	0.047	0.047	n/a	n/a
Slab insulation R-Value	n/a	n/a	0	0
Ceilings (Uo)	0.030	0.035	0.035	0.030
Roof solar absorptance ( $\alpha$ )	0.75	0.75	0.75	0.75
Roof infrared emittance ( $\epsilon$ )	0.90	0.90	0.90	0.90
Attic vent area* (ft <sup>2</sup> )	5.13	5.13	5.13	5.13
Crawlspace vent area* (ft <sup>2</sup> )	n/a	10.26	n/a	n/a
Exposed masonry floor area * (ft <sup>2</sup> )	n/a	n/a	307.8	307.8
Carpet & pad R-Value	n/a	n/a	2.0	2.0
Door Area (ft <sup>2</sup> )	40	40	40	40
Door U-Factor	0.40	0.65	1.20	0.35
North window area* (ft <sup>2</sup> )	69.26	69.26	69.26	102.63
South window area* (ft <sup>2</sup> )	69.26	69.26	69.26	102.63
East window area* (ft <sup>2</sup> )	69.26	69.26	69.26	102.63
West window area* (ft <sup>2</sup> )	69.26	69.26	69.26	102.63
Window U-Factor	0.40	0.65	1.20	0.35
Window SHGCo (heating)	0.34	0.34	0.34	0.34
Window SHGCo (cooling)	0.28	0.28	0.28	0.28
SLAo (ft <sup>2</sup> /ft <sup>2</sup> )	0.00036	0.00036	0.00036	0.00036
Sensible Internal gains* (Btu/day)	55,470	52,794	48,111	83,103
Latent Internal gains* (Btu/day)	13,807	12,698	9,259	17,934
Labeled heating system rating and efficiency	AFUE = 78%	HSPF = 7.7	HSPF = 7.7	AFUE = 78%
Labeled cooling system rating and efficiency	SEER = 13.0	SEER = 13.0	SEER = 13.0	SEER = 13.0
Air Distribution System Efficiency	0.80	0.80	0.80	0.80
Thermostat Type	Manual	Manual	Manual	Manual
Heating thermostat settings	68 F (all hours)	68 F (all hours)	68 F (all hours)	68 F (all hours)
Cooling thermostat settings	78 F (all hours)	78 F (all hours)	78 F (all hours)	78 F (all hours)
Mechanical ventilation (kWh/y) ( $\pm 0.1\%$ )	0.0	77.9	140.4	379.1
DHW pipe length refPipeL ( $\pm 0.1$ ft)	88.5	88.5	88.5	98.5
DHW loop length refLoopL ( $\pm 0.1$ ft)	156.9	156.9	156.9	176.9
e-Ratio ( $\pm 0.005$ )	1.000	1.000	1.000	1.000

### **R6.1.3 HERS Method Tests**

The HERS Method tests are intended to determine the ability of software compliance tools to accurately calculate the HERS Index given a set of *Reference Home End Use Loads* (REUL), *Reference Home End Use Energy Consumptions* (EC\_r), *Rated Home End Use Energy Consumptions* (EC\_x), and the applicable manufacturer's equipment performance ratings (MEPR). And all hot water values shall be calculated according to the procedures in ANSI/RESNET 300-2014 Addendum A-2015.

#### **R6.1.3.1 HERS Method Tests Minimum Reporting Requirements**

The compliance software shall have the capability to report at least the following values:

Reference Home End Use Loads (REUL) to the nearest 0.1 MBtu

- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot water (MBtu)

Reference Home End Use Energy Consumption (EC\_r) to the nearest 0.1 MBtu

- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot Water (MBtu)

Rated Home End Use Energy Consumption (EC\_x) to the nearest 0.1 MBtu

- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot Water (MBtu)

Manufacturer's Equipment Performance Ratings (MEPR)

- i. Heating system (HSPF, COP, AFUE)
- ii. Cooling system (SEER, EER or COP)
- iii. Hot Water system (EF)

#### **R6.1.3.2 HERS Method Test Descriptions**

The compliance software shall simulate the following five test cases, located in Colorado Springs, CO, generate the above reporting requirements and recorded the values in the accompanying evaluation spreadsheet workbook named "2014\_HERS-Method\_Results-Form.xlsx". The compliance software shall demonstrate that the difference between the HERS index calculated by the software tool and those calculated by this spreadsheet is less than 0.5% of the index reported by the software tool for all test cases.

Case L100A-01: Using the HERS BESTEST L100 case, create a 3-bedroom Rated Home containing the following equipment:

- i. Heating system – electric HP with HSPF = 6.8
- ii. Cooling system – electric A/C with SEER = 10.0
- iii. Hot Water – 40 gal electric with EF = 0.88
- iv. All the equipment are to be located inside the conditioned space and heating and air conditioning ductwork are to be located in the conditioned space and have zero (0) air leakage.
- v. All appliances are standard electric

Case L100A-02: Identical to Case L100A-01 except for the following:

- i. Hot water heater is changed to a tankless natural gas with EF = 0.82
- ii. Range/oven and clothes dryer are changed to standard natural gas.

Case L100A-03: Identical to Case L100A-01 except for the following:

- i. Space heating system is changed to a natural gas furnace with AFUE = 78%
- ii. Number of bedrooms is changed from 3 to 2
- iii. Range/oven and clothes dryer are changed to standard natural gas.

Case L100A-04: Identical to Case L100A-01 except for the following:

- i. Space heating system is changed to a high efficiency HP with HSPF = 9.85
- ii. Number of bedrooms is changed from 3 to 4.

Case L100A-05: Identical to Case L100A-01 except for the following:

- i. Space heating system is changed to a natural gas furnace with AFUE = 96%
- ii. Range/oven and clothes dryer are changed to standard natural gas.

### **R6.1.4 HVAC Tests**

The compliance software must be capable of generating HVAC results using system type and efficiency as inputs and acceptance criteria specified in Section 4.4 of RESNET publication (RESNET, 2017). The software must also account for duct leakage, duct insulation levels and the presence of a programmable thermostat per the test suite requirements. The compliance software vendors shall conduct the test, record their results in the accompanying HVAC test evaluation spreadsheet workbook named “HVACresult\_form.xlsx”, and submit the completed spreadsheet to the Florida Building Commission for approval.

### **R6.1.5 Duct Distribution System Efficiency Tests**

The compliance software shall conduct the Distribution System Efficiency (DSE) tests designed to account for the impacts of duct insulation, duct air leakage, and duct location using the test suites and acceptance criteria specified in Section 4.5 of RESNET publication (RESNET, 2017). The compliance software vendors shall conduct the test, record their results in the accompanying DSE test evaluation spreadsheet workbook named “DSEresults\_form.xlsx”, and submit the completed spreadsheet to the Florida Building Commission for approval.

### **R6.1.6 Hot Water System Performance Tests**

The compliance software shall conduct the Hot Water System Performance tests designed to account for the impacts of hot water usage rate (gallons/day) and climate (inlet water temperature) using the test suites and acceptance criteria specified in Section 4.6 of RESNET publication (RESNET, 2017). The compliance software vendors shall conduct the tests, record their results in the accompanying hot water system performance test evaluation spreadsheet workbook named “2017\_DHW-Results\_form.xlsx”, and submit the completed spreadsheet to the Florida Building Commission for approval.

### **R6.1.7 Florida HERS BESTEST Tests**

The Florida-HERS BESTEST tests are intended to determine the ability of software compliance tools to accurately determine heating and cooling loads for Orlando, Florida. The acceptance criteria for this tests is provided in the accompanying spreadsheet named “FL-HERS\_BESTEST\_results-form.xlsx”.

### **R6.2 Florida ERI Alternative Method Test Case Descriptions**

The Florida Energy Code compliance vendor’s software evaluation for ERI compliance alternative method shall be computed using the specifications of the four test houses described in the following four pages. These four houses were created using the geometry of the L100 test case home described by Section 7 of ASHRAE Standard 140 as a base case. The software must run each of the four single family houses in Orlando, Florida. Each of the tests is designed to test one or more features of the software. All equipment are assumed to be in conditioned space for all four tests. Compliance software vendors shall conduct the four test cases described and submit the results to the Florida Building Commission according to the instruction provided in Section R6.3 of this Manual. The source and data used for testing must be submitted with the compliance software approval application.

ERI Test Case 1 (L1000-01) Characteristics – Location: Orlando, Florida Single Family Detached Home with No Attached Garage, Single Story, Three bedroom

Parameter	Size	Efficiency Level
Conditioned Floor Area	1539 ft <sup>2</sup>	N/A
Raised Floor, carpeted	1539 ft <sup>2</sup> , framing fraction = 0.13	R13 insulation, grade I
Roof <sup>1</sup> – gable type- 4 in 12 slope No overhangs	1622 ft <sup>2</sup> above 1539 ft <sup>2</sup> conditioned space	N/A
Ceiling <sup>2</sup> –flat under attic	1539 ft <sup>2</sup>	R30, grade I
Wall 1 – Faces North, Wood Frame <sup>3</sup>	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
Door 1 – Faces North	20 ft <sup>2</sup>	U = 0.46
Window 1 – Wood Frame Low-e Double Pane	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Wall 2 – Faces East, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
Window 2 – Wood Frame Low-e Double Pane	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Wall 3 –Faces South, Wood Frame	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
Door 2 – Faces South	20 ft <sup>2</sup>	U = 0.46
Window 3 – Wood Frame Low-e Double Pane	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Wall 4 –faces West, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
Window 4 – Wood Frame Low-e Double Pane	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Air leakage	House Volume = 1539 ft <sup>2</sup> x 8 ft height = 12,312 ft <sup>3</sup>	ACH50 = 7.0
Heating – electric heat pump	24.0 kBtu/h	HSPF = 8.5
Cooling – electric A/C	24.0 kBtu/h	SEER = 16
AHU in conditioned space	N/A	Factory Sealed
Ducts – supply in conditioned space	385 ft <sup>2</sup>	R6 insulation
Ducts – return in conditioned space	77 ft <sup>2</sup>	R6 insulation
Duct Tightness	N/A	N/A
Thermostat Type	N/A	Programmable
Mechanical Ventilation	None	N/A
Attic Ventilation	Vented	N/A
Hot Water System – Electric HP	50 gallon	EF = 3.20
All Hot Water Lines	Runs 35 feet	R3 insulation
Hot Water Circulation -none	N/A	NA
Heat Trap	N/A	Installed
Clothes Washer, Dryer, Range, Refrigerator and Dishwasher	Same as ANSI/RESNET/ICC 301-2014 Reference Case	Same as ANSI/RESNET/ICC 301-2014 Reference Case
Interior Lighting	20 installed fixtures	20 fixtures compact fluorescent
Exterior Lighting	1 installed fixtures	1 fixture compact fluorescent
Pool and Spa - none	N/A	N/A
PV – System	N/A	N/A

<sup>1</sup> Roof construction: composite shingles, roof framing fraction of 0.10. Solar absorptance = 0.9, roof emittance = 0.9.

<sup>2</sup> Layers from outside: Attic air, R30 batt insulation with 2x4 framing with 0.11 framing fraction, ½” drywall

<sup>3</sup> Wood frame wall layers from outside: synthetic stucco applied over #30 asphalt building paper, ½” exterior plywood, 2x4 frame with R-15 fiberglass batt insulation with a 0.25 total framing fraction, and ½” drywall. Solar absorptance = 0.6.

ERI Test Case 2 (L1000-02) Characteristics – Location: Orlando, Florida Single Family Detached Home with No Attached Garage, Single Story, Three bedroom  
**Red type illustrates rows with differences from L1000-01**

Parameter	Size	Efficiency Level
Conditioned Floor Area	1539 ft <sup>2</sup>	N/A
Raised Floor, carpeted	1539 ft <sup>2</sup> , framing fraction = 0.13	R13 insulation, grade I
Roof <sup>1</sup> – gable type- 4 in 12 slope No overhangs	1622 ft <sup>2</sup> above 1539 ft <sup>2</sup> conditioned space	N/A
Ceiling <sup>2</sup> –flat under attic	1539 ft <sup>2</sup>	R30, grade I
Wall 1 – Faces North, Wood Frame <sup>3</sup>	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
Door 1 – Faces North	20 ft <sup>2</sup>	U = 0.46
Window 1 – Wood Frame Low-e Double Pane	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Wall 2 – Faces East, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
Window 2 – Wood Frame Low-e Double Pane	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Wall 3 –Faces South, Wood Frame	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
Door 2 – Faces South	20 ft <sup>2</sup>	U = 0.46
Window 3 – Wood Frame Low-e Double Pane	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Wall 4 –faces West, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
Window 4 – Wood Frame Low-e Double Pane	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	U = 0.40 SHGC=0.25
Air leakage	House Volume = 1539 ft <sup>2</sup> x 8 ft height = 12,312 ft <sup>3</sup>	ACH50 = 7.0
Heating – natural gas furnace	24.0 kBtu/h	AFUE = 0.82
Cooling – electric A/C	24.0 kBtu/h	SEER = 14
AHU in conditioned space	N/A	Factory Sealed
Ducts – supply in conditioned space	385 ft <sup>2</sup>	R6 insulation
Ducts – return in conditioned space	77 ft <sup>2</sup>	R6 insulation
Duct Tightness	N/A	N/A
Thermostat Type	N/A	Programmable
Mechanical Ventilation	None	N/A
Attic Ventilation	Vented	N/A
Hot Water System – natural gas water heater	50 gallon	EF = 0.63
All Hot Water Lines	Runs 35 feet	R3 insulation
Hot Water Circulation -none	NA	NA
Heat Trap	N/A	Installed
Clothes Washer, Dryer, Range, Refrigerator and Dishwasher	Same as ANSI/RESNET/ICC 301-2014 Reference Case	Same as ANSI/RESNET/ICC 301-2014 Reference Case
Interior Lighting	20 installed fixtures	20 fixtures compact fluorescent
Exterior Lighting	1 installed fixtures	1 fixture compact fluorescent
Pool and Spa - none	N/A	N/A
PV – System	N/A	N/A

<sup>1</sup> Roof construction: composite shingles, roof framing fraction of 0.10. Solar absorptance = 0.9, roof emittance = 0.9.

<sup>2</sup> Layers from outside: Attic air, R30 batt insulation with 2x4 framing with 0.11 framing fraction, ½” drywall

<sup>3</sup> Wood frame wall layers from outside: synthetic stucco applied over #30 asphalt building paper, ½” exterior plywood, 2x4 frame with R-15 fiberglass batt insulation with a 0.25 total framing fraction, and ½” drywall. Solar absorptance = 0.6.



ERI Test Case 3 (L1000-03) Characteristics – Location: Orlando, Florida Single Family Detached Home with No Attached Garage, Single Story, Three bedroom  
 Red type illustrates rows with differences from L1000-01

Parameter	Size	Efficiency Level
Conditioned Floor Area	1539 ft <sup>2</sup>	N/A
Raised Floor, carpeted	1539 ft <sup>2</sup> , framing fraction = 0.13	R13 insulation, grade I
Roof <sup>1</sup> – gable type- 4 in 12 slope No overhangs	1622 ft <sup>2</sup> above 1539 ft <sup>2</sup> conditioned space	N/A
<b>Ceiling<sup>2</sup> –flat under attic</b>	1539 ft <sup>2</sup>	<b>R38, grade I</b>
Wall 1 – Faces North, Wood Frame <sup>3</sup>	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
<b>Door 1 – Faces North</b>	20 ft <sup>2</sup>	<b>U = 0.40</b>
<b>Window 1 – Wood Frame Low-e Double Pane</b>	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	<b>U = 0.30</b> SHGC=0.25
Wall 2 – Faces East, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
<b>Window 2 – Wood Frame Low-e Double Pane</b>	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	<b>U = 0.30</b> SHGC=0.25
Wall 3 –Faces South, Wood Frame	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
<b>Door 2 – Faces South</b>	20 ft <sup>2</sup>	<b>U = 0.40</b>
<b>Window 3 – Wood Frame Low-e Double Pane</b>	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	<b>U = 0.30</b> SHGC=0.25
Wall 4 –faces West, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
<b>Window 4 – Wood Frame Low-e Double Pane</b>	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	<b>U = 0.30</b> SHGC=0.25
Air leakage	House Volume = 1539 ft <sup>2</sup> x 8 ft height = 12,312 ft <sup>3</sup>	ACH50 = 7.0
<b>Heating – electric heat pump</b>	24.0 kBtu/h	<b>HSPF = 9.5</b>
<b>Cooling – electric A/C</b>	24.0 kBtu/h	<b>SEER = 18</b>
AHU in conditioned space	N/A	Factory Sealed
Ducts – supply in conditioned space	385 ft <sup>2</sup>	R6 insulation
Ducts – return in conditioned space	77 ft <sup>2</sup>	R6 insulation
Duct Tightness	N/A	N/A
Thermostat Type	N/A	Programmable
Mechanical Ventilation	None	N/A
Attic Ventilation	Vented	N/A
<b>Hot Water System – Electric HP</b>	50 gallon	<b>EF = 3.5</b>
All Hot Water Lines	Runs 35 feet	R3 insulation
Hot Water Circulation -none	N/A	N/A
Heat Trap	N/A	Installed
Clothes Washer, Dryer, Range, Refrigerator and Dishwasher	Same as ANSI/RESNET/ICC 301-2014 Reference Case	Same as ANSI/RESNET/ICC 301-2014 Reference Case
Interior Lighting	20 installed fixtures	20 fixtures compact fluorescent
Exterior Lighting	1 installed fixtures	1 fixture compact fluorescent
Pool and Spa - none	N/A	N/A
<b>PV – System</b>	<b>2.55 kW Capacity, Azimuth = 180°, Tilt = 23°, Area = 232.3 ft<sup>2</sup>.</b>	<b>PV efficiency = 10.87 % &amp; Temperature Coeff = 0.0035 K<sup>-1</sup> Inverter efficiency = 90% at 2.5 kW</b>

<sup>1</sup> Roof construction: composite shingles, roof framing fraction of 0.10. **Solar absorptance = 0.6**, roof emittance = 0.9.

<sup>2</sup> Layers from outside: Attic air, R38 batt insulation with 2x4 framing with 0.11 framing fraction, ½” drywall

<sup>3</sup> Wood frame wall layers from outside: synthetic stucco applied over #30 asphalt building paper, ½” exterior plywood, 2x4 frame with R-15 fiberglass batt insulation with a 0.25 total framing fraction, and ½” drywall. Solar absorptance = 0.6.

ERI Test Case 4 (L1000-04) Characteristics – Location: Orlando, Florida Single Family Detached Home with No Attached Garage, Single Story, Three bedroom

Red type illustrates rows with differences from L1000-01

Parameter	Size	Efficiency Level
Conditioned Floor Area	1539 ft <sup>2</sup>	N/A
Raised Floor, carpeted	1539 ft <sup>2</sup> , framing fraction = 0.13	R13 insulation, grade I
Roof <sup>1</sup> – gable type- 4 in 12 slope No overhangs	1622 ft <sup>2</sup> above 1539 ft <sup>2</sup> conditioned space	N/A
Ceiling <sup>2</sup> – flat under attic	1539 ft <sup>2</sup>	R38, grade I
Wall 1 – Faces North, Wood Frame <sup>3</sup>	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
Door 1 – Faces North	20 ft <sup>2</sup>	U = 0.46
Window 1 – Wood Frame Low-e Double Pane	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	U = 0.30 SHGC=0.30
Wall 2 – Faces East, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
Window 2 – Wood Frame Low-e Double Pane	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	U = 0.30 SHGC=0.30
Wall 3 – Faces South, Wood Frame	57 ft wide x 8 ft high = 456 ft <sup>2</sup>	R15, grade I
Door 2 – Faces South	20 ft <sup>2</sup>	U = 0.46
Window 3 – Wood Frame Low-e Double Pane	90 ft <sup>2</sup> (six 3 ft wide by 5 ft high)	U = 0.30 SHGC=0.30
Wall 4 – faces West, Wood Frame	27 ft wide x 8 ft high = 216 ft <sup>2</sup>	R15, grade I
Window 4 – Wood Frame Low-e Double Pane	45 ft <sup>2</sup> (three 3 ft wide by 5 ft high)	U = 0.30 SHGC=0.30
Air leakage	House Volume = 1539 ft <sup>2</sup> x 8 ft height = 12,312 ft <sup>3</sup>	ACH50 = 7.0
Heating – electric heat pump	24.0 kBtu/h	HSPF = 9.5
Cooling – electric A/C	24.0 kBtu/h	SEER = 18
AHU in conditioned space	N/A	Factory Sealed
Ducts – supply in conditioned space	385 ft <sup>2</sup>	R6 insulation
Ducts – return in conditioned space	77 ft <sup>2</sup>	R6 insulation
Duct Tightness	N/A	N/A
Thermostat Type	N/A	Programmable
Mechanical Ventilation	None	N/A
Attic Ventilation	Vented	N/A
Hot Water System – Electric HP	50 gallon	EF = 3.5
All Hot Water Lines	Runs 35 feet	R3 insulation
Hot Water Circulation -none	N/A	N/A
Heat Trap	N/A	Installed
Clothes Washer, Dryer, Range, Refrigerator and Dishwasher	Same as ANSI/RESNET/ICC 301-2014 Reference Case	Same as ANSI/RESNET/ICC 301-2014 Reference Case
Interior Lighting	20 installed fixtures	20 fixtures compact fluorescent
Exterior Lighting	1 installed fixtures	1 fixture compact fluorescent
Pool and Spa - none	N/A	N/A
PV – System	2.55 kW Capacity, Azimuth = 180°, Tilt = 23°, Area = 232.3 ft <sup>2</sup> .	PV efficiency = 10.87 % & Temperature Coeff = 0.0035 K <sup>-1</sup> Inverter efficiency = 90% at 2.5 kW

<sup>1</sup> Roof construction: composite shingles, roof framing fraction of 0.10. Solar absorptance = 0.6, roof emittance = 0.9.

<sup>2</sup> Layers from outside: Attic air, R38 batt insulation with 2x4 framing with 0.11 framing fraction, ½” drywall

<sup>3</sup> Wood frame wall layers from outside: synthetic stucco applied over #30 asphalt building paper, ½” exterior plywood, 2x4 frame with R-15 fiberglass batt insulation with a 0.25 total framing fraction, and ½” drywall. Solar absorptance = 0.6.

### **R6.3 Florida ERI Alternative Method Tests Acceptance Criteria**

The Florida ERI alternative method test acceptance criteria are based on the ERI-value listed in Table R406.4, and the mandatory and thermal envelope efficiency requirements in Section R406.2. Using the results spreadsheet provided by the Florida Building Commission (2017-Florida\_ERI-Test\_Results-form.xlsx), software tools shall demonstrate the following:

- vendor's software calculated *rated ERI* value (ERI-Vendor) shall indicate a "FAIL" result if the ERI is greater than the ERI-Target value in Table R406.4 of the Florida Energy Code; and
- vendor's software shall check the thermal envelope efficiency level and some mandatory requirements specified in the results spreadsheet. If the thermal envelope acceptance criteria fails to meet either the R-Value method or U-Factor method or listed mandatory requirements, the Vendor's software shall indicate "FAIL" even if the ERI-Target value in Table R406.4 of the Florida Energy Code was met;

The second set of tests for the Florida ERI alternative method is comparing the vendor's software reported ERI values against those values computed by the spreadsheet "2017-FLCode\_ERIFromEndUses\_Results-form.xlsx" for the same four test cases but without on-site power generation. Vendor's software shall demonstrate the following:

- vendors shall enter the Reference Home End Use Loads (REUL), Reference Home End Use Energy Consumption (EC\_r), Rated Home End Use Energy Consumption (EC\_x), and Manufacturer's Equipment Performance Ratings (MEPR) to calculate the rated ERI in the results spreadsheet workbook named "2017-FLCode\_ERIFromEndUses\_Results-form.xlsx" for the four Florida home test cases described in Section R6.2 in this Manual. The rated ERI values shall be computed without any on-site power generation for all the four test cases. Vendors also enter rated ERI value calculated by their software in the results spreadsheet provided. In order to pass the test the difference between rated ERI values calculated by the vendor's software and those computed by the spreadsheet provided is expected to be within  $\pm 0.5\%$  of the rated ERI-value reported by the vendor's software for each test case.

### **R6.4 ERI Alternative Method Software Output Reports**

For each test case the following software produced reports are required (see Section R6.5 of this Manual for blank sample form) in addition to any test specific reports mentioned above:

- 1) A Form R406-2017 report that documents that the Rated Design complies with Section R406 of the Florida Energy Code. This form shall include a summary page indicating home address, ERI value and the pass or fail status along with name and version of the compliance software tool, name and signature of the third party individual completing the compliance report. The FORM R406-2017 shall indicate whether the home thermal envelope efficiency level is greater than or equal to 2009 IECC Table 402.1.1 or 402.1.3, unless credit has been given for on-site renewable power production in which case it shall be greater than or equal to the efficiency of 2015 IECC Table R402.1.2 or R402.1.4. It shall also indicate if the home complies with 2015 IECC R403.5.3. An ERI submitted at the time of permit should indicate it is a projected ERI and indicate any testing required.
- 2) Input summary checklist report. Sample report is in [Appendix R-7](#) of this Manual (usually four pages/may be greater)
- 3) Energy Performance Level (EPL) Display Card. See [Appendix R-8](#) of this Manual (one page)
- 4) HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- 5) Mandatory requirements summarized in [Appendix R-9](#) of this Manual (usually five pages/may be greater)

Required prior to CO for the Energy Rating Index alternative method:

- 6) A completed Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page). See [Appendix R-10](#) of this Manual.
- 7) A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply. See [Appendix R-11](#) of this Manual.
- 8) A completed Form 2017 Duct Leakage Test Report (usually one page). See [Appendix R-12](#) of this Manual.

## **R6.5 ERI Alternative Method Reporting Requirements**

In accordance with Section R406.4 of the Florida Building Code, Energy Conservation, the printout from computer programs approved by the Florida Building Commission for use as Energy Code compliance Form R406-2017 for residential applications shall contain all information required to determine Energy Code compliance for low-rise residential buildings, to include but not be limited to the following information. Compliance software program printout Form R406 should be consistent with the content described below. ERI method compliance alternative sample Forms are provided in [Appendix R6.6](#) of this Manual.

A.1 Residential Energy Rating Index Method Compliance Alternative Report output should contain the following information:

- Form title and headings:
  - Form R406-2017
  - Florida Building Code, Energy Conservation
  - Residential Energy Rating Index Method Compliance Alternative
  - Permit Office
  - Jurisdiction
  - Worst Case Orientation Calculation
  - Permit Number
  - County
  - Florida Climate Zone
  - Simulation Location
  
- Project information box
  - Property
  - Owner Name
  - Street address/city/state/zip
  - Builder Name
  - Builder Address / Phone
  - R406 Specific Requirements
    - One-site Renewable Power
    - Envelope Levels Meet or Exceed IECC Code (2009 or 2015)
    - R403.5.3 Hot Water Pipe Insulation
  
- Building performance parameters
  - ERI value for this house
  - Maximum Allowed ERI value
  - Estimated Annual Energy Use Breakdown

- Annual Energy Costs by use. Utility rates should be consistent with the requirements of ANSI/RESNET/ICC 301-2014 5.1.2.1.1. Energy Prices: Energy costs for all homes shall be calculated using state-wide, revenue based energy price rate data published annually by the U.S. Department of Energy (DOE), Energy Information Administration (EIA).
- Compliance certification box
  - Statement, signature and date by the 3<sup>rd</sup> party verifier completing the compliance report as follows:
    - Statement: “This home is **projected** to meet the Energy Rating Index requirement of Section R406 of the Florida Building Code, Energy Conservation, 6th Edition (2017). Other mandatory measures must also be met”
      - Name: \_\_\_\_\_
      - Address: \_\_\_\_\_
      - Phone: \_\_\_\_\_
      - Signature: \_\_\_\_\_
      - Date: \_\_\_\_\_

Statement, signature and date by the code official reviewing the plans and compliance report:

- Statement: “Review of the plans and specifications covered by this calculation indicates compliance with the *Florida Building Code, Energy Conservation*. Before construction is completed, this building will be inspected for compliance with Section 553.908, *Florida Statutes*.”
  - BUILDING OFFICIAL: \_\_\_\_\_
  - DATE: \_\_\_\_\_
- Bottom section of form R406
  - Air handler enclosure status
  - Air tightness test ACH value
  - Duct test leakage rate
  - Roof absorptance and emittance tested results requirement
- Footer Section
  - Date/Time, Software title and version, Florida Code

A.2 Building component characteristics and features. Input Summary Checklist Report to be consistent with the plans may include, but not be limited to:

- Form name
- Project Summary
  - Title
  - Climate zone information by design location
  - New construction or existing
  - Single or multiple-family
  - Number of units should be 1
  - Number of bedrooms
  - Whether it is a worst-case orientation calculation
- Floor type, materials, area or perimeter, insulation R-value

- Roof type, materials area, insulation R-value, solar absorptance, testing radiant barrier system, pitch, other relevant information as required by Energy Code
- Ceiling type, materials, insulation R-value, area, truss type, framing fraction
- Wall type, orientation, whether it is exterior or adjacent, insulation R-value, area, sheathing, framing fraction solar absorptance
- Door type, orientation, U-factor, area
- Window type(s), orientation, U-factor, SHGC, area, overhang, separation, interior shading, screening or storm windows
- Infiltration of the building (SLA, CFM, ACH, ELA, EqLA) and forced ventilation of the building (supply CFM, exhaust CFM, run time, fan Watts)
- Garage area, insulation R-value if conditioned
- Cooling system type, efficiency, capacity, air flow, SHR, other relevant information
- Heating system type, efficiency, capacity, other relevant information
- Water heaters requirements
- Duct and air handler location, R-value and type for supply, return and air handler, area, leakage type and percent,  $Q_n$ , RLF, Duct location
- Thermostat type and setting
- Ceiling fan use, if applicable
- Appliances and lighting fixtures included in the ERI method rated calculations

### **R6.5.1 Additional documentation**

The compliance software vendors are required to provide instructions on how to generate the additional reporting requirements per Section R406.6.3 of the 2017 Florida Energy Code. The *code official* shall be permitted to require the following documents:

- Documentation of the building component characteristics of the *ERI reference design*.
- A certification signed by the builder providing the building component characteristics of the *rated design*.
- Documentation of the actual values used in the software calculations for the *rated design*.

Vendors shall use the additional sample forms provided in the [ERI Rated Design Building Component Characteristics Report](#) and [ERI Reference Design Building Component Characteristics Report](#) sections of this Manual.

### **R6.6 Energy Rating Index Alternative Method Sample Reports**

The following sample forms are for the ERI alternative compliance method reports. The sample forms are vendor's software output report forms requirements described in the checklist of Section R6.4 and additional reporting requirement forms described in Section R6.5.1 of this Manual.

FORM R406-2017

**RESIDENTIAL ENERGY CONSERVATION CODE DOCUMENTATION CHECKLIST**

*Florida Department of Business and Professional Regulation  
Residential Energy Rating Index Method Compliance Alternative*

*Applications for compliance with the 2017 Florida Building Code, Energy Conservation via the residential Energy Rating Index Method Compliance Alternative shall include:*

- This checklist
- A Form R406-2017 report that documents that the Rated Design complies with Section R406 of the Florida Energy Code. This form shall include a summary page indicating home address, ERI value and the pass or fail status along with name and version of the compliance software tool, name and signature of the third party individual completing the compliance report. The FORM R406-2017 shall indicate whether the home thermal envelope efficiency level is greater than or equal to 2009 IECC Table 402.1.1 or 402.1.3, unless credit has been given for on-site renewable power production in which case it shall be greater than or equal to the efficiency of 2015 IECC Table R402.1.2 or R402.1.4. It shall also indicate if the home complies with 2015 IECC R403.5.3. An ERI submitted at the time of permit should indicate it is projected ERI and indicate any testing required.*
- Input Summary Checklist Report (usually four pages/may be greater)*
- Energy Performance Level (EPL) Display Card (one page)
- HVAC system sizing and selection based on ACCA Manual S or per exceptions provided in Section R403.7
- Mandatory Requirements (five pages)

*Required prior to CO for the Performance Method:*

- 2017 Air Barrier and Insulation Inspection Component Criteria checklist (Table R402.4.1.1 of the 2017 Florida Building Code, Energy Conservation - one page)*
- A completed Form 2017 Envelope Leakage Test Report (usually one page). Section R402.4 or R402.4.1.2 exceptions may apply*
- A completed Form 2017 Duct Leakage Test Report (usually one page)*

FORM R406-2017

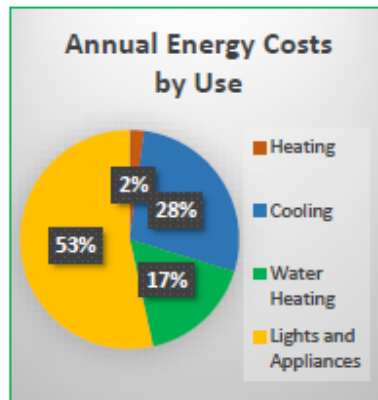
## FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

### Residential Energy Rating Index Method Compliance Alternative

Permit Office: City Hall	Permit Number: 12345678910	Florida Climate Zone: 1
Jurisdiction: North Miami Beach	County: Miami-Dade	Simulation Location:
Worst Case Orientation Calculation: No		FL_MIAMI_INTL_AP

<u>Property</u>	<u>R406 Specific Requirements</u>	<u>Builder</u>
Owner: Street Building Co. 25 Parkes Street North Miami Beach, FL 33101	On-site Renewable Power? No Envelope Levels Meet or Exceed: IECC-2009 R403.5.3 HW Pipe Insulation? Yes	Street Building Co. 2147 Southwest Barton Street Miami FL 33101 Phone: 305-555-5555

ERI for this House	50	<b>PASS</b>
Maximum Allowed ERI	58	
ERI of this House if Built to 2006 Code	100	



#### Estimated Annual Energy Use Breakdown \*

Source	Use	Price**	Cost
Electricity	10942 kWh	\$ 0.1098/kWh	\$ 1201
Natural Gas	0 Therms	\$ 0.198/Therm	\$ 0
Oil	0 Gallons	NA	\$ 0
On-site power production	0 kWh	NA	\$ 0***
<b>Total</b>			<b>\$ 1201</b>

\* Based on standard operating conditions  
 \*\* Energy prices are 2016 state wide averages published by USDOE EIA  
 \*\*\* Assumes net metering

#### 3<sup>rd</sup> Party Verifier:

This home is projected to meet the Energy Rating Index requirement of Section R406 of the Florida Building Code, Energy Conservation, 6th Edition (2017). Other mandatory measures must also be met.

Name: Joe Rater  
 Address: Liberty ERI Rating Co.  
 Phone: \_\_\_\_\_  
 Signature: \_\_\_\_\_  
 Date: \_\_\_\_\_

Review of the plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is complete this building will be inspected for compliance with Section 553.908 Florida Statutes.



BUILDING OFFICIAL: \_\_\_\_\_  
 DATE: \_\_\_\_\_

- Compliance requires the air handler enclosure qualifies as certified factory-sealed in accordance with R403.3.2.1.
- Compliance requires air tightness test demonstrating an ACH50 ≤ 5.4 ACH50 conducted according to R402.4.1.2.
- ANSI/RESNET/ICC 380 compliance requires a duct leakage test report confirming a leakage rate to outdoors of ≤ 2.5 cfm/100ft<sup>2</sup>.
- ANSI/RESNET/ICC 301 compliance requires a tested roof absorptance of 0.76 and a tested roof emittance of 0.90.



ERI Rated Design Building Component Characteristics Report – 2017 – SAMPLE

2017 FL Code

**ERI RATED DESIGN BUILDING COMPONENT CHARACTERICS REPORT**

PROJECT												
Title:	Bedrooms:	Address Type:										
Building Type:	Conditioned Area:	Lot #										
Owner Name:	Total Stories:	Block/Subdivision:										
# of Units:	Worst Case:	PlatBook:										
Builder Name:	Rotate Angle:	Street:										
Permit Office:	Cross Ventilation:	County:										
Jurisdiction:	Whole House Fan:	City, State, Zip:										
Family Type:												
New/Existing:												
Comment:												
CLIMATE												
<input checked="" type="checkbox"/>	Design Location	TMY Site	Design Temp 97.5 %	2.5 %	Int Design Temp Winter	Summer	Heating Degree Days	Design Moisture	Daily Temp Range			
BLOCKS												
<input checked="" type="checkbox"/>	Number	Name	Area	Volume								
_____	1											
SPACES												
<input checked="" type="checkbox"/>	Number	Name	Area	Volume	Kitchen	Occupants	Bedrooms	Infil ID	Finished	Cooled	Heated	
_____	1											
FLOORS												
<input checked="" type="checkbox"/>	#	Floor Type	Space	Perimeter	R-Value	Area	Tile	Wood	Carpet			
ROOF												
<input checked="" type="checkbox"/>	#	Type	Materials	Roof Area	Gable Area	Roof Color	Solar Absor.	SA Tested	Emitt Tested	Emitt Tested	Deck Insul.	Pitch (deg)
ATTIC												
<input checked="" type="checkbox"/>	#	Type	Ventilation	Vent Ratio (1 in)	Area	RBS	IRCC					
CEILING												
<input checked="" type="checkbox"/>	#	Ceiling Type	Space	R-Value	Ins Type	Area	Framing Frac	Truss Type				

ERI Rated Design Building Component Characteristics Report – 2017 – SAMPLE

2017 FL Code

**ERI RATED DESIGN BUILDING COMPONENT CHARACTERICS REPORT**

WALLS															
<input checked="" type="checkbox"/>	#	Omt	Adjacent To	Wall Type	Space	Cavity R-Value	Width Ft	In	Height Ft	In	Area	Sheathing R-Value	Framing Fraction	Solar Absor	Below Grade%
_____	1														
_____	2														
_____	3														
_____	4														
_____	5														

DOORS											
<input checked="" type="checkbox"/>	#	Omt	Door Type	Space	Storms	U-Value	Width Ft	In	Height Ft	In	Area
_____											

WINDOWS														
Orientation shown is the entered, Proposed orientation.														
<input checked="" type="checkbox"/>	#	Omt	Wall ID	Frame	Panes	NFRC	U-Factor	SHGC	Imp	Area	Overhang Depth	Separation	Int Shade	Screening
_____	1													
_____	2													
_____	3													
_____	4													

GARAGE						
<input checked="" type="checkbox"/>	#	Floor Area	Ceiling Area	Exposed Wall Perimeter	Avg. Wall Height	Exposed Wall Insulation
_____						

INFILTRATION									
<input checked="" type="checkbox"/>	#	Scope	Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50
_____									

HEATING SYSTEM							
<input checked="" type="checkbox"/>	#	System Type	Subtype	Efficiency	Capacity	Block	Ducts
_____							

COOLING SYSTEM									
<input checked="" type="checkbox"/>	#	System Type	Subtype	Efficiency	Capacity	Air Flow	SHR	Block	Ducts
_____									

ERI Rated Design Building Component Characteristics Report – 2017 – SAMPLE

2017 FL Code

**ERI RATED DESIGN BUILDING COMPONENT CHARACTERICS REPORT**

HOT WATER SYSTEM														
<input checked="" type="checkbox"/>	#	System Type	SubType	Location	EF	Cap	Use	SetPnt	Conservation					
SOLAR HOT WATER SYSTEM														
<input checked="" type="checkbox"/>	FSEC Cert #	Company Name	System Model #			Collector Model #			Collector Area	Storage Volume	FEF			
	None	None							ft²					
DUCTS														
<input checked="" type="checkbox"/>	#	Location	--- Supply --- R-Value Area		--- Return --- Location Area		Leakage Type	Air Handler	CFM 25 TOT	CFM25 OUT	QN	RLF	HVAC # Heat Cool	
TEMPERATURES														
Programable Thermostat: N						Ceiling Fans:								
Cooling	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Dec
Heating	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Dec
Venting	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Dec
Thermostat Schedule:														
Schedule Type		Hours												
		1	2	3	4	5	6	7	8	9	10	11	12	
Cooling (WD)	AM	75	75	75	75	75	75	75	75	75	75	75	75	
	PM	75	75	75	75	75	75	75	75	75	75	75	75	
Cooling (WEH)	AM	75	75	75	75	75	75	75	75	75	75	75	75	
	PM	75	75	75	75	75	75	75	75	75	75	75	75	
Heating (WD)	AM	72	72	72	72	72	72	72	72	72	72	72	72	
	PM	72	72	72	72	72	72	72	72	72	72	72	72	
Heating (WEH)	AM	72	72	72	72	72	72	72	72	72	72	72	72	
	PM	72	72	72	72	72	72	72	72	72	72	72	72	

2017 FL Code

**ERI REFERENCE DESIGN BUILDING COMPONENT CHARACTERISTICS REPORT**

PROJECT												
Title:	Bedrooms:	Address Type:										
Building Type:	Conditioned Area:	Lot #										
Owner Name:	Total Stories:	Block/Subdivision:										
# of Units:	Worst Case:	PlatBook:										
Builder Name:	Rotate Angle:	Street:										
Permit Office:	Cross Ventilation:	County:										
Jurisdiction:	Whole House Fan:	City, State, Zip:										
Family Type:												
New/Existing:												
Comment:												
CLIMATE												
<input checked="" type="checkbox"/>	Design Location	TMY Site	Design Temp 97.5 %	2.5 %	Int Design Temp Winter	Summer	Heating Degree Days	Design Moisture	Daily Temp Range			
BLOCKS												
<input checked="" type="checkbox"/>	Number	Name	Area	Volume								
SPACES												
<input checked="" type="checkbox"/>	Number	Name	Area	Volume	Kitchen	Occupants	Bedrooms	Infil ID	Finished	Cooled	Heated	
FLOORS												
<input checked="" type="checkbox"/>	#	Floor Type	Space	Perimeter	R-Value	Area	U-Factor	Tile	Wood	Carpet		
ROOF												
<input checked="" type="checkbox"/>	#	Type	Materials	Roof Area	Gable Area	Roof Color	Solar Absor.	SA Tested	Emitt Tested	Emitt Tested	Deck Insul.	Pitch (deg)
ATTIC												
<input checked="" type="checkbox"/>	#	Type	Ventilation	Vent Ratio (1 in)	Area	RBS	IRCC					
CEILING												
<input checked="" type="checkbox"/>	#	Ceiling Type	Space	R-Value	Ins Type	Area	U-Factor	Framing Frac	Truss Type			

2017 FL Code

**ERI REFERENCE DESIGN BUILDING COMPONENT CHARACTERISTICS REPORT**

WALLS																
✓	#	Ornt	Adjacent To	Wall Type	Space	Cavity R-Value	Width Ft	In	Height Ft	In	Area	U-Factor	Sheathing R-Value	Framing Fraction	Solar Absor	Below Grade%
___	1															
___	2															
___	3															
___	4															
___	5															

DOORS											
✓	#	Ornt	Door Type	Space	Storms	U-Value	Width Ft	In	Height Ft	In	Area
___											

WINDOWS														
Orientation shown is the entered, Proposed orientation.														
✓	#	Ornt	Wall ID	Frame	Panes	NFRC	U-Factor	SHGC	Imp	Area	Overhang Depth	Separation	Int Shade	Screening
___	1													
___	2													
___	3													
___	4													

GARAGE						
✓	#	Floor Area	Ceiling Area	Exposed Wall Perimeter	Avg. Wall Height	Exposed Wall Insulation
___						

INFILTRATION									
✓	#	Scope	Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50
___									

HEATING SYSTEM							
✓	#	System Type	Subtype	Efficiency	Capacity	Block	Ducts
___							

COOLING SYSTEM									
✓	#	System Type	Subtype	Efficiency	Capacity	Air Flow	SHR	Block	Ducts
___									

2017 FL Code

**ERI REFERENCE DESIGN BUILDING COMPONENT CHARACTERISTICS REPORT**

HOT WATER SYSTEM														
<input checked="" type="checkbox"/>	#	System Type	SubType	Location	EF	Cap	Use	SetPnt	Conservation					
SOLAR HOT WATER SYSTEM														
<input checked="" type="checkbox"/>	FSEC Cert #	Company Name	System Model #			Collector Model #			Collector Area	Storage Volume	FEF			
None		None								ft <sup>2</sup>				
DUCTS														
<input checked="" type="checkbox"/>	#	---- Supply ----			---- Return ----			Air Handler	CFM 25 TOT	CFM25 OUT	QN	RLF	HVAC # Heat Cool	
TEMPERATURES														
Programable Thermostat: N							Ceiling Fans:							
Cooling	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec		
Heating	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec		
Venting	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec		
Thermostat Schedule:														
Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12	
Cooling (WD)	AM PM	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	
Cooling (WEH)	AM PM	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	75 75	
Heating (WD)	AM PM	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	
Heating (WEH)	AM PM	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	72 72	

## **Appendix R-7 Residential Input Summary Checklist Sample Form**

A user inputs summary checklist report for the 6<sup>th</sup> Edition (2017) Residential Florida Energy Code. The input summary checklist report sample forms in the next three pages apply to the following five residential code compliance methods allowed by the Residential Florida Energy Code:

- Residential prescriptive R-value
- Residential prescriptive U-factor alternative
- Residential prescriptive total UA alternative
- Residential simulated performance alternative
- Residential Energy Rating Index compliance alternative

User Inputs Summary Checklist Report-2017 – SAMPLE

2017 FL Code

**INPUT SUMMARY CHECKLIST REPORT**

PROJECT												
Title:	Bedrooms:	Address Type:										
Building Type:	Conditioned Area:	Lot #										
Owner Name:	Total Stories:	Block/Subdivision:										
# of Units:	Worst Case:	PlatBook:										
Builder Name:	Rotate Angle:	Street:										
Permit Office:	Cross Ventilation:	County:										
Jurisdiction:	Whole House Fan:	City, State, Zip:										
Family Type:												
New/Existing:												
Comment:												
CLIMATE												
✓	Design Location	TMY Site	Design Temp	97.5 %	2.5 %	Int Design Temp	Winter	Summer	Heating Degree Days	Design Moisture	Daily Temp Range	
_____												
BLOCKS												
✓	Number	Name	Area	Volume								
_____ 1												
SPACES												
✓	Number	Name	Area	Volume	Kitchen	Occupants	Bedrooms	Infil ID	Finished	Cooled	Heated	
_____ 1												
FLOORS												
✓	#	Floor Type	Space	Perimeter	R-Value	Area		Tile	Wood	Carpet		
_____												
ROOF												
✓	#	Type	Materials	Roof Area	Gable Area	Roof Color	Solar Absor.	SA Tested	Emitt Tested	Emitt Tested	Deck Insul.	Pitch (deg)
_____												
ATTIC												
✓	#	Type	Ventilation		Vent Ratio (1 in)	Area	RBS	IRCC				
_____												
CEILING												
✓	#	Ceiling Type	Space	R-Value	Ins Type	Area	Framing Frac	Truss Type				
_____												



User Inputs Summary Checklist Report-2017 – SAMPLE

2017 FL Code

**INPUT SUMMARY CHECKLIST REPORT**

WALLS																
✓	#	Ornt	Adjacent To	Wall Type	Space	Cavity R-Value	Width Ft	In	Height Ft	In	Area	Sheathing R-Value	Framing Fraction	Solar Absor	Below Grade%	
___	1															
___	2															
___	3															
___	4															
___	5															

DOORS											
✓	#	Ornt	Door Type	Space	Storms	U-Value	Width Ft	In	Height Ft	In	Area
___											

WINDOWS														
Orientation shown is the entered, Proposed orientation.														
✓	#	Ornt	Wall ID	Frame	Panes	NFRC	U-Factor	SHGC	Imp	Area	Overhang Depth	Separation	Int Shade	Screening
___	1													
___	2													
___	3													
___	4													

GARAGE						
✓	#	Floor Area	Ceiling Area	Exposed Wall Perimeter	Avg. Wall Height	Exposed Wall Insulation
___						

INFILTRATION									
✓	#	Scope	Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50
___									

HEATING SYSTEM							
✓	#	System Type	Subtype	Efficiency	Capacity	Block	Ducts
___							

COOLING SYSTEM									
✓	#	System Type	Subtype	Efficiency	Capacity	Air Flow	SHR	Block	Ducts
___									

User Inputs Summary Checklist Report-2017 – SAMPLE

2017 FL Code

**INPUT SUMMARY CHECKLIST REPORT**

HOT WATER SYSTEM																									
<input checked="" type="checkbox"/>	#	System Type	SubType	Location	EF	Cap	Use	SetPnt	Conservation																
SOLAR HOT WATER SYSTEM																									
<input checked="" type="checkbox"/>	FSEC Cert #	Company Name	System Model #				Collector Model #		Collector Area	Storage Volume	FEF														
None		None						ft <sup>2</sup>																	
DUCTS																									
<input checked="" type="checkbox"/>	#	--- Supply ---			--- Return ---			Leakage Type	Air Handler	CFM 25 TOT	CFM25 OUT	QN	RLF	HVAC # Heat Cool											
TEMPERATURES																									
Programable Thermostat: N						Ceiling Fans:																			
Cooling	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec	Heating	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec
Venting	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec	Cooling	<input checked="" type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input checked="" type="checkbox"/> Mar	<input checked="" type="checkbox"/> Apr	<input checked="" type="checkbox"/> May	<input checked="" type="checkbox"/> Jun	<input checked="" type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input checked="" type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input checked="" type="checkbox"/> Dec
Thermostat Schedule:																									
Schedule Type		Hours																							
		1	2	3	4	5	6	7	8	9	10	11	12												
Cooling (WD)		AM 75	75	75	75	75	75	75	75	75	75	75	75												
Cooling (WEH)		AM 75	75	75	75	75	75	75	75	75	75	75	75												
Heating (WD)		AM 72	72	72	72	72	72	72	72	72	72	72	72												
Heating (WEH)		AM 72	72	72	72	72	72	72	72	72	72	72	72												
		PM 72	72	72	72	72	72	72	72	72	72	72	72												

Add appliance and lighting characteristics to input summary checklist report when using the ERI Method compliance alternative.

## **Appendix R-8 Residential Energy Performance Level Display Card**

An Energy Performance Level (EPL) display card sample form for the 6<sup>th</sup> Edition (2017) Residential Florida Energy Code. The EPL display card sample form on the next page applies to all five residential code compliance methods allowed by the Residential Florida Energy Code:

- Residential prescriptive R-value
- Residential prescriptive U-factor alternative
- Residential prescriptive total UA alternative
- Residential simulated performance alternative
- Residential Energy Rating Index compliance alternative

# Energy Performance Level Display Card – SAMPLE

2017 EPL DISPLAY CARD

## ENERGY PERFORMANCE LEVEL (EPL) DISPLAY CARD

ESTIMATED ENERGY PERFORMANCE INDEX\* = \_\_\_\_\_

**The lower the Energy Performance Index, the more efficient the home.**

<p>1. New home or, addition 1. _____</p> <p>2. Single-family or multiple-family 2. _____</p> <p>3. No. of units (if multiple-family) 3. _____</p> <p>4. Number of bedrooms 4. _____</p> <p>5. Is this a worst case? (yes/no) 5. _____</p> <p>6. Conditioned floor area (sq. ft.) 6. _____</p> <p>7. Windows, type and area</p> <p style="padding-left: 20px;">a) U-factor: 7a. _____</p> <p style="padding-left: 20px;">b) Solar Heat Gain Coefficient (SHGC) 7b. _____</p> <p style="padding-left: 20px;">c) Area 7c. _____</p> <p>8. Skylights</p> <p style="padding-left: 20px;">a) U-factor 8a. _____</p> <p style="padding-left: 20px;">b) Solar Heat Gain Coefficient (SHGC) 8b. _____</p> <p>9. Floor type, insulation level:</p> <p style="padding-left: 20px;">a) Slab-on-grade (R-value) 9a. _____</p> <p style="padding-left: 20px;">b) Wood, raised (R-value) 9b. _____</p> <p style="padding-left: 20px;">c) Concrete, raised (R-value) 9c. _____</p> <p>10. Wall type and insulation:</p> <p style="padding-left: 20px;">A. Exterior:</p> <p style="padding-left: 40px;">1. Wood frame (Insulation R-value) 10A1. _____</p> <p style="padding-left: 40px;">2. Masonry (Insulation R-value) 10A2. _____</p> <p style="padding-left: 20px;">B. Adjacent:</p> <p style="padding-left: 40px;">1. Wood frame (Insulation R-value) 10B1. _____</p> <p style="padding-left: 40px;">2. Masonry (Insulation R-value) 10B2. _____</p> <p>11. Ceiling type and insulation level</p> <p style="padding-left: 20px;">a) Under attic 11a. _____</p> <p style="padding-left: 20px;">b) Single assembly 11b. _____</p> <p style="padding-left: 20px;">c) Knee walls/skylight walls 11c. _____</p> <p style="padding-left: 20px;">d) Radiant barrier installed 11d. _____</p>	<p>12. Ducts, location &amp; insulation level</p> <p style="padding-left: 20px;">a) Supply ducts R= _____</p> <p style="padding-left: 20px;">b) Return ducts R= _____</p> <p style="padding-left: 20px;">c) AHU location _____</p> <p>13. Cooling system: Capacity: _____</p> <p style="padding-left: 20px;">a) Split system SEER _____</p> <p style="padding-left: 20px;">b) Single package SEER _____</p> <p style="padding-left: 20px;">c) Ground/water source COP _____</p> <p style="padding-left: 20px;">d) Room unit/PTAC EER _____</p> <p style="padding-left: 20px;">e) Other _____</p> <p>14. Heating system:</p> <p style="padding-left: 20px;">a) Split system heat pump HSPF _____</p> <p style="padding-left: 20px;">b) Single package heat pump HSPF _____</p> <p style="padding-left: 20px;">c) Electric resistance COP _____</p> <p style="padding-left: 20px;">d) Gas furnace, natural gas AFUE _____</p> <p style="padding-left: 20px;">e) Gas furnace, LPG AFUE _____</p> <p style="padding-left: 20px;">f) Other _____</p> <p>15. Water heating system</p> <p style="padding-left: 20px;">a) Electric resistance EF _____</p> <p style="padding-left: 20px;">b) Gas fired, natural gas EF _____</p> <p style="padding-left: 20px;">c) Gas fired, LPG EF _____</p> <p style="padding-left: 20px;">d) Solar system with tank EF _____</p> <p style="padding-left: 20px;">e) Dedicated heat pump with tank EF _____</p> <p style="padding-left: 20px;">f) Heat recovery unit HeatRec% _____</p> <p style="padding-left: 20px;">g) Other _____</p> <p>16. HVAC credits claimed (Performance Method) _____</p> <p style="padding-left: 20px;">a) Ceiling fans _____</p> <p style="padding-left: 20px;">b) Cross ventilation _____</p> <p style="padding-left: 20px;">c) Whole house fan _____</p> <p style="padding-left: 20px;">d) Multizone cooling credit _____</p> <p style="padding-left: 20px;">e) Multizone heating credit _____</p> <p style="padding-left: 20px;">f) Programmable thermostat _____</p>
--	---

\*Label required by Section R303.1.3 of the *Florida Building Code, Energy Conservation*, if not DEFAULT.

I certify that this home has complied with the *Florida Building Code, Energy Conservation*, through the above energy saving features which will be installed (or exceeded) in this home before final inspection. Otherwise, a new EPL display card will be completed based on installed code compliant features.

Builder Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Address of New Home: \_\_\_\_\_ City/FL Zip: \_\_\_\_\_

## **Appendix R-9 Residential Mandatory Requirements**

This section summarizes the mandatory requirements of the 6<sup>th</sup> Edition (2017) Residential Florida Energy Code. The mandatory requirements apply to all five residential code compliance methods:

- Residential prescriptive R-value
- Residential prescriptive U-factor alternative
- Residential prescriptive total UA alternative
- Residential simulated performance alternative
- Residential Energy Rating Index compliance alternative

# Mandatory Requirements for Residential Performance, Prescriptive and ERI Methods

## Florida Building Code, Energy Conservation, 6<sup>th</sup> Edition (2017) Mandatory Requirements for Residential Performance, Prescriptive and ERI Methods

ADDRESS: 123 Main Street  
Orlando, FL, 32922

PERMIT #:

### SECTION R401 GENERAL

**R401.3 Energy performance level (EPL) display card (Mandatory).** The building official shall require that an energy performance level (EPL) display card be completed and certified by the builder to be accurate and correct before final approval of the building for occupancy. Florida law (Section 553.9085, *Florida Statutes*) requires the EPL display card to be included as an addendum to each sales contract for both presold and nonpresold residential buildings. The EPL display card contains information indicating the energy performance level and efficiencies of components installed in a dwelling unit. The building official shall verify that the EPL display card completed and signed by the builder accurately reflects the plans and specifications submitted to demonstrate code compliance for the building. A copy of the EPL display card can be found in Appendix RD.

**R402.4 Air leakage (Mandatory).** The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

**Exception:** Dwelling units of R-2 Occupancies and multiple attached single family dwellings shall be permitted to comply with Section C402.5.

**R402.4.1 Building thermal envelope.** The *building thermal envelope* shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

**R402.4.1.1 Installation.** The components of the *building thermal envelope* as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

**R402.4.1.2 Testing.** The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding seven air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380 and reported at a pressure of 0.2 inch w.g. (50 pascals). Testing shall be conducted by either individuals as defined in Section 553.993(5) or (7), *Florida Statutes*, or individuals licensed as set forth in Section 489.105(3)(f), (g) or (i) or an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

**Exception:** Testing is not required for additions, alterations, renovations, or repairs, of the building thermal envelope of existing buildings in which the new construction is less than 85 percent of the building thermal envelope.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

**R402.4.2 Fireplaces.** New wood-burning fireplaces shall have tight-fitting flue dampers or doors, and outdoor combustion air. Where using tight-fitting doors on factory-built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907.

**R402.4.3 Fenestration air leakage.** Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m<sup>2</sup>), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m<sup>2</sup>), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and *listed* and *labeled* by the manufacturer.

**Exception:** Site-built windows, skylights and doors.

**R402.4.4 Rooms containing fuel-burning appliances.** In Climate Zones 3 through 8, where open combustion air ducts provide combustion air to open combustion fuel burning appliances, the appliances and combustion air opening shall be located outside the building thermal envelope or enclosed in a room, isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table R402.1.2, where the walls, floors and ceilings shall meet not less than the basement wall R-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section R403. The combustion air duct shall be insulated where it passes through conditioned space to a minimum.

## Mandatory Requirements for Residential Performance, Prescriptive and ERI Methods

### Mandatory Requirements (Continued)

#### Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Section R402.4.2 and Section R1006 of the *Florida Building Code, Residential*.

**R402.4.5 Recessed lighting.** Recessed luminaires installed in the *building thermal envelope* shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and labeled as having an air leakage rate not more than 2.0 cfm (0.944 L/s) when tested in accordance with ASTM E283 at a 1.57 psf (75 Pa) pressure differential. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

### SECTION R403 SYSTEMS

#### R403.1 Controls.

**R403.1.1 Thermostat provision (Mandatory).** At least one thermostat shall be provided for each separate heating and cooling system.

**R403.1.3 Heat pump supplementary heat (Mandatory).** Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

**R403.3.2 Sealing (Mandatory).** All ducts, air handlers, filter boxes and building cavities that form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers, shall be constructed and sealed in accordance with Section C403.2.9.2 of the Commercial Provisions of this code and shall be shown to meet duct tightness criteria below.

Duct tightness shall be verified by testing in accordance with ANSI/RESNET/ICC 380 by either individuals as defined in Section 553.993(5) or (7), *Florida Statutes*, or individuals licensed as set forth in Section 489.105(3)(f), (g) or (i), *Florida Statutes*, to be "substantially leak free" in accordance with Section R403.3.3.

**R403.3.2.1 Sealed air handler.** Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

**R403.3.3 Duct testing (Mandatory).** Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

#### Exceptions:

1. A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.
2. Duct testing is not mandatory for buildings complying with Section 405 of this code.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

**R403.3.5 Building cavities (Mandatory).** Building framing cavities shall not be used as ducts or plenums.

**R403.4 Mechanical system piping insulation (Mandatory).** Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

**R403.4.1 Protection of piping insulation.** Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind, and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

**R403.5.1 Heated water circulation and temperature maintenance systems (Mandatory).** Heated water circulation systems shall be in accordance with Section R403.5.1.1. Heat trace temperature maintenance systems shall be in accordance with Section R403.5.1.2. Automatic controls, temperature sensors and pumps shall be accessible. Manual controls shall be readily accessible.

**R403.5.1.1 Circulation systems.** Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosiphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

**R403.5.1.2 Heat trace systems.** Electric heat trace systems shall comply with IEEE 515.1 or UL 515. Controls for such systems shall automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

**R403.5.5 Heat traps (Mandatory).** Storage water heaters not equipped with integral heat traps and having vertical pipe risers shall have heat traps installed on both the inlets and outlets. External heat traps shall consist of either a commercially available heat trap or a downward and upward bend of at least 3 ½ inches (89 mm) in the hot water distribution line and cold water line located as close as possible to the storage tank.

**R403.5.6 Water heater efficiencies (Mandatory).**

**R403.5.6.1 Storage water heater temperature controls.**

**403.5.6.1.1 Automatic controls.** Service water-heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use. The minimum temperature setting range shall be from 100°F to 140°F (38°C to 60°C).



# Mandatory Requirements for Residential Performance, Prescriptive and ERI Methods

## Mandatory Requirements (Continued)

**R403.5.6.1.2 Shut down.** A separate switch or a clearly marked circuit breaker shall be provided to permit the power supplied to electric service systems to be turned off. A separate valve shall be provided to permit the energy supplied to the main burner(s) of combustion types of service water-heating systems to be turned off.

**R403.5.6.2 Water-heating equipment.** Water-heating equipment installed in residential units shall meet the minimum efficiencies of Table C404.2 in Chapter 4 of the *Florida Building Code, Energy Conservation, Commercial Provisions*, for the type of equipment installed. Equipment used to provide heating functions as part of a combination system shall satisfy all stated requirements for the appropriate water-heating category. Solar water heaters shall meet the criteria of Section R403.5.6.2.1.

**R403.5.6.2.1 Solar water-heating systems.** Solar systems for domestic hot water production are rated by the annual solar energy factor of the system. The solar energy factor of a system shall be determined from the Florida Solar Energy Center Directory of Certified Solar Systems. Solar collectors shall be tested in accordance with ISO Standard 9806, *Test Methods for Solar Collectors*, and SRCC Standard TM-1, *Solar Domestic Hot Water System and Component Test Protocol*. Collectors in installed solar water-heating systems should meet the following criteria:

1. Be installed with a tilt angle between 10 degrees and 40 degrees of the horizontal; and
2. Be installed at an orientation within 45 degrees of true south.

**R403.6 Mechanical ventilation (Mandatory).** The building shall be provided with ventilation that meets the requirements of the *Florida Building Code, Residential*, or *Florida Building Code, Mechanical*, as applicable, or with other approved means of ventilation including: Natural, Infiltration or Mechanical means. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

**R403.6.1 Whole-house mechanical ventilation system fan efficacy.** When installed to function as a whole-house mechanical ventilation system, fans shall meet the efficacy requirements of Table R403.6.1.

**Exception:** Where whole-house mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

**R403.6.2 Ventilation air.** Residential buildings designed to be operated at a positive indoor pressure or for mechanical ventilation shall meet the following criteria:

1. The design air change per hour minimums for residential buildings in ASHRAE 62.2, *Ventilation for Acceptable Indoor Air Quality*, shall be the maximum rates allowed for residential applications.
2. No ventilation or air-conditioning system make-up air shall be provided to conditioned space from attics, crawlspaces, attached enclosed garages or outdoor spaces adjacent to swimming pools or spas.
3. If ventilation air is drawn from enclosed space(s), then the walls of the space(s) from which air is drawn shall be insulated to a minimum of R-11 and the ceiling shall be insulated to a minimum of R-19, space permitting, or R-10 otherwise.

**R403.7 Heating and cooling equipment (Mandatory).**

**R403.7.1 Equipment sizing.** Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on the equipment loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies, based on building loads for the directional orientation of the building. The manufacturer and model number of the outdoor and indoor units (if split system) shall be submitted along with the sensible and total cooling capacities at the design conditions described in Section R302.1. This Code does not allow designer safety factors, provisions for future expansion or other factors that affect equipment sizing. System sizing calculations shall not include loads created by local intermittent mechanical ventilation such as standard kitchen and bathroom exhaust systems. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

TABLE R403.6.1  
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIRFLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY* (CFM/WATT)	AIRFLOW RATE MAXIMUM (CFM)
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

a. When tested in accordance with HVI Standard 916

**R403.7.1.1 Cooling equipment capacity.** Cooling only equipment shall be selected so that its total capacity is not less than the calculated total load but not more than 1.15 times greater than the total load calculated according to the procedure selected in Section 403.7, or the closest available size provided by the manufacturer's product lines. The corresponding latent capacity of the equipment shall not be less than the calculated latent load.

The published value for AHRI total capacity is a nominal, rating-test value and shall not be used for equipment sizing. Manufacturer's expanded performance data shall be used to select cooling-only equipment. This selection shall be based on the outdoor design dry-bulb temperature for the load calculation (or entering water temperature for water-source equipment), the blower CFM provided by the expanded performance data, the design value for entering wet-bulb temperature and the design value for entering dry-bulb temperature.

## Mandatory Requirements for Residential Performance, Prescriptive and ERI Methods

### Mandatory Requirements (Continued)

Design values for entering wet-bulb and dry-bulb temperatures shall be for the indoor dry bulb and relative humidity used for the load calculation and shall be adjusted for return side gains if the return duct(s) is installed in an unconditioned space.

#### Exceptions:

1. Attached single- and multiple-family residential equipment sizing may be selected so that its cooling capacity is less than the calculated total sensible load but not less than 80 percent of that load.
2. When signed and sealed by a Florida-registered engineer, in attached single- and multiple-family units, the capacity of equipment may be sized in accordance with good design practice.

#### R403.7.1.2 Heating equipment capacity.

**R403.7.1.2.1 Heat pumps.** Heat pump sizing shall be based on the cooling requirements as calculated according to Section R403.7.1.1, and the heat pump total cooling capacity shall not be more than 1.15 times greater than the design cooling load even if the design heating load is 1.15 times greater than the design cooling load.

**R403.7.1.2.2 Electric resistance furnaces.** Electric resistance furnaces shall be sized within 4 kW of the design requirements calculated according to the procedure selected in Section R403.7.1.

**R403.7.1.2.3 Fossil fuel heating equipment.** The capacity of fossil fuel heating equipment with natural draft atmospheric burners shall not be less than the design load calculated in accordance with Section R403.7.1.

**R403.7.1.3 Extra capacity required for special occasions.** Residences requiring excess cooling or heating equipment capacity on an intermittent basis, such as anticipated additional loads caused by major entertainment events, shall have equipment sized or controlled to prevent continuous space cooling or heating within that space by one or more of the following options:

1. A separate cooling or heating system is utilized to provide cooling or heating to the major entertainment areas.
2. A variable capacity system sized for optimum performance during base load periods is utilized.

**R403.8 Systems serving multiple dwelling units (Mandatory).** Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the IECC—Commercial Provisions in lieu of Section R403.

**R403.9 Snow melt and ice system controls (Mandatory).** Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C), and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (4.8°C).

**R403.10 Pools and permanent spa energy consumption (Mandatory).** The energy consumption of pools and permanent spas shall be in accordance with Sections R403.10.1 through R403.10.5.

**R403.10.1 Heaters.** The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

**R403.10.2 Time switches.** Time switches or other control methods that can automatically turn off and on according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

#### Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.
3. Where pumps are powered exclusively from onsite renewable generation.

**R403.10.3 Covers.** Outdoor heated swimming pools and outdoor permanent spas shall be equipped with a vapor-retardant cover on or at the water surface or a liquid cover or other means proven to reduce heat loss.

**Exception:** Where more than 70 percent of the energy for heating, computed over an operation season, is from site-recovered energy, such as from a heat pump or solar energy source, covers or other vapor-retardant means shall not be required.

**R403.10.4 Gas- and oil-fired pool and spa heaters.** All gas- and oil-fired pool and spa heaters shall have a minimum thermal efficiency of 82 percent for heaters manufactured on or after April 16, 2013, when tested in accordance with ANSI Z 21.56. Pool heaters fired by natural or LP gas shall not have continuously burning pilot lights.

**R403.10.5 Heat pump pool heaters.** Heat pump pool heaters shall have a minimum COP of 4.0 when tested in accordance with AHRI 1160, Table 2, Standard Rating Conditions-Low Air Temperature. A test report from an independent laboratory is required to verify procedure compliance. Geothermal swimming pool heat pumps are not required to meet this standard.

**R403.11 Portable spas (Mandatory).** The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14.

**R403.12 Residential pools and permanent residential spas.** Residential swimming pools and permanent residential spas that are accessory to detached one- and two-family dwellings and townhouses three stories or less in height above plane and that are available only to the household and its guests shall be in accordance with APSP-15.

**Mandatory Requirements (Continued)**

**SECTION R404**

**ELECTRICAL POWER AND LIGHTING SYSTEMS**

**R404.1 Lighting equipment (Mandatory).** Not less than 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps or not less than 75 percent of the permanently installed lighting fixtures shall contain only high-efficacy lamps.

**Exception:** Low-voltage lighting.

**R404.1.1 Lighting equipment (Mandatory).** Fuel gas lighting systems shall not have continuously burning pilot lights.

## **Appendix R-10 Residential Air Barrier and Insulation Installation**

An Air Barrier and Insulation Inspection Installation requirement for the 6<sup>th</sup> Edition (2017) Residential Florida Energy Code. The air barrier and insulation installation requirement table on the next page applies to all five residential code compliance methods allowed by the Residential Florida Energy Code:

- Residential prescriptive R-value
- Residential prescriptive U-factor alternative
- Residential prescriptive total UA alternative
- Residential simulated performance alternative
- Residential Energy Rating Index compliance alternative

# Air Barrier and Insulation Inspection Component Criteria-2017 – SAMPLE

## 2017 - AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

**TABLE R402.4.1.1  
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA**

Project Name: Street: City, State, Zip: Owner: Design Location:	Builder Name: Permit Office: Permit Number: Jurisdiction:	
COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing, and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior walls	The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.	
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air-sealed boxes shall be installed.	
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

## **Appendix R-11 Residential Envelope Leakage Test Report**

Envelope leakage (blower door) test report requirement for the 6<sup>th</sup> Edition (2017) Residential Florida Energy Code. The envelope leakage (blower door) test report shown on the next page applies to all five residential code compliance methods allowed by the Residential Florida Energy Code:

- Residential prescriptive R-value
- Residential prescriptive U-factor alternative
- Residential prescriptive total UA alternative
- Residential simulated performance alternative
- Residential Energy Rating Index compliance alternative

## Envelope Leakage Test Report (Blower Door Test)

Residential Prescriptive, Performance or ERI Method Compliance  
2017 Florida Building Code, Energy Conservation, 6th Edition

Jurisdiction: _____	Permit #: _____
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### Job Information

Builder: _____	Community: _____	Lot: _____
Address: _____	Unit: _____	
City: _____	State: _____	Zip: _____

### Air Leakage Test Results Passing results must meet either the Performance, Prescriptive, or ERI Method

**PRESCRIPTIVE METHOD**- The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 7 air changes per hour at a pressure of 0.2 inch w.g. (50 pascals) in Climate Zones 1 and 2.

**PERFORMANCE or ERI METHOD**- The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding the selected ACH(50) value, as shown on FORM R405-2017 (Performance) or R406-2017 (ERI), section labeled as Infiltration, sub-section ACH50.  
*ACH(50) specified on Form R405-2017-Energy Calc (Performance) or R406-2017 (ERI):*

$\frac{\text{CFM}(50)}{\text{Building Volume}} \times 60 \div \text{ACH}(50) = \text{ACH}(50)$ <p style="text-align: center; font-size: 24px; font-weight: bold;"> <input checked="" type="checkbox"/> <b>PASS</b> </p> <p><input type="checkbox"/> When ACH(50) is less than 3, Mechanical Ventilation installation must be verified by building department.</p>	<p><b>Method for calculating building volume:</b></p> <p><input type="radio"/> Retrieved from architectural plans</p> <p><input type="radio"/> Code software calculated</p> <p><input type="radio"/> Field measured and calculated</p>
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**R402.4.1.2 Testing.** Testing shall be conducted in accordance with ANSI/RESNET/ICC 380 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Testing shall be conducted by either individuals as defined in Section 553.993(5) or (7), *Florida Statutes*, or individuals licensed as set forth in Section 489.105(3)(f), (g), or (i) or an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

- During testing:**
1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
  2. Dampers including exhaust, intake, makeup air, back draft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
  3. Interior doors, if installed at the time of the test, shall be open.
  4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
  5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
  6. Supply and return registers, if installed at the time of the test, shall be fully open.

### Testing Company

Company Name: \_\_\_\_\_ Phone: \_\_\_\_\_

I hereby verify that the above Air Leakage results are in accordance with the 2017 6th Edition Florida Building Code Energy Conservation requirements according to the compliance method selected above.

Signature of Tester: \_\_\_\_\_ Date of Test: \_\_\_\_\_

Printed Name of Tester: \_\_\_\_\_

License/Certification #: \_\_\_\_\_ Issuing Authority: \_\_\_\_\_

## Appendix R-12 Residential Duct Leakage Test Report

Duct leakage test report requirement for the 6<sup>th</sup> Edition (2017) Residential Florida Energy Code. The duct leakage test report shown on the next page applies to all five residential code compliance methods allowed by the Residential Florida Energy Code:

- Residential prescriptive R-value
- Residential prescriptive U-factor alternative
- Residential prescriptive total UA alternative
- Residential simulated performance alternative
- Residential Energy Rating Index compliance alternative



## Duct Leakage Test Report

Residential Prescriptive, Performance or ERI Method Compliance  
2017 Florida Building Code, Energy Conservation, 6th Edition

Jurisdiction: _____	Permit #: _____
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### Job Information

Builder: _____	Community: _____	Lot: _____
Address: _____	Unit: _____	
City: _____	State: _____	Zip: _____

### Duct Leakage Test Results

System 1	_____ cfm25
System 2	_____ cfm25
System 3	_____ cfm25
Sum of any additional systems	_____ cfm25
<b>Total of all systems</b>	<b>_____ cfm25</b>

**Prescriptive Method** cfm25 (Total)

To qualify as "substantially leak free" Qn Total must be less than or equal to 0.04 if air handler unit is installed. If air handler unit is not installed, Qn Total must be less than or equal to 0.03. This testing method meets the requirements in accordance with Section R403.3.3.

Is the air handler unit installed during testing?  YES ( $\frac{s.04}{Qn}$ )  NO ( $\frac{s.03}{Qn}$ )

**Performance / ERI Method** cfm25 (Out or Total)

To qualify using this method, Qn must not be greater than the proposed duct leakage Qn specified on Form R405-2017 or R406-2017.

Leakage Type selected on Form R405-2017 (Energy Calc) or R406-2017	Qn specified on Form R405-2017 (Energy Calc) or R406-2017

$\frac{\text{Total of all systems}}{\text{Total Conditioned Square Footage}} = \text{_____ } Qn$

**PASS**

Duct tightness shall be verified by testing in accordance with ANSI/RESNET/ICC380 by either individuals as defined in Section 553.993(5) or (7), Florida Statutes, or individuals licensed as set forth in Section 489.105(3)(f), (g) or (i), Florida Statutes.

### Testing Company

Company Name: \_\_\_\_\_ Phone: \_\_\_\_\_

I hereby verify that the above duct leakage testing results are in accordance with the 2017 6th Edition Florida Building Code Energy Conservation requirements according to the compliance method selected above.

Signature of Tester: \_\_\_\_\_ Date of Test: \_\_\_\_\_

Printed Name of Tester: \_\_\_\_\_

License/Certification #: \_\_\_\_\_ Issuing Authority: \_\_\_\_\_

## **APPENDIX C**

### **Commercial and High-Rise Residential Minimum Required Content and Format**

In accordance with Section C407.4.1 of the 2017 Florida Building Code, Energy Conservation, the printout from computer programs approved by the Florida Building Commission for use as Commercial Energy Code compliance for commercial and high-rise residential applications shall contain all information required to determine Energy Code compliance for said buildings, to include but not be limited to the following information. Compliance software program printout Forms should be consistent with the format described below should contain, but not be limited to, the following information and be consistent with the format described below.

C.1 An Administrative page of the printout should contain the following information:

- Form Title and Headings:
  - Florida Building Code, Energy Conservation and other suitable clarifying titles
- Project Information Box
  - Project Name
  - Street Address/city/state/zip
  - Type of Building (occupancy)
  - Class of Building (new, renovation, etc.)
  - Conditioned Floor Area
  - Number of Stories
  - Owner
  - Design Location
  - Builder Name
  - Permit Office/Jurisdiction
  - Permit Number

C.2 Output Data

- Climate Zone  
The software output data depends on the compliance method. Apart from the common outputs three options are summarized to choose depending on the compliance method:
- Building End Uses: Proposed Design vs. Standard Reference Design (Performance Method only)
  - Electricity
  - Natural Gas
  - Area Lights
  - Space Cooling
  - Space Heating
  - Vent Fans
  - Miscellaneous Equipment
  - Pumps & Miscellaneous

- Envelope Prescriptive Compliance: Proposed Design vs. Standard Reference Design  
Pass or Fail for each building envelope elements categorized by zone or space  
(Prescriptive Method only)
  - Building Envelope Element (Proposed Design, Required/Criteria, Pass or Fail Results)
    - Windows (SHGC, U-Factor, VT, PF)
    - Window-Wall-Ratio (WWR)
    - Exterior Walls (U-Factor, or R-Value)
    - Floors (U-Factor, or F-Factor)
    - Below Grade Walls (U-Factor, or C-Factor)
  
- Envelope Trade-Off Option Compliance: Proposed Envelope Design vs. Base Envelope Design Envelope Performance Factor (EPF) for the whole building  
(Envelope Trade-Off Option Method only)
  - Building EPF: Proposed Envelope Design and Base Envelope Design (Pass or Fail)
  - Building envelope assembly type, gross area, and orientation by space category
    - Roof (gross area, U-factor, HC, and insulation position)
    - Above Grade Exterior Walls (gross area, U-factor, HC, and insulation position )
    - Below Grade Walls (gross area, U-factor, HC, and insulation position)
    - Floors (gross area, U-factor, HC, and insulation position)
    - Slab-on-Grade Floors (perimeter length, F-factor, and HC)
    - Opaque Doors (area, and U-factor)
    - Windows (area, U-factor, SHGC, VT, and PF)
    - Skylight Wells (area, U-factor, SHGC, and VT)
  
- Component Performance Alternative Compliance: Proposed Envelope Design vs. Baseline (Budget) Envelope Design UA differences (Component Performance Method only)
  - Building UA differences: Proposed and Baseline Envelope Design (Complied or Not Complied)
  - Envelope UA differences by construction assembly category
    - Roof, Floor and Above Grade Exterior Walls (U-factor, Area, and UA)
    - Below Grade Walls (C-factor, Area, and C multiplied A)
    - Slab-on-Grade Floors (F-factor, Perimeter, and F multiplied Perimeter)
    - Opaque Doors (U-factor, Area, and UA)
    - Windows (U-factor, Area, and UA)
    - Skylight Wells (U-factor, Area, and UA)

The following are common to the three compliance methods

- External lighting compliance
- Lighting controls compliance
- System report compliance
- Plant compliance
- Water Heater Compliance
- Piping system Compliance
- Other Required Compliance Requirements

### C.3 Compliance Summary

- Whether the building Passes or Fails Energy Code compliance
- The summary depends on the compliance method. Three options are provided depending on the compliance method:
  - Gross Energy Cost (in dollars): Performance Methods only
  - Envelope Prescriptive Compliance (Pass or Fail): Prescriptive Methods only
  - Envelope Performance Factor (EPF): Building Envelope Trade-Off Option Method only

The following are common to the three compliance methods

- Lighting Controls
  - External Lighting
  - HVAC System
  - Plant
  - Water Heating System
  - Piping Systems
  - Inspection Checklist
- Any conservation credits provided in the calculation per Section C407.5.2.4 of the Florida Energy Code.
  - Compliance Certification Box
    - Statement, signature and date by the individual completing the compliance report as follows:
      - Statement: “I hereby certify that the plans and specifications covered by this calculation are in compliance with the Florida Building Code, Energy Conservation.”
      - PREPARED BY: \_\_\_\_\_
      - DATE: \_\_\_\_\_
    - Statement, signature and date by the owner of the building
      - Statement: “I hereby certify that this building, as designed, is in compliance with the Florida Building Code, Energy Conservation.”
      - OWNER/AGENT: \_\_\_\_\_
      - DATE: \_\_\_\_\_
    - Where Florida law requires a design to be performed by a registered design professional, said design professional shall certify compliance of building by signing and providing their registration number:
      - Architect: \_\_\_\_\_ Registration No.: \_\_\_\_\_
      - Electrical Designer: \_\_\_\_\_ Registration No.: \_\_\_\_\_
      - Lighting Designer: \_\_\_\_\_ Registration No.: \_\_\_\_\_
      - Mechanical Designer: \_\_\_\_\_ Registration No.: \_\_\_\_\_
      - Plumbing Designer: \_\_\_\_\_ Registration No.: \_\_\_\_\_

- Statement, signature and date by the code official reviewing the plans and compliance report:
  - Statement: “Review of the plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance with Section 553.908, Florida Statutes.”
    - BUILDING OFFICIAL: \_\_\_\_\_
    - DATE: \_\_\_\_\_
- Name and version of the compliance software tool

#### C.4 Input data

Description of the building; data to be consistent with the plans may include, but not be limited to:

- Project Information
  - Zones
  - Spaces
  - Lighting
  - Walls
  - Windows
  - Doors
  - Roofs
  - Skylights
  - Floors ○
  - Systems ○
  - Plant
    - Water heaters
    - Exterior lighting
    - Piping
    - Fenestration used
    - Materials used
    - Constructs used

#### C.5 Energy Code Compliance Checklist

- Form name, compliance method
- Address and permit number of building permitted
- Other prescriptive measures checklist by component, Energy Code section and summary of requirement(s)

#### C.6 Other forms that may be required by the Florida Building Commission.