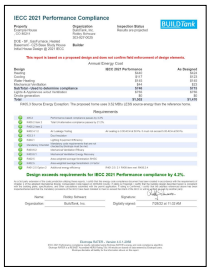
2021 Total Building Performance Path and Reading the Reports R405 Energy Code Support Program

Section R405 establishes criteria for compliance using simulated energy total building performance analysis. This compliance path option is a method of utilizing the whole building or house performance for trade offs. It uses the twin building concept of the referenced design and proposed design, and compliance is determined by the annual energy cost for heating, cooling, service water heating, and mechanical ventilation only.

- Table R405.4.2(1) will be utilized for the building's components in both the referenced design building and the proposed design building.
- Table R405.2 lists the required sections for compliance.
- Compliance with this pathway is determined if the proposed design has an annual energy cost that is less than or equal to the standard referenced design.
- Two reports are required for compliance
  - Report submitted for permit - (Proposed or projected performance)
  - Report submitted for certificate of occupancy - (Confirmed or verified performance)
- Specific information is required in the report as listed in R405.3.2
- Software is utilized in accordance with R405.5
  - Ekotrope, or REM/Rate typical, but others can be utilized when approved by code official (REScheck is not a software for this)
- Input values used shall be from an approved source



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2021 Total Building Performance Path and Reading the Reports R405

This tables establishes the parameters that various software utilize for this compliance path. This is an example of how the table works. (The U-factors are from Table R402.1.2 of the IECC and not the New Mexico amendments for the roof)

***Portion of* TABLE R405.4.2(1)**

SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Building component permitted for trading

How the values shall be utilized for the standard reference home (code required u-factors), and often the table to be utilized.

How the values shall be inputted for the proposed design

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass, where the proposed wall is a mass wall; otherwise, wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed

STANDARD REFERENCE DESIGN

- Wood framed
- 1000 ft^2
- R-20 but using U-value from Table R402.1.4 0.060 U-factor
- .75 Solar absorbance
- .90 Emittance

PROPOSED DESIGN

- Wood framed
- 1000 ft^2
- R-15 = 0.066 U-factor
- .80 Solar absorbance
- .85 Emittances

2021 Total Building Performance Path and Reading the Reports R405

This tables establishes the sections in the code that are still required with this compliance path. (Originally sections labeled mandatory)

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

Sections required **Title of required sections**

SECTION	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installations
R402.4.1.1	Installation
R402.4.1.2	Testing
R402.5	Maximum fenestration U-factor and SHGC
Mechanical	
R403.1	Controls
R403.3, including R403.3.1, except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls

2021 Total Building Performance Path and Reading the Reports R405

Two reports are required to be submitted at two different phases of the project. These reports have specific information per the IECC that must be provided.

Compliance Report for Permit Application

1. Building street address, or other building site identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design complies with Section R405.3. The certificate shall document the building components' energy specifications that are included in the calculation including: component-level insulation R-values or U-factors; duct system and building envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
6. Where a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

2021 Total Building Performance Path and Reading the Reports R405

Two reports are required to be submitted at two different phases of the project. These reports have specific information per the IECC that must be provided.

Compliance Report for Certificate of Occupancy

1. Building street address, or other building site identification.
2. Declaration of the total building performance path on the title page of the energy report and the title page of the building plans.
3. A statement, bearing the name of the individual performing the analysis and generating the report, indicating that the as-built building complies with Section R405.3.
4. The name and version of the compliance software tool.
5. A site-specific energy analysis report that is in compliance with Section R405.3.
6. A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the confirmed rated design of the built home complies with Section R405.3. The certificate shall report the energy features that were confirmed to be in the home, including component-level insulation R-values or U-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation and service water -heating equipment installed.
7. When on-site renewable energy systems have been installed, the certificate shall report the type and production size of the installed system.

2021 Total Building Performance Path and Reading the Reports R405

Ekotrope Report

Let's you know which report this is for. Projected or Per Plans (Permit Submittal)

1. Address

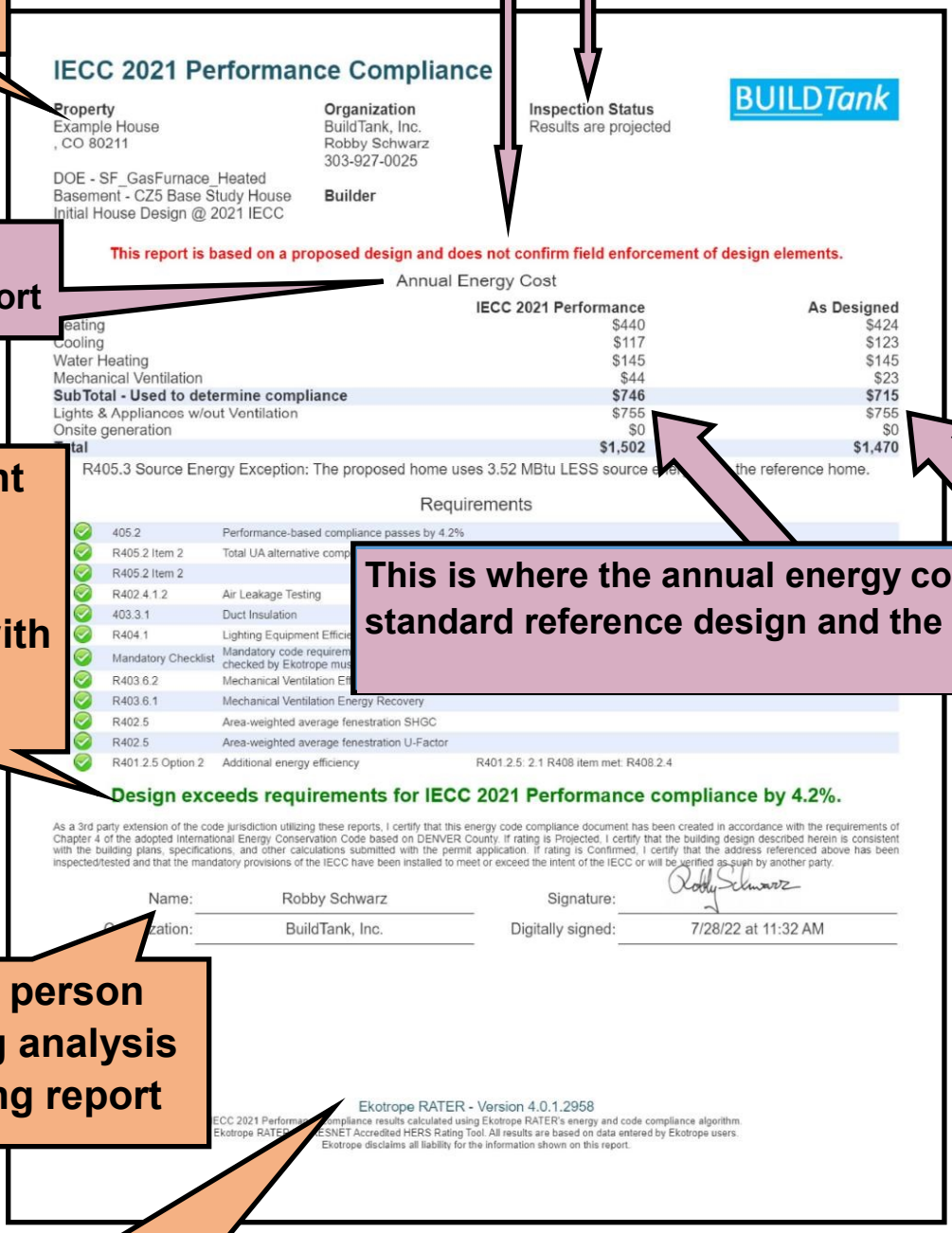
Energy analysis report

5. Statement proposed design complies with R405.3

This is where the annual energy cost for the standard reference design and the proposed

2. Name of person performing analysis and creating report

3. Name and version of software



IECC 2021 Performance Compliance

BUILDTank

Property
Example House
, CO 80211

DOE - SF_GasFurnace_Heated
Basement - CZ5 Base Study House
Initial House Design @ 2021 IECC

Organization
BuildTank, Inc.
Robby Schwarz
303-927-0025

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost

	IECC 2021 Performance	As Designed
Heating	$440	$424
Cooling	$117	$123
Water Heating	$145	$145
Mechanical Ventilation	$44	$23
SubTotal - Used to determine compliance	**$746**	**$715**
Lights & Appliances w/out Ventilation	$755	$755
Onsite generation	$0	$0
Total	**$1,502**	**$1,470**

R405.3 Source Energy Exception: The proposed home uses 3.52 MBtu LESS source energy than the reference home.

Requirements

✓	405.2	Performance-based compliance passes by 4.2%	
✓	R405.2 Item 2	Total UA alternative comp	
✓	R405.2 Item 2		
✓	R402.4.1.2	Air Leakage Testing	
✓	403.3.1	Duct Insulation	
✓	R404.1	Lighting Equipment Effici	
✓	Mandatory Checklist	Mandatory code requirem checked by Ekotrope mus	
✓	R403.6.2	Mechanical Ventilation Ef	
✓	R403.6.1	Mechanical Ventilation Energy Recovery	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R401.2.5 Option 2	Additional energy efficiency	R401.2.5: 2.1 R408 item met: R408.2.4

Design exceeds requirements for IECC 2021 Performance compliance by 4.2%.

As a 3rd party extension of the code jurisdiction utilizing these reports, I certify that this energy code compliance document has been created in accordance with the requirements of Chapter 4 of the adopted International Energy Conservation Code based on DENVER County. If rating is Projected, I certify that the building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. If rating is Confirmed, I certify that the address referenced above has been inspected/tested and that the mandatory provisions of the IECC have been installed to meet or exceed the intent of the IECC or will be verified as such by another party.

Name: Robby Schwarz
Signature: Robby Schwarz
Organization: BuildTank, Inc.
Digitally signed: 7/28/22 at 11:32 AM

Ekotrope RATER - Version 4.0.1.2958

IECC 2021 Performance compliance results calculated using Ekotrope RATER's energy and code compliance algorithm.
Ekotrope RATER is a RESNET Accredited HERS Rating Tool. All results are based on data entered by Ekotrope users.
Ekotrope disclaims all liability for the information shown on this report.

SHUMS CODA ASSOCIATES

4. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.

IECC 2021 Proposed Home Summary

BUILDTank

Property
Example House
, CO 80211

DOE - SF_GasFurnace_Heated Basement - CZ5
Base Study House
IECC 2021 Proposed

Organization
BuildTank, Inc.
Robby Schwarz
303-927-0025

Builder

Inspection Status
Results are projected

General Building Information

Number Of Bedrooms	3
Number Of Floors	2
Conditioned Floor Area [sq. ft.]	3,564
Has Electric Vehicle Ready Space	No
Unconditioned, attached garage?	No
Conditioned Volume [cu. ft.]	30,294
Total Units in Building	1
Residence Type	Single family detached
Number of Floors in Building	-
Floor Number	-
Model	
Community	
RESNET/IECC 2006 Climate Zone	5B

Foundation Wall

Name	Library Type	Height Above Grade	Depth Below Grade	Perimeter	Location	Enclosing
Basement Wall	R-15 Perforated FG Blanket	1.5	7	139.2	Exposed Exterior	Conditioned Space

Foundation Wall Library List

Name	Feet From Wall Top To Continuous Insulation Top	Feet From Wall Top To Continuous Insulation Bottom	Is Fully Insulated	Continuous R-value	Cavity R-value	Effective Insulation R-value
R-15 Perforated FG Blanket	N/A	N/A	Yes	15.00	N/A	N/A

Slab

Name	Library Type	Perimeter	Floor Grade	Carpet R	Exposed Masonry Area	Surface Area	Location	Enclosing
Basement Slab	Uninsulated slab	139.2	Below Grade	2	1,188	1,188.0 ft²	Exposed Exterior	Conditioned Space

Slab Library List

Name	Wall Construction Type	Slab Completely Insulated?	Underslab Insulation Width [ft]	Perimeter Insulation Depth [ft]	Perimeter Insulation R Value	Thermal Break	Effective R-value
Uninsulated slab	Wood Frame / Other	No	0	0	0	No	0.00

2021 Total Building Performance Path and Reading the Reports R405

5. A certificate indicating that the proposed design complies with Section R405.3. The certificate shall document the building components' energy specifications that are included in the calculation including: component-level insulation R-values or U-factors; duct system and building envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.

Example House

, CO 80211

Builder:

This report is based on a proposed design and does not confirm field enforcement of design elements.

THIS HOME IS CERTIFIED TO MEET THE 2021 INTERNATIONAL ENERGY CONSERVATION CODE

Building Features

Ceiling	Attic, R-60	**Duct**	Supply R-8.0, Return R-8.0
Above Grade Walls	R-25	**Duct Leakage to Outside**	94 CFM @ 25Pa (2.64 / 100 ft²)
Foundation Walls	R-15	**Total Duct Leakage**	94 CFM @ 25Pa (Post-Construction)
Framed Floor	N/A	**Heating**	Furnace • Natural Gas • 80 AFUE
Slab	R-0.0 Perimeter, R-0.0 Under	**Cooling**	Air Conditioner • Electric • 13 SEER
Infiltration	3 ACH50	**Water Heating**	Residential Water Heater • Natural Gas • 0.59 Energy Factor
Window	U-Value: 0.3, SHGC: 0.4		

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Name: Robby Schwarz — Signature: Robby Schwarz

Organization: BuildTank, Inc. — Digitally signed: 7/28/22 at 11:32 AM

Ekotrope RATER - Version 4.0.1.2958

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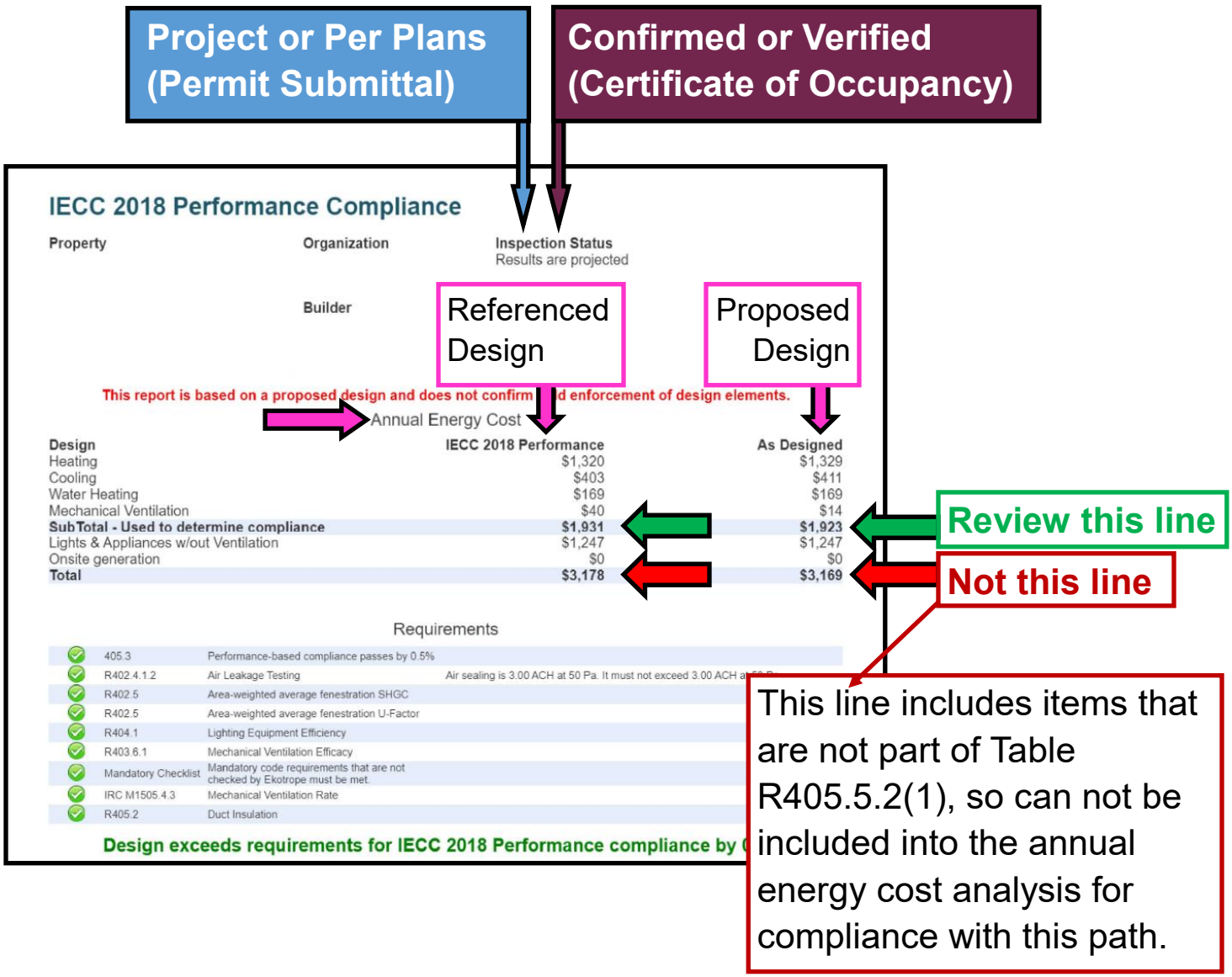
2021 Total Building Performance Path and Reading the Reports R405

Compliance is determined by the annual energy cost. If the proposed design is equal to or less than the reference design it is considered to be compliant with the path.



Always review the sub total line item to determine compliance for this path.

Keep an eye on the cost difference between the two columns. When the amount is close to each other's values the results of what is actually installed in the field can impact if the project will comply with this path when the second report is generated.

2021 Total Building Performance Path and Reading the Reports R405

IECC 2021 Performance Compliance

BUILDTank

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Onsite generation	$0	$0
Total	**$1,502**	**$1,470**

R405.3 Source Energy Exception: The proposed home uses 3.52 MBtu LESS source energy than the reference home.

R405.3 - Energy prices shall be taken by an approved source. This can be one of the sources listed in the section as approved by the code official for example Xcel Energy is permitted. The exception allows for the use of Btu or Btu per square foot of conditioned area. This has been provided.

IECC 2021 Performance Compliance

Property

Organization

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost

Design	IECC 2018 Performance	As Designed
Heating	$1,320	$1,329
Cooling	$403	$411
Water Heating	$169	$169
Mechanical Ventilation	$40	$14
SubTotal - Used to determine compliance	**$1,931**	**$1,923**
Lights & Appliances w/out Ventilation	$1,247	$1,247
Onsite generation	$0	$0
Total	**$3,178**	**$3,169**

Example where the sources were not provided, like the example above

Requirements

The energy prices used for this analysis was not provided for this report.