

Maui Energy Code Low-rise Residential Requirements

April 23, 2024



Presentation Collaborators







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COURSE DESCRIPTION

Maui's 2018 IECC building energy code took effect in December 2022. This session covers low-rise residential requirements including townhomes and three-story multifamily buildings. Maui-specific amendments will be covered, including solar-ready and electric-vehicle-ready.

LEARNING OBJECTIVES

At the end of this course, participants will be able to:

- 1. Identify applicable requirements in the 2018 IECC, including Maui-specific amendments
- 2. Determine applicability and requirements for the Tropical-Zone energy code compliance
- 3. Determine compliance with the new solar ready and EV ready requirements
- 4. Use energy code checklists to review designs for compliance

Introductions

Presenters

- Howard Wiig, State Energy Office
- Erik Kolderup, PE, Kolderup Consulting
- Justin Bizer, Hawaii Energy

Acknowledgments

- Karen Shishido, Hawaii Energy
- Gail Suzuki-Jones, State Energy Office

Topics

Hawaii Energy Programs Introduction & Scope Compliance Tropical Zone Option Prescriptive Option

- Envelope
- Systems
- Electrical & Lighting

EV and Solar Readiness

Performance Compliance Options Large One- and Two-Family Home Existing Building Compliance

- Additions
 - Alterations

Q&A

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Hawaii Energy Incentives

New construction & major renovation projects can receive rebates for incorporating energy-efficient features into building designs and exceeding building code requirements.

Single Family Homes

Multifamily Projects

HawaiiEnergy.com

RESIDENTIAL NEW CONSTRUCTION

SYSTEMS APPROACH (Single Family (Detached)) Minimum Requirements

85% LED Lighting 50% ENERGY STAR® Appliances Installed

ENERGY STAR® certified (refrigerator, dishwasher, clothes washer, and clothes dryer)

Optional Incentives High SEER A/C

Smart Thermostats

\$250

HawaiiEnergy.com

Hawai'i Energy

AFFORDABILITY & ACCESSIBILITY PROGRAMS

Who is Eligible?

- 1. Underserved Communities, such as Low-income, Elderly, Disabilities, Transitional Housing, Non-profit, etc.
- 2. A&A Properties and Communities
 - a) Single Family Residence
 - b) Multifamily Property (Single Audit for all units)
- 3. Community Based Energy Efficiency projects (Maui County?, Designated Zip Codes)
- 4. UPGRADES: Water Heating, Air Conditioning, & Appliances

Mahalo!

Justin Bizer

Residential New Construction Affordability and Accessibility Programs justin.v.bizer@leidos.com

Stay Connected

Oahu: 537-5577 (Residential) 839-8880 (Business) Neighbor Islands: 1-877-231-8222 toll-free

www.hawaiienergy.com

Section 1 Introduction & Scope

Source: Energy Efficient Codes Coalition. <u>https://energyefficientcodes.org/iecc/</u>

2018 IECC Adoption

State amendments 12 pages

Hawai'i State Energy Code

Amendments to the

2018 International Energy Conservation Code

State Building Code Council

Effective Date: December 15, 2020

Subchapter 1 Rules of General Applicability

Conservation Code_____

(1) Purpose

(4) Adoption of the International Energy

(2) Scope

(5) Permit authorization

Definitions

Adopted by SBCC on 12/15/2020

Page #

State Energy Code

(3)

2 A Member of the International Code Family INTERNATIONAL **ENERGY CONSERVATION CODE**

https://codes.iccsafe.org/content/iecc2018

https://energy.hawaii.gov/what-we-do/energyefficiency/hawaii-energy-building-code-iecc-updates

Maui amendments 13 pages

ORDINANCE NO. 5455 BILL NO. 153, CD1 (2022) A BILL FOR AN ORDINANCE REPEALING CHAPTER 16.16B, MAUI COUNTY CODE, AND ESTABLISHING A NEW CHAPTER 16.16C, MAUI COUNTY CODE, RELATING TO THE ENERGY CODE BE IT ORDAINED BY THE PEOPLE OF THE COUNTY OF MAUI: SECTION 1. Chapter 16.16B, Maui County Code, is repealed. SECTION 2. The "Hawai'i State Energy Code," which adopts, with modifications, the "2018 International Energy Conservation Code" as published and copyrighted by the International Code Council, Inc., 500 New Jersey Avenue, NW, 6th Floor, Washington, DC, 20001, is adopted, subject to the provisions of Chapter 16.16C, Maui County Code. SECTION 3. Title 16, Maui County Code, is amended by adding a new chapter to be appropriately designated and to read as follows: "Chapter 16.16C ENERGY CODE Sections: 16.16C.010 Hawai'i State Energy Code incorporated. Subsection C101.6 added. 16.16C.C101.6 16.16C.C405.10 Subsection C405.10 added. 16.16C.C406.1 Subsection C406.1 amended 16.16C.C406.10 Subsection C406.10 added. 16.16C.R101.6 Subsection R101.6 added. 16 16C R401 2 Subsection R.401.2 amended. Subsection R401.2.1 amended. 16.16C.R401.2.1 16.16C.R401.3 Subsection R401.3 amended. Subsection R402.1 amended.

https://www.mauicounty.gov/1308/Building -Plans-Review-Section

16.16C.R402.1

Today's topic

- 1- and 2-family dwellings (R-3)
- Multi-family (R-2 \leq 3 stories)
- Residential care/assisted living ($R-4 \le 3$ stories)

Commercial

- All other buildings
 - Including R-1 (hotels) and $R-2 \ge 4$ stories

Courtesy Daniel Sandomire, Armstrong Builders

Scope

Mixed use buildings

- Commercial code for commercial portion
- Residential code for residential portion ≤ 3 stories

https://www.drhorton.com/hawaii/oahu/ewa-beach/kohina-at-hoopili

What's covered

Envelope

Roof Walls Windows & skylights Air leakage

Systems

Air conditioning controls Duct insulation Duct leakage Water heating Swimming pool

Electrical

Permanently installed lighting Ceiling fans Solar readiness Maui EV readiness Amendment

Not covered

AC efficiency Water heater efficiency Plug-in lighting Appliances

Resources

Checklist

This checklist covers requirements of the Maui Energy Conservation Code, approved November 23, 2022. This code is an amended version of the 2018 International Energy Conservation Code (IECC), with Maui amendments applied to the State amended version (December 15, 2020).

- State amendments: <u>https://energy.hawaii.gov/what-we-do/energy-efficiency/hawaii-energy-building-code-iecc-updates</u>
- Subsequent Maui amendments: <u>https://www.mauicounty.gov/1308/Building-Plans-Review-Section</u>
- View the 2018 IECC here: <u>https://codes.iccsafe.org/content/iecc2018</u>

Red text in this checklist indicates changes compared to the previous Maui energy code (2015 IECC with Maui Amendments)

SCOPE

Red

Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane. The code applies to new construction, additions and alterations. See a separate Commercial Checklist for high-rise residential and commercial buildings.

RESIDENTIAL COMPLIANCE OPTIONS

	Tropical Zone	Prescriptive		Simulated Performance	Energy Rating Index		
				Alternative	Compliance Alternative		
ext = cł	Allowed when: 1. ≤50% air conditioned, 2. not heated, and 3. elevation < 5,000 feet. Nange vs. 2015	Includes three options for walls and roof compliance: 1. Prescriptive 2. Total UA (typically with ResCheck software) 3. Points option (added by Hawaii amendment) Envelope compliance not required for: • Unconditioned, not habitable space • Unconditioned dwelling with enclosed habitable space < 1,100 ft ² • Permitted off-grid dwellings with PV and battery backup (Maui amendment, R402,1)		Simulated energy performance analysis for heating, cooling and water heating. Proposed design must have annual energy cost less than or equal to energy cost of reference design.	Third-party Home Energy Rating System (HERS) calculation. Allows the designer to pick and choose from many efficiency options. Scores range from 100 to 0. The 100 score indicates compliance with the 2006 IECC. Each efficiency measure beyond 2006 lowers the score. A passing score for Climate Zone 1 is 57.		
	See Tropical Zone Checklist below See Prescriptive Chec See Points Option tab		cklist below. bles below.	See code Section R405	See code Section R406		
			Large One- or Two-F	o-Family			
		lf	≥5,000 ft ² conditioned space, then Energy R	ating Index ≤0 is required			
	CHECKLIST CONTENTS Tropical zone checklist Prescriptive checklist Additions and alterations checklis Points option tables	PAGE 2 4 t 9 11	Sponsor: Hawaii State Energy Office Acknowledgment: This material is based upon Disclaimer: This report was prepared as an acc States Government nor the State of Hawaii, nor assumes any legal liability or responsibility for t disclosed, or represents that its use would not i or service by trade name, trademark, manufact or favoring by the United States Government, t do not necessarily state or reflect those of the l	work supported by the Department of Energy un count of work sponsored by an agency of the Unit r any agency thereof, nor any of their employees, the accuracy, completeness, or usefulness of any in infringe privately owned rights. Reference herein curer, or otherwise does not necessarily constitute he State of Hawaii or any agency thereof. The vie United States Government, the State of Hawaii or	der Award Number EE0006986. ed States Government. Neither the United makes any warranty, express or implied, or information, apparatus, product, or process to any specific commercial product, process, e or imply its endorsement, recommendation, ews and opinions of authors expressed herein any agency thereof.		

RESIDENTIAL – with Maui amendments

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Resources

Checklist

PRESCRIPTIVE REQUIREMENTS CHECKLIST

Component/System	Requirement	Code Section	Plan Review Notes	Info on Plans
Certificate	Permanent certificate	R401.3 [†]	T = Maui amendment personal rosted on a wait in approved location. Includes insulation R-values, window SHGC, results of duct and air leakage testing (if required), efficiency of air conditioning and water heating equipment. Identifies conditioned and unconditioned spaces.	
Roof – wood frame	□ R-30 , □ U-0.035 , □ Total UA alternative, or □ Points option	R402.1, R402.1.5, R407*	Some R-30 options: 10 in. batt insulation 5 to 8 in. spray foam	 Insulation location on plans Insulation R-value on plans
Roof – metal truss	□ R-38, □ U-0.035, □ R-30 + R-3, □ R-26 + R-5, □ Total UA alternative, or □ Points option	R402.1, R402.2, R402.1.5, R407*	Metal frame creates a thermal bridge, and more insulation is required. "R-3" and R-5" refer to intinuous insulation, typically foam board. * = State amendment	☐ Insulation location on plans ☐ Insulation R-value on plans
Roof – metal joist	 R-38 in 2x4, 2x6 or 2x8 framing, R-49 in any framing <i>Total UA alternative</i>, or <i>Points option</i> 	R402.1, R402.2, R402.1.5, R407*		 Insulation location on plans Insulation R-value on plans
Wall – wood frame	□ R-13 , □ U-0.084 , □ Total UA alternative, or □ Points option	R402.1, R402.1.5, R407*	Some R-13 options: • 3.5 in. batt insulation • 2 to 3.5 in. spray foam	 Insulation location on plans Insulation R-value on plans
Wall – metal frame	Framing 16 in. on center: R-13 + R-4.2 R-21 + R-2.8 Framing 24 in. on center: R-13 + R-3.0 R-15 + R-2.4 Total UA alternative, or Points option	R402.1, R402.2, R402.1.5, R402.2.6, R407*	Requires insulation in framing cavity plus a layer of continuous insulation (typically foam board). Other complying combinations of batt and board insulation are listed in Table R402.2.6 in the 2018 IECC	☐ Insulation location on plans ☐ Insulation R-value on plans

RESIDENTIAL – with Maui amendments

Resources

HSEO Website

Past training materials

https://energy.hawaii.gov/what-we-do/energyefficiency/Hawaii-energy-building-code-iecc-updates/

TRAININGS

December 5 and 6, 2023 - Honolulu Energy Code Updates

This code update moves Honolulu from the 2015 to the 2018 International Energy Conservation Code, with updated County amendments. Join these sessions to learn how these changes will affect your projects.

Low-rise residential requirements

- Presentation: Honolulu Energy Code Low-rise Residential Requirements
- Checklist: Residential 2018 IECC with Honolulu Amendments
- Video:

Commercial and high-rise residential requirements

- Presentation: Honolulu Energy Code Commerical and High-rise Residential Requirements
- Checklist: Commerical 2018 IECC with Honolulu Amendments
- Video:

This workshop is approved by AIA for 1.5 LU (HSW).

October 12, 2022 - Energy Efficient Homes of the Future

Leading edge Hawai'i builders Castle & Cooke, D.R. Horton, Gentry Homes and Stanford Carr share their expertise in delivering efficient, comfortable and affordable homes. Take advantage of their experience and support the State's transition to 100% clean energy.

- Presentation: Energy Efficient Homes of the Future
- Video: Energy Efficient Homes of the Future

April 21, 2022 – Beyond Code, Net Zero Energy and Existing Buildings

This was the third in a series of three webinars covering building energy efficiency and the energy code in Hawai'i. This final session covered the topics of designing to exceed energy code requirements, efficiency strategies in both new and existing buildings, and incentives that are available for energy efficiency measures.

- Presentation: Beyond Code, Net Zero Energy and Existing Buildings
- Video: Workshop 3 Beyond Code, Net Zero Energy and Existing Buildings

Section 2 Compliance

COUNTY OF MAUI MAUI COUNTY CODE, CHAPTER 16.16C ENERGY CODE RESIDENTIAL PROVISIONS						
COMPLIANCE METHOD Check applicable method						
	R401.2(1) R401.3 through R404 (Prescript	ive)				
	R401.2(2) R405, R401 through R404 labeled Mandatory (Simulated Performance Alternative)					
	R401.2(3) R406 (Energy Rating Index Compliance Alternative)					
	R401.2(4) R401.2.1 (Tropical Zone)					
	R102.1 (Alternative)					
To the best of my knowledge, this project's design substantially conforms to the Energy Code.						
Ener	Jy Code.					
Ener S	ignature:	Date:				
Ener	ignature: Name:	Date:				
Ener	ignature: Name: Title:	Date:				

Compliance options – low-rise residential

New

- 1. Tropical Zone
 - ≤50% air conditioned
 - not heated
 - elevation < 5,000 feet
- 2. Prescriptive

🖌 Amendment

State

Maui

Amendment

- Envelope (+ Points Option)
- Systems
- Electrical power and lighting systems
- 3. Simulated performance alternative
 - Proposed design energy cost ≤ standard reference design
- 4. Energy rating index (ERI)
 - ERI ≤ 57
- 5. Large one- and two-family homes
 - ≥5,000 ft² conditioned floor area
 - ERI ≤ 0

Climate Zone	Fenestr ation U- Factor	Skylight U-Factor	Glazed Fenestr ation SHGC	Ceiling R-Value	Wood Frame Wall R- Value	Mass Wall R- Value	Floor R- Value	Baseme nt R- Value	Slab R- Value	Crawl Space Wall R- Value
1	NR	0.75	0.25	30	13	3/4	NA ¹	0	0	0

Design professional certification

Sample energy code certification block

COUNTY OF MAUI MAUI COUNTY CODE, CHAPTER 16.16C ENERGY CODE RESIDENTIAL PROVISIONS						
COMPLIANCE METHOD Check applicable method						
R401.2(1) R401.3 through R404 (Prescriptive)						
R401.2(2) R405, R401 through R404 labeled Mandatory (Simulated Performance Alternative)						
R401.2(3) R406 (Energy Rating Index Compliance Alternative)						
R401.2(4) R401.2.1 (Tropical Zone)						
R102.1 (Alternative)						
To the best of my knowledge, this project's design substantially conforms to the Energy Code.						
Signature: Date:						
Name:						
Title:						
License No.:						
https://www.mauicounty.gov/1308/Building-Plans-Review-Section						

Certificate (R401.3)

- Permanent certificate
- Completed by the builder or registered design professional
 Maui
 Amendment
- Utility room or approved location
- Includes
 - R-values of insulation
 - U-factors and SHGC of fenestration
 - Air leakage test results (if applicable)
 - Equipment efficiencies

EXAMPLE

+ Energy Efficiency Certificate							
Insulation Ratin		<i>R</i> -Value		<i>R</i> -Value			
Ceiling /Roof			<i>R</i> -			R-	
Walls	Walls		<i>R</i> -	Mass		<i>R</i> -	
		Basement	<i>R</i> -	Crawl	space	R-	
Floors	Over uncon	nditioned space	<i>R</i> -	Sla	b edge	<i>R</i> -	
Ducts		Attic	<i>R</i> -		Other	R-	
Air Leakage Tes	st Results						
Blower door		ACH/50 Pa.	Duct tes	ting		Cfi	m/100 ft²
Fenestration Ra	ting	NFRC U-F	actor	NFRC	SHGO		
Window		<i>U</i> -					
Opaque door		<i>U</i> -					
Skylight		<i>U</i> -					
Equipment Perf	formance	Туре		Effic	iency		
Heating system							AFUE
Cooling system							SEER
Water heater							EF
Indicate if the foll electric furnad	lowing have	been installed (gas-fire unvente	an efficiency sl d room heater	nall not be	listed) oard ele	ectric	heater
Designer/b	uilder						
Code e	dition			Date			

Section 3 Tropical Zone Compliance Path

Can use this path if

- ≤50% air conditioned,
- not heated, and
- elevation < 5,000 feet

Tropical Zone - Snapshot

* Some exceptions

Maui amended version

Changes vs. 2015 are highlighted

R401.2.1 Tropical zone. Residential buildings in the tropical zone at elevations below 5,000 feet (1,524 m) above sea level must be deemed to comply with this chapter where the following conditions are met:

1. Not more than one-half of the dwelling unit is air conditioned and additional air conditioning is not added after permitting.

2. The dwelling unit is not heated.

3. Solar, wind or other renewable energy source supplies not less than 90 percent of the energy for service water heating.

4. Glazing in dwelling units must have a maximum solar heat gain coefficient as specified in table R402.1.2.

5. Skylights in dwelling units must have a maximum U-factor as specified in table R402.1.4.

6. Permanently installed lighting is in accordance with Section R404.

7. The roof or ceiling complies with one of the following options:

a. Comply with one of the roof surface options in table C402.3 and install R-13 insulation or greater.

b. Install R-19 insulation or greater.

8. Roof surfaces have a minimum slope of onequarter inch per foot of run. The finished roof does not have water accumulation areas. 9. Operable fenestration provides ventilation area equal to not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.

10. Bedrooms with exterior walls facing two different direction have operable fenestration or exterior walls facing two different directions.

11. Interior doors to bedrooms are capable of being secured in the open position.

12. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as bedroom.

13. Walls, floors, and ceilings separating airconditioned spaces from non-air-conditioned spaces must be constructed to limit air leakage in accordance with the requirements in table R402.4.1.1.

14. The project complies with Subsection R401.3.

Window SHGC Requirements

Projection Factor of	SHGC
overhang from base of	
average window sill	
< .30	.25
.3050	.40
≥.50	N/A

Exception: North-facing windows with pf > .20 are exempt from the SHGC requirement. Overhangs shall extend 2 feet on each side of window or to nearest wall, whichever is less.

Motivations behind the Tropical Zone Option

- Efficiency
 - Little or no AC
 - Solar water heating
 - High efficacy lighting
- Comfort (keep the sun out, let the breeze in)
 - Window & roof heat gain
 - Natural ventilation openings
 - Ceiling fans

Lower indoor air temperature Lower ceiling temperature Increased air movement

Roof insulation Wall Windows Skylights Natural ventilation Ceiling fans Solar water heating Lighting Envelope air sealing

Roof insulation

Wall

Windows

Skylights

Natural ventilation

Ceiling fans

Solar water heating

Lighting Envelope air sealing

- 1. R-19 insulation
- 2. Cool roof + R-13 insulation

Roof insulation

Wall

Windows

Skylights

Natural ventilation

Ceiling fans

Solar water heating

Lighting

Envelope air sealing

- 1. R-19 insulation
- 2. Cool roof + R-13 insulation

Typical insulation thickness required

Insulation type	R-13	R-19
Batt or blown-in	3.5″	6"
Open-cell spray foam	3-4"	5-6"
Closed-cell spray foam	2-3″	3-4"
Polystyrene board	2.75″	4"
Polyisocyanurate board	2″	3″

Roof insulation

Wall

Windows

Skylights

Natural ventilation

Ceiling fans

Solar water heating

Lighting

Envelope air sealing

- 1. R-19 insulation
- 2. Cool roof + R-13 insulation

Cool roof definitions (C402.3)

- 1. Solar reflectance ≥ 0.55 & thermal emittance ≥ 0.75
- 2. Solar reflectance index ≥ 0.64
- 3. Shaded (see C402.3)

Architect: Daniel Sandomire, Armstrong Builders

Roof insulation

Wall

Windows

Skylights

Natural ventilation

Ceiling fans

Solar water heating

Lighting

Envelope air sealing

- 1. R-19 insulation
- 2. Cool roof + R-13 insulation

Cool roof definitions (C402.3)

- 1. Solar reflectance ≥ 0.55 & thermal emittance ≥ 0.75
- 2. Solar reflectance index ≥ 0.64
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www.hansonrooftile.com
Roof insulation

Wall

Windows

Skylights

Natural ventilation

Ceiling fans

Solar water heating

Lighting

Envelope air sealing

- 1. R-19 insulation
- 2. Cool roof + R-13 insulation

Cool roof definitions (C402.3)

- 1. Solar reflectance ≥ 0.55 & thermal emittance ≥ 0.75
- 2. Solar reflectance index ≥ 0.64
- 3. Shaded (see C402.3)



http://coolroofhawaii.com

Roof insulation

Wall

Windows

Skylights

Natural ventilation

Ceiling fans

Solar water heating

Lighting Envelope air sealing If there is an attic

- Vented if attic above insulation
- Unvented if attic below insulation





Attic must be vented

Attic must be unvented

Roof insulation **Wall** Windows Skylights Natural ventilation Ceiling fans Solar water heating Lighting Envelope air sealing No requirements!

Roof insulation
Wall
Windows
Skylights
Natural ventilation
Ceiling fans
Solar water heating
Lighting
Envelope air sealing

Maximum solar heat gain coefficient (SHGC)



North windows: no requirement if PF > 0.20

Wall Windows Skylights Natural ventilation Ceiling fans Solar water heating Lighting Envelope air sealing

Roof insulation

Overhang size that allows clear glass to comply?

PF ≥ **0.5**



Roof insulation Wall **Windows** Skylights Natural ventilation Ceiling fans Solar water heating Lighting Envelope air sealing

Overhang size that allows clear glass to comply?

PF ≥ **0.5**



≥ 1 ft Roof insulation ≥ 1.6 ft Wall Windows Overhang size that Skylights allows clear glass to Natural ventilation comply? Ceiling fans Solar water heating **8 ft** North-facing windows Lighting **PF** ≥ 0.2 Envelope air sealing

5 ft

Roof insulation Wall Windows **Skylights** Natural ventilation Ceiling fans

Solar water heating

Envelope air sealing

Lighting

U-factor ≤ 0.75 Requires double-pane skylights





www.veluxusa.com

Roof insulation Wall Windows Skylights **Natural ventilation** Ceiling fans Solar water heating Lighting Envelope air sealing

Operable windows

- Ventilation area ≥ 14% of floor area in each room
- Or equivalent fan

Bedroom interior doors can be secured open

Bedroom windows two different directions

If there are two exterior walls



Roof insulation Wall Windows Skylights **Natural ventilation** Ceiling fans Solar water heating Lighting Envelope air sealing Ventilation area \geq 14% of floor area



Roof insulation Wall Windows Skylights **Natural ventilation** Ceiling fans Solar water heating Lighting Envelope air sealing Ventilation area \geq 14% of floor area



Roof insulation Wall Windows Skylights **Natural ventilation** Ceiling fans Solar water heating Lighting Envelope air sealing Ventilation area \geq 14% of floor area



Roof insulation Wall Windows Skylights **Natural ventilation** Ceiling fans Solar water heating Lighting Envelope air sealing Ventilation area \geq 14% of floor area



Roof insulation

Wall

Windows

Skylights

Natural ventilation

Ceiling fans

Solar water heating Lighting Envelope air sealing

Ceiling fans or rough-ins

Bedrooms + largest space









Roof insulation Wall Windows Skylights Natural ventilation Ceiling fans **Solar water heating** Lighting Envelope air sealing

Solar, wind or other renewable > 90%



Roof insulation Wall Windows Skylights Natural ventilation Ceiling fans Solar water heating Lighting Envelope air sealing High efficacy \geq 90% of permanently installed lamps

Lamp Wattage	Efficacy (lumens/watt)
> 40 watts	60
15-40 watts	50
< 15 watts	40



Source: DOE/NREL PIX20307

Roof insulation Wall Windows Skylights Natural ventilation Ceiling fans Solar water heating Lighting **Envelope air sealing** Walls, floor and ceilings that separate AC spaces and non-AC spaces use air-tight construction

TROPICAL ZONE REQUIREMENTS CHECKLIST

Component/System	Requirement	Code Section	Plan Review Notes	Info on Plans
Tropical zone qualification	 ≤ 50% of the dwelling unit has AC No heating installed Elevation < 5,000 ft 	R401.2.1 [†]	Dwellings that do not meet all these criteria must use another compliance option.	AC space clearly indicated (if applicable)
Certificate	Permanent certificate	R401.3 [†]	Completed by the building or registered design professional. Posted on a wall in approved location. Includes insulation R-values, window SHGC, results of duct and air leakage testing (if required), efficiency of air conditioning and water heating equipment. Identifies conditioned and unconditioned spaces.	
Water heating - solar	Solar, wind or other renewable source supplies ≥ 90% of energy for water heating	R401.2.1*	HRS 196-6.5: https://www.capitol.hawaii.gov/hrscurrent/Vol03_Ch 0121-0200D/HRS0196/HRS_0196-0006_0005.htm HSEO guidance: https://energy.hawaii.gov/what-we- do/energy-efficiency/solar-water-heat-variance	Water heating system specs on plans
Windows – solar heat gain coefficient (SHGC)	 ≤ 0.25 if projection factor < 0.30 ≤ 0.40 if projection factor 0.30-0.50 N/A: projection factor ≥ 0.50 N/A: north windows if PF > 0.20 Jalousie windows exempt. 	R401.2.1*	 SHGC = solar heat gain factor. Low SHGC typically requires dual-pane glazing with a low-emittance coating that is designed to reduce solar heat gain. Projection factor = horizontal projection of overhang ÷ vertical distance from overhang to bottom of window. Overhang must extend at least 2 ft on each side of the window or to the nearest wall, whichever is less. 	 SHGC indicated on plans Overhang dimensions on plans, if applicable
Skylights – U-factor	≤ 0.75	R401.2.1*	Skylights must have dual-pane glazing.	□ Skylight U-factor on plans
Lighting	≥ 90% of lamps or fixtures are high efficacy	R202 [†] R404.1*	High efficacy lamps are defined as: T-8 or smaller diameter fluorescent Compact fluorescent 60 lumens/watt if >40W 50 lumens/watt if >15W and ≤40W 40 lumens/watt if ≤15W Most, but not all, LED lamps will qualify. Applies to permanently-installed fixtures. Low-voltage lighting is exempt.	□ Lighting fixture locations on plans □ Lighting fixture schedule includes input power and lumen output

Component/System	Requirement	Code Section	Plan Review Notes	Info on Plans
Roof – insulation and membrane	□ R-13 + cool roof, □ R-19 , or □ <i>Points option (section R407)</i>	R401.2.1*	Qualifying cool roof membranes must meet one of the following (per Table C402.3): 1. Aged reflectance ≥ 0.55 & aged thermal emittance ≥ 0.75 2. Aged solar reflectance index (SRI) ≥ 0.64 Qualifying cool roofs will typically be white in color. Typical options include white painted metal, white tile, white liquid applied coating, and white single-ply membranes. If present, attics above insulation must be vented and attics below insulation must be unvented.	 Insulation location on plans Insulation R-value on plans Membrane specs on plans (if applicable
Roof – slope	≥¼ in. per foot	R401.2.1*	No water accumulation areas allowed.	□ Roof slope indicated on plans
Walls and floor	No requirement			
Natural ventilation	 Opening area ≥ 14% of floor area in each room (or provide a ventilation fan) Bedrooms with exterior walls facing two different directions have operable fenestration facing two directions Interior doors to bedrooms capable of being secured open 	R401.2.1*	Operable windows and/or skylights are required for natural ventilation. Ventilation fans can be provided as an alternative.	 Operable openings on plans Ventilation fans on plans (if applicable)
Ceiling fans	Ceiling fans or rough-ins required for: Each bedroom Largest space not used as a bedroom	R401.2.1*	A "rough-in" is an electrical junction box mounted in the ceiling that is rated for ceiling fan installation.	Ceiling fan locations on plans
Air leakage	Walls, floor and ceilings that separate AC spaces and non-AC spaces use air- tight construction	R401.2.1*	For air conditioned spaces, see section R402.4: Continuous air barrier Breaks or joints are sealed Recessed lighting Fenestration air leakage	Plan notes indicate installation requirements
Solar conduit and electrical panel readiness	See prescriptive checklist	R408 [†]		
Electric vehicle readiness	See prescriptive checklist	R408 [†]		

Page 2 of 2

* Code section added or modified by State amendment

[†] Code section added or modified by Maui amendment END OF TROPICAL ZONE CHECKLIST

Section 4 Prescriptive Compliance Option

Prescriptive Requirements - Snapshot



* Some exceptions

Section 5 Prescriptive - Envelope



- Windows
 - SHGC (Table R402.1.2)
- Skylights
 - SHGC & U-factor (Table R402.1.2)
 - Total UA (R402.1.5)
- Wall and roof four options
 - Insulation R-value (Table R402.1.2)
 - Assembly U-factor (Table R402.1.4)
 - Total UA (R402.1.5)
 - Points option (R407)
- Air leakage
 - Air barrier, sealing
 - Testing

- Windows
 - SHGC (Table R402.1.2)
- Skylights
 - SHGC & U-factor (Table R402.1.2)
 - Total UA (R402.1.5)
- Wall and roof four options
 - Insulation R-value (Table R402.1.2)
 - Assembly U-factor (Table R402.1.4)
 - Total UA (R402.1.5)
 - Points option (R407)

• Air leakage

- Air barrier, sealing
- Testing (optional Kauai, Maui, Hawaii County)

Minimum Insulation R-value

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT ^a										
CLIMATE ZONE	FENESTRATION <i>U-</i> FACTOR ^b	SKYLIGHT ^b <i>U-</i> FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING <i>R</i> -VALUE	WOOD FRAME WALL <i>R</i> -VALUE	MASS WALL <i>R</i> -VALUE ⁱ	FLOOR <i>R</i> -VALUE	BASEMENT ^C WALL <i>R</i> -VALUE	SLAB ^d <i>R</i> -VALUE & DEPTH	CRAWL SPACE ^c WALL <i>R</i> -VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

- Windows
 - SHGC (Table R402.1.2)
- Skylights
 - SHGC & U-factor (Table R402.1.2)
 - Total UA (R402.1.5)
- Wall and roof four options
 - Insulation R-value (Table R402.1.2)
 - Assembly U-factor (Table R402.1.4)
 - Total UA (R402.1.5)
 - Points option (R407)
- Air leakage
 - Air barrier, sealing
 - Testing (optional Kauai, Maui, Hawaii County)

Maximum Assembly U-factor

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT <i>U-</i> FACTOR	CEILING U-FACTOR	FRAME WALL <i>U-</i> FACTOR	MASS WALL U-FACTOR ^b	FLOOR <i>U</i> -FACTOR	BASEMENT WALL <i>U-</i> FACTOR	CRAWL SPACE WAL <i>U</i> -FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

- Windows
 - SHGC (Table R402.1.2)
- Skylights
 - SHGC & U-factor (Table R402.1.2)
 - Total UA (R402.1.5)
- Wall and roof four options
 - Insulation R-value (Table R402.1.2)
 - Assembly U-factor (Table R402.1.4)
 - Total UA (R402.1.5)
 - Points option (R407)
- Air leakage
 - Air barrier, sealing
 - Testing (optional Kauai, Maui, Hawaii County)

C Secure	https://energycode.pnl.gov/REScheckWeb/#/new-project	:/	아 ☆ 🚺 🛆 💹
RESchee	ck•Web™	erik@kolderupconsulting.com	Help Sign off 🏠
e » New Project			
roject Envelope	e Compliance 🗙	Cancel 🖺 Save 🖹 Report	Compliance Check
Project Info:		Building Characteristics	
Project Title [*]	Tropical house	Construction Type 1- and 2-Family, Deta Multifamily	iched
Energy Code: What's my code?	2015 IECC •	Conditioned Floor 1500	ft ²
Location	Honolulu County, Hawaii	Orientation - Front Enable:	
Project Type	New Construction		
	Addition	reatures	
	Alteration	All ducts and air handlers are located within conditioned spaces:) Yes 🖲 No
Compliance	UA Trade-Off	Thermally isolated sunroom:	Yes 🖲 No
Method	Performance Alternative	Pool or inground spa:	Yes 🖲 No
		Interior wood-burning fireplace:	Yes 🖲 No

- Windows
 - SHGC (Table R402.1.2)
- Skylights
 - SHGC & U-factor (Table R402.1.2)
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 - Insulation R-value (Table R402.1.2)
 - Assembly U-factor (Table R402.1.4)
 - Total UA (R402.1.5)
 - Points option (R407)
- Air leakage
 - Air barrier, sealing
 - Testing

Measure <u>Metal</u> Framed Walls	Standard Home Points	Tropical Zone Points
R-13 + R-3 wall insulation	0	1
R-13 cavity wall insulation + R-0	-1	0
R-13 wall insulation + high reflectance walls ⁴	0	1
R-13 wall + 90% high efficacy lighting and Energy Star Appliances ⁵	1	2
R-13 wall insulation + exterior shading wpf=0.36	0	1
R-30 roof insulation	0	1
R-19 roof insulation	-1	0
R-19 + cool roof membrane ¹ or radiant barrier ³	0	1
R-19 roof insulation + attic venting ²	0	1
Ductless air conditioner ⁷	1	1
1.071 X Federal minimum SEER for air conditioner	1	1
1.142 X Federal minimum SEER for air conditioner	2	2
No air conditioning installed	NA	2
House floor area \leq 1,000 ft ²	1	1
House floor area \geq 2,500 ft ²	-1	-1
Energy Star Fans ⁸	1	1
Install 1 kW or greater of solar electric	1	1

Residential envelope exemptions

- Those with a peak design rate of energy usage less than 3. 4 Btu/h•ft² 10.7 W/m²) or 1.0 watt/ft² (10. 7 W/m²) of floor area for space conditioning purposes.
- 2. Unconditioned space that does not contain habitable space.
- 3. Unconditioned dwellings with enclosed habitable areas less than 1,100 square feet.
- 4. Dwellings with permitted, off-grid, self supplying photovoltaic with battery back up.

Maui Amendment



Windows

- 1. U-factor no requirement
- 2. Solar heat gain coefficient (SHGC) ≤ 0.25

Exceptions

- 1. Up to 15 ft^2
- 2. Area-weighted average allowed
- 3. Jalousie windows exempt



Skylights

- 1. U-factor ≤ 0.75
- 2. Solar heat gain coefficient (SHGC) ≤ 0.30

Exceptions

- 1. Up to 15 ft^2 (total for window + skylight)
- 2. Area-weighted average allowed





www.veluxusa.com

Ceiling – wood framed

- 1. R-30 insulation (Table R402.1.2)
- 2. U-0.035 (Table R402.1.4)

Insulation type & thickness	R-30
Batt	8-10"
Blown-in	12"
Open-cell spray foam	~8"
Closed-cell spray foam	~5″
Polystyrene board	6″
Polyisocyanurate board	5″

Or use the points option (R407)



Ceiling – steel truss

- 1. R-38 insulation
- 2. R-30 + 3
- 3. R-26 + 5

Ceiling – <u>steel joist</u>

- 1. R-38 insulation
- 2. R-49 in any framing >2x8

(Table R402.2.6)

Insulation type & thickness	R-38	R-49
Batt	10-12"	15″
Blown-in	15″	19"
Open-cell spray foam	~10"	
Closed-cell spray foam	~6"	

Walls – wood frame

- 1. R-13 insulation (Table R402.1.2)
- 2. U-0.084 (Table R402.1.4)

Insulation type & thickness	R-13
Batt or blown-in	3.5″
Open-cell spray foam	3-4"
Closed-cell spray foam	2-3"
Polystyrene board	2.75″
Polyisocyanurate board	2″



Walls – metal frame

1. Table R402.2.6

2. U-0.084 (Table R402.1.4)



Frame spacing	Cavity insulation R-value	Continuous insulation R-value	Extruded Polystyrene (R-5/in.)	Poly- isocyanurate (R-6/in.)
16 in. o.c.	R-0	R-9.3	≥ 1.86 in.	≥ 1.55 in.
	R-13	R-4.2	≥ 0.84 in.	≥ 0.70 in.
	R-15	R-3.8	≥ 0.76 in.	≥ 0.63 in.
24 in. o.c.	R-0	R-9.3	≥ 1.86 in.	≥ 1.55 in.
	R-13	R-3.0	≥ 0.60 in.	≥ 0.50 in.
	R-15	R-2.4	≥ 0.48 in.	≥ 0.40 in.

Or use the points option (R407)

U-factor source: ASHRAE Standard 90.1-2019, Table A3.3.3.1 and Table A3.4.3.1



Why is extra insulation is required with metal framing?

R-13 in wood frame





R-13 in steel frame (effective R-6)

Walls – mass

- 1. R-3 exterior insulation (Table R402.1.2)
- 2. R-4 interior insulation (Table R402.1.2)
- 3. U-0.197 (Table R402.1.4)

Or use the points option (R407)





U-factor ≤ 0.197 ≥ R-4 in wood furring ≥ R-11 in metal furring
Envelope - Prescriptive

Walls – mass

- 1. R-3 exterior insulation (Table R402.1.2)
- 2. R-4 interior insulation (Table R402.1.2)
- 3. U-0.197 (Table R402.1.4)

Alternatives by State Amendment



Envelope - Prescriptive

Floors

1. R-O (Table R402.1.2)



Total points ≥ 0

- Roof and walls, or
- Roof alone and wall alone

Options for credit

- Insulation
- Cool roof
- Radiant barrier
- Wall reflectance
- More efficient lighting
- Efficient appliances
- Wall shading
- Ductless AC
- High efficiency AC
- No AC
- Small dwelling
- Energy Star fans
- Solar electric

State Amendment

Reasons to use it

- 1. Want <R-30 roof insulation
- 2. Have metal-framed walls and don't want
 - to add foam board insulation

Total points ≥ 0

- Roof and walls, or
- Roof alone and wall alone

Options for credit

- Insulation
- Cool roof
- Radiant barrier
- Attic venting
- Wall reflectance
- More efficient lighting
- Efficient appliances
- Wall shading
- Ductless AC
- High efficiency AC
- No AC
- Small dwelling
- Energy Star fans
- Solar electric

Measure <u>Wood</u> Framed Walls	Standard Home Points	Tropical Zone Points
R-13 cavity wall insulation	0	1
R-19 roof insulation	-1	0
R-19 roof insulation + cool roof membrane ¹ or radiant barrier ³	0	1
R-19 roof insulation + attic venting ²	0	1
R-30 roof insulation	0	1
R-13 wall insulation + high reflectance walls ⁴	1	2
R-13 wall + 90% high efficacy lighting and Energy Star appliances ⁵	1	2
R-13 wall insulation + exterior shading wpf=0.3 ⁶	1	2
Ductless air conditioner ⁷	1	1
1.071 X Federal minimum SEER for air conditioner	1	1
1.142 X Federal minimum SEER for air conditioner	2	2
No air conditioning installed	NA	2
House floor area \leq 1,000 ft ²	1	1
House floor area \geq 2,500 ft ²	-1	-1
Energy Star fans ⁸	1	1
Install 1 kW or greater of solar electric	1	1

See also checklist

Total points ≥ 0

- Roof and walls, or
- Roof alone and wall alone

Options for credit

- Insulation
- Cool roof
- Radiant barrier
- Attic venting
- Wall reflectance
- More efficient lighting
- Efficient appliances
- Wall shading
- Ductless AC
- High efficiency AC
- No AC
- Small dwelling
- Energy Star fans
- Solar electric

Measure Metal Framed Walls	Standard	Tropical
	Points	Points
R-13 + R-3 wall insulation	0	1
R-13 cavity wall insulation + R-0	-1	0
R-13 wall insulation + high reflectance walls ⁴	0	1
R-13 wall + 90% high efficacy lighting and Energy Star Appliances ⁵	1	2
R-13 wall insulation + exterior shading wpf=0.3 ⁶	0	1
R-30 roof insulation	0	1
R-19 roof insulation	-1	0
R-19 + cool roof membrane ¹ or radiant barrier ³	0	1
R-19 roof insulation + attic venting ²	0	1
Ductless air conditioner ⁷	1	1
1.071 X Federal minimum SEER for air conditioner	1	1
1.142 X Federal minimum SEER for air conditioner	2	2
No air conditioning installed	NA	2
House floor area ≤ 1,000 ft ²	1	1
House floor area ≥ 2,500 ft ²	-1	-1
Energy Star Fans ⁸	1	1
Install 1 kW or greater of solar electric	1	1

See also checklist

Total points ≥ 0

- Roof and walls, or
- Roof alone and wall alone

Options for credit

- Insulation
- Cool roof
- Radiant barrier
- Attic venting
- Wall reflectance
- More efficient lighting
- Efficient appliances
- Wall shading
- Ductless AC
- High efficiency AC
- No AC
- Small dwelling
- Energy Star fans
- Solar electric

Measure	Standard	Tropical
<u>Mass</u> Walls	Home	Home
	Points	Points
R-3/4 Insulation	0	1
R-0 Wall insulation	-1	0
R-0 Wall Insulation + high reflectance walls ⁴	0	1
R-0 Wall + 90% high efficacy lighting and Energy Star Appliances ⁵	1	2
R-0 Wall Insulation + exterior shading wpf=0.3 ⁶	0	1
R-19 Roof/ceiling Insulation	-1	0
R-19 + Cool roof membrane ¹ or Radiant Barrier ³	0	1
R-19 Roof Insulation + Attic Venting ²	0	1
R-30 Roof/ceiling Insulation	0	1
Ductless Air Conditioner ⁷	1	1
1.071 X Federal Minimum SEER for Air Conditioner	1	1
1.142 X Federal Minimum SEER for Air Conditioner	2	2
No air conditioning installed	NA	2
House floor area \leq 1,000 ft ²	1	1
House floor area \geq 2,500 ft ²	-1	-1
Energy Star Fans ⁸	1	1
Install 1 kW or greater of solar electric	1	1
	_	_

See also checklist

Envelope – Total UA (R402.1.4)

Alternative to prescriptive envelope

- Calculate total (U-factor x Area) for walls, roof and fenestration
- Typically use REScheck software
 - Desktop or Web version
 - Does not include Hawaii amendments
 - https://energycode.pnl.gov/REScheckWeb





Envelope – Air Leakage (R402.4)



Installation details in Table R402.4.1.1

- Continuous air barrier
- Breaks or joints are sealed
- Recessed lighting
- Around windows and skylights



	AIR BARRIE	TABLE R402.4.1.1 R AND INSULATION INSTALLATIO	N		
COMPONENT		AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA		
General requirements	A continuous a building envelo The exterior the air barrier. Breaks or joints	ir barrier shall be installed in the pe. ermal envelope contains a continuous s in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.		
Ceiling/attic	c 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.		
The junction of the foundation and sill plate shall be sealed. Walls The junction of the top plate and the top of exterior		Cavities within comers 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.			
	Knee walls s	CO	MPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Windows, skylights and doors	The space be and skylights			A continuous air barrier shall be installed in the	
Rim joists	Rim joists sh			building envelope.	
Floors (including above garage and The air barrie		General requirements		The exterior thermal envelope contains a continuous air barrier.	sealing material.
cantilevered floors)	of insulation.			Breaks or joints in the air barrier shall be sealed.	
	Exposed earth	n unvented crawl spaces shall be	Where provided instead of floor insulation		
Crawl space walls	covered with		where provided instead of noor instanton,	-	
Shafts, penetrations	Duct shafts, 1 opening to er sealed.	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.
Narrow cavities			bats in narrow cavines 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.		
Batt insulation sha wiring and plumbin insulation that on i available space she 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 wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.		Exterior walls adjacent to showers and tubs shall be insulated.		
Electrical/phone box on exterior walls	x 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.				
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.

Envelope – Air Leakage (R402.4)

Testing

Leakage \leq 5 air changes per hour at 0.2 in. w.c. pressure (50 Pa) Testing conducted by an approved third party

> Maui Calibrated Blower Doorway Door Test Amendment Window Now required Fan Blower door Outward Leaking air Outgoing air Inward Leaking air



Envelope – Air Leakage (R402.4)

Fenestration air leakage

- $\leq 0.3 \text{ cfm/ft}^2$ for windows, skylights and sliding doors
- $\leq 0.5 \text{ cfm/ft}^2 \text{ for swinging doors}$
- Exception for site-built

Recessed lighting in thermal envelope

- IC rated (insulation contact)
- Labeled ≤ 2 cfm at 75 Pa





Prescriptive Envelope Summary

- Windows
 - SHGC (Table R402.1.2)
- Skylights
 - SHGC & U-factor (Table R402.1.2)
 - Total UA (R402.1.5)
- Wall and roof four options
 - Insulation R-value (Table R402.1.2)
 - Assembly U-factor (Table R402.1.4)
 - Total UA (R402.1.5)
 - Points option (R407)
- Air leakage
 - Air barrier, sealing
 - Testing

Or Tropical Zone option



Section 6 Prescriptive - Systems



What's covered

Envelope

Roof Walls Windows & skylights Air leakage

Systems

Air conditioning controls Duct insulation Duct leakage Water heating Swimming pool

Electrical

Permanently installed lighting Ceiling fans Solar readiness Maui EV readiness Amendment



Not covered

AC efficiency Water heater efficiency Plug-in lighting Appliances

Systems – AC Requirements

Programmable thermostat



Duct insulation



Duct sealing & fastening



Source: www.energycodes.gov

Duct testing



Source: DOE/NREL PIX04869

Systems – Duct Insulation



Systems – Duct Insulation

Examples



R-6 (~1.75" thick)



R-8 (~2.5" thick)

Systems – Duct Insulation

DUCTS WITHIN THERMAL ENVELOPE EXAMPLES



Source: DOE/NREL PIX03067



Source: DOE/NREL PIX10076

Systems – Duct Sealing (R403.3.2)

IRC M1601.4.1 Joints, seams and connections

Ducts mechanically fastened and sealed

Sealing options





Source: DOE/NREL PIX04869

Systems – Duct Sealing (R403.3.2)

IRC M1601.4.1 Joints, seams and connections

Ducts mechanically fastened and sealed

Fastening options



Mechanical fasteners with UL mark "181 B-C"



Metallic duct

- At least 1 inch overlap
- At least three screws/rivets

Systems – Duct Testing (R403.3.3 & R403.3.4)

Rough-in test





Leakage $\leq 4 \text{ cfm}/100 \text{ ft}^2$

Postconstruction test



Leakage $\leq 4 \text{ cfm}/100 \text{ ft}^2$

Leakage $\leq 3 \text{ cfm}/100 \text{ ft}^2$ (without air handler)

Test **not** required if air handler and all ducts are within the thermal envelope

Systems – Solar Water Heating (R403.5.4)

Solar water heating systems are required for new single-family residential construction pursuant to HRS 196-6.5



More information

https://energy.hawaii.gov/what-we-do/energy-efficiency/solar-water-heat-variance/

https://www.capitol.hawaii.gov/hrscurrent/Vol03_Ch0121-0200D/HRS0196/HRS_0196-0006_0005.htm

Systems – Service Hot Water

Circulation systems (R403.5.1.1)

If a pump is installed, automatic temperature and demand controls required

Heat trace systems (R403.5.1.1)

 If a heat trace is installed, automatic temperature controls required

Demand recirculation systems (R403.5.2)

- Control based on signal from user action
- Limit on hot water temperature entering cold water piping



Systems – Service Hot Water

R-3 hot water pipe insulation (R403.5.3)

- $\geq \frac{3}{4}$ diameter
- Serving more than one dwelling
- Outside conditioned space
- From water heater to manifold
- Under a slab
- Buried
- In recirculating systems



Systems – Pools and Spas (R403.10)

On/off switch

Time switch

Cover for heated pool

• Unless >75% solar or heat pump



Courtesy Daniel Sandomire, Armstrong Builders

Section 7 Prescriptive - Electrical & Lighting



What's covered

Envelope

Roof Walls Windows & skylights Air leakage

Systems

Air conditioning controls Duct insulation Duct leakage Water heating Swimming pool





Not covered

AC efficiency Water heater efficiency Plug-in lighting Appliances

Lighting (R404.1)

High efficacy ≥ 90% of lamps

Lamp Wattage	Efficacy (lumens/watt)
> 40 watts	60
15-40 watts	50
< 15 watts	40







Full-size

fluorescent



Source: DOE/NREL PIX20307

LED

Ceiling Fans (R404.2)

R404.2 Ceiling Fans (Mandatory). A ceiling fan, ceiling fan rough-in or whole house fan is provided for bedrooms and the largest space that is not used as bedroom.









Solar and Electric Vehicle Readiness





https://www.clippercreek.com/

What's covered

Envelope

Roof Walls Windows & skylights Air leakage

Systems

Air conditioning controls Duct insulation Duct leakage Water heating Swimming pool

Electrical





Not covered

AC efficiency Water heater efficiency Plug-in lighting Appliances

Appendix RA Solar-Ready Provisions

- Area reserved for PV or solar thermal system
- Pathways for routing of conduit or plumbing
- Electrical panel reserved space
- Permanent certificate near electrical panel



Maui Amendment





That is oriented between 110° and 270°

Exceptions

- Permanently installed on-site renewable energy system
- Roof is shaded >70% of daylight hours
- Tropical Zone compliance or Energy Rating Index compliance

Solar-ready zone area requirements

(Excluding mandatory fire code setback or access areas)

Total area

 \geq 300 ft², or

 \geq 150 ft² for townhouses \leq 2,000 ft² floor area

Multiple separate areas ok

Minimum area dimensions

 \geq 5 ft wide

≥ 80 ft²



Other requirements

Free from obstructions

Roof load documentation

Interconnection pathway for conduit or plumbing

Electrical service reserved space

Construction documentation certificate
Electric Vehicle Readiness (R404.3)

Updated from previous code

Dedicated receptable must be provided for each enclosed attached garage to support AC Level 2 charging





https://www.clippercreek.com/

Section 10 **Performance Compliance Options**



Simulated Performance Alternative (R405)



- REM/Rate and REM/Design •
- Ekotrope •
- EnergyGauge USA
- IC3 (Texas A&M)

- Windows equally distributed all sides •
- No window shading •
- Proposed cooling system ٠
- Proposed water heating system •

Energy Rating Index Compliance (R406)

Compliance

- Mandatory requirements
- Envelope performance \geq 2009 IECC
- Energy Rating Index ≤ 57 (was 52)
- Verification by approved third party

Accredited providers

https://www.resnet.us/providers/accredited-providers/accredited-rating-providers/

Accredited software tools (Dec. 2023)

https://www.resnet.us/providers/accredited-providers/hers-software-tools/

- Ekotrope
- EnergyGauge USA
- REM/Rate



Section 9 Large homes compliance

Large home compliance (R401.3)

R401.2 Compliance. New one- or two-family residential buildings with five thousand square feet or more of conditioned floor area must achieve a verified maximum energy rating index (ERI) score of zero. All projects must also comply with one of the following:

1. Sections R401.3 through R404.

2. Section R405 and the provisions of Section R401 through R404 labeled "Mandatory."

3. An energy rating index (ERI) approach in Section R406.

4. The tropical zone requirements in Subsection R401.2.1.





Section 11 Existing Building Compliance



Additions (R502)

Three options

- 1. New construction requirements for addition alone
- 2. Performance method for existing + addition
- 3. Existing + addition no more energy than existing



Envelope	Sy
New roof	Ne
New walls	Ne
New windows & skylights	Ne
Air leakage	Ne

Systems

Iew AC Iew duct Iew water heating Iew lighting

General requirement for alterations

Altered components meet new construction requirements

Example alterations

- New windows in existing wall
- Replaced windows with sash and frame
- New AC system
- New water heating system
- New lighting systems
- Replace wall siding
- Roof replacement

Some exceptions

Roof

Meet new construction insulation requirements

Exceptions

- Roof repair no requirement
- Roof recover no requirement



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

Roof replacement options

- 1. R-30 insulation or cool roof
- 2. R-19 or cool roof (Tropical Zone)
- 3. Choose two
 - 1. Energy Star roof covering
 - 2. Radiant barrier
 - 3. Attic ventilation
 - 4. Exceptions listed in C402.3
- 4. Shake on battens replaced with equal or better performance
- 1. Portions covered by:
 - Photovoltaic systems or components.
 - Solar air or water-heating systems or components.
 - Roof gardens or landscaped roofs.
 - Above-roof decks or walkways.
 - Skylights.
 - HVAC systems and components, and other opaque objects mounted above the roof.
- 2. Portions shaded during summer solstice
- 3. Portions ballasted with stone 17 lb/sf

Walls

R-value or U-factor for new construction

Exceptions

- Wall cavity is not exposed
- Wall cavity is filled with insulation

Windows

0.25 SHGC for new windows and replacement windows or skylights

(Area weighted average allowed)

Skylights

U-factor ≤ 0.75

 $\mathsf{SHGC} \leq 0.30$

(Area weighted average allowed)

Exception

• Glazing-only repairs of existing windows and skylights

Air conditioning systems

New systems and components meet new construction requirements

Exceptions

• Duct extensions of less than 40 ft in unconditioned space

Water heating systems

New systems and components meet new construction requirements

Lighting

High efficacy \ge 90% of lamps

Exceptions

• Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

Section 12 Wrap Up

Wrap Up – Compliance Alternatives

- 1. Tropical Zone
 - ≤50% air conditioned
 - not heated
 - elevation < 2,400 feet
- 2. Prescriptive
 - Envelope (+ Points Option)
 - Systems
 - Electrical power and lighting systems
- 3. Simulated performance alternative
- 4. Energy rating index (ERI)
 - ERI ≤ 57
- 5. Large one- and two-family homes
 - >5,000 ft² conditioned floor area

Plus PV readiness EV readiness



Howard Wiig, State Energy Office Erik Kolderup, PE, Kolderup Consulting Justin Bizer, Hawaii Energy

Evaluation Survey

https://www.surveymonkey.com/r/9RVYMQ5

Maui Energy Code - Resident	ial - April 23, 2024		Г
Your feedback will help improve future	webinars.		í.
1. My role		T-107E-4	
Architect or designer	Product vendor		
Engineer	Building official		
Contractor	Other government	이 이 이 가지 않는 것 같아요.	┛┖
Developer	Educator		
Real estate sales	Student		
Other (please specify)		▋▆▋▌▚▖▖▝▙▞▜▖	
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For more energy code information

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2018 IECC available:

- <u>http://iccsafe.org/publications</u>
- <u>https://codes.iccsafe.org/content/iecc2018</u>

State Energy Code Website:

<u>http://energy.hawaii.gov/hawaii-energy-building-code</u>

Maui Energy Code Website

<u>https://www.mauicounty.gov/1308/Building-Plans-Review-Section</u>