

2024 CBES Building Shell and Air Barrier Design

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Lead Engineering Consultant

June 20, 2024

A person wearing a bright pink long-sleeved shirt is holding a white spiral-bound notebook. The notebook has a grid pattern and the text "Build Tight, Ventilate Right!" written in a black, cursive font. The person's hands, with pink nail polish, are visible holding the notebook. The background is dark, and the image has a torn-paper effect at the bottom.

*Build Tight,
Ventilate Right!*

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Target Effective Date

July 1, 2024

Do RBES and CBES have the same code version trigger?

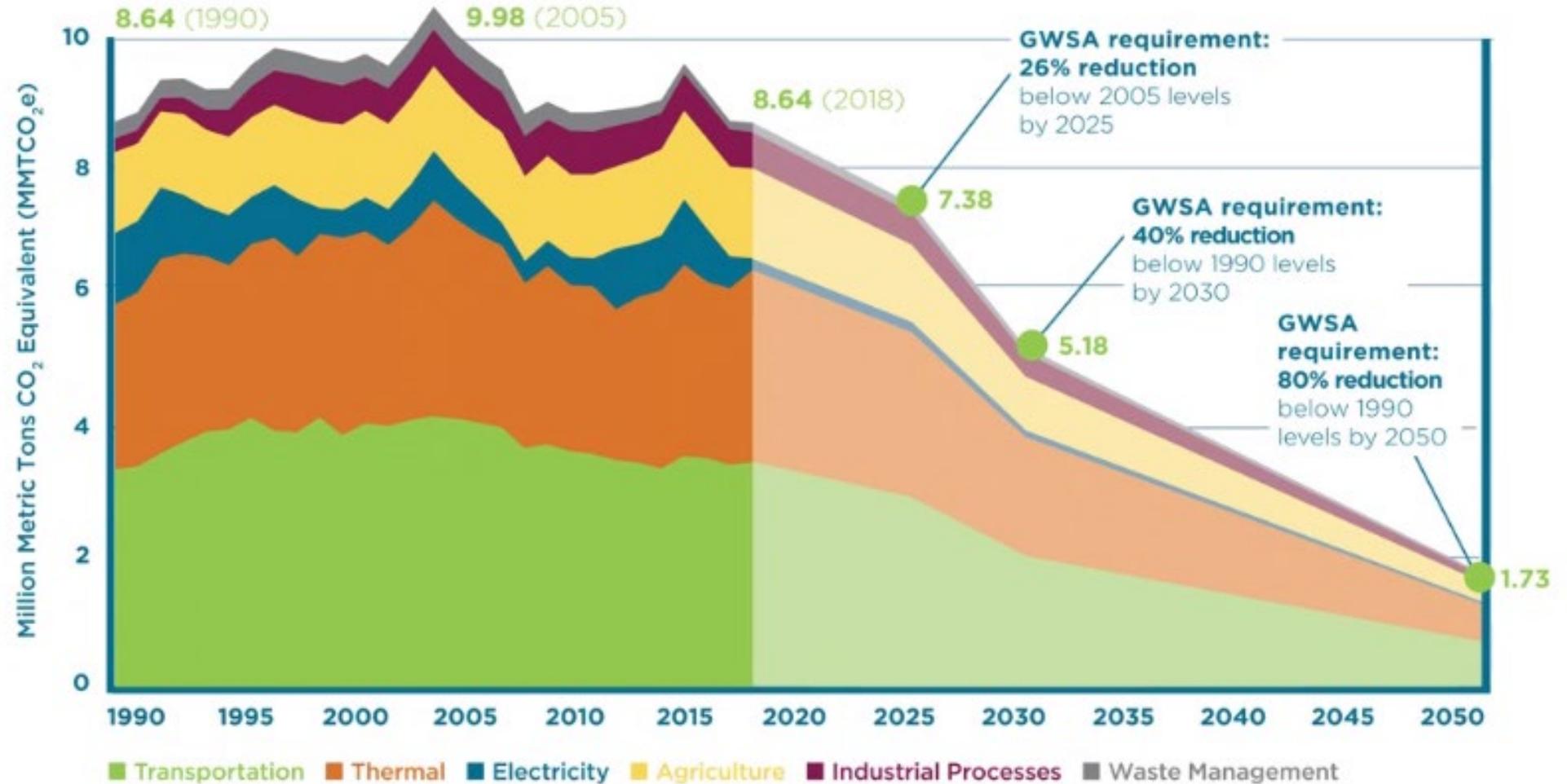
- CBES: Building Permit application date
- RBES: Construction start date

CBES caveat: For buildings permitted under 2020 CBES: construction must start prior to December 31, 2024



Source: R. Edwards & Co. Architects

Vermont's historical GHG emissions and future requirements



Source: Vermont Agency of Natural Resources, Vermont GHG Emissions Inventory and Forecast (1990-2017), 2021.



Chapter 1

~~Scope &~~ Administration



C103 Construction Documents

C103.2 Information on Construction Documents

- **Air barrier** and air sealing details, **including the location of the air barrier**, a diagram showing the building's pressure boundary in plan(s) and section(s), and calculation of the area of the pressure boundary as specified in Section C402.4.1.3.

Chapter 4

Commercial Energy Efficiency

Efficiency
Vermont



C401.3 CBES Certificate and Affidavits

2020 Vermont Commercial Building Energy Standards (CBES) Certificate

This certificate is for projects whose state or local permit application was submitted on or after September 1, 2020.
Before completing this form, refer to the instructions

Site Address (Street, City, ZIP Code) _____

Construction START Date _____ Construction FINISH Date _____ Act 250 (Y/N): _____ Act 250 Permit # _____

Project Description: _____

# Stories Above Grade _____	# Stories _____
# Building Sq. Ft. _____	# Conditioned Sq. Ft. _____

Compliance Methods **Option 1a: Chapter 5-Plus-Credits** (see CBES for full requirements each point option)
(Must select option 1a, 1b, 2a, 2b or 3) **Option 1b: ASHRAE 90.1-2016 (with CBES amendments C401.2.1) Plus-Credits**
Credits achieved: _____ Occupancy Group _____ (See Table C406.1 for credits and groups)

<input type="checkbox"/> 1 More efficient HVAC performance	<input type="checkbox"/> 2.1 Reduced lighting power: Option 1	<input type="checkbox"/> 2.2 Reduced lighting power: Option 2
<input type="checkbox"/> 3 Enhanced lighting controls	<input type="checkbox"/> 4 On-site supply of renewable energy	<input type="checkbox"/> 5 Dedicated outdoor air system
<input type="checkbox"/> 6.1 High-efficiency service water heating	<input type="checkbox"/> 6.2 High-efficiency service water heating	<input type="checkbox"/> 6.3 Heat pump water heating equipment
<input type="checkbox"/> 7 Enhanced envelope	<input type="checkbox"/> 8 Reduced air infiltration	<input type="checkbox"/> 9 Efficient kitchen appliances
<input type="checkbox"/> 10 Controlled Receptacles		

Compliance Documentation required: COMcheck™ Software Vermont 2020 CBES Version

Option 2a: ASHRAE/IESNA Standard 90.1-2016 Energy Cost Budget Method
Compliance documentation requirements as noted in Section 11.7

Option 2b: ASHRAE/IESNA Standard 90.1-2016 Appendix G -Performance Rating Method (Review CBES amendments C401.2.1)
Compliance documentation requirements as noted in Appendix G

Option 3: Above Code Program
Contact Vermont PSD for approval of Above Code Program and documentation requirements

Air Sealing / Blower Door Test (if required) _____ CFM75/sq ft of building shell (6 sides) Date of Test _____

Air Leakage Tester Firm and Testers Name: _____

Other Requirements Where applicable:
 EV charging requirement: _____ # Total Parking Spaces: _____ # Total EVSE Equipped Parking Spaces: _____ # Total EVSE Ready Parking Spaces _____

C401.3 Draft CBES Certificate

The 2024 certificate will require the following information:

- Thermal envelope details including R-values of assembly insulation and U-factors & SHGC of fenestrations
- Results from any building envelope air leakage testing
- An indication of the solar-ready zone and other requirements of C402.5

C401.3 Draft CBES Certificate

Thermal Envelope Details Wood framed Metal framed Metal building Mass walls Slab-on-grade Heated slab Basement

Where applicable, either provide area-weighted average value below or provide an attachment with each value that applies to 10% or more of the total component area

R-values: _____ Ceiling _____ Roof _____ Above Grade Wall _____ Below Grade Wall _____ Floors _____ Slab

_____ Non-Swinging Door _____ Garage Door <14% Glazing _____ Ducts outside conditioned spaces

U-values _____ Fixed fenestration _____ Operable fenestration _____ Storefront fenestration

_____ Skylight _____ Entrance Door w/fenestration _____ Swinging Opaque Doors

SHGC _____ Fixed fenestration _____ Operable fenestration _____ Storefront fenestration _____ Skylight

Projection Factor (See Section C402.3.3, Equation 4-4) _____ Fixed fenestration _____ Operable fenestration

C401.3 Draft CBES Certificate

Air Sealing / Blower Door Test (if required) _____ Test Date _____ CFM75/SF (6 sides) _____ For R-2 buildings < 7 stories, CFM50/SF (6 sides)

Air Leakage Tester Firm and Testers Name: _____

Other Requirements Where applicable

For R-2 buildings _____ # dwelling and sleeping units

Solar-ready Zone Requirement: _____ Net Roof Area after subtractions (SF), (See Section C402.5.3) _____ Solar-ready area (SF)

EV Charging Requirement: _____ # Parking Spaces: _____ # EVSE Parking Spaces: _____ # EV Ready Parking Spaces _____ # EV Capable Parking Spaces

C402.1(2) Conditioned Space Building Envelope Requirements

Highlights:

- Adjustments to all U-value requirements
- Better alignment with RBES for R-2 occupancy classifications
- An indication of the solar-ready zone and other requirements of C402.5
- Example assemblies for meeting U-factor requirement

C402.1(2) Conditioned Space Building Envelope Requirements

TABLE C402.1(2)
CONDITIONED SPACE BUILDING ENVELOPE REQUIREMENTS—OPAQUE ASSEMBLIES

COMPONENT	MAXIMUM OVERALL U-FACTOR			EXAMPLE ASSEMBLIES MEETING U-FACTOR REQUIREMENT	
	2020 CBES	All Other Occupancy Classifications	R-2 Occupancy Classifications	All Other Occupancy Classifications	R-2 Occupancy Classifications
Roofs					
Insulation above deck	U-0.025	U-0.022	← Same	R-45ci	← Same
Metal buildings	U-0.026	U-0.023	← Same	R-10 + R-10 + R-32ci	← Same
Attic and Other	U-0.021	U-0.017	U-0.020	R-60	R-49
Walls, Above grade					
Mass	U-0.048	U-0.037	← Same	R-25ci	← Same
Metal Building	U-0.044	U-0.039	← Same	R-13 + R-19.5ci or R-25ci	← Same
Metal-framed	U-0.044	U-0.037	← Same	R-13 + R-18.8ci or R-25ci	← Same
Wood-framed and other	U-0.042	U-0.036	U-0.042	R-13 + R-16ci or R-19 + R-12ci or R-25ci	R-13 + R-12ci or R-19 + R-8ci or R-20ci

C402.1(2) Conditioned Space Building Envelope Requirements

COMPONENT	MAXIMUM OVERALL U-FACTOR			EXAMPLE ASSEMBLIES MEETING U-FACTOR REQUIREMENT	
	2020 CBES	All Other Occupancy Classifications	R-2 Occupancy Classifications	All Other Occupancy Classifications	R-2 Occupancy Classifications
<i>Walls, Below Grade</i>					
Below-grade wall	C-0.063	C-0.048	← Same	R-20ci	← Same
<i>Floors</i>					
Mass	U-0.051	U-0.038	← Same	R-23ci	← Same
Joist/Framing—Metal	U-0.032	U-0.027	← Same	R-38 + R-6ci	← Same
Joist/Framing—Wood	U-0.033	U-0.027	← Same	R-38	← Same
<i>Slab-on-Grade Floors</i>					
Unheated slabs	F-0.360	F-0.434	← Same	R-20 for 48" below	← Same
Heated slabs	F-0.373	F-0.433	← Same	R-20 for 48" below + R-15 full slab	← Same

C402.1(3) Semi-Conditioned Space Building Envelope

TABLE C402.1(3) SEMI-CONDITIONED SPACE BUILDING ENVELOPE REQUIREMENTS			
COMPONENT	MAXIMUM OVERALL U-FACTOR		EXAMPLE ASSEMBLIES MEETING U-FACTOR REQUIREMENT
	2020 CBES	All Occupancy Classifications	All Occupancy Classifications
Roofs			
Insulation above deck	U-0.025	U-0.039	R-25ci
Metal buildings	U-0.026	U-0.037	R-19 + R-11 LS or R-25 + R-8 LS
Attic and Other	U-0.021	U-0.027	R-38
Walls, Above grade			
Mass	U-0.048	U-0.104	R-9.5ci
Metal Building	U-0.044	U-0.060	R-15.8ci
Metal-framed	U-0.044	U-0.064	R-13 + R-7.5ci
Wood-framed and other	U-0.042	U-0.051	R-13 + R-7.5ci
Walls, Below Grade			
Below-grade wall	C-0.063	C-0.119	R-7.5ci
Floors			
Mass	U-0.051	U-0.064	R-12.5ci
Joist/Framing—Metal	U-0.032	U-0.052	R-19
Joist/Framing—Wood	U-0.033	U-0.033	R-30
Slab-on-Grade Floors			
Unheated slabs	F-0.036	F-0.540	R-10 for 24 in. below
Heated slabs	F-0.073	F-0.860	R-15 for 24 in below

C402.1.2.1.1 Tapered above-deck insulation based on thickness

Calculate the simple average R-value and comply with the U-value requirement in the table C402.1(2)

COMPONENT	MAXIMUM OVERALL U-FACTOR			EXAMPLE ASSEMBLIES MEETING U-FACTOR REQUIREMENT	
	2020 CBES	All Other Occupancy Classifications	R-2 Occupancy Classifications	All Other Occupancy Classifications	R-2 Occupancy Classifications
<i>Roofs</i>					
Insulation above deck	U-0.025	U-0.022	←Same	R-45ci	←Same

C402.2.1 Roof Assembly

2020 CBES had different language regarding minimum R-value for tapered roof insulation and low-pitch sloped roofs with continuous insulation

- 2024 CBES cleans this up by simply requiring a minimum of R-12 at the lowest point, gutter edge, roof drain or scupper
- Still need to meet the average R-value requirement for the whole roof!

C402.2.3 Floors

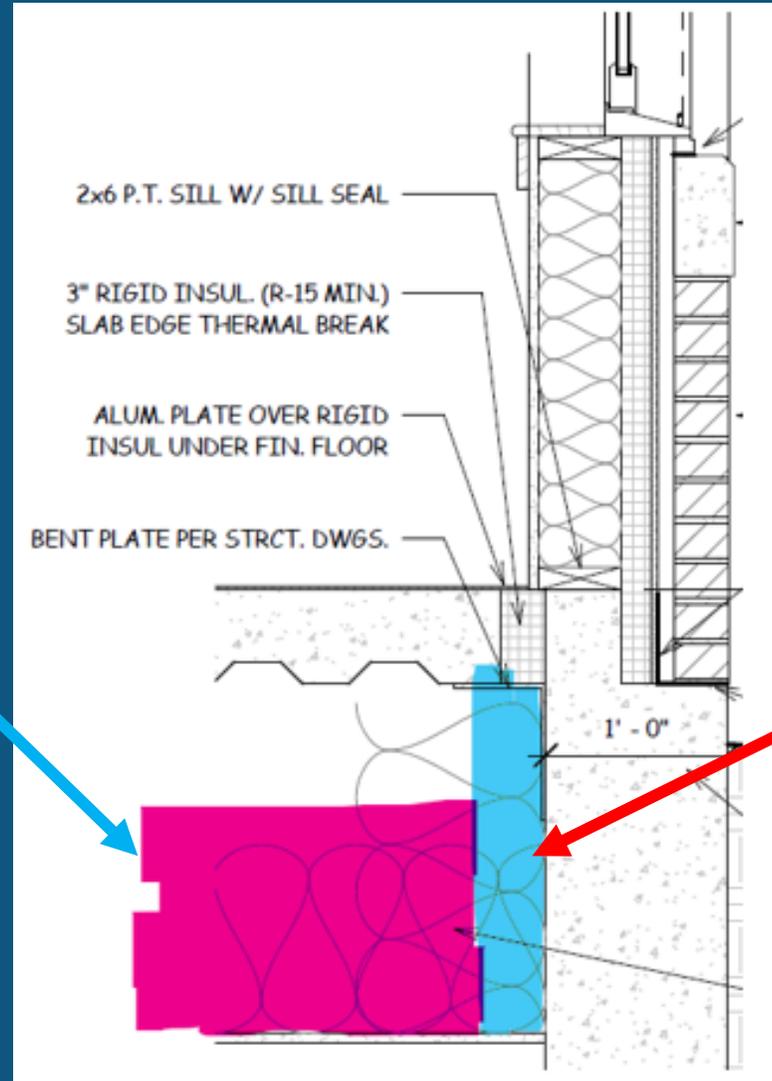
Floor framing cavity insulation or structural slab insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or structural slabs

- Exception 1. The floor framing cavity insulation or structural slab insulation shall be permitted to be in contact with the top side of sheathing or continuous insulation installed on the bottom side of floor assemblies where combined with insulation that meets or exceeds the minimum U-values and extends from the bottom to the top of all perimeter floor framing or floor assembly members.
- Exception 2. Insulation applied to the underside of concrete floor slabs shall be permitted an airspace of not more than 1 inch (25 mm) where it turns up and is in contact with the underside of the floor under walls associated with the building thermal envelope.

C402.2.3 Floors

Exception 1:

Joist/Framing Metal Floor
R-38 plus R-6 continuous
(U-0.032)



Mass Wall, Above-Grade
R-25 continuous

C402.2.3 Floors

Exception 2: ????

Here's that language again:

Insulation applied to the underside of concrete floor slabs shall be permitted an airspace of not more than 1 inch (25 mm) where it turns up and is in contact with the underside of the floor under walls associated with the building thermal envelope.

C402.3 Fenestration Maximum U-Factor and SHGC

TABLE C402.3 BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS				
VERTICAL FENESTRATION				
U-factor	2020 CBES		2023 CBES	
Fixed fenestration <i>other than storefront</i>	0.33		0.29	
Storefront fenestration	n/a		0.33	
Operable fenestration, R-2 occupancy classifications	n/a		0.30	
Operable fenestration, occupancy classifications <i>other than R-2</i>	0.37		0.36	
Entrance doors	0.68		0.63	
SHGC				
Orientation PF	SEW Fixed	N Operable	SEW Fixed	N Operable
PF < 0.2	0.40	0.53	0.38	0.34
0.2 ≤ PF < 0.5	0.48	0.58	0.46	0.41
PF ≥ 0.5	0.64	0.64	0.61	0.54
SKYLIGHTS				
U-factor	0.48		0.41	
SHGC	0.38		0.38	

C402.4.1.1 Air Barrier Performance Testing

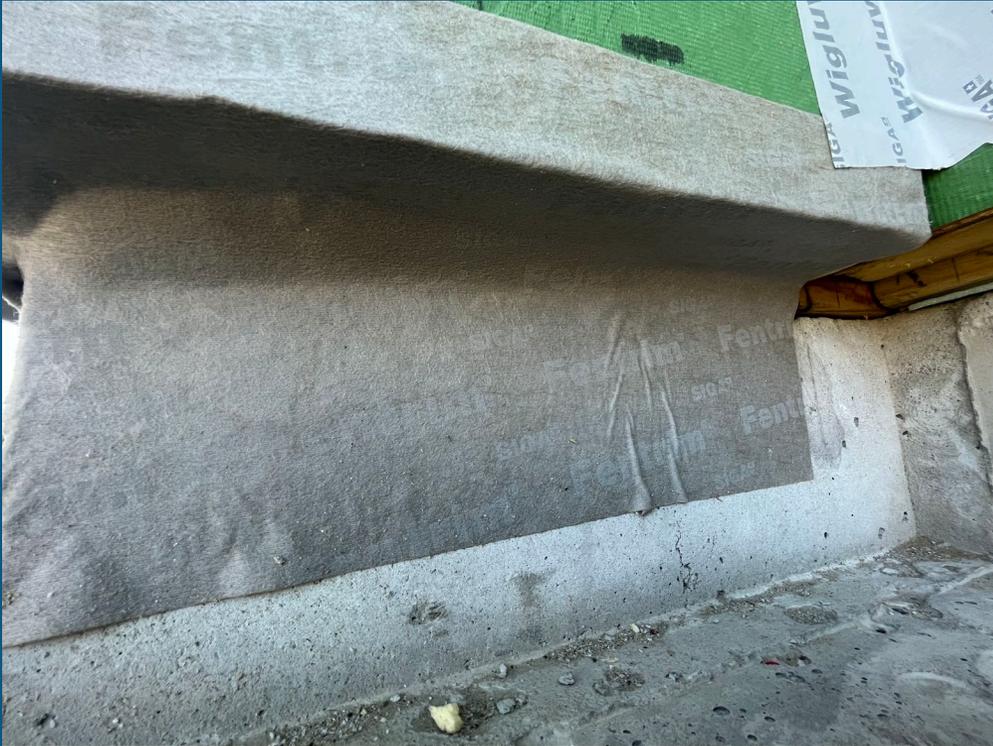
Air leakage shall not exceed 0.25 cfm/ft² tested at 75Pa

- Exceptions:
 - R-2 building occupancies six stories or less:
 - Tested at 50 Pa
 - ≤ 0.15 cfm/ft² of the building thermal envelope area
 - Larger than 250,000 ft² that do not include Group R or Group I occupancies: test or commission
 - Unfeasible to test (as determined by VTDPs): commission

Air Barrier Details



Air Barrier Details



Note: only some spray foams are approved for contact with cementitious fireproofing

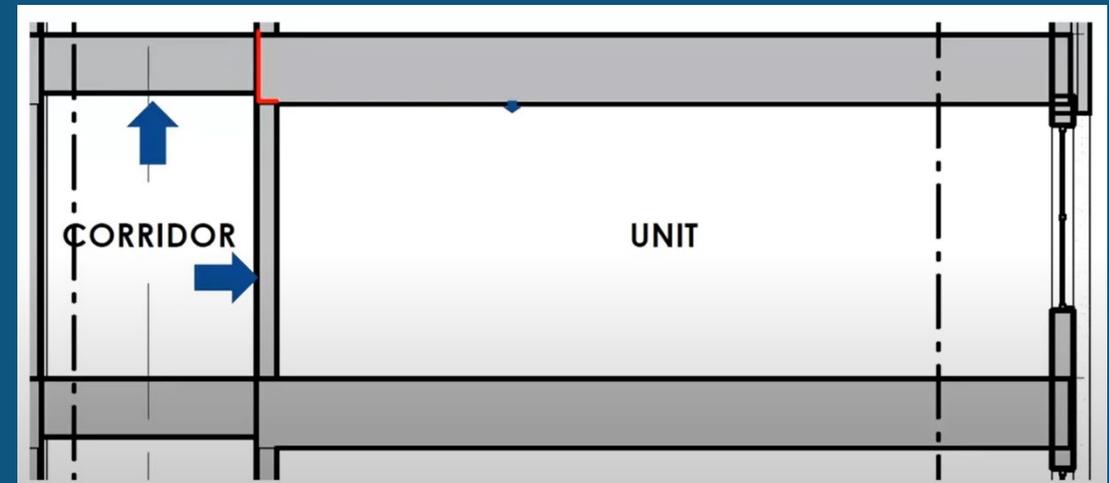
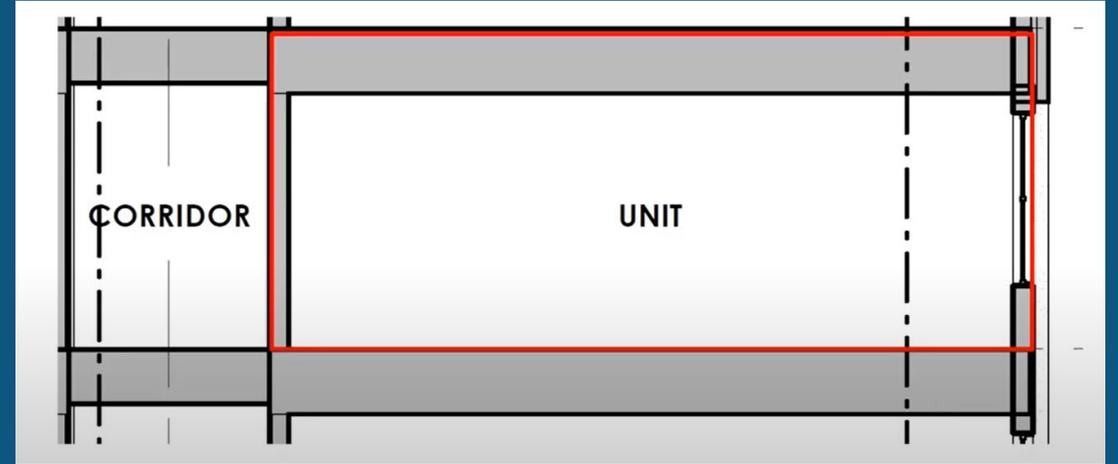
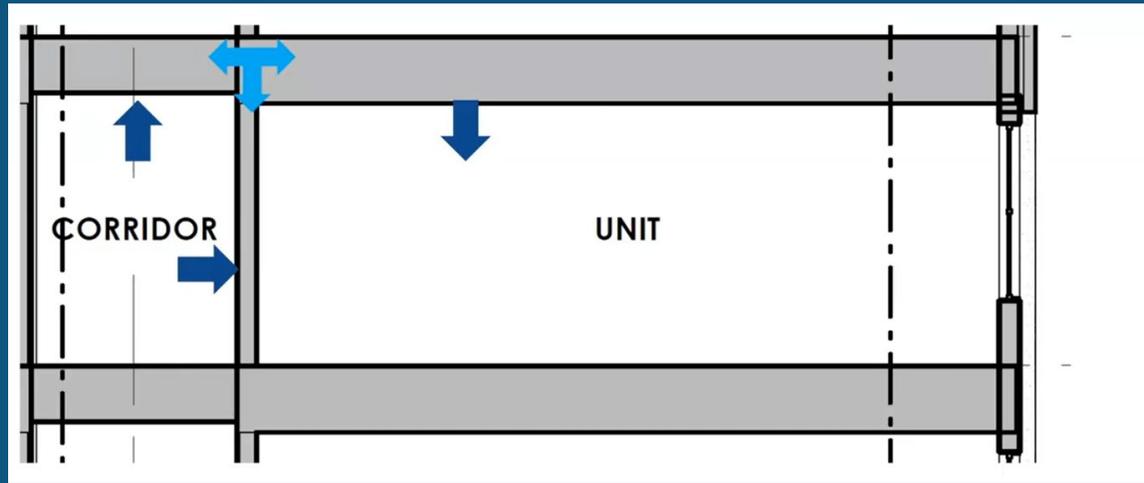


C402.4.2 Dwelling & sleeping unit enclosure testing

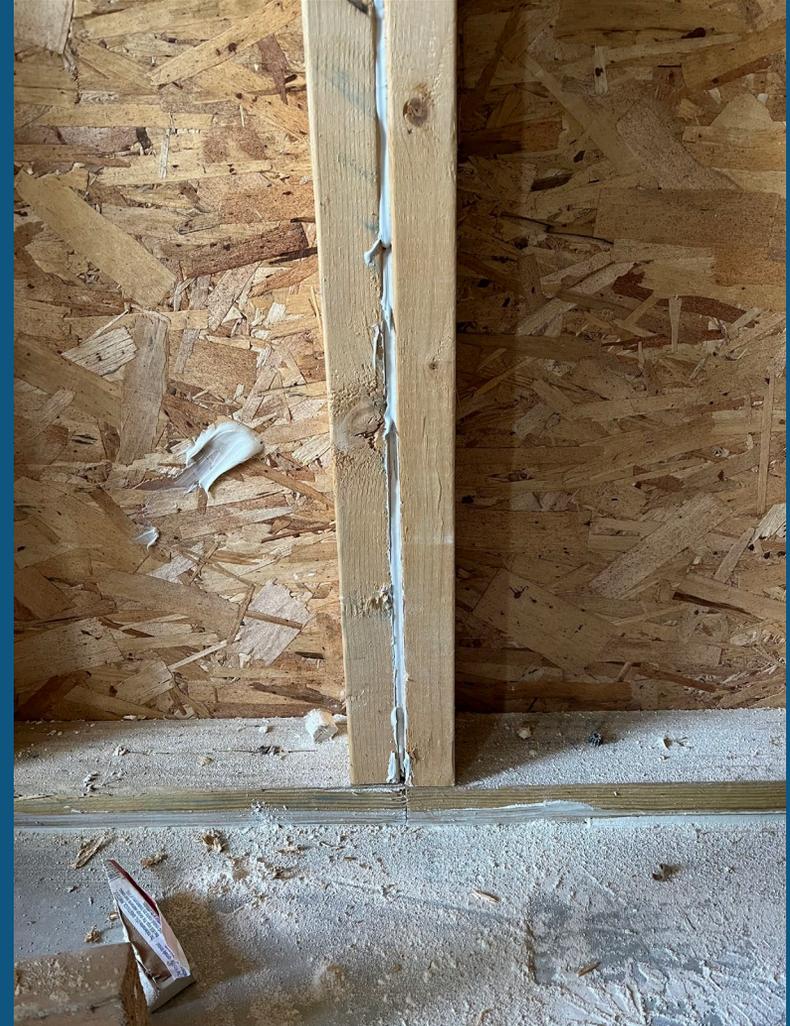
Air leakage shall not exceed 0.15 cfm/ft² tested at 50Pa

- Fewer than 8 units: test all units
- More than 8 units: test 20% of units, minimum of 7

C402.4.2 Dwelling & sleeping unit enclosure testing



C402.4.2 Dwelling & sleeping unit enclosure testing



Chapter 4

Additional Efficiency, Renewable and Load Management Requirements



C406.1.1 Compliance

Buildings shall comply as follows:

1. Buildings >1,000 s.f.:

comply with Additional Energy Credits Requirement:

2. Buildings >2,500 s.f.:

comply with Additional Energy Credits Requirement AND

comply with Additional Renewable & Load Management Credits

C406.1.1 Additional Energy Efficiency Credit Requirements

How many points does my building need?

	Building Occupancy Group								
	R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
Energy Credit Requirements	79	46	83	30	60	75	90	65	36

What about mixed occupancy?

Calculate weighted average of credit requirements based on square footage of floor area

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group	
		R-2, R-4, and I-1	De
E01	Envelope Performance		
E02	UA Reduction	19	
E03	Envelope Leak Reduction	13	
E04	Add Roof Insulation	7	
E05	Add Wall Insulation	13	
E06	Improve Fenestration	42	
H01	HVAC Performance	6	
H02	Heating Efficiency	14	
H03	Cooling Efficiency	3	
H04	Residential HVAC Control	21	
H05	Energy Recovery	46	
W01	Recovered/Renewable Water Heat	93	
W02	Heat Pump Water Heater	81	
W03	SWH Pipe Insulation	6	
W04	Point of Use Water Heaters		
W05	Thermostatic Balance Valves	3	

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group									
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other	
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5	
W07	SWH Submeters	17								17	
W08	SWH Distribution Sizing	68		26						47	
W09	Shower Heat Recovery	25	1	9						10	
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3	
L01	Lighting Performance										
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3	
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3	
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4	
L05	Residential Light Control	3									
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4	
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3	
Q02	Commercial Kitchen Equipment					21					
Q03	Residential Kitchen Equipment	13		10							
Q04	Fault Detection	3	3	2	3	3	3	4	6	4	

C406.2 Energy Efficiency Measures and Credits

Improved Envelope Performance 90.1 Appendix C:

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
E01	Envelope Performance	Determined in accordance with Section C406.2.1.1								
E02	UA Reduction	19	5	13	20	33	28	25	37	28
E03	Envelope Leak Reduction									
E04	Add Roof Insulation									
E05	Add Wall Insulation									
E06	Improve Fenestration									
H01	HVAC Performance									
H02	Heating Efficiency									
H03	Cooling Efficiency									
H04	Residential HVAC Control									
H05	Energy Recovery									
W01	Recovered/Renewable Water Heating									
W02	Heat Pump Water Heating									
W03	SWH Pipe Insulation									
W04	Point of Use Water Heating									
W05	Thermostatic Balance Valves									

The achieved energy credits shall be determined using Equation 4-13

$$EC_{env} = 1000 \times (EPF_B - EPF_P) / EPF_B$$

where:

- EC_{ENV} = E01 energy credits
- EPF_B = base envelope performance factor calculated in accordance with ASHRAE 90.1 Appendix C.
- EPF_P = proposed envelope performance factor calculated in accordance with ASHRAE 90.1-Appendix C.

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
E01	Envelope Performance	Determined in accordance with Section C406.2.1.1								
E02	UA Reduction	19	5	13	20	33	28	25	37	28
E03	Envelope Leak Reduction	13	9	28	6	42	13	8	68	41
E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
H05	Energy Recovery	46	65	41	114	84	242	43	180	90
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

Total UA Envelope Reduction:

U-value of entire thermal envelope 15% better than C402.1.3 (prescriptive tables)

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

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E02	UUA Reduction	19	5	13	20	33	28	25	37	28
E03	Envelope Leak Reduction	13	9	28	6	42	13	8	68	41
E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
H05	Energy Recovery	46	65	41	114	84	242	43	180	90
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

Reduced Air Leakage:

Tested air leakage is less than 0.15 cfm/sf

Does not differentiate between cfm50 or cfm75

- cfm50 = MF
- cfm75 = other commercial

C406.2 Energy Efficiency Measures and Credits

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E03	Envelope Leak Reduction	13	9	28	6	42	13	8	68	41
E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
H05	Energy Recovery	46	65	41	114	84	242	43	180	90
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

Add Roof Insulation:

Flat roof: R-10 continuous

Attic: fill or batt rated at R-10 that is continuous

- Interrupted by joists?: R-13

1/2 of base credit achieved for installing 50% of R-value

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
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E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
H05	Energy Recovery	46	65	41	114	84	242	43	180	90
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

Added Wall Insulation:

90% or more of opaque wall area addressed

Additional R-5 continuous

1/2 of base credit achieved for installing R-2.5 continuous

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
E01	Envelope Performance	Determined in accordance with Section C406.2.1.1								
E02	UA Reduction	19	5	13	20	33	28	25	37	28
E03	Envelope Leak Reduction	13	9	28	6	42	13	8	68	41
E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
H05	Energy Recovery	46	65	41	114	84	242	43	180	90
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

Improve Fenestration:

Area-weighted U-factor of all vertical fenestrations \leq U-0.22

C406.1.2 Renewable & Load Management Credit Requirements

How many points does my building need?

**TABLE C406.1.2
RENEWABLE AND LOAD MANAGEMENT CREDIT REQUIREMENTS BY BUILDING
OCCUPANCY GROUP**

	Building Occupancy Group								
	R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
Renewable and Load Management Credit Requirements	16	11	14	24	4	25	22	20	17

C406.3 Renewable and Load Management Credit Requirements

**TABLE C406.3.1
Renewable and Load Management Credit Requirements by Building Occupancy Group**

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

Building Thermal Mass:

Projects where $\geq 80\%$ of floor area is unoccupied 12am to 6am

- 10lb/sf thermal mass per sf of floor area (mass located on wall or floor)
- HVAC with economizer and variable/low speed fans
- Night flush controls
- Contractual obligation for post-occupancy commissioning and control tuning

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
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G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
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G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

Insulation Embodied Carbon:

Calculate Global Warming Potential Intensity per s.f. of floor area

Includes foundation, wall and roof insulation materials

Credits determined by formular. Material GWP table and formula provided

C406.1.2 Renewable & Load Management Credit Requirements

R&LM Exceptions:

1. Building achieves additional 70% of Energy Efficiency Credits from Table C406.1.1:
only 50% of R&LM credits required
2. Building achieves additional 120% of Energy Efficiency Credits from Table C406.1.1:
Zero R&LM credits required
3. Buildings 1,000-2,500 s.f. do not need to achieve R&LM Credits (only have to comply with Energy Credits Requirement)

Chapter 5

Existing Buildings



Existing Buildings

Vertical fenestration language added

- a. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for U-factor and SHGC in Table C402.4.
- b. If the fenestration involves a historic building consult with SHPO regarding the “Historic Building Exemption Report” (R501.6 Historic buildings).
- c. An exception for an area-weighted average of the U-factor of replacement fenestration products.



Questions?

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