



How-to Guide: *Supporting Documentation*

In Compliance with 2020 New York City Energy Conservation Code

- GENERAL
- **BUILDING ENVELOPE**
- MECHANICAL SYSTEMS
- LIGHTING & ELECTRICAL POWER
- OTHER REQUIREMENTS

NOTE: In this *How-To Guide: Supporting Documentation*, selected Energy Code provisions have been generalized, summarized, rephrased, and/or highlighted. This guide is intended: 1) To provide general guidance for the job applications seeking compliance with the 2020 NYCECC; 2) Not to replace or represent the entire 2020 NYCECC and related regulations of the City of New York and the Department of Buildings; and 3) Not to provide complete compliance solutions for any particular type of job or work. Comprehensive mandates, applicability, exemptions, exceptions and options will be found in the 2020 NYCECC and related regulations of the City of New York and the Department of Buildings.

OPAQUE ENVELOPE ASSEMBLIES

Minimum R-value

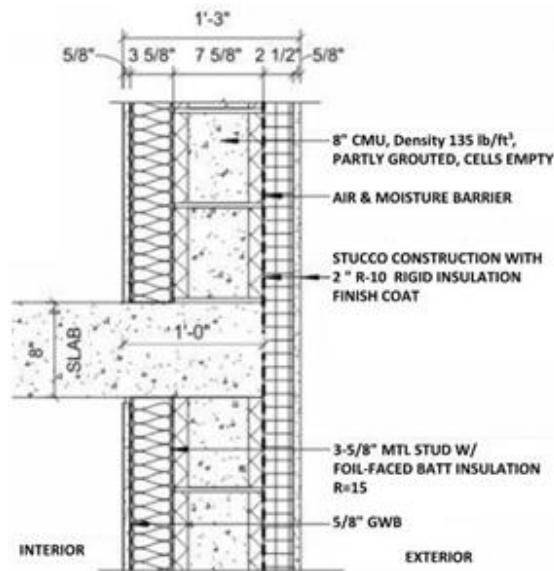
- For each building envelope type (e.g., roof, above-grade/below-grade walls, floors over unconditioned space, etc.), its section detail must indicate that the R-value of the insulation meets or exceeds the minimum allowed R-value prescribed for the envelope type (e.g., R-values shown in Table C402.1.3).
- Specifically, in the assembly details, clearly call out each of the proposed *insulation type, thickness and the manufacturer-published R-value* to satisfy the thermal requirements for the envelope assembly type.

R402.1.3
C402.1.3
5.5.3

Maximum U-factor

- Alternatively, it must be demonstrated that the proposed assembly's calculated U-factor (or C- or F-factor) value does not exceed the maximum allowed U-factor value prescribed for the envelope type (e.g., U-factors shown in Table C402.1.4).
- Determination of an assembly's overall U-factor (or C- or F-factor) value must be supported by the pre-calculated values or the calculation methods established in Appendix A of ASHRAE 90.1-2016.
- **Spandrel Panels** are Opaque walls. Determination of effective U-factors for the proposed Spandrel Panels must follow Table C402.1.4.2/ Table 5.5.3. See page [BE-9]. The proposed U-factor value identified from the Table must be compared against the baseline U-factor of metal-framed walls (U-0.061) in COMcheck.

R402.1.4
C402.1.4
5.5.3



E7 TYPICAL STUCCO-8" CMU WALL
TOTAL WALL R VALUE = 16.73 1"= 1'-0"

WALL TYPE E7	
Wall Assembly	R-Value
2" R-10 Rigid Insulation	10
8" CMU, Partly Grouted, Cells Empty	1.83 ^(a)
3-1/2" R-15 Foil-faced Batt Insulation	4.9 ^(b)
Total R-Value of Wall Assembly	16.73
U-Factor of Wall Assembly (= 1/16.73)	0.060
^(a) Assembly R _U for Concrete Block Walls from ASHRAE Table A3.1-3	
^(b) Effective R-Value from ASHRAE Table A3.1-4	
Slab Assembly	R-Value
2" R-10 Rigid Insulation	10
12"-Thick Solid Concrete Wall (Density: 144 lb/ft ³)	1.60 ^(c)
Total R-Value of Slab Assembly	11.60
U-Factor of Slab Assembly (=1/11.60)	0.086
^(c) Assembly R _U for Concrete from ASHRAE Table A3.1-2	

Area-Weighted Assembly U-factor Calculation for the Unit Wall			
Typical 10'-6" floor to floor height (8" slab + 9'-10" wall height)			
Assembly	U-Factor	Height (in)	UA
Wall Assembly	0.060	118	7.053
Slab Assembly	0.086	8	0.690
Total		126	7.743
Area-Weighted Assembly U-factor (=7.743/126)			0.061
Code-Allowed Maximum U-Factor (ASHRAE Table 5.5-4)			0.090

NOTE: One common error in the U-factor calculation is misrepresenting thermal values of assembly layers (e.g., face brick, gypsum board, air films, etc.) from unapproved sources.

Figure BE-1. Sample Wall Assembly & Area-Weighted U-factor Calculation

WINDOWS & DOORS – FENESTRATION IN THE ENVELOPE

U-factor and SHGC values

- For each fenestration type (e.g., fixed/operable window, skylight, exterior door, storefront, etc.), Assembly U-factor and Solar Heat Gain Coefficient (SHGC) values must be specified in the window/door schedule on drawings, and must not exceed the maximum allowed values. For Commercial building windows, the maximum assembly U-factors depend on the vertical location of the window on the above-grade wall, with more stringent U-factors for windows installed below 95' above-grade. See page [BE-3]. The 95' demarcation line must be indicated on building elevation drawings for Commercial buildings.
- Next to the U-factor and SHGC values specified in the schedule, provide the fenestration assembly manufacturer's information (e.g., 'ABC Windows/xyz 9000 series, or Approved equal') that will satisfy the U-factor and SHGC requirements.

R402.3
C402.4
5.5.4.3
5.5.4.4
1 RCNY
§5000-01
(g)(1)(i)

Air Leakage Rate and Visible Transmittance (VT)

- The window/door schedule on drawings must specify the air leakage rate of each proposed fenestration assembly type to demonstrate that the air leakage of fenestration assemblies do not exceed the maximum allowed leakage rate.
- Where required, the window/door schedule must identify Visible Transmittance (VT) of the proposed glazed fenestration products to meet the provisions in the applicable Code sections.

R402.4
C402.5.2/ 5.4.3.2

R303.1.3
C303.1.3/ C402.4.1
C405.2.3/ 5.5.4.6

WINDOW & DOOR SCHEDULE								
TAG	TYPE	FRAJE MATERIAL	NOMINAL DIM. (W X H)	MANUFACTURER - MODEL NO.	ASSEMBLY U-FACTOR	SHGC	VT	AIR LEAKAGE RATE (CFM/SF)
W1	FIXED	METAL	7'-0" X 7'-0"	ABC WINDOWS - D999 SERIES OR APPROVED EQUAL	0.28	0.34	0.50	0.16
W2	CASEMENT - OPERABLE	METAL	4'-6" X 2'-3"	ABC WINDOWS - EFOO SERIES OR APPROVED EQUAL	0.38	0.34	0.50	0.18
SW1	SKYLIGHT	METAL	2'-10" X 5'-2"	SKL CORP. - GHT000 SERIES OR APPROVED EQUAL	0.46	0.38	0.54	0.18
W5	STOREFRONT - FIXED GLAZING	METAL	VARIABLE; SEE A-301 ~305 FOR LOCATIONS & DIM.	GLD CO. - STR #Z111 OR APPROVED EQUAL	0.30	0.34	0.50	0.05
D1	STOREFRONT - ENTRANCE GLASS DOOR	METAL	3'-0" X 7'-6"	GLD CO. - STR #Z111 OR APPROVED EQUAL	0.70	0.36	0.52	0.80
D2	OPAQUE SWINGING DOOR	METAL	3'-0" X 7'-0"	OPQ COMPANY RST-#22-33 OR APPROVED EQUAL	0.48	N/A	N/A	0.80

Figure BE-2. Sample Window & Door Schedule

- Fenestration U-factor values must be the 'whole assembly' U-factor, instead of 'center-of-glass' U-factor, and must be furnished by the manufacturer.
- Differentiate Fixed and Operable windows' U-factor values in the window schedule where required, as the Code-prescribed maximum U-factors for Fixed and Operable windows may vary depending on the referenced Code.

SPANDREL PANEL EFFECTIVE U-FACTORS

TABLE C402.1.4.2
EFFECTIVE U-FACTORS FOR SPANDREL PANELS^a

C402.1.4.2
5.5.3

FRAME TYPE	SPANDREL PANEL	RATED R-VALUE OF INSULATION BETWEEN FRAMING MEMBERS						
		R-4	R-7	R-10	R-15	R-20	R-25	R-30
Aluminum without Thermal Break ^b	Single glass pane, stone, or metal panel	0.242	0.222	0.212	0.203	0.198	0.195	0.193
	Double glass with no low-e coatings	0.233	0.218	0.209	0.202	0.197	0.194	0.192
	Triple or low-e glass	0.226	0.214	0.207	0.200	0.196	0.194	0.192
Aluminum with Thermal Break ^c	Single glass pane, stone, or metal panel	0.211	0.186	0.173	0.162	0.155	0.151	0.149
	Double glass with no low-e coatings	0.200	0.180	0.170	0.160	0.154	0.151	0.148
	Triple or low-e glass	0.191	0.176	0.167	0.159	0.153	0.150	0.148
Structural Glazing ^d	Single glass pane, stone, or metal panel	0.195	0.163	0.147	0.132	0.123	0.118	0.114
	Double glass with no low-e coatings	0.180	0.156	0.142	0.129	0.122	0.117	0.114
	Triple or low-e glass	0.169	0.150	0.138	0.127	0.121	0.116	0.113
No framing or Insulation is Continuous ^e	Single glass pane, stone, or metal panel	0.148	0.102	0.078	0.056	0.044	0.036	0.031
	Double glass with no low-e coatings	0.136	0.097	0.075	0.054	0.043	0.035	0.030
	Triple or low-e glass	0.129	0.093	0.073	0.053	0.042	0.035	0.030

- NOTE 1: To demonstrate compliance, provide COMcheck envelope analysis by:
 - entering the Proposed Spandrel panel U-factor value identified from the Table C402.1.4.2; and
 - choosing the Baseline U-factor of metal-framed walls (U-0.061).
- NOTE 2: If the Proposed Spandrel panel type is not found in the Table – e.g., Assembly with backpans, Assembly with no insulation – THERM Analysis must be performed and documented on drawings.

Info for THERM is found in the link below.
<https://windows.lbl.gov/software/therm>

COMMERCIAL BUILDING FENESTRATION MAXIMUM U-FACTORS

TABLE C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS

C402.4
5.5.4.3

CLIMATE ZONE	4 EXCEPT MARINE	
	Vertical fenestration U-factor ^a	
	Below 95' ^b	95' and above ^b
Nonmetal framing (all)	0.28	0.28
Metal framing fixed	0.30	0.36
Metal framing operable	0.40	0.42
Curtainwall fixed	0.36	0.36
Entrance doors	0.77	

- NOTE: Where any portion of the window unit is installed above 95' above-grade, U-factor requirement of 95' and above may apply.

See Table 5.5-4 for ASHRAE-following job applications.

CONTINUOUS INSULATION

Balconies and Parapets

Balconies and Parapets that interrupt the building thermal envelope are required to be:

C402.2.9
5.5.3.7

- a) Insulated with continuous insulation of a minimum R-value for the wall assembly as listed in Table C402.1.3/ Table 5.5-4. **OR**
- b) Insulated with a minimum R-3 thermal break where the structural element penetrates the building thermal envelope.

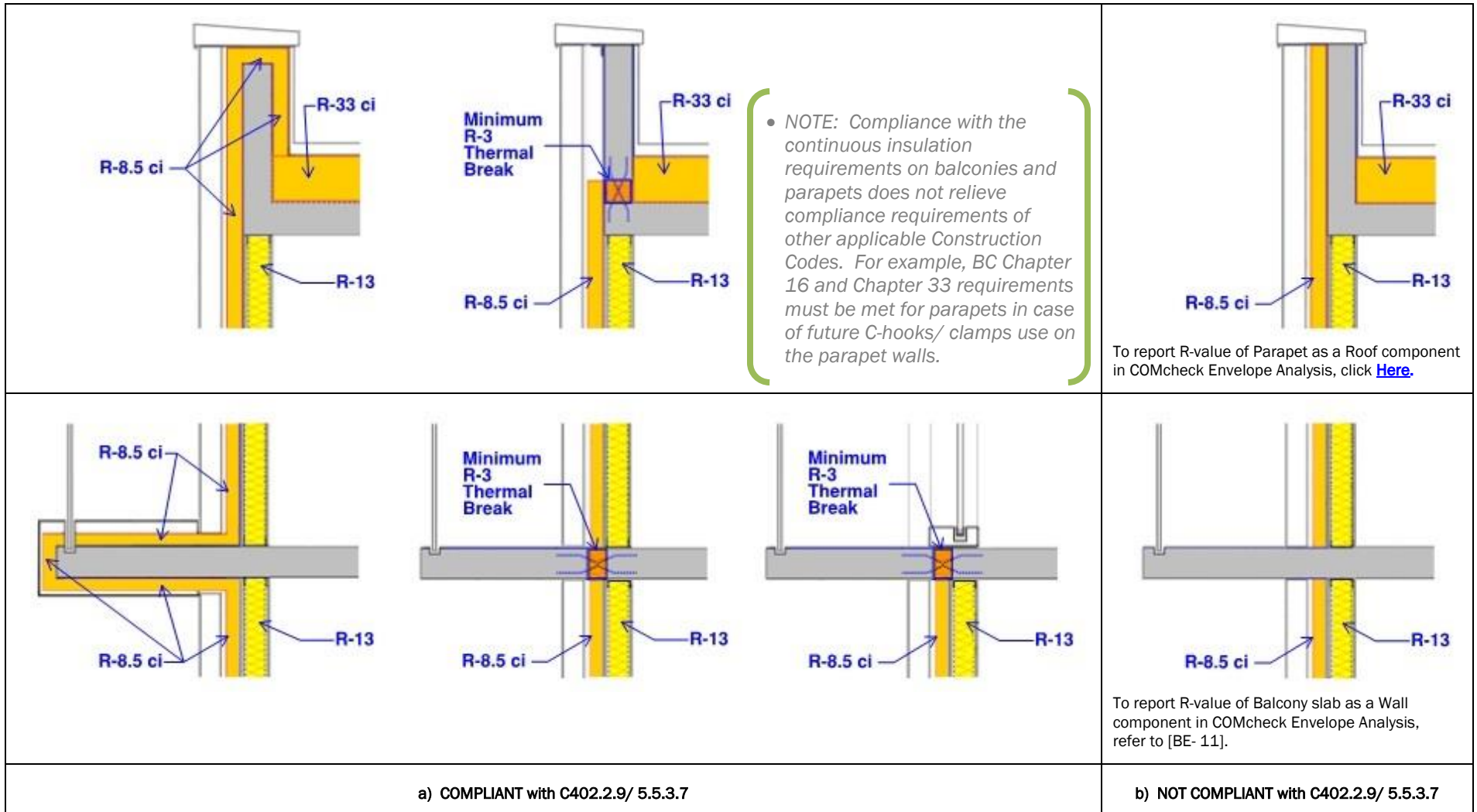


Figure BE-4. Examples of Balcony and Parapet Insulation

FENESTRATION AREA

The **Window-to-Wall Ratio (WWR)** – the ratio (%) of vertical fenestration area to gross above-grade wall area (or gross wall area for Appendix CA applications) – must be noted on an EN- labeled drawing in conjunction with building envelope diagrams and the envelope energy analysis. The building envelope diagrams must list all opaque wall areas and vertical fenestration areas per each building orientation. The area values of each opaque wall type and fenestration type listed in the envelope diagrams must match the values entered in the envelope energy analysis (e.g., ‘Gross Area’ values in COMcheck).

▪ **Maximum Vertical Fenestration Area (when following ECC)**

- **Maximum WWR:** 30% C402.4.1
- **Maximum WWR:** 40% *permitted with certain requirements including daylight responsive controls*
- **When WWR > 40%:** ASHRAE must be chosen as Code Compliance Path, as ECC does not allow WWR > 40%.

▪ **Maximum Vertical Fenestration Area (when following ASHRAE)**

- **Maximum WWR:** 40% 5.5.4.2.1
- **When WWR > 40%:** Energy Code compliance may be demonstrated through either
 - a) **COMcheck** (with envelope tradeoff) envelope analysis, or
 - b) **Energy Modeling** (total building performance) energy analysis.

▪ **Maximum Skylight Fenestration Area**

- **Maximum skylight fenestration area:** 3% of the gross roof area C402.4.1
- **Maximum skylight fenestration area:** 6% of the gross roof area *permitted with daylight responsive controls* 5.5.4.2.2

▪ **Minimum Skylight Fenestration Area**

- For an enclosed space
 - $\geq 2,500$ sf, and directly under a roof with ceiling height > 15’ and
 - of space types including office, lobby, atrium, concourse, corridor, warehouse storage, among others

C402.4.2
5.5.4.2.3

Minimum skylight fenestration area requirement: **Minimum 3%** of the gross roof area, *or*
Minimum 1% ‘Skylight Effective Aperture’

- See Section C402.4.2 and 5.5.4.2.3 for complete applicable space types, minimum total daylight area requirement, and definition of ‘Skylight Effective Aperture.’

AIR BARRIER

Continuous Air Barrier

To ensure air barrier continuity in the building thermal envelope, drawings must specify required continuous air barrier construction measures (Section C402.5.1.1), and indicate that the continuous air barrier shall be achieved by either

- 1) **Materials** not exceeding maximum allowed air permeability (Section C402.5.1.2.1), or
- 2) **Assemblies** not exceeding allowed maximum air leakage (Section C402.5.1.2.2).

C402.5.1
5.4.3.1.2
5.4.3.1.3

Openings in the Building Envelope

Drawings must identify specific construction measures, configuration, devices and/or performance standards to limit air leakage in particular envelope areas including, but not limited to, the following:

- 1) **Fenestration and doors:** Maximum allowed air leakage. C402.5.2/5.4.3.2
- 2) **Outdoor air intakes and exhaust openings:** Motorized Shutoff dampers are required unless gravity dampers are allowed. C402.5.5/6.4.3.4
- 3) **Doors/Access Openings to shafts, chutes, vents, stairways and elevator lobbies:** Gasketing, weatherstripping, and sealing. C402.5.4/5.4.3.1.2
- 4) **Loading dock:** Weatherseals to restrict infiltration. C402.5.6/5.4.3.3
- 5) **Vestibules*:** Plan configuration and self-closing devices on doors. C402.5.7/5.4.3.4

* Note that Air Curtains are NO longer an acceptable alternative. C402.5.8/5.4.3.1.1

- 6) **Recessed lighting:** Luminaires installed in building envelope must be:
 - a) IC-rated, b) Labeled with the Code-prescribed maximum air leakage rate, and c) Sealed with gasket or caulk.

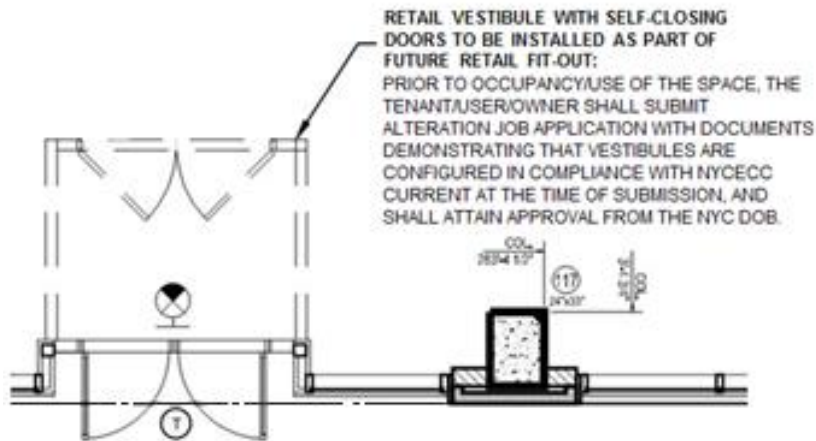


Figure BE-6.
A Sample Acceptable Plan with Specific Notes Requiring Future Compliance

AIR LEAKAGE/BARRIER TESTING & AIR BARRIER CONTINUITY PLAN – NEW BUILDINGS

Drawings must specify mandatory air barrier testing/inspection requirements specific to the building type.

■ Residential Buildings – See R202 for the definition of Residential Building

1 RCNY §5000-01 (g)(5)(iv)

Building Types	Required Testing/Inspection	Required Progress Inspections	Reference Code
• New buildings with 1 dwelling unit	(A) AND (B)	IA6 AND IA7	R402.4.1.2
• New buildings with dwelling units ≥ 2	(A) AND (B) or (C)	IA6 AND IA7	R402.4.1.3
• New buildings with dwelling units ≥ 8	(A) AND (B) or (D)	IA6 AND IA7	R402.4.1.3.1

(A) Visual Inspection of Air Barrier

Visual inspection of openings and penetrations in the building envelope, including site-built fenestration and doors to verify continuous air barrier installation

(B) Whole Building Air Leakage Testing [maximum 3 ACH]

Testing conducted at a pressure differential of 50 Pascals must verify that the Building air leakage rate does not exceed 3 air changes per hour (3 ACH).

(C) Air Leakage Testing of ALL “Testing Units”

Testing conducted at a pressure differential of 50 Pascals must verify that the air leakage rate of EACH testing unit does not exceed 0.3 cfm/sf of the testing unit envelope.

(D) Air Leakage Testing of SAMPLE “Testing Units”

Testing conducted at a pressure differential of 50 Pascals must verify that the air leakage rate of EACH Sample testing unit does not exceed 0.3 cfm/sf of the testing unit envelope. SAMPLE Testing Unit selection must follow the code provision.

■ Commercial Buildings – See C202 for the definition of Commercial Building

1 RCNY §5000-01 (g)(5)(iv)

Building types	Required Testing/Inspection	Required Progress Inspections	Reference code
• New buildings with conditioned space < 10,000 sf	(A)	IIA6	1 RCNY §5000-01 (g)(5)(iv) 5.9
• New buildings with conditioned space ≥ 10,000 sf and < 50,000 sf, and Height ≤ 75'	(A) AND (E)	IIA6 AND IIA7	C402.5.1.3 5.4.3.1.3 5.9
• R-2 occupancy Only: New Buildings with conditioned space ≥ 10,000 sf and < 50,000 sf, and Height ≤ 75'	(A) AND (E) or (D)	IIA6 AND IIA7	C402.5.1.3 5.4.3.1.3 5.9
• New buildings with conditioned space ≥ 10,000 sf and < 50,000 sf, and Height > 75'	(A) AND (F) or (D) or (E)	IIA6 AND IIA8 or IIA7	C402.5.1.3 5.4.3.1.3 5.9
• New buildings with conditioned space ≥ 50,000 sf			
• R-3 occupancy Only: all New Buildings	(A) AND (B) or (C)	IIA6 AND IIA7	C401.2.1

(E) Whole Building Air Leakage Testing [maximum 0.4 cfm/sf]

Testing conducted at a pressure differential of 75 Pascals must verify that the Building air leakage rate does not exceed 0.4 cfm/sf of the building envelope.

(F) Testing/Inspection conducted per Air Barrier Continuity (ABC) Plan

Air Barrier Continuity Plan must be developed to specify the below.

- List (Schedule of Details) of each unique assembly, joint, seam and penetration, keyed to building thermal/air boundary section diagrams (on Architectural Plans)
- Testing/Inspection standards (e.g., ASTM E1186) and performance criteria for each assembly, joint, seam and penetration type (on Architectural Plans)
- Specifications of sealing (continuity-ensuring) materials/measures, and Remediation procedures
- Sampling protocol, if applicable, and Test reporting/submittal guidelines

ABC Plan, and Final Reports of Testing/Inspection conducted per the ABC Plan shall be provided to DOB upon request.

AIR LEAKAGE/BARRIER TESTING & AIR BARRIER CONTINUITY PLAN – ADDITIONS & ALTERATIONS

Drawings must specify mandatory air barrier testing/inspection requirements specific to the building type.

Residential Buildings – See R202 for the definition of Residential Building

1 RCNY §5000-01 (g)(5)(iv), R502, R503

Building Types	Required Testing/Inspection	Required Progress Inspections	Reference Code
<ul style="list-style-type: none"> Any Additions Alterations to the existing building envelope 	(A)	IA6	R402.4.1.
<ul style="list-style-type: none"> Additions thermally isolated from the existing building envelope Alterations of the entire existing building envelope including air barrier 	(A) AND (B)	IA6 AND IA7	R402.4.1.2
<ul style="list-style-type: none"> Additions with dwelling units ≥ 2 	(A) AND (B) or (C)	IA6 AND IA7	R402.4.1.3
<ul style="list-style-type: none"> Additions with dwelling units ≥ 8 	(A) AND (B) or (D)	IA6 AND IA7	R402.4.1.3.1

(A) Visual Inspection of Air Barrier

Visual inspection of openings and penetrations in the building envelope, including site-built fenestration and doors to verify continuous air barrier installation

(B) Whole Building Air Leakage Testing [maximum 3 ACH]

Testing conducted at a pressure differential of 50 Pascals must verify that the Building air leakage rate does not exceed 3 air changes per hour (3 ACH).

(C) Air Leakage Testing of ALL “Testing Units”

Testing conducted at a pressure differential of 50 Pascals must verify that the air leakage rate of EACH testing unit does not exceed 0.3 cfm/sf of the testing unit envelope.

(D) Air Leakage Testing of SAMPLE “Testing Units”

Testing conducted at a pressure differential of 50 Pascals must verify that the air leakage rate of EACH Sample testing unit does not exceed 0.3 cfm/sf of the testing unit envelope. SAMPLE Testing Unit selection must follow the code provision.

Commercial Buildings – See C202 for the definition of Commercial Building

1 RCNY §5000-01 (g)(5)(iv), C502, C503

Building types	Required Testing/Inspection	Required Progress Inspections	Reference code
<ul style="list-style-type: none"> Additions with conditioned space < 10,000 sf Alterations to the existing building envelope 	(A)	IIA6	1 RCNY §5000-01 (g)(5)(iv), C503.3
<ul style="list-style-type: none"> Additions with conditioned space $\geq 10,000$ sf and < 50,000 sf, & Height $\leq 75'$ Alterations of the entire existing building envelope including air barrier 	(A) AND (E)	IIA6 AND IIA7	C402.5.1.3 5.4.3.1.3
<ul style="list-style-type: none"> R-2 occupancy Only: Additions with conditioned space $\geq 10,000$ sf and < 50,000 sf, and Height $\leq 75'$ 	(A) AND (E) or (D)	IIA6 AND IIA7	C402.5.1.3 5.4.3.1.3
<ul style="list-style-type: none"> Additions with conditioned space $\geq 10,000$ sf and < 50,000 sf, & Height > 75' Additions with conditioned space $\geq 50,000$ sf 	(A) AND (F) or (D) or (E)	IIA6 AND IIA8 or IIA7	C402.5.1.3 5.4.3.1.3
<ul style="list-style-type: none"> R-3 occupancy Only: Additions thermally isolated from the existing building envelope 	(A) AND (B) or (C)	IIA6 AND IIA7	C401.2.1

(E) Whole Building Air Leakage Testing [maximum 0.4 cfm/sf]

Testing conducted at a pressure differential of 75 Pascals must verify that the Building air leakage rate does not exceed 0.4 cfm/sf of the building envelope.

(F) Testing/Inspection conducted per Air Barrier Continuity (ABC) Plan

Air Barrier Continuity Plan must be developed to specify the below.

- List (Schedule of Details) of each unique assembly, joint, seam and penetration, keyed to building thermal/air boundary section diagrams (on Architectural Plans)
- Testing/Inspection standards (e.g., ASTM E1186) and performance criteria for each assembly, joint, seam and penetration type (on Architectural Plans)
- Specifications of sealing (continuity-ensuring) materials/measures, and Remediation procedures
- Sampling protocol, if applicable, and Test reporting/submittal guidelines

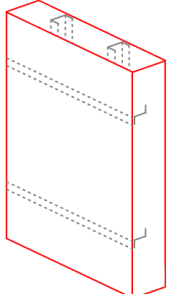
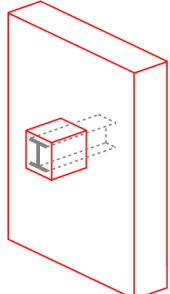
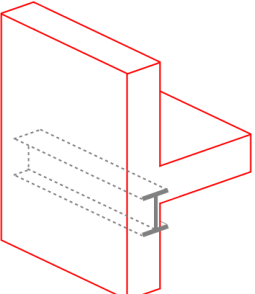
ABC Plan, and Final Reports of Testing/Inspection conducted per the ABC Plan shall be provided to DOB upon request.

THEMAL BRIDGES IN BUILDING ENVELOPE

Documentation of Thermal Bridges

1 RCNY §5000-01
(g)(1)(iii)
R402.6
C402.6
5.4.4

- Architectural plan set drawings must report all thermal bridges in the building thermal envelope in **three categories** below.
- Documentation requirements apply to Residential and Commercial buildings for all New buildings, Additions, and Alterations to the building envelope work scope.

Category	CLEAR FIELD Thermal Bridge	POINT Thermal Bridge	LINEAR Thermal Bridge
Definition	<p>Area-based thermal transmittance associated with elements of a building envelope assembly which repeat at regular intervals.</p> <p>Most clear field thermal bridges are taken into account in the assembly types found in ASHRAE 90.1-2016 Appendix A.</p>	<p>Element-based thermal transmittance associated with a discrete element that penetrates the building envelope.</p> <p>Point thermal transmittance is heat flow divided by the temperature difference between the interior and exterior sides of the assembly, represented by a X-value (Chi-Value) in units Btu/hr • °F.</p>	<p>Length-based thermal transmittance associated with horizontal, vertical, or diagonal elements within the building envelope</p> <p>Linear thermal transmittance is heat flow divided by length and by the temperature difference between the interior and exterior sides of the assembly, represented by a Ψ-value (Psi-Value) in units Btu/hr • ft • °F.</p>
Typical Assemblies	Wall assembly with metal studs, or brick ties, or z-girts	A beam penetrating a wall, A column penetrating a roof or floor, An anchor or connection used to attach an element to the building	Balcony, Floor, Fenestration perimeter transition, Parapet, Floor slab edge, Shelf angle
Sample Illustration			
Documentation Requirements on Architectural Plan Set	<ul style="list-style-type: none"> - List of CLEAR FIELD Thermal Bridges - How they are entered in Envelope energy analysis - Reference section detail locations 	<ul style="list-style-type: none"> - List of POINT Thermal Bridges ≥ 8 in² for Residential buildings, and ≥ 12 in² for Commercial buildings - Size and quantity of each thermal bridge type - Reference section detail locations 	<ul style="list-style-type: none"> - List of LINEAR Thermal Bridges - Ψ-value of each thermal bridge type and its source - Total length of each thermal bridge - How they are entered in Envelope energy analysis - Reference section detail locations

[EXAMPLE] DOCUMENTATION OF THERMAL BRIDGES (REQUIRED IN ARCHITECTURAL PLANS)

CLEAR FIELD Thermal Bridges			
CFTB.no	Assembly/Thermal Bridge Description	Assembly ID in Energy Analysis ¹	Section Detail Location
CFTB.1	Concrete roof deck with R-33ci	RF-1	A-502/4
CFTB.2	Concrete roof deck with R-30ci	RF-2	A-502/5
CFTB.3	CMU wall, EIFS finish	WT-1	A-501/1
CFTB.4	CMU wall, Metal panel cladding	WT-2	A-501/2
CFTB.5	Spandrel wall – Aluminum frame w. thermal break, Single pane glass, Metal panel	WT-3	A-508/4
CFTB.6	Mass floor over parking garage	FL-1	A-503/5
CFTB.7	Mass floor over unconditioned space at courtyard	FL-2	A-503/6

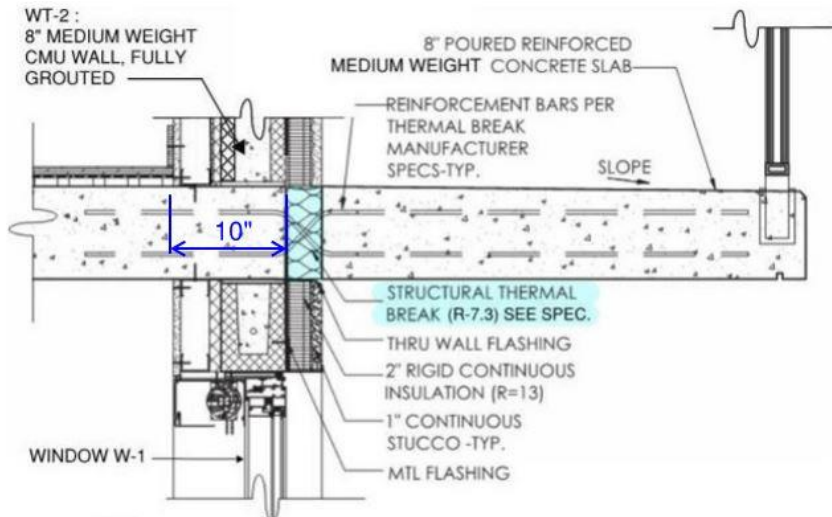
1. Envelope COMcheck report on EN-004

POINT Thermal Bridges				
PTB.no	Assembly/Thermal Bridge Description	Size [sq. inches]	Number of Occurrence	Section Detail Location
PTB.1	Structural beam penetration on walls @ courtyard	14	6	A-502/7
PTB.2	Structural column (pilotis) penetrating 2nd floor slab/soffit @ courtyard	21	4	A-504/1
PTB.3	Main entrance canopy structural member penetration on walls	9	2	A-504/2

LINEAR Thermal Bridges						
LTB.no	Type of Thermal Bridge	Ψ - Value [Btu/hr•ft•°F]	Ψ - Value Source/ Calculation	Total Length [ft]	Assembly ID in Energy Analysis ¹	Section Detail Location
LTB.1	Parapet	0.42	Default value from Table C402.6	284	n/a	A507/1
LTB.2	Balcony	0.45	Ψ - Value of better performing details per BC Hydro Building Envelope Thermal Bridging Guide v.1.2	34	WT-B	A507/7
LTB.3	Floor Slab Edge-1	0.44	Default value from Table C402.6	72	WT-SE1	A507/2
LTB.4	Floor Slab Edge-2	0.40	Ψ - Value of better performing details per BC Hydro Building Envelope Thermal Bridging Guide v.1.2	21	WT-SE2	A507/3
LTB.5	Fenestration Perimeter	0.32	Default value from Table C402.6	617	n/a	A702/1, A702/2, A702/5, A702/6
LTB.6	Shelf Angle	0.41	Default value from Table C402.6	65	n/a	A508/2, A508/3

1. Envelope COMcheck report on EN-004

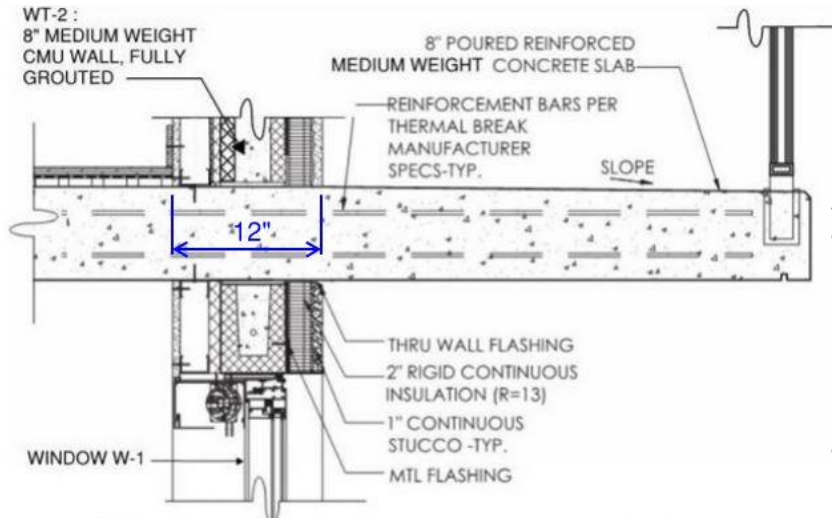
DOCUMENTING THERMAL BRIDGES IN BALCONY SLAB



1 BALCONY CONNECTION WITH THERMAL BREAK

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor _(a)
NORTH					
Exterior Wall 1: Concrete Block:8", Solid Grouted, Medium Density, Furring: None, [Bldg. Use 1 - Multifamily]	3780	---	13.0	0.066	0.086
Window 1: Metal Frame:Fixed, 95' above-grade, Perf. Specs.: Product ID WT1, SHGC 0.36, < 95' above-grade, [Bldg. Use 1 - Multifamily] (b)	580	---	---	0.380	0.300
Window 2: Metal Frame:Fixed, >= 95' above-grade, Perf. Specs.: Product ID WT2, SHGC 0.36, >= 95' above-grade, [Bldg. Use 1 - Multifamily] (b)	720	---	---	0.380	0.360
Slab edge1: Solid Concrete:10" Thickness, Medium Density, Furring: None, [Bldg. Use 1 - Multifamily]	255	---	7.3	0.103	0.086



2 BALCONY CONNECTION WITHOUT THERMAL BREAK

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor _(a)
NORTH					
Exterior Wall 1: Concrete Block:8", Solid Grouted, Medium Density, Furring: None, [Bldg. Use 1 - Multifamily]	3780	---	13.0	0.066	0.086
Window 1: Metal Frame:Fixed, 95' above-grade, Perf. Specs.: Product ID WT1, SHGC 0.36, < 95' above-grade, [Bldg. Use 1 - Multifamily] (b)	580	---	---	0.380	0.300
Window 2: Metal Frame:Fixed, >= 95' above-grade, Perf. Specs.: Product ID WT2, SHGC 0.36, >= 95' above-grade, [Bldg. Use 1 - Multifamily] (b)	720	---	---	0.380	0.360
Slab edge1: Solid Concrete:12" Thickness, Medium Density, Furring: None, [Bldg. Use 1 - Multifamily]	255	---	0.0	0.450	0.086

Figure BE-11.
Sample Balcony Edge Details & Matching Envelope COMcheck Reports

BUILDING ENVELOPE TRADEOFFS

When not all building envelope components individually could meet the prescriptive minimum insulation requirements, compliance with ECC Envelope provisions could be demonstrated through Envelope Tradeoffs.

Trade-Offs for Residential Buildings – Total UA Alternative

- To accomplish compliance with ECC Envelope provisions through Envelope Tradeoffs, Residential building envelope components must demonstrate that:

R402.1.5

$$\text{Total building thermal envelope UA (Sum of Assembly area x its U-factor)} < \text{Total UA resulting from the Code-prescriptive U-factors (Sum of Assembly area x Code U-factor value for the assembly type)}$$

- Compliance could be verified by the REScheck envelope energy analysis by entering all building envelope components' varying thermal values.

Trade-Offs for Commercial Buildings – Component Performance Alternative [following ECC] – Buildings Envelope Trade-Off Option [following ASHRAE]

- To accomplish compliance with ECC Envelope provisions through Envelope Tradeoffs, Commercial building envelope components must satisfy the formula in C402.1.5 for ECC, and the provision in 5.6.1.b for ASHRAE (calculation per Appendix C of ASHRAE).
- Compliance could be verified by the COMcheck envelope energy analysis by entering all building envelope components' varying thermal values.

C402.1.5
5.6

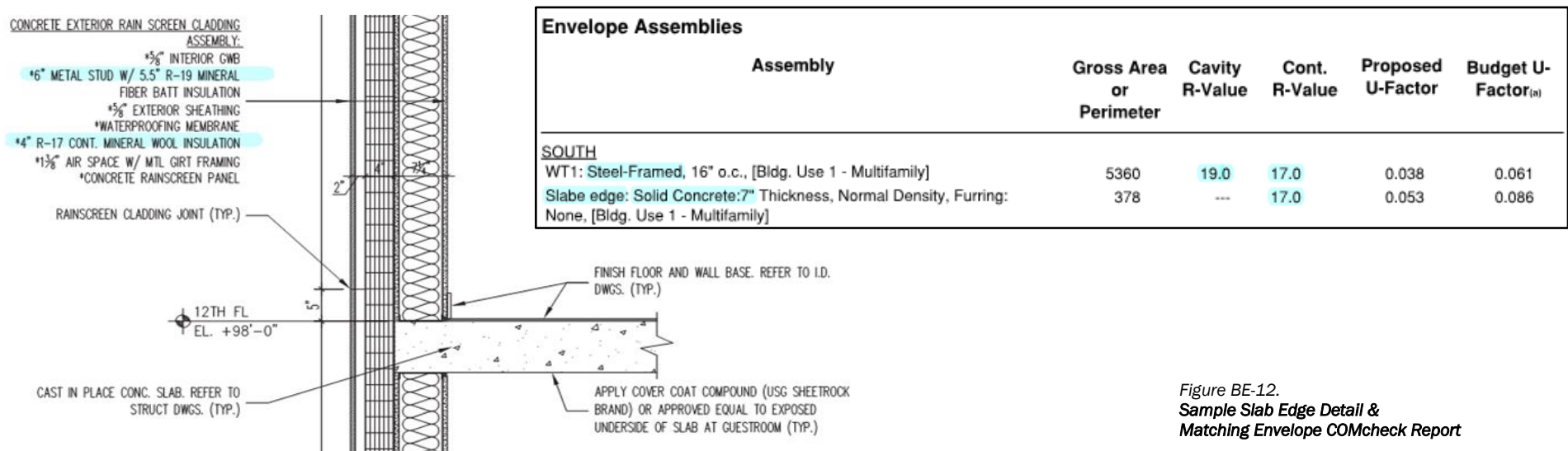


Figure BE-12.
Sample Slab Edge Detail & Matching Envelope COMcheck Report

EQUIPMENT PENETRATIONS IN BUILDING ENVELOPE

Calculation of Equipment Penetration Areas

When mechanical equipment listed in Table C403.3.2(3) or Table 6.8.1-4 are proposed in a *New Commercial* building application:

C402.1.4.2
5.5.3

- Drawings must identify the calculated total area of the equipment penetrations in the opaque above-grade walls by the supporting diagrammatic building elevations.
- Drawings must also identify the percentage of the total equipment penetration area out of the total opaque above-grade wall area.

U-factor 0.5 for Penetration Areas > 1% of Opaque Walls

- If the total area of penetrations from mechanical equipment specified above exceeds 1% of the total opaque above-grade wall area, the equipment penetration area must be identified as a separate wall assembly with a *default U-factor of 0.5*.
- Accordingly, in the envelope energy analysis (e.g., Component performance alternative calculation, COMcheck, or Energy Modeling) the total equipment penetration area must be entered as a separate exterior wall type of proposed U-factor 0.5 and budget U-factor identical to the surrounding wall.

C402.1.4.2
C402.1.5
5.6.1.1



Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor ^(a)
SOUTH					
Exterior Wall - Type 1A: Concrete Block:8", Partially Grouted, Cells Empty, Normal Density, Furring: None, [Bldg. Use 1 - Multifamily]	4350	---	10.0	0.082	0.086
Window - WF1: Metal Frame:Fixed, >= 95' above-grade, Perf. Specs.: Product ID WF1, SHGC 0.36, >= 95' above-grade, [Bldg. Use 1 - Multifamily] (c)	78	---	---	0.350	0.360
Window - WO1: Metal Frame:Fixed, 95' above-grade, Perf. Specs.: Product ID WO1, SHGC 0.36, < 95' above-grade, [Bldg. Use 1 - Multifamily] (c)	1568	---	---	0.420	0.300
Mech PTAC Units Through-Wall: Other Mass Wall, Heat capacity 5.0, [Bldg. Use 1 - Multifamily] (b)	462	---	---	0.500	0.086

Figure BE-13.
Sample Envelope COMcheck report with
Equipment Penetration Area entered as a separate opaque wall type

FUEL-BURNING APPLIANCES

Thermally Isolated and Insulated Rooms

When open combustion air ducts provide combustion air to open combustion fuel-burning appliances (e.g., natural draft boilers or furnaces) in a room, the room must be thermally isolated from the building it serves, and sealed and insulated to meet the requirements of Table R402.1.2, Table C402.1.3 or C402.1.4.

R402.4.4
C402.5.3

Direct Vent Appliances

If the fuel-burning appliances are to be located in a room within the building thermal envelope, the appliances must be identified as direct vent appliances with both intake and exhaust pipes installed continuous to the outside.

R402.4.4
C402.5.3

Fireplaces with Tight-fitting Doors or Dampers

Fireplaces or fireplace units that are designed to allow an open burn must be specified with tight-fitting flue dampers or tight-fitting doors labeled with applicable Code-required UL listings.

R402.4.2
C402.2.8

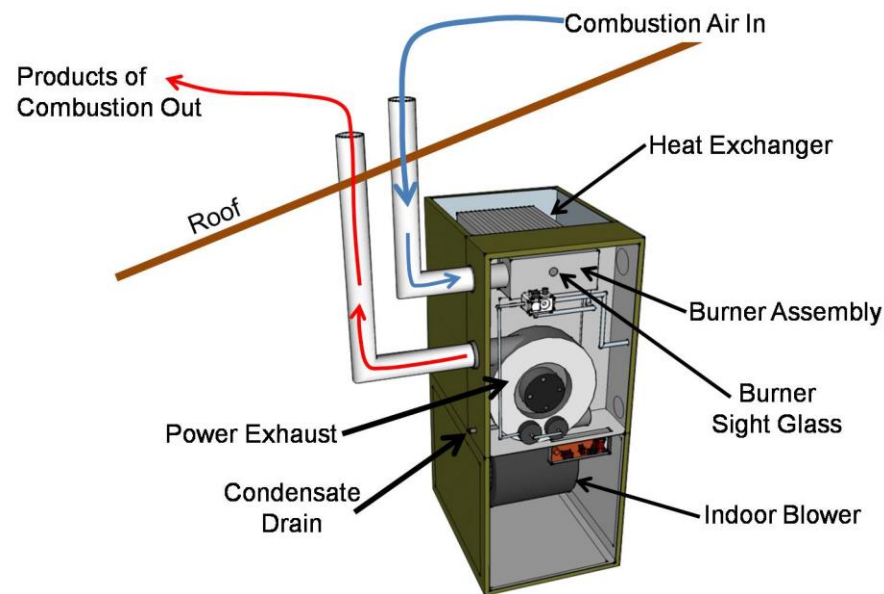


Figure BE-14. A direct-vent sealed-combustion furnace with dedicated pipes for combustion air and exhaust installed continuous to the outside
Source: basc.pnnl.gov/images

FENESTRATION ORIENTATION – ASHRAE-ONLY, PRESCRIPTIVE¹ REQUIREMENTS

▪ The Vertical Fenestration on the West- and East-Oriented Walls

(must comply with either A or B below)

A) Limiting Fenestration Area

5.5.4.5

West-oriented vertical fenestration area must be $\leq 1/4$ of the Total vertical fenestration area,
and
East-oriented vertical fenestration area must be $\leq 1/4$ of the Total vertical fenestration area.

B) Limiting SHGC Values

5.5.4.5

West-oriented vertical fenestration area x SHGC for West-oriented fenestration must be \leq
 $1/4$ of the Total vertical fenestration area x Code-prescribed maximum SHGC for Climate Zone 4a (from Table 5.5-4),
and
East-oriented vertical fenestration area x SHGC for East-oriented fenestration must be \leq
 $1/4$ of the Total vertical fenestration area x Code-prescribed maximum SHGC for Climate Zone 4a (from Table 5.5-4).

1. **Prescriptive** requirements **MUST** be met when Prescriptive energy analysis method (e.g., Tabular analysis) is chosen to demonstrate Energy Code compliance. If COMcheck or Energy Modeling is used for the energy analysis, the software program automatically takes into account the vertical fenestration areas and SHGC values on the west and east-oriented wall in its computation.

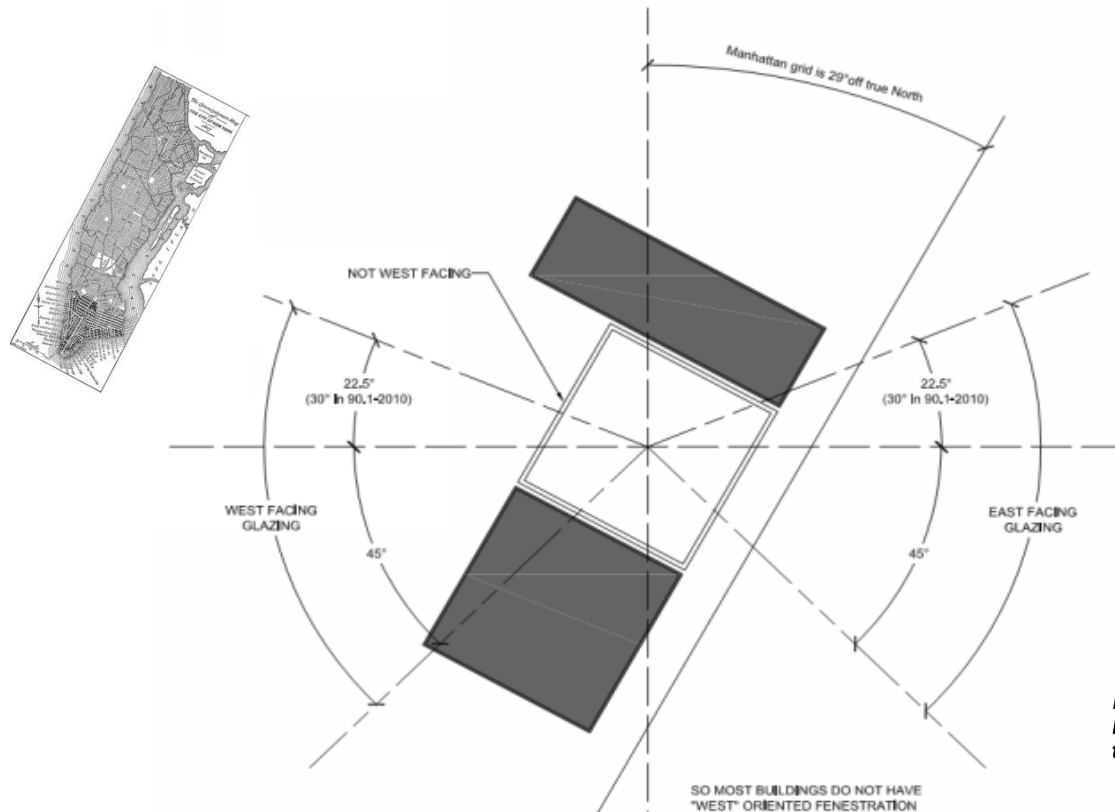


Figure BE-15.
Buildings on Manhattan's grid $\pm 29^\circ$ off of true north are likely to have no West-oriented vertical fenestration

RESIDENTIAL BUILDING ENVELOPE

Blown or Sprayed Roof/Ceiling Insulation

- The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose) in the attic must be indicated on markers for every 300 sf.
- The markers must indicate minimum initial installed thickness with numbers of a minimum of 1 inch in height.

R303.1.1.1

Protection of Exposed Foundation Insulation

Rigid, opaque and weather-resistant protective coverings must be applied to protect the insulation over the exterior of basement walls, crawl space walls and the perimeter of slab-on-grade floors.

R303.2.1

Slab-on-Grade Floor Insulation at the Perimeter

- Slab-on-grade floors with a floor surface < 12" below-grade must be insulated at the slab perimeter with minimum R-10. For Heated slab floors on-grade, R-10 insulation must be provided under the full heated slab area in addition to the required slab perimeter insulation of minimum R-10.
- The insulation must be extended downward or horizontally (as shown in the Figures below) a minimum of 4' for Climate Zone 4A.
- Insulation extending away from the building must be protected by pavement or by minimum 10" of soil.

R402.2.10

Insulation at Tenant Separation Walls

Fire-separated walls between dwelling units in two-family houses or townhouses must be insulated at a minimum R-value of R-10.

R402.4.6

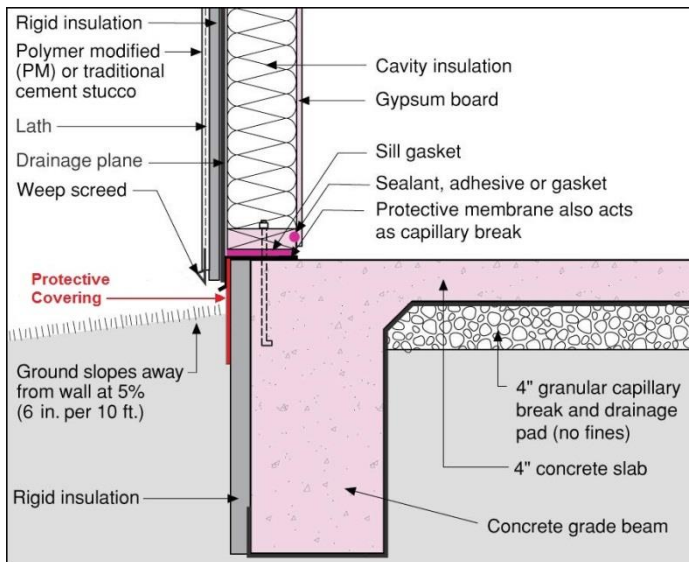


Figure BE-16.a.
Protection of Insulation Over the Grade Beam
Source: basc.pnnl.gov/images

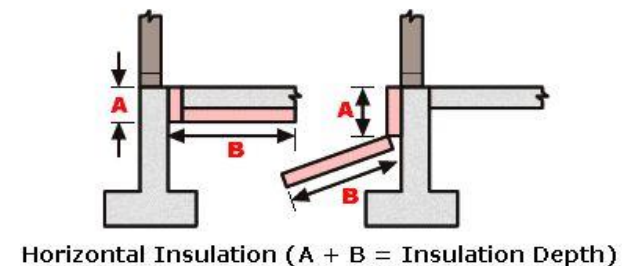
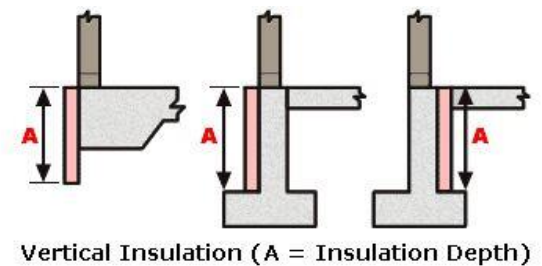


Figure BE-16.b.
Slab Insulation Methods
Source: basc.pnnl.gov/images

RESIDENTIAL BUILDING ENVELOPE

Insulation in Ceilings

- **Ceiling with Attic Spaces:** Minimum R-49; or *Uncompressed R-38* covering 100% of ceiling and extended over the wall top plate at the eaves (See Figures below).
- **Ceiling without Attic Spaces:** When installation of required minimum R-49 insulation in 100% of the ceiling is unachievable, R-30 insulation is allowed for a maximum 500 sf or maximum 20% of the total insulated ceiling area, whichever is less. If partial R-30 insulation is proposed, provide roof area calculations with roof plan diagrams.

R402.2.1
R402.2.2

Access Hatches and Doors

Access doors to unconditioned spaces such as attics and crawl spaces must be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces (e.g., adjacent ceiling surface).

R402.2.4

Sunroom Insulation and Fenestration

- Sunrooms enclosing conditioned space must meet the Residential building envelope insulation and fenestration requirements.
- Sunrooms *with thermal isolation* and enclosing conditioned space must meet the following insulation and fenestration requirements:
 - **Ceiling Insulation:** Min. R-19
 - **Wall Insulation:** Min. R-13
 - **Vertical Fenestration:** Max. U-0.45
 - **Skylight:** Max. U-0.70
- Conditioned space *with thermal isolation* must be controlled as a separate zone for heating and cooling, or conditioned by separate equipment.

R402.2.13
R402.3.5

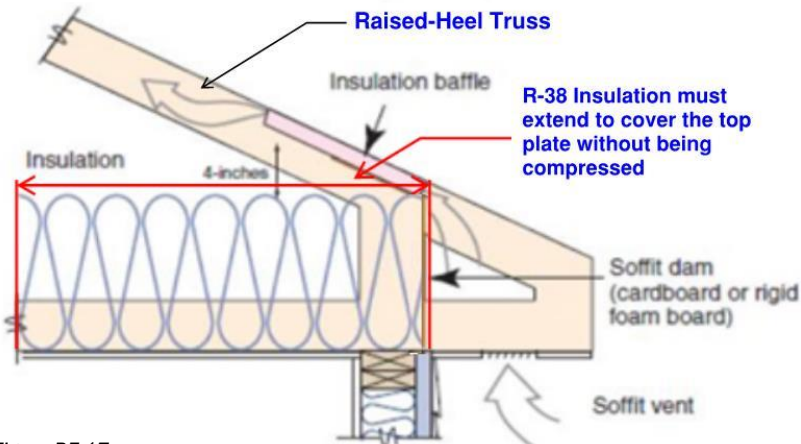


Figure BE-17.a.
Raised-Heel Truss (achieving Energy Truss)
Source: basc.pnnl.gov/images



Figure BE-17.b.
Access Hatch Properly Insulated
Source: basc.pnnl.gov/images

ADDITIONAL ENVELOPE REQUIREMENTS – ENERGY MODELED JOBS PER ASHRAE SECTION 11 OR APPENDIX G

For new buildings $\geq 25,000$ sf and Energy-modeled per the Energy Cost Budget Method (Section 11) or the Performance Rating Method (Appendix G), the building envelope must satisfy one of the following compliance options.

1RCNY §5000-01 (f)

■ Prescriptive Compliance - Section 5.5, “Prescriptive Building Envelope Option”

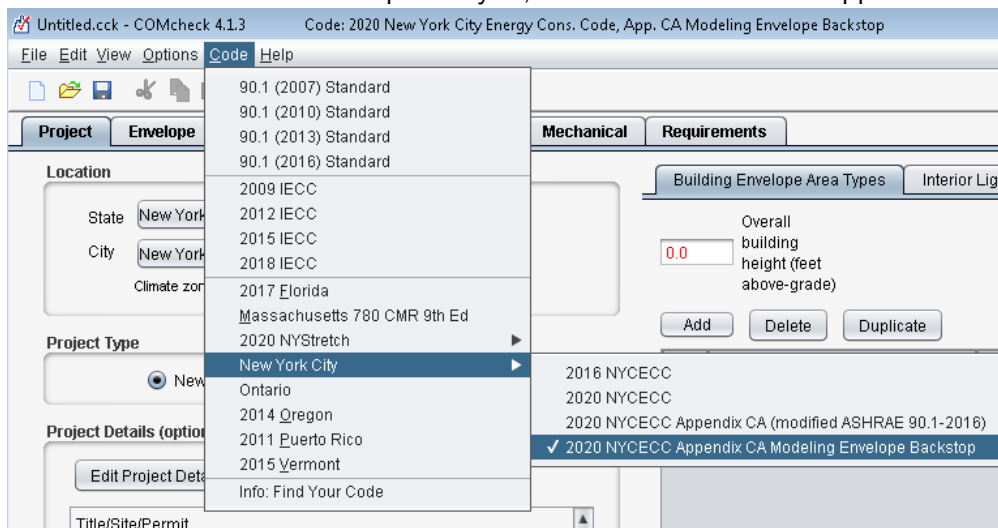
5.2.3.a

- All building envelope components in the Architectural Plans must demonstrate compliance with Section 5.5.
- **Tabular analysis** must be submitted in an EN- sheet listing both proposed envelope thermal performance values and code-prescriptive values of the entire building envelope components.

■ Envelope Performance Factor Compliance

5.2.3.b

- The proposed building’s Envelope Performance Factor in accordance with Appendix C of ASHRAE must be calculated through **COMcheck** Envelope energy analysis.
- To demonstrate compliance, the COMcheck Envelope report must indicate that:
 - a) For **Multifamily**, hotel/motel and dormitory building types:
The proposed envelope design does not exceed the allowable margin of - **15%** in the performance factor.
 - b) For all **Other** building types:
The proposed envelope design does not exceed the allowable margin of - **7%** in the performance factor.
 - c) For **Mixed-Use** building types:
The proposed envelope design does not exceed the allowable margin, determined from the area-weighted average of the gross wall area, auto-calculated by COMcheck.
- To start this **COMcheck** Envelope analysis, choose ‘2020 NYCECC Appendix CA Modeling Envelope Backstop’ under the Code tab.



• Example of COMcheck Envelope analysis results appearing in the compliance bar at the bottom of the analysis:

“Qualifies for 2020 NYCECC, App. CA Modeling: Envelope design -12% (allowable margin = -15.0%)” or

“Qualifies for 2020 NYCECC, App. CA Modeling: Envelope design -3% (allowable margin = -11.4%)” or

“FAILS to qualify for 2020 NYCECC, App. CA Modeling: Envelope design -16% (allowable margin = -15.0%)”: Note that this is NOT Compliant.