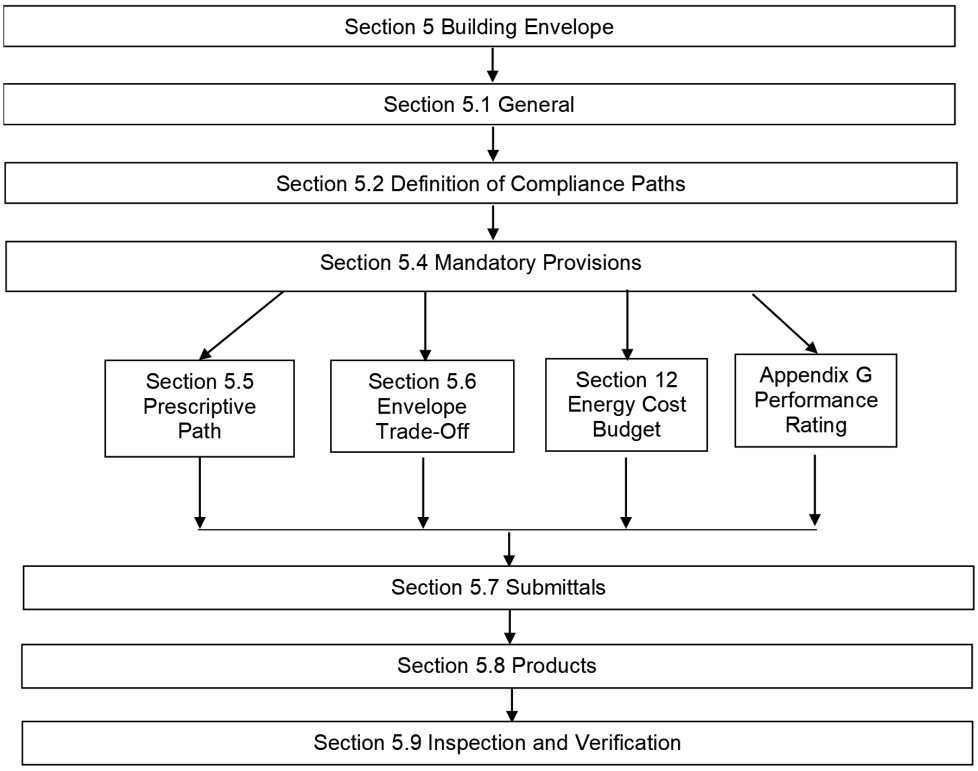

5. BUILDING ENVELOPE

5.1 General

5.1.1 Scope. Section 5 specifies requirements for the *building envelope*.

5.1.2 New Buildings. *Building envelope* components installed in new *buildings* shall comply with the requirements of Section 5.2.

5.1.3 Additions to Existing Buildings. *Building envelope* components installed in *additions* shall comply with the requirements of Section 5.2.

5.1.4 Alterations to Building Envelopes. *Alterations* to the *building envelope* shall comply with the requirements of Section 5.2 for insulation, *air leakage*, and *fenestration* applicable to those specific portions of the *building* that are being altered.

Exceptions to 5.1.4: The following *alterations* need not comply with these requirements, provided such *alterations* will not increase the *energy* use of the *building*:

1. Installation of storm windows or glazing panels over existing glazing, provided the storm window or glazing panel contains a low-emissivity coating. However, a low-emissivity coating is not required where the existing glazing already has a low-emissivity coating. Installation is permitted to be either on the inside or outside of the existing glazing.
2. Replacement of glazing in existing sash and frame, provided the *U-factor* and *SHGC* will be equal to or lower than before the glass replacement.
3. *Alterations* to *roof*, *wall*, or *floor* cavities that are insulated to full depth with insulation having a minimum nominal value of R-3.0/in.
4. *Alterations* to *walls* and *floors*, where the existing *structure* is without framing cavities and no new framing cavities are created.
5. *Roof recovering*.
6. *Roof replacements*, where the existing *roof* insulation is integral to or is located below the *roof* deck.
7. *Roof replacement*, provided the area of the replacement *roof covering* complies with the *opaque* element requirements for *roofs* in Tables 5.5-4 through 5.5-8 and Section 5.5.3.1.4.
8. Replacement of existing *doors* that separate a *conditioned space* from the exterior shall not require the installation of a vestibule or revolving *door*, provided that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed.

9. Replacement of existing *fenestration*, provided that the area of the replacement *fenestration* does not exceed 25% of the total *fenestration area* of an *existing building* and that the *U-factor* and *SHGC* will be equal to or lower than before the *fenestration* replacement.

[NY] 5.1.4.1 Roof Replacement for Roofs with Insulation Entirely Above Deck. *Roof replacement* for *roofs with insulation entirely above deck* shall comply with Section 5.5.3.1, shall not be required to comply with the requirements of Section 5.4.3, and shall not increase the *energy* use of the *building*.

[NY] 5.1.5 Climate. Determine the climate zone for the location. Follow the procedure in Section 5.1.5 or use Figure C301.1 and Table C301.1(1) in the 2025 Energy Conservation Construction Code of New York State.

5.1.6 Space Conditioning Categories

5.1.6.1 Separate *building envelope* requirements are specified for (a) *nonresidential conditioned space*, (b) *residential conditioned space*, and (c) *semiheated space*.

5.1.6.2 The minimum *skylight* area requirements in Section 5.5.4.2.3 are also specified for *unconditioned spaces*.

5.1.6.3 *Spaces* shall be assumed to be *conditioned spaces* and shall comply with the requirements for *conditioned spaces* at the time of *construction*, regardless of whether mechanical or electrical *equipment* is included in the *building* permit application or installed at that time.

Exception to 5.1.6.3: A *space* may be designated as either a *semiheated space* or an *unconditioned space* only if approved by the *building official*.

5.2 Compliance Paths. The *building envelope* shall comply with Sections 5.2.1 and 5.2.2.

5.2.1 Requirements for All Compliance Paths. The *building envelope* shall comply with Sections 5.1, "General"; 5.4, "Mandatory Provisions"; 5.7, "Submittals"; 5.8, "Product Information and Installation Requirements"; and 5.9, "Verification, Testing, and Commissioning."

5.2.2 Additional Requirements to Comply with Section 5. The *building envelope* shall comply with either:

a. Section 5.5, "Prescriptive Building Envelope Compliance Path," provided that the *fenestration area* does not exceed the maximum allowed by Section 5.5.4.2, or
b. Section 5.6, "Building Envelope Trade-Off Compliance Path."

5.3 Simplified Building Compliance Path (Not Used)

5.4 Mandatory Provisions

5.4.1 Insulation. Where insulation is required in Section 5.5 or Section 5.6, it shall comply with the requirements found in Section 5.8.1.

5.4.2 Fenestration and Doors. Procedures for determining *fenestration* and *door* performance are described in Section 5.8.2. Product samples used for determining *fenestration* performance shall be production line units or representative of units purchased by the consumer or contractor.

5.4.3 Air Leakage

a. *Air leakage* control for the *building envelope* shall comply with this section. Materials and assemblies that are part of the *continuous air barrier* and *fenestration* and *doors* shall comply with Section 5.8.3.
b. The *exterior building envelope* and the *semiexterior building envelope* shall have a *continuous air barrier* complying with Sections 5.4.3.1 and 5.4.3.2.

Exceptions to 5.4.3(b):

1. *Semiheated spaces* except as required to complete the *continuous air barrier* of an adjacent *conditioned space*.

5.4.3.1 Whole-Building Air Leakage

5.4.3.1.1 New *buildings* less than 10,000 ft^2 of *gross conditioned floor area* shall comply with measured *air leakage* requirements in Section 5.4.3.1.4.

5.4.3.1.2 New *buildings* not less than 10,000 ft^2 of *gross conditioned floor area* shall comply with one of the following:

a. Measured *air leakage* requirements in Section 5.4.3.1.4
b. A c*ontinuous air barrier* design and installation verification program performed in accordance with Section 5.9.1.2

5.4.3.1.3 In *alterations* and *additions* to an *existing building* where portions of the *continuous air barrier* are impacted, those portions shall be installed or reinstalled and comply with one of the following:

a. Measured *air leakage* requirements in Section 5.4.3.1.4
b. A c*ontinuous air barrier* design and installation verification program performed in accordance with Section 5.9.1.2

5.4.3.1.4 Measured Air Leakage. Where measured *air leakage* is used for compliance, the rate of *air leakage* of the *building envelope* shall not exceed 0.35 cfm/ft^2 under a pressure differential of 75 Pa (0.30 in. of water), with this *air leakage* rate normalized by the sum of the above-*grade* and below-*grade building envelope* areas of the *conditioned space* and *semiheated space* and in accordance with this section.

a. Whole-*building* pressurization testing shall be conducted in accordance with ASTM E3158. For *buildings* less than 10,000 ft^2 of *gross conditioned floor area*, and that contain no more than one *single-zone system*, *air leakage* testing may be conducted in accordance with ASTM E779, ASTM E1827, or ASTM E3158. Testing shall be conducted excluding HVAC related elements and be performed by an independent third-party *verification and testing provider* in accordance with Section 4.2.5.1.
b. Where a *building* contains both *conditioned space* and *semiheated space*, compliance shall be shown using one of the following as applicable:
    1. Separately for the *conditioned space* and for the *semiheated space*, with the *air leakage* rate for the *conditioned space* normalized by the *exterior building envelope* area of the *conditioned space* and the *air leakage* rate for the *semiheated space* normalized by the *semiexterior building envelope* area of the *semiheated space.*
    2. For the *conditioned space* and for the *semiheated space* together, with the *air leakage* rate for the overall *space* normalized by the sum of the *exterior building envelope* area and the *semiexterior building envelope* area minus the *semiexterior building envelope* area that separates the *conditioned space* from the *semiheated space.*
c. Where the measured *air leakage* rate exceeds 0.35 cfm/ft^2 but does not exceed 0.45 cfm/ft^2, a diagnostic evaluation, such as a smoke tracer or infrared imaging, shall be conducted while the *building* is pressurized, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. In addition, a visual inspection of the air barrier shall be conducted, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the *code official* and the *building* owner and shall be deemed to satisfy the requirements of this section.
d. Where the measured *air leakage* rate exceeds 0.45 cfm/ft^2, corrective actions must be made to the *envelope* and an additional test completed where results are 0.45 cfm/ft^2 or less in order to demonstrate compliance.
e. Reporting shall be in compliance with Section 4.2.5.1.2.

5.4.3.2 Continuous Air Barrier Design and Installation. The *continuous air barrier* shall be designed and installed in the following manner:

a. Components designed to provide the *continuous air barrier*, and the component's position within each of the *building envelope* assemblies, shall be clearly identified on *construction documents*.
b. The joints, interconnections, and penetrations of the *continuous air barrier* components shall be detailed in the *construction documents*.
c. The *continuous air barrier* shall extend over all surfaces of the *building envelope* and be identified in the *construction documents* to be continuous across the components of the below-*grade* areas, *walls*, *fenestration*, *doors*, and *roofs*.
d. The *continuous air barrier* shall be designed to resist positive and negative pressures from wind, stack effect, and mechanical *ventilation* and allow for anticipated movements.
e. The following areas of the *continuous air barrier* in the *building envelope* shall be wrapped, sealed, caulked, gasketed, or taped in an approved manner to minimize *air leakage*:
    1. Joints around *fenestration* and *door* frames
    2. Junctions between *walls* and *floors*; between *walls* at *building* corners; between *walls* and *roofs*, including parapets and copings; and *walls* at foundations
    3. Penetrations through the *continuous air barrier* in *building envelope roofs*, *walls*, and *floors*
    4. *Building* assemblies used as ducts or *plenums*
    5. Joints, seams, connections between planes, and other changes in *continuous air barrier* materials
    6. *Building* and *service* components projecting through or attached through the *continuous air barrier*

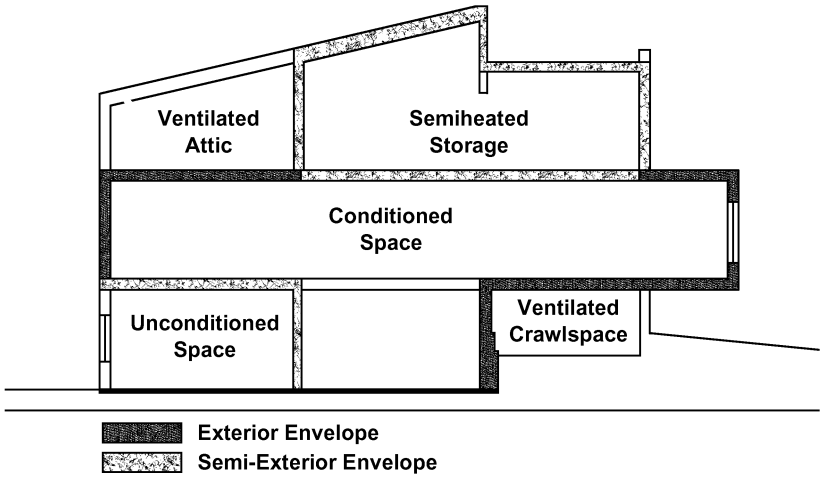

Figure 5.5.2 Exterior and semiexterior building envelope.

7. Junctions of the *continuous air barrier* that separate *conditioned spaces* from *unconditioned spaces*, *semiheated spaces,* and areas that are not *enclosed spaces*

5.4.3.3 Loading Dock Weatherseals. Cargo *doors* and loading dock *doors* shall be equipped with weatherseals to restrict *air leakage* when vehicles are parked in the doorway.

5.4.3.4 Vestibules and Revolving Doors. Vestibules and revolving *doors* shall be installed in accordance with this section.

5.4.3.4.1 Location. *Building entrances* that separate *conditioned space* from the exterior shall have one of the following:

a. An enclosed vestibule, with all *doors* opening into and out of the vestibule equipped with self-closing devices
b. A revolving *door* or *doors* opening into a vestibule or directly into the *conditioned space*
c. A combination of (a) and (b)

5.4.3.4.2 Vestibule Size. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior *doors* to open at the same time. Interior and exterior *doors* shall have a minimum distance between them of not less than 7 ft when in the closed position. The *floor* area of each vestibule shall not exceed the greater of 50 ft^2 or 2% of the *gross conditioned floor area* for that level of the *building*.

[NY] 5.4.3.4.3 Vestibule Envelope. The exterior surfaces of both conditioned vestibules and unconditioned vestibules shall comply with the *continuous air barrier* requirements.

Exceptions to 5.4.3.4.3:

1. *Doors* not intended to be used as a *building entrance.*
2. *Doors* opening directly from a *dwelling unit.*
3. (Reserved)
4. Enclosed elevator lobbies for *building entrances* directly from parking garages.
5. (Reserved)
6. *Doors* that open directly from a *space* that is less than 3000 ft^2 in area and is separate from the *building entrance.*
7. Self-closing *doors* in *buildings* in Climate Zone 4 that have an air curtain unit complying with Sections 6.4.3.9 and 10.4.5.Self-closing *doors* in *buildings* 15 *stories* or less in Climate Zones 5 and 6 that have an air curtain unit complying with Sections 6.4.3.9 and 10.4.5.

5.4.3.4.4 Vestibules for Large Spaces. Where vestibules are required under Sections 5.4.3.4 and 10.4.5, for *spaces* having a *gross conditioned floor area* for that level of the *building* of 40,000 ft^2 and greater, and when the *doors* opening into and out of the vestibule are equipped with *automatic*, electrically driven, self-closing devices, the interior and exterior *doors* shall have a minimum distance between them of not less than 16 ft.

5.5 Prescriptive Building Envelope Compliance Path

5.5.1 Exterior Building Envelope. For a *conditioned space*, the *exterior building envelope* shall comply with either the *nonresidential* or *residential* requirements in Tables 5.5-4 through 5.5-6 for the appropriate climate.

The exterior surfaces of conditioned vestibules shall comply with the *building envelope* requirements for a *conditioned space*.

5.5.2 Semiexterior Building Envelope. If a *building* contains any *semiheated space* or *unconditioned space* then the *semiexterior building envelope* shall comply with the requirements for *semiheated space* in Tables 5.5-4 through 5.5-6 for the appropriate climate. (See Figure 5.5.2.)

The interior surfaces and exterior surfaces of unconditioned vestibules shall comply with the *building envelope* requirements for a *semiheated space*.

[NY] 5.5.3 Opaque Elements. For all *opaque* elements, compliance with Tables 5.5-4 through 5.5-6 for each *class of construction* as described in Normative Appendix A, Sections A2 through A8 shall be demonstrated by one of the following two methods:

a. Providing a minimum *rated R-value of insulation* added to the assembly equal to or greater than the insulation minimum *R-value* required of each insulation component.
b. Providing insulation such that the maximum *U-factor*, *C-factor*, or *F-factor* for the entire assembly is not exceeded as determined by one of the following:
    1. Precalculated values in accordance with Normative Appendix A, Section A1.1.
    2. Applicant-determined values in accordance with Normative Appendix A, Section A1.2 where such values are approved by the *code official*.

Exceptions to 5.5.3:

1. For *opaque* assemblies not complying with the *classes of construction* as described in Normative Appendix A, Sections A2 through A8, compliance with the maximum *U-factors* for the "attic and other" or "wood frame and other" *opaque* element conditions in Tables 5.5-4 through 5.5-8 shall be demonstrated by testing or calculations representative of the designed assembly in accordance with Normative Appendix A, Section A9.1 where approved by the *code official*.
2. For multiple assemblies within a single *class of construction* for a single *space conditioning category*, compliance shall be shown for either (a) the most restrictive requirement or (b) an area-weighted average *U-factor*, *C-factor*, or *F-factor*.
3. When the total area of through the wall penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1 percent of the opaque above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly using a published and approved U-factor for that equipment or a default U-factor of 0.5 and compliance shall be shown in accordance with method b of this section.

5.5.3.1 Roofs

5.5.3.1.1 All *roofs* shall comply with the insulation values specified in Tables 5.5-4 through 5.5-8.

5.5.3.1.2 Roof Curbs. *Skylight* and other *roof* curbs shall be insulated to not less than R-5.0.

5.5.3.1.3 Joints in Roof Insulation. Joints in the insulation shall be installed in accordance with Section 5.8.1.10.

5.5.3.1.4 (Reserved)

5.5.3.1.5 Insulated Metal Panels. The *U-factor* of *roof* assemblies that include *insulated metal panels* shall not be greater than the *U-factors* of Tables 5.5-4 through 5.5-8 for the applicable *class of construction*. *U-factors* of *insulated metal panels* shall be determined in accordance with Section A9.4.7.

5.5.3.2 Above-Grade Walls. *Above-grade walls* shall comply with the insulation values specified in Tables 5.5-4 through 5.5-8. For the purposes of this provision, *wall* plates, tracks, headers, or bond beams are considered part of the base *wall* assembly.

Exception to 5.5.3.2: For *mass walls*, where the requirement in Tables 5.5-4 through 5.5-8 is for a maximum assembly U-0.151 followed by footnote "b," concrete masonry unit (CMU) walls complying with ASTM C90 that are ungrouted or partially grouted at 32 in. or greater on center vertically and 48 in. or greater on center horizontally, shall have their ungrouted openings (e.g., cores, cells) filled with insulating material having a maximum thermal conductivity of 0.44 Btu·in./h·ft^2·°F.

5.5.3.2.1 Walls That Are Both Above and Below Grade. When a *wall* consists of both *above-grade* and *below-grade* portions, the entire *wall* for that *story* shall be insulated on either the exterior or the interior or be integral.

a. If insulated on the interior, the *wall* shall be insulated to the *above-grade wall* requirements.
b. If insulated on the exterior or integral, the *below-grade wall* portion shall be insulated to the *below-grade wall* requirements, and the *above-grade wall* portion shall be insulated to the *above-grade wall* requirements.

5.5.3.2.2 (Reserved)

Table 5.5-4 Building Envelope Requirements for Climate Zone 4 (A,B,C)*

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
			Roofs			
Insulation entirely above deck	U-0.032	R-30 *c.i.*	U-0.032	R-30 *c.i.*	U-0.093	R-10 *c.i.*
Metal building [a]	U-0.037	R-19 + R-11 *Ls* or R-25 + R-8 *Ls*	U-0.037	R-19 + R-11 *Ls* or R-25 + R-8 *Ls*	U-0.082	R-19
Attic and other	U-0.021	R-49	U-0.021	R-49	U-0.034	R-30
			Walls, above Grade			
Mass	U-0.104	R-9.5 *c.i.*	U-0.090	R-11.4 *c.i.*	U-0.580	NR
Metal building	U-0.060	R-0 + R-15.8 *c.i.*	U-0.050	R-0 + R-19 *c.i.*	U-0.162	R-13
Steel-framed	U-0.064	R-13 + R-7.5 *c.i.*	U-0.064	R-13 + R-7.5 c.i	U-0.124	R-13
Wood-framed and other	U-0.064	R-13 + R-3.8 *c.i.* or R-20	U-0.064	R-13 + R-3.8 *c.i.* or R-20	U-0.089	R-13
			Wall, below Grade			
Below-grade wall	C-0.119	R-7.5 *c.i.*	C-0.092	R-10 *c.i.*	C-1.140	NR
			Floors			
Mass	U-0.057	R-14.6 *c.i.*	U-0.051	R-16.7 *c.i.*	U-0.107	R-6.3 *c.i.*
Steel joist	U-0.038	R-30	U-0.038	R-30	U-0.052	R-19
Wood-framed and other	U-0.033	R-30	U-0.033	R-30	U-0.051	R-19
			Slab-on-Grade Floors			
Unheated	F-0.520	R-15 for 24 in.	F-0.520	R-15 for 24 in.	F-0.730	NR
Heated	F-0.843	R-20 for 24 in.	F-0.688	R-20 for 48 in.	F-0.900	R-10 for 24 in.
			Opaque Doors			
Swinging	U-0.370		U-0.370		U-0.370	
Nonswinging	U-0.310		U-0.310		U-0.360	

Fenestration	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**
				Vertical Fenestration, 0% to 40% of *Wall*					
Fixed	0.36	0.36	1.10 (for all types)	0.36	0.36	1.10 (for all types)	0.50	NR (for all types)	NR (for all types)
Operable	0.45	0.33		0.45	0.33		0.65		
Entrance door	0.63	0.33		0.63	0.33		0.77		
				Skylight, 0% to 3% of *Roof*					
All types	0.50	0.40	NR	0.50	0.40	NR	0.75	NR	NR

* The following definitions apply: *c.i.* = *continuous insulation* (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), *Ls* = *liner system* (see Section A2.3.2.4); NR = no (insulation) requirement.

a. When using the *R-value* compliance method for *metal building roofs*, a thermal spacer block is required (see Section A2.3.2).