

# 2016 NEW YORK CITY ENERGY CONSERVATION CODE REPLACEMENT PAGES

The 2016 *Energy Conservation Code* replacement pages reflect changes made by Local Law 125 of 2016 to align the 2016 *New York City Energy Conservation Code* with the revised (August 2016) Supplement to the *New York State Energy Conservation Construction Code*.

These pages also contain ministerial administrative corrections; noted with an asterisk.

By starting with a loose-leaf copy of the 2016 *New York City Energy Conservation Code*, and substituting the *New York City Energy Conservation Code* replacement pages, the user will have a complete 2016 *New York City Energy Conservation Code*, in correct numerical sequence.

## **Remove 2016 New York City Energy Conservation Code Pages**

Pages R-3 through R-6  
Pages R-19 through R-20  
Pages C-3 through C-4  
Pages C-13 through C-16  
Pages C-43 through C-44  
ASHRAE 90.1 Pages 85 through 86

## **Insert Replacement Pages**

Replacement Pages R-3 through R-6  
Replacement Pages R-19 through R-20  
Replacement Pages C-3 through C-4  
Pages C-13 through C-16  
Replacement Pages C-43 through C-44  
Replacement Pages ASHRAE 90.1 Pages 85 through 86



## DEFINITIONS

NYC  
NYC  
NYC  
NYC  
NYC  
NYC

**BUILDING THERMAL ENVELOPE.** The exterior walls (above and below grade), floor, roof, and any other building elements that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

**C-FACTOR (THERMAL CONDUCTANCE).** The coefficient of heat transmission (surface to surface) through a building component or assembly, equal to the time rate of heat flow per unit area and the unit temperature difference between the warm side and cold side surfaces (Btu/h·ft<sup>2</sup>·°F) [W/(m<sup>2</sup>·K)].

**CIRCULATING HOT WATER SYSTEM.** A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment.

**CLIMATE ZONE.** A geographical region based on climatic criteria as specified in this code.

NYC  
NYC

**CODE OFFICIAL.** The commissioner or the commissioner's designee.

**COMMERCIAL BUILDING.** For this code, all buildings that are not included in the definition of "Residential building."

**CONDITIONED FLOOR AREA.** The horizontal projection of the floors associated with the conditioned space.

NYC  
NYC

**CONDITIONED SPACE.** An area or room within a building which is within the thermal envelope of a building which is directly or indirectly heated or cooled using fossil fuel or electricity as the energy source. Spaces that are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling using fossil fuel or electricity.

**CONTINUOUS AIR BARRIER.** A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

**CONTINUOUS INSULATION (ci).** Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior, or is integral to any opaque surface, of the building envelope.

**CRAWL SPACE WALL.** The opaque portion of a wall that encloses a crawl space and is partially or totally below grade.

**CURTAIN WALL.** Fenestration products used to create an external nonload-bearing wall that is designed to separate the exterior and interior environments.

**DEMAND RECIRCULATION WATER SYSTEM.** A water distribution system where pump(s) prime the service hot water piping with heated water upon demand for hot water.

**DUCT.** A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

**DUCT SYSTEM.** A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings,

dampers, plenums, fans and accessory air-handling equipment and appliances.

**DWELLING UNIT.** A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

**ENERGY ANALYSIS.** A method for estimating the annual energy use of the proposed design and standard reference design based on estimates of energy use.

⇨

**ENERGY COST.** The total estimated annual cost for purchased energy for the building functions regulated by this code, including applicable demand charges.

**ENERGY SIMULATION TOOL.** An approved software program or calculation-based methodology that projects the annual energy use of a building.

**ERI REFERENCE DESIGN.** A version of the rated design that meets the minimum requirements of the 2006 *International Energy Conservation Code*, and which establishes the index value of 100 on the Energy Rating Index scale.

NYC  
NYC  
NYC

**EXTERIOR WALL.** Walls including both above-grade walls and basement walls.

**FENESTRATION.** Products classified as either vertical fenestration or skylights.

**FENESTRATION PRODUCT, SITE-BUILT.** A fenestration designed to be made up of field-glazed or field-assembled units using specific factory cut or otherwise factory-formed framing and glazing units. Examples of site-built fenestration include storefront systems, curtain walls and atrium roof systems.

**F-FACTOR.** The perimeter heat loss factor for slab-on-grade floors (Btu/h·ft·°F) [W/(m·K)].

**GRADE PLANE.** A reference plane representing the average of finished ground level adjoining the building at exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

NYC  
NYC

**HEATED SLAB.** Slab-on-grade construction in which the heating elements, hydronic tubing, or hot air distribution system is in contact with, or placed within or under, the slab.

**HIGH-EFFICACY LAMPS.** Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy of:

1. 60 lumens per watt for lamps over 40 watts;
2. 50 lumens per watt for lamps over 15 watts to 40 watts; and
3. 40 lumens per watt for lamps 15 watts or less.

**HISTORIC BUILDING.** Any building that is (a) listed on the national register of historic places or on the state register of historic places, (b) determined by the commissioner of parks, recreation and historic preservation to be eligible for listing on the state register of historic places, (c) determined by the commissioner of parks, recreation and historic preser-

NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC



## DEFINITIONS

**R-VALUE (THERMAL RESISTANCE).** The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ( $h \cdot ft^2 \cdot ^\circ F/Btu$ ) [ $m^2 \cdot K/W$ ].

**SERVICE WATER HEATING.** Supply of hot water for purposes other than comfort heating.

**SKYLIGHT.** Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal.

**SOLAR HEAT GAIN COEFFICIENT (SHGC).** The ratio of the solar heat gain entering the space through the fenestration assembly to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation that is then reradiated, conducted or convected into the space.

**STANDARD REFERENCE DESIGN.** A version of the proposed design that meets the minimum requirements of this code and is used to determine the maximum annual energy use requirement for compliance based on total building performance.

**SUNROOM.** A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

**THERMAL ISOLATION.** Physical and space conditioning separation from conditioned space(s). The conditioned space(s) shall be controlled as separate zones for heating and cooling or conditioned by separate equipment.

**THERMOSTAT.** An automatic control device used to maintain temperature at a fixed or adjustable set point.

**U-FACTOR (THERMAL TRANSMITTANCE).** The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ( $Btu/h \cdot ft^2 \cdot ^\circ F$ ) [ $W/(m^2 \cdot K)$ ].

**VENTILATION.** The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

**VENTILATION AIR.** That portion of supply air that comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

**VERTICAL FENESTRATION.** Windows (fixed or moveable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of at least 60 degrees (1.05 rad) from horizontal.

**VISIBLE TRANSMITTANCE [VT].** The ratio of visible light entering the space through the fenestration product assembly to the incident visible light, Visible Transmittance, includes the effects of glazing material and frame and is expressed as a number between 0 and 1.

**WHOLE HOUSE MECHANICAL VENTILATION SYSTEM.** An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air when operating continuously or through a programmed intermittent schedule to satisfy the whole house ventilation rates.

**ZONE.** A space or group of spaces within a building with heating or cooling requirements that are sufficiently similar so that desired conditions can be maintained throughout using a single controlling device.

**R405.5 Calculation procedure.** Calculations of the performance design shall be in accordance with Sections R405.5.1 and R405.5.2.

**R405.5.1 General.** Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

**R405.5.2 Residence specifications.** The standard reference design and proposed design shall be configured and analyzed as specified by Table R405.5.2(1). Table R405.5.2(1) shall include, by reference, all notes contained in Table R402.1.2.

**R405.6 Calculation software tools.** Calculation software, where used, shall be in accordance with Sections R405.6.1 through R405.6.3.

**R405.6.1 Minimum capabilities.** Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

1. Computer generation of the standard reference design using only the input for the proposed design. The calculation procedure shall not allow the user to directly modify the building component characteristics of the standard reference design.
2. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence in accordance with Section R403.6.
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.
4. Printed code official inspection checklist listing each of the proposed design component characteristics from Table R405.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (*R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER, EF are some examples).

**R405.6.2 Specific approval.** Performance analysis tools meeting the applicable provisions of Section R405 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or limited scope.

**R405.6.3 Input values.** When calculations require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from an approved source.

**SECTION ECC R406  
ENERGY RATING INDEX  
COMPLIANCE ALTERNATIVE**

**R406.1 Scope.** This section establishes criteria for compliance using an Energy Rating Index (ERI) analysis.

**R406.2 Mandatory requirements.** Compliance with this section requires that (1) the provisions in Sections R401 through R404 labeled as “mandatory” and (2) the provisions of Section R403.5.3 be met. The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.1 or 402.1.3 of the 2011 *New York City Energy Conservation Code*.

**Exception:** Supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-6.

**R406.3 Energy Rating Index.** The Energy Rating Index (ERI) shall be a numerical integer value that is based on a linear scale constructed such that the ERI reference design has an Index value of 100 and a residential building that uses no net purchased energy has an Index value of 0. Each integer value on the scale shall represent a 1-percent change in the total energy use of the rated design relative to the total energy use of the ERI reference design. The ERI shall consider all energy used in the residential building.

**R406.3.1 ERI reference design.** The ERI reference design shall be configured such that it meets the minimum requirements of the 2006 *International Energy Conservation Code* prescriptive requirements.

The proposed residential building shall be shown to have an annual total normalized modified load less than or equal to the annual total loads of the ERI reference design.

**R406.4 ERI-based compliance.** Compliance based on an ERI analysis requires that the rated design be shown to have an ERI less than or equal to the appropriate value listed in Table R406.4 when compared to the ERI reference design.

**TABLE R406.4  
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

**R406.5 Verification by approved agency.** Verification of compliance with Section R406 shall be completed by an approved third party.

**TABLE R405.5.2(1)**  
**SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame.	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: as specified in Table R402.1.4	As proposed
	Solar absorptance = 0.75	As proposed
	Emittance = 0.90	As proposed
Basement and crawl space walls	Type: same as proposed	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: from Table R402.1.4, with insulation layer on interior side of walls	As proposed
Above-grade floors	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: as specified in Table R402.1.4	As proposed
Ceilings	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: as specified in Table R402.1.4	As proposed
Roofs	Type: composition shingle on wood sheathing	As proposed
	Gross area: same as proposed	As proposed
	Solar absorptance = 0.75	As proposed
	Emittance = 0.90	As proposed
Attics	Type: vented with aperture = 1 ft <sup>2</sup> per 300 ft <sup>2</sup> ceiling area	As proposed
Foundations	Type: same as proposed	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed	As proposed
Opaque doors	Area: 40 ft <sup>2</sup>	As proposed
	Orientation: North	As proposed
	<i>U</i> -factor: same as fenestration from Table R402.1.4	As proposed
Vertical fenestration other than opaque doors	Total area <sup>b</sup> = (a) The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area (b) 15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	<i>U</i> -factor: as specified in Table R402.1.4	As proposed
	SHGC: as specified in Table R402.1.2 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
	Interior shade fraction: 0.92-(0.21 × SHGC for the standard reference design)	0.92-(0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
Air exchange rate	Air leakage rate of 5 air changes per hour in climate zones 1 and 2, and 3 air changes per hour in climate zones 3 through 8 at a pressure of 0.2 inches w.g (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where: <i>CFA</i> = conditioned floor area <i>N<sub>br</sub></i> = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	For residences that are not tested, the same air leakage rate as the standard reference design. For tested residences, the measured air exchange rate <sup>a</sup> . The mechanical ventilation rate <sup>b</sup> shall be in addition to the air leakage rate and shall be as proposed.

(continued)



## DEFINITIONS

NYC structure. The term “building” shall include, but shall not be  
NYC limited to, factory manufactured homes (as defined in section  
NYC 372(8) of the *Executive Law*) and mobile homes (as defined  
NYC in section 372(13) of the *Executive Law*).

**BUILDING COMMISSIONING.** A process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner’s project requirements and construction documents, and to minimum code requirements.

**BUILDING ENTRANCE.** Any door, set of doors, doorway, or other form of portal that is used to gain access to the building from the outside by the public.

NYC **BUILDING SITE.** A contiguous area of land that is under the ownership or control of one entity.

NYC **BUILDING SYSTEM.** The term “building system” means a  
NYC combination of central or terminal equipment or components  
NYC or controls, accessories, interconnecting means, and terminal  
NYC devices by which energy is transformed so as to perform a  
NYC specific function, such as heating, ventilation and air condi-  
NYC tioning, service water heating or illumination.

NYC **BUILDING THERMAL ENVELOPE.** The exterior walls  
NYC (above and below grade), floor, roof, and any other building ele-  
NYC ments that enclose conditioned space or provides a boundary  
NYC between conditioned space and exempt or unconditioned space.

**C-FACTOR (THERMAL CONDUCTANCE).** The coefficient of heat transmission (surface to surface) through a building component or assembly, equal to the time rate of heat flow per unit area and the unit temperature difference between the warm side and cold side surfaces ( $\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$  [ $\text{W}/(\text{m}^2 \cdot \text{K})$ ]).

**CIRCULATING HOT WATER SYSTEM.** A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to the fixture supply and back to the water-heating equipment.

**CLIMATE ZONE.** A geographical region based on climatic criteria as specified in this code.

NYC **CODE OFFICIAL.** The commissioner or the commis-  
NYC sioner’s designee.

**COEFFICIENT OF PERFORMANCE (COP) – COOLING.** The ratio of the rate of heat input, in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.

**COEFFICIENT OF PERFORMANCE (COP) – HEATING.** The ratio of the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system, including the compressor and, if applicable, auxiliary heat, under designated operating conditions.

NYC **COMMERCIAL BUILDING.** The term “commercial  
NYC building” includes all buildings that are not included in the  
NYC definition of “residential building.”

**COMPUTER ROOM.** A room whose primary function is to house equipment for the processing and storage of electronic data and that has a design electronic data equipment power density exceeding 20 watts per square foot of conditioned floor area.

**CONDENSING UNIT.** A factory-made assembly of refrigeration components designed to compress and liquefy a specific refrigerant. The unit consists of one or more refrigerant compressors, refrigerant condensers (air-cooled, evaporatively cooled, or water-cooled), condenser fans and motors (where used) and factory-supplied accessories.

**CONDITIONED FLOOR AREA.** The horizontal projection of the floors associated with the conditioned space.

**CONDITIONED SPACE.** An area or room within a building which is within the thermal envelope of a building which is directly or indirectly heated or cooled using fossil fuel or electricity as the energy source. Spaces that are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling using fossil fuel or electricity.

NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC

**CONTINUOUS AIR BARRIER.** A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

**CONTINUOUS INSULATION (ci).** Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

**CRAWL SPACE WALL.** The opaque portion of a wall that encloses a crawl space and is partially or totally below grade.

**CURTAIN WALL.** Fenestration products used to create an external nonload-bearing wall that is designed to separate the exterior and interior environments.

**DAYLIGHT RESPONSIVE CONTROL.** A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

**DAYLIGHT ZONE.** That portion of a building’s interior floor area that is illuminated by natural light.

**DEMAND CONTROL VENTILATION (DCV).** A ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.

**DEMAND RECIRCULATION WATER SYSTEM.** A water distribution system where pumps prime the service hot water piping with heated water upon demand for hot water.

**DUCT.** A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

**DUCT SYSTEM.** A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

**DWELLING UNIT.** A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

- $U_{Wall}$  = Area-weighted average  $U$ -value of all above-grade wall assemblies.
- $UAV$  = Sum of the (UA Proposed) values for each vertical glazing assembly.
- $UV$  =  $UAV$ /total vertical glazing area.

Where the proposed skylight area is less than or equal to the skylight area allowed by Section C402.4.1, the value of  $E$  (Excess Skylight Value) shall be zero. Otherwise:

$$E = (EA \cdot US) - (EA \cdot U_{Roof}), \text{ but not less than zero.}$$

- $EA$  = (Proposed Skylight Area) - (Allowable Skylight Area as specified in Section C402.4.1).
- $U_{Roof}$  = Area-weighted average  $U$ -value of all roof assemblies.
- $UAS$  = Sum of the (UA Proposed) values for each skylight assembly.
- $US$  =  $UAS$ /total skylight area.

**C402.2 Specific building thermal envelope insulation requirements (Prescriptive).** Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through C402.2.6 and Table C402.1.3.

**C402.2.1 Multiple layers of continuous insulation board.** Where two or more layers of continuous insulation board are used in a construction assembly, the continuous insulation boards shall be installed in accordance with Section C303.2. Where the continuous insulation board manufacturer’s instructions do not address installation of two or more layers, the edge joints between each layer of continuous insulation boards shall be staggered.

**C402.2.2 Roof assembly.** The minimum thermal resistance ( $R$ -value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or  $R$ -5, whichever is less.

**Exceptions:**

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted  $U$ -factor is equivalent to the same assembly with the  $R$ -value specified in Table C402.1.3.
2. Where tapered insulation is used with insulation entirely above deck, the  $R$ -value where the insulation thickness varies 1 inch (25 mm) or less from the minimum thickness of tapered insulation shall comply with the  $R$ -value specified in Table C402.1.3.

3. Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

**C402.2.3 Thermal resistance of above-grade walls.** The minimum thermal resistance ( $R$ -value) of materials installed in the wall cavity between framing members and continuously on the walls shall be as specified in Table C402.1.3, based on framing type and construction materials used in the wall assembly. The  $R$ -value of integral insulation installed in concrete masonry units shall not be used in determining compliance with Table C402.1.3.

“Mass walls” shall include walls:

1. Weighing not less than 35 psf (170 kg/m<sup>2</sup>) of wall surface area.
2. Weighing not less than 25 psf (120 kg/m<sup>2</sup>) of wall surface area where the material weight is not more than 120 pcf (1900 kg/m<sup>3</sup>).
3. Having a heat capacity exceeding 7 Btu/ft<sup>2</sup> · °F (144 kJ/m<sup>2</sup> · K).
4. Having a heat capacity exceeding 5 Btu/ft<sup>2</sup> · °F (103 kJ/m<sup>2</sup> · K), where the material weight is not more than 120 pcf (1900 kg/m<sup>3</sup>).

**C402.2.4 Floors.** The thermal properties (component  $R$ -values or assembly  $U$ -,  $C$ - or  $F$ -factors) of floor assemblies over outdoor air or unconditioned space shall be as specified in Table C402.1.3 or C402.1.4 based on the construction materials used in the floor assembly. Floor framing cavity insulation or structural slab insulation shall be installed to maintain permanent contact with the underside of the sub-floor decking or structural slabs.

**Exceptions:**

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  $R$ -value in Table C402.1.3 for “Metal framed” or “Wood framed and other” values for “Walls, Above Grade” and extends from the bottom to the top of all perimeter floor framing or floor assembly members.
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.

NYC  
NYC  
NYC

TABLE C402.1.3 OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD<sup>a</sup>

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R														
<b>Roofs</b>																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings <sup>b</sup>	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS												
Attic and other	R-38	R-49	R-49	R-49	R-49	R-49	R-49									
<b>Walls, above grade</b>																
Mass	R-5.7ci <sup>c</sup>	R-5.7ci <sup>c</sup>	R-7.6ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci
Metal building	R-13 + R-6.5ci															
Metal framed	R-13 + R-5ci															
Wood framed and other	R-13 + R-3.8ci or R-20															
<b>Walls, below grade</b>																
Below-grade wall <sup>d</sup>	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci						
<b>Floors</b>																
Mass <sup>e</sup>	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>	R-30 <sup>f</sup>									
<b>Slab-on-grade floors</b>																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below					
Heated slabs	R-7.5 for 12" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 36" below	R-20 for 48" below										
<b>Opaque doors</b>																
Nonswinging	R-4.75															

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m<sup>2</sup>, 1 pound per cubic foot = 16 kg/m<sup>3</sup>.

ci = Continuous insulation, NR = No requirement, LS = Liner system.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft<sup>2</sup>-°F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall include floors weighing not less than:

- 35 pounds per square foot of floor surface area; or
- 25 pounds per square foot of floor surface area where the material weight is not more than 120 pounds per cubic foot.

f. Steel floor joist systems shall be insulated to R-38.

TABLE C402.1.4  
**OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD<sup>a,b</sup>**

CLIMATE ZONE	1		2		3		4		5		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
<b>Roofs</b>																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.044	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021
<b>Walls, above grade</b>																
Mass	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.090	U-0.080	U-0.071	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.039	U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.052	U-0.052	U-0.052	U-0.052
Wood framed and other <sup>c</sup>	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036
<b>Walls, below grade</b>																
Below-grade wall <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-1.140 <sup>e</sup>	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
<b>Floors</b>																
Mass <sup>d</sup>	U-0.322 <sup>e</sup>	U-0.107	U-0.087	U-0.087	U-0.076	U-0.076	U-0.074	U-0.074	U-0.074	U-0.064	U-0.057	U-0.057	U-0.051	U-0.051	U-0.051	U-0.051
Joist/framing	U-0.066 <sup>e</sup>	U-0.066 <sup>e</sup>	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
<b>Slab-on-grade floors</b>																
Unheated slabs	F-0.73 <sup>e</sup>	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40					
Heated slabs <sup>f</sup>	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.65	F-0.65	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55
<b>Opaque doors</b>																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37

For SI: 1 pound per square foot = 4.88 kg/m<sup>2</sup>, 1 pound per cubic foot = 16 kg/m<sup>3</sup>.

ci = Continuous insulation, NR = No requirement, LS = Liner system.

a. Use of Opaque assembly U-factors, C-factors, and F-factors from ANSI/ASHRAE/IESNA 90.1 Appendix A shall be permitted, provided the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

b. Opaque assembly U-factors based on designs tested in accordance with ASTM C1363 shall be permitted. The R-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.

c. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.

d. "Mass floors" shall include floors weighing not less than:

- 1. 35 pounds per square foot of floor surface area; or
- 2. 25 pounds per square foot of floor surface area where the material weight is not more than 120 pounds per cubic foot.

e. These C-, F-, and U-factors are based on assemblies that are not required to contain insulation.

f. Evidence of compliance with the F-factors indicated in the table for heated slabs shall be demonstrated by the application of the unheated slab F-factors and R-values derived from ASHRAE 90.1 Appendix A.





5. Systems expected to operate less than 20 hours per week.
6. Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems.
7. Where the cooling efficiency meets or exceeds the efficiency requirements in Table C403.3(2).
8. Chilled-water cooling systems that are passive (without a fan) or use induction where the total chilled water system capacity less the capacity of fan units with air economizers is less than the minimum specified in Table C403.3(1).
9. Systems that include a heat recovery system in accordance with Section C403.4.5.

**TABLE C403.3(2)  
EQUIPMENT EFFICIENCY PERFORMANCE  
EXCEPTION FOR ECONOMIZERS**

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% efficiency improvement
3B	15% efficiency improvement
4B	20% efficiency improvement

**C403.3.1 Integrated economizer control.** Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to provide the remainder of the cooling load. Controls shall not be capable of creating a false load in the mechanical cooling systems by limiting or disabling the economizer or any other means, such as hot gas bypass, except at the lowest stage of mechanical cooling.

Units that include an air economizer shall comply with the following:

1. Unit controls shall have the mechanical cooling capacity control interlocked with the air economizer controls such that the outdoor air damper is at the 100-percent open position when mechanical cooling is on and the outdoor air damper does not begin to close to prevent coil freezing due to minimum compressor run time until the leaving air temperature is less than 45°F (7°C).
2. Direct expansion (DX) units that control 75,000 Btu/h (22 kW) or greater of rated capacity of the capacity of the mechanical cooling directly based on occupied

space temperature shall have not fewer than two stages of mechanical cooling capacity.

3. Other DX units, including those that control space temperature by modulating the airflow to the space, shall be in accordance with Table C403.3.1.

**C403.3.2 Economizer heating system impact.** HVAC system design and economizer controls shall be such that economizer operation does not increase building heating energy use during normal operation.

**Exception:** Economizers on variable air volume (VAV) systems that cause zone level heating to increase due to a reduction in supply air temperature.

**C403.3.3 Air economizers.** Air economizers shall comply with Sections C403.3.3.1 through C403.3.3.5.

**C403.3.3.1 Design capacity.** Air economizer systems shall be capable of modulating outdoor air and return air dampers to provide up to 100 percent of the design supply air quantity as outdoor air for cooling.

**C403.3.3.2 Control signal.** Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed-air temperature.

**Exception:** The use of mixed-air temperature limit control shall be permitted for systems controlled from space temperature (such as single-zone systems).

**C403.3.3.3 High-limit shutoff.** Air economizers shall be capable of automatically reducing outdoor air intake to the design minimum outdoor air quantity when outdoor air intake will no longer reduce cooling energy usage. High-limit shutoff control types for specific climates shall be chosen from Table C403.3.3.3. High-limit shutoff control settings for these control types shall be those specified in Table C403.3.3.3.

**C403.3.3.4 Relief of excess outdoor air.** Systems shall be capable of relieving excess outdoor air during air economizer operation to prevent overpressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

**C403.3.3.5 Economizer dampers.** Return, exhaust/relief and outdoor air dampers used in economizers shall comply with Section C403.2.4.3.

**C403.3.4 Water-side economizers.** Water-side economizers shall comply with Sections C403.3.4.1 and C403.3.4.2.

**TABLE C403.3.1  
DX COOLING STAGE REQUIREMENTS FOR MODULATING AIRFLOW UNITS**

RATING CAPACITY	MINIMUM NUMBER OF MECHANICAL COOLING STAGES	MINIMUM COMPRESSOR DISPLACEMENT <sup>a</sup>
≥ 65,000 Btu/h and < 240,000 Btu/h	3 stages	≤ 35% of full load
≥ 240,000 Btu/h	4 stages	≤ 25% full load

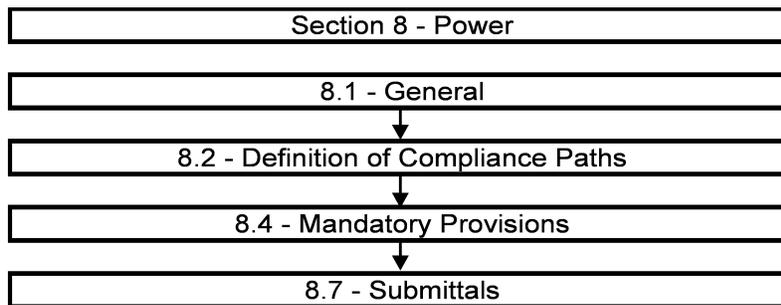
For SI: 1 British thermal unit per hour = 0.2931 W.

a. For mechanical cooling stage control that does not use variable compressor displacement, the percent displacement shall be equivalent to the mechanical cooling capacity reduction evaluated at the full load rating conditions for the compressor.

**TABLE 7.8 Performance Requirements for Water-Heating Equipment**

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Performance Required <sup>a</sup>	Test Procedure <sup>b,c</sup>
Electric table-top water heaters	≤ 12 kW	Resistance ≥ 20 gal	0.93–0.00035V EF	DOE 10 CFR Part 430
Electric water heaters	≤ 12 kW <sup>e</sup>	Resistance ≥ 20 gal	0.97–0.00035V EF	DOE 10 CFR Part 430
	> 12 kW	Resistance ≥ 20 gal	0.3 + 27/V <sub>m</sub> %/h	Section G.2 of ANSI Z21.10.3
	≤ 24 Amps and ≤ 250 Volts	Heat Pump	0.93–0.00035V EF	DOE 10 CFR Part 430
Gas storage water heaters	≤ 75,000 Btu/h	≥ 20 gal	0.67–0.0005V EF	DOE 10 CFR Part 430
	> 75,000 Btu/h	< 4,000 (Btu/h)/gal	$Q/799 + 16.6\sqrt{V}$ SL, Btu/h	Sections G.1 and G.2 of ANSI Z21.10.3
Gas instantaneous water heaters	> 50,000 Btu/h < 200,000 Btu/h	≥ 4,000 (Btu/h)/gal and < 2 gal	0.67–0.0005V EF	DOE 10 CFR Part 430
	≥ 200,000 Btu/h <sup>d</sup>	≥ 4,000 (Btu/h)/gal and < 10 gal	80% $E_t$	Sections G.1 and G.2 of ANSI Z21.10.3
	≥ 200,000 Btu/h	≥ 4,000 (Btu/h)/gal and ≥ 10 gal	80% $E_t$ ( $Q/799 + 16.6\sqrt{V}$ ) SL, Btu/h	
Oil storage water heaters	≤ 105,000 Btu/h	≥ 20 gal	0.59–0.0005V EF	DOE 10 CFR Part 430
	> 105,000 Btu/h	< 4,000 (Btu/h)/gal	80% $E_t$ ( $Q/799 + 16.6\sqrt{V}$ ) SL, Btu/h	Sections G.1 and G.2 of ANSI Z21.10.3
Oil instantaneous water heaters	≤ 210,000 Btu/h	≥ 4,000 (Btu/h)/gal and < 2 gal	0.59–0.0005V EF	DOE 10 CFR Part 430
	> 210,000 Btu/h	≥ 4,000 (Btu/h)/gal and < 10 gal	80% $E_t$	Sections G.1 and G.2 of ANSI Z21.10.3
	> 210,000 Btu/h	≥ 4,000 (Btu/h)/gal and ≥ 10 gal	78% $E_t$ ( $Q/799 + 16.6\sqrt{V}$ ) SL, Btu/h	
Hot-water supply boilers, gas and oil	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 4,000 (Btu/h)/gal and < 10 gal	80% $E_t$	Sections G.1 and G.2 of ANSI Z21.10.3
Hot-water supply boilers, gas		≥ 4,000 (Btu/h)/gal and ≥ 10 gal	80% $E_t$ ( $Q/799 + 16.6\sqrt{V}$ ) SL, Btu/h	
Hot-water supply boilers, oil		≥ 4,000 (Btu/h)/gal and ≥ 10 gal	78% $E_t$ ( $Q/800 + 110\sqrt{V}$ ) SL, Btu/h	
Pool heaters, oil and gas	All		78% $E_t$	ASHRAE 146
Heat-pump pool heaters	All		4.0 COP	ASHRAE 146
Unfired storage tanks	All		R-12.5	(none)

- a. Energy factor (EF) and thermal efficiency ( $E_t$ ) are minimum requirements, while standby loss (SL) is maximum Btu/h based on a 70°F temperature difference between stored water and ambient requirements. In the EF equation,  $V$  is the rated volume in gallons. In the SL equation,  $V$  is the rated volume in gallons and  $Q$  is the nameplate input rate in Btu/h.  $V_m$  is the measured volume in the tank
- b. Section 12 contains a complete specification, including the year version, of the referenced test procedure.
- c. Section G.1 is titled “Test Method for Measuring Thermal Efficiency” and Section G.2 is titled “Test Method for Measuring Standby Loss.”
- d. Instantaneous water heaters with input rates below 200,000 Btu/h must comply with these requirements if the water heater is designed to heat water to temperatures of 180°F or higher.
- e. Electric water heaters with input rates below 12 kW must comply with these requirements if the water heater is designed to heat water to temperatures of 180°F or higher.
- f. Refer to Section 7.5.3 for additional requirements for gas storage and instantaneous water heaters and gas hot-water supply boilers.



## 8. POWER

### 8.1 General

**8.1.1 Scope.** This section applies to all building power distribution systems and only to equipment described below.

**8.1.2 New Buildings.** Equipment installed in new buildings shall comply with the requirements of this section.

**8.1.3 Addition to Existing Buildings.** Equipment installed in addition to existing buildings shall comply with the requirements of this section.

#### 8.1.4 Alterations to Existing Buildings

**Exception:** Compliance shall not be required for the relocation or reuse of existing equipment at the same site.

**8.1.4.1** Alterations to building service equipment or systems shall comply with the requirements of this section applicable to those specific portions of the building and its systems that are being altered.

**8.1.4.2** Any new equipment subject to the requirements of this section that is installed in conjunction with the alterations as a direct replacement of existing equipment shall comply with the specific requirements applicable to that equipment.

### 8.2 Compliance Paths

**8.2.1 Compliance.** Power distribution systems in all projects shall comply with the requirements of Section 8.1, “General”; Section 8.4, “Mandatory Provisions”; and Section 8.7, “Submittals.”

### 8.3 Simplified/Small Building Option (Not Used)

### 8.4 Mandatory Provisions

**8.4.1 Voltage Drop.** The conductors for feeders and branch circuits combined shall be sized for a maximum of 5% voltage drop total.

**Exception:** Feeder conductors and branch circuits that are dedicated to emergency services.

**8.4.2 Automatic Receptacle Control.** The following shall be automatically controlled:

- a. At least 50% of all 125-volt 15- and 20-amp receptacles in all private offices, conference rooms, rooms used primarily for printing and/or copying functions, break rooms, classrooms, and individual workstations
- b. At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents

This control shall function on

- a. a scheduled basis using a time-of-day operated control device that turns receptacles off at specific programmed times—an independent program schedule shall be provided for controlled areas of no more than 5000 ft<sup>2</sup> and not more than one floor (the occupant shall be able to manually override the control device for up to two hours),
- b. an occupant sensor that shall turn receptacles off within 20 minutes of all occupants leaving a space, or
- c. an automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.

All controlled receptacles shall be permanently marked to visually differentiate them from uncontrolled receptacles and are to be uniformly distributed throughout the space.

Plug-in devices shall not be used to comply with Section 8.4.2.

**Exceptions:** Receptacles for the following shall not require an automatic control device:

1. Receptacles specifically designated for equipment requiring continuous operation (24 hours/day, 365 days/year)
2. Spaces where an automatic control would endanger the safety or security of the room or building occupant(s).

### 8.4.3 Electrical Energy Monitoring

**8.4.3.1 Monitoring.** Measurement devices shall be installed in new buildings to monitor the electrical energy use for each of the following separately:

- a. Total electrical energy
- b. HVAC systems
- c. Interior lighting
- d. Exterior lighting
- e. Receptacle circuits

For buildings with tenants, these systems shall be separately monitored for the total building and (excluding shared systems) for each individual tenant.

**Exception:** Up to 10% of the load for each of the categories (b) through (e) shall be allowed to be from other electrical loads.

**8.4.3.2 Recording and Reporting.** The electrical energy usage for all loads specified in Section 8.4.3.1 shall be recorded a minimum of every 15 minutes and reported at least hourly, daily, monthly, and annually. The data for each tenant

NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC  
NYC

