

C402.2 Specific building thermal envelope insulation requirements (Prescriptive). Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.1 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 on 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:**

- 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.
- 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.
- 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:

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

C402.3 Roof solar reflectance and thermal emittance. Low-sloped roofs directly above cooled conditioned spaces in Climate Zones 1, 2 and 3 shall comply with one or more of the options in Table C402.3.

**Exceptions:** The following roofs and portions of roofs are exempt from the requirements of Table C402.3:

- Portions of the roof that include or are covered by the following:
  - Photovoltaic systems or components.
  - Solar air or water-heating systems or components.
  - Roof gardens or landscaped roofs.
  - Above-roof decks or walkways.
  - Skylights.
  - HVAC systems and components, and other opaque objects mounted above the roof.
- Portions of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings.
- Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m<sup>2</sup>) or 23 psf [117 kg/m<sup>2</sup>] pavers.

**TABLE C402.3**  
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS<sup>a</sup>

Three-year aged solar reflectance <sup>b</sup> of 0.55 and 3-year aged thermal emittance <sup>c</sup> of 0.75
Three-year aged solar reflectance index <sup>d</sup> of 64

- <sup>a</sup> The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year aged solar reflectance in accordance with Section C402.3.1 and a 3-year aged thermal emittance of 0.90.
- <sup>b</sup> Aged solar reflectance tested in accordance with ASTM C 1549, ASTM E 903 or ASTM E 1918 or CRRC-1 Standard.
- <sup>c</sup> Aged thermal emittance tested in accordance with ASTM C 1371 or ASTM E 408 or CRRC-1 Standard.
- <sup>d</sup> Solar reflectance index (SRI) shall be determined in accordance with ASTM E 1990 using a conversion coefficient of 2.1 Btu/h · ft<sup>2</sup> · °F (12W/m<sup>2</sup> · K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

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

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
U-factor	Vertical fenestration															
	Fixed fenestration															
	Operable fenestration															
SHGC	Entrance doors															
	Orientation <sup>a</sup>															
	PF < 0.2															
0.2 ≤ PF < 0.5																
PF ≥ 0.5																
U-factor	Skylights															
	SHGC															

NR = No requirement; PF = Projection factor.  
<sup>a</sup> "N" indicates vertical fenestration oriented within 45 degrees of true north. "SW" indicates orientations other than "N" for buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SW for all orientations.

C402.4 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 subfloor decking or structural slabs.

**Exceptions:**

- 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 C402.1.4 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.
- Insulation applied to the underside of concrete floor slabs shall be permitted an airspace of not more than 1 inch (25 mm) where it turns up and is in contact with the underside of the floor under walls associated with the building thermal envelope.

C402.5 Slabs-on-grade perimeter insulation. Where the slab on grade is in contact with the ground, the minimum thermal resistance (R-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors designed in accordance with the R-value method of Section C402.1.3 shall be as specified in Table C402.1.3. The insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil.

**Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

C402.6 Insulation of radiant heating systems. Radiant heating system panels, and their associated components that are installed in interior or exterior assemblies shall be insulated with a minimum of R-3.5 (0.62 m<sup>2</sup>K/W) on all surfaces not facing the space being heated. Radiant heating system panels that are installed in the building thermal envelope shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the R-value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with Section C402.1.4.

**Exception:** Heated slabs on grade insulated in accordance with Section C402.2.5.

4. R-5s where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.

C402.3.1 Aged roof solar reflectance. Where an aged solar reflectance required by Section C402.3 is not available, it shall be determined in accordance with Equation 4-3.

$$R_{solar} = [0.2 + 0.7(R_{min} - 0.2)] \quad (\text{Equation 4-3})$$

where:  
 $R_{solar}$  = The aged solar reflectance.  
 $R_{min}$  = The initial solar reflectance determined in accordance with CRRC-1 Standard.

C402.4 Fenestration (Prescriptive). Fenestration shall comply with Sections C402.4 through C402.4.4 and Table C402.4. Daylight responsive controls shall comply with this section and Section C405.2.3.1.

C402.4.1 Maximum area. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not be greater than 30 percent of the gross above-grade wall area. The skylight area shall not be greater than 3 percent of the gross roof area.

C402.4.1.1 Increased vertical fenestration area with daylight responsive controls. In Climate Zones 1 through 6, not more than 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided all of the following requirements are met:

- In buildings not greater than two stories above grade, not less than 50 percent of the net floor area is within a daylight zone.
- In buildings three or more stories above grade, not less than 25 percent of the net floor area is within a daylight zone.
- Daylight responsive controls complying with Section C405.2.3.1 are installed in daylight zones.
- Visible transmittance (VT) of vertical fenestration is not less than 1.1 times solar heat gain coefficient (SHGC).

**Exception:** Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 4.

C402.4.1.2 Increased skylight area with daylight responsive controls. The skylight area shall be provided to be not more than 5 percent of the roof area permitted daylight responsive controls complying with Section C405.2.3.1 are installed in daylight zones under skylights.

C402.4.2 Minimum skylight fenestration area. In an enclosed space greater than 2,500 square feet (232 m<sup>2</sup>) in floor area, directly under a roof with not less than 75 percent of the ceiling area with a ceiling height greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space where manufacturing occurs, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation depot or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide one of the following:

- A minimum skylight area to daylight zone under skylights of not less than 3 percent where all skylights have a VT of at least 0.40 as determined in accordance with Section C303.1.3.
- A minimum skylight effective aperture of at least 1 percent, determined in accordance with Equation 4-4.

$$\text{Skylight Effective Aperture} = 0.85 \cdot \text{Skylight Area} \cdot \text{Skylight VT} \cdot \text{WF} \quad (\text{Equation 4-4})$$

where:  
Skylight area = Total fenestration area of skylights.  
Skylight VT = Area weighted average visible transmittance of skylights.  
WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.

C402.4.3.1 Increased skylight SHGC. In Climate Zones 1 through 6, skylights shall be permitted a maximum SHGC of 0.60 where located above daylight zones provided with daylight responsive controls.

C402.4.3.2 Increased skylight U-factor. Where skylights are installed above daylight zones provided with daylight responsive controls, a maximum U-factor of 0.9 shall be permitted in Climate Zones 1 through 3 and a maximum U-factor of 0.75 shall be permitted in Climate Zones 4 through 8.

C402.4.3.3 Dynamic glazing. Where dynamic glazing is intended to satisfy the SHGC and VT requirements of Table C402.4, the ratio of the higher to lower labeled SHGC shall be greater than or equal to 2.4, and the dynamic glazing shall be automatically controlled to modulate the amount of solar gain into the space in multiple steps. Dynamic glazing shall be covered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

**Exception:** Dynamic glazing is not required to comply with this section where both the lower and higher labeled SHGC already comply with the requirements of Table C402.4.

C402.4.3.4 Area-weighted U-factor. An area-weighted average shall be permitted to satisfy the U-factor requirements for each fenestration product category listed in Table C402.4. Individual fenestration products from different fenestration product categories listed in Table C402.4 shall not be combined in calculating area-weighted average U-factor.

C402.4.4 Doors. Opaque doors shall comply with the applicable requirements for doors as specified in Tables C402.1.3 and C402.1.4 and be considered part of the gross area of above-grade walls that are part of the building thermal envelope. Other doors shall comply with the provisions of Section C402.4.3 for vertical fenestration.

C402.5 Air leakage—thermal envelope (Mandatory). The thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft<sup>2</sup> (0.2 L/s · m<sup>2</sup>), where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

**Exception:** Air barriers are not required in buildings located in Climate Zone 2B.

Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

**Exception:** Skylights above daylight zones of enclosed spaces are not required in:

- Buildings in Climate Zones 6 through 8.
- Spaces where the designed general lighting power densities are less than 0.5 W/ft<sup>2</sup> (5.4 W/m<sup>2</sup>).
- Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.
- Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.
- Spaces where the total area minus the area of daylight zones adjacent to vertical fenestration is less than 2,500 square feet (232 m<sup>2</sup>), and where the lighting is controlled according to Section C405.2.5.

C402.5.1.1 Lighting controls in daylight zones under skylights. Daylight responsive controls complying with Section C405.2.3.1 shall be provided to control all electric lights with daylight zones under skylights.

C402.5.1.2 Hazard factor. Skylights in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing material or diffuser with a hazard factor greater than 90 percent when tested in accordance with ASTM D 1003.

**Exception:** Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of skylight and light well.

C402.4.3 Maximum U-factor and SHGC. The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$$PF = A/B \quad (\text{Equation 4-5})$$

where:  
PF = Projection factor (decimal).  
A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.  
B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave or permanently attached shading device.

Where different windows or glass doors have different PF values, they shall each be evaluated separately.

C402.5.1.1 Air barrier construction. The continuous air barrier shall be constructed to comply with the following:

- The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
- Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
- Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals associated with penetrations shall be sealed in the same manner or taped or covered with moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed and shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
- Recessed lighting fixtures shall comply with Section C402.5.8. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

C402.5.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall comply with Section C402.5.1.1 and C402.5.1.2.

C402.5.1.2.1 Materials. Materials with an air permeability not greater than 0.004 cfm/ft<sup>2</sup> (0.02 L/s · m<sup>2</sup>) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

- Plywood with a thickness of not less than 1/2 inch (10 mm).
- Oriented strand board having a thickness of not less than 1/2 inch (10 mm).
- Extruded polystyrene insulation board having a thickness of not less than 1/2 inch (12.7 mm).

4. Foil-backed polyisocyanurate insulation board having a thickness of not less than 1/2 inch (12.7 mm).

- Closed-cell spray foam a minimum density of 1.5 pcf (2.4 kg/m<sup>3</sup>) having a thickness of not less than 1 1/2 inches (38 mm).
- Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m<sup>3</sup>) and having a thickness of not less than 4.5 inches (113 mm).
- Exterior or interior gypsum board having a thickness of not less than 1/2 inch (12.7 mm).
- Cement board having a thickness of not less than 1/2 inch (12.7 mm).
- Built-up roofing membrane.
- Modified bituminous roof membrane.
1. Fully adhered single-ply roof membrane.
2. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 1/2 inch (15.9 mm).
3. Cast-in-place and precast concrete.
4. Fully grouted concrete block masonry.
5. Steel sheet or aluminum.
6. Solid or hollow masonry constructed of clay or shale masonry units.

C402.5.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ft<sup>2</sup> (0.2 L/s · m<sup>2</sup>) under a pressure differential of 0.3 inch water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided joints are sealed and the requirements of Section C402.5.1.1 are met.

- Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
- Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches (102 mm) or more.
- A Portland cement/sand parge, stucco or plaster not less than 1/2 inch (12.7 mm) in thickness.

C402.5.2 Air leakage of fenestration. The air leakage of fenestration assemblies shall meet the provisions of Table C402.5.2. Testing shall be in accordance with the applicable reference test standard in Table C402.5.2 by an accredited, independent testing laboratory and labeled by the manufacturer.

**Exceptions:**

- Field-fabricated fenestration assemblies that are sealed in accordance with Section C402.5.1.
- Fenestration in buildings that comply with the testing alternative of Section C402.5 are not

C402.5.3 Air intakes, exhaust openings, stairways and shafts. Stairway enclosures, elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be provided with dampers in accordance with Section C403.2.4.3.

C402.5.6 Loading dock weathereals. Cargo doors and loading dock doors shall be equipped with weathereals to restrict infiltration when vehicles are parked in the doorway.

C402.5.7 Vestibules. Building entrances shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. 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. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

**Exceptions:** Vestibules are not required for the following:

- Buildings in Climate Zones 1 and 2.
- Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
- Doors opening directly from a sleeping unit or dwelling unit.
- Doors that open directly from a space less than 3,000 square feet (298 m<sup>2</sup>) in area.
- Revolving doors.
- Doors that have an air curtain with a velocity of not more than 6.56 feet per second (2 m/s) at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer's instructions. Manual or automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with Section C408.2.3.

C402.5.8 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be all of the following:

- IC-rated.
- Labeled as having an air leakage rate of not more than 0.20 cfm (0.944 L/s) when tested in accordance with ASTM E 283 at a 1.57 psf (75 Pa) pressure differential.
- Sealed with a gasket or caulk between the housing and interior wall or ceiling covering.

**SECTION C403**  
**BUILDING MECHANICAL SYSTEMS**

C403.1 General. Mechanical systems and equipment serving the building heating, cooling or ventilating needs shall comply with Section C403.2 and shall comply with Sections

required to meet the air leakage requirements in Table C402.5.2.

C402.5.3 Rooms containing fuel-burning appliances. In Climate Zones 3 through 8, where open combustion air ducts provide combustion air to open combustion space conditioning fuel-burning appliances, the appliances and combustion air openings shall be located outside of the building thermal envelope or enclosed in a room isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table C402.1.3 or C402.1.4, where the below-grade wall R-value requirement. The door into the room shall be fully gasketed, and any water lines and ducts in the room insulated in accordance with Section C403. The combustion air duct shall be insulated, where it passes through conditioned space, to a minimum of R-8.

**Exceptions:**

- Direct vent appliances with both intake and exhaust pipes installed continuously to the outside.
- Fireplaces and stoves complying with Sections 901 through 905 of the International Mechanical Code, and Section 2111.13 of the International Building Code.

C402.5.4 Doors and access openings to shafts, chutes, stairways and elevator lobbies. Doors and access openings from conditioned space to shafts, chutes stairways and elevator lobbies not within the scope of the fenestration assemblies covered by Section C402.5.2 shall be gasketed, weatherstripped or sealed.

**Exceptions:**

- Door openings required to comply with Section 716 or 716.6 of the International Building Code.
- Doors and door openings required to comply with UL 1784 by the International Building Code.

**TABLE C402.5.2**  
MAXIMUM AIR LEAKAGE RATE FOR FENESTRATION ASSEMBLIES

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT <sup>2</sup> )	TEST PROCEDURE
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Windows	0.20 <sup>a</sup>	
Sliding doors	0.20 <sup>a</sup>	AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400
Swing doors	0.20 <sup>a</sup>	
Skylights - with condensation weepage openings	0.30	
Skylights - all other	0.20 <sup>a</sup>	
Curtain walls	0.06	NFRC 400
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	1.00	ASTM E 283 at 1.57 psf (75 Pa)
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf (75 Pa)
Rolling doors	1.00	
High-speed doors	1.30	

For SI: 1 cubic foot per minute = 0.047 L/s, 1 square foot = 0.093 m<sup>2</sup>.  
<sup>a</sup> The maximum rate for windows, sliding and swinging doors, and skylights is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or 6.24 psf (300 Pa).

C403.3 and C403.4 based on the equipment and systems provided.

Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.2.15 or C403.2.16.

C403.2 Provisions applicable to all mechanical systems (Mandatory). Mechanical systems and equipment serving the building heating, cooling or ventilating needs shall comply with Sections C403.2.1 through C403.2.16.

C403.2.1 Calculation of heating and cooling loads. Design loads associated with heating, ventilation and air conditioning of the building shall be determined in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent computational procedure using the design parameters specified in Chapter 3. Heating and cooling loads shall be adjusted to account for load reductions that are achieved where energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE HVAC Systems and Equipment Handbook by an approved equivalent computational procedure.

C403.2.2 Equipment sizing. The output capacity of heating and cooling equipment shall be not greater than the loads calculated in accordance with Section C403.2.1. A single piece of equipment providing both heating and cooling shall satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

**Exceptions:**

- Required standby equipment and systems provided with controls and devices that allow such systems or equipment to operate automatically only when the primary equipment is not operating.
- Multiple units of the same equipment type with combined capacities exceeding the design load and provided with controls that have the capability to sequence the operation of each unit based on load.

C403.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables C403.2.3(1), C403.2.3(2), C403.2.3(3), C403.2.3(4), C403.2.3(5), C403.2.3(6), C403.2.3(7), C403.2.3(8) and C403.2.3(9) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table C403.2.3(10). The efficiency shall be verified through certification under an approved certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

REVISIONS	BY

REVISIONS	BY

THE BRIARCLIFF MANOR - ALTERATION/ADDITION  
BRIARCLIFF MANOR, NY  
25 STUDIO HILL ROAD  
HESS ARCHITECTS - LEED AP  
254 SICKLETOWN ROAD  
WEST NYACK, NY  
845-358-1486



DRAWN
CHECKED
DATE
SCALE
JOB NO.
SHEET

6 OF SHEETS